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.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

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Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

User's Guide

HP ESG Series Signal Generators

Serial Number Prefixes:

HP ESG-1000A, US36220
HP ESG-2000A, US36220
HP ESG-3000A, US36220
HP ESG-4000A, US36220
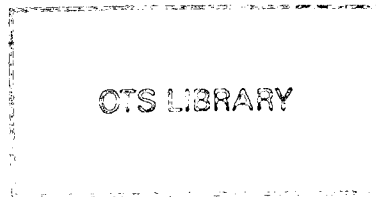
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1   Preparing for Use

This chapter contains procedures that show you how to install your signal generator, and how to perform a functional check to verify signal generator operation.

Installing the Signal Generator

This section contains procedures for properly installing your signal generator:

- checking the shipment
- installing front handles and rack flange kits
- meeting electrical and environmental requirements
- adjusting the display
- selecting the signal generator's HP-IB address
- selecting the programming language

Checking the Shipment

1. Inspect the shipping container for damage.

   Look for signs of damage such as a dented or torn shipping container or cushioning material that shows signs of unusual stress or compacting.

2. Carefully remove the contents from the shipping container and verify that your order is complete. Refer to Table 1-1 for a list of items that are shipped standard with the signal generator and for a list of options that you may also have ordered.

Table 1-1. **Shipment Verification List**

Part Number	Item Description	Option
Unique to Country	AC Power Cable	Standard
5063-9227	Front Handle Kit	1CN
5063-9214	Rack Flange Kit (without handles)	1CM
5063-9221	Rack Flange Kit (with handles)	1CP
E4400-90004	User's Guide (part of manual set E4400-90003)	Standard
E4400-90005	Programming Guide (part of manual set E4400-90003)	Standard
E4400-90006	Quick Reference Guide (part of manual set E4400-90003)	Standard
E4400-90007	Calibration Guide (part of manual set E4400-90003)	Standard
E4400-90003	Additional Manual Set	OB1
E4400-90008	Service Guide	0BW, 0BX
E4400-90015	Component Level Information Guide	0BV, 0BX
E4400-90024	User's Guide, Chinese for Taiwan	AB0
E4400-90023	User's Guide, Korean	AB1
E4400-90022	User's Guide, Chinese	AB2
E4400-90027	User's Guide, German	ABD
E4400-90026	User's Guide, Spanish	ABE
E4400-90025	User's Guide, Japanese	ABJ

Installing Front Handles and Rack Mount Flanges

You can attach handles to the front of the signal generator to facilitate transportation of the instrument. Handles are available in a kit which can be ordered when the signal generator is purchased (Option 1CN), or at any time afterward. Assembly instructions are included with the kit. The kit part number is listed in Table 1-2.

You can also rack mount the signal generator. Hardware is available in kits to install rack mount flanges on the signal generator without or with handles. These kits can be ordered when the signal generator is purchased (Options 1CM and 1CP), or at any time afterward. Assembly instructions are included with the kits. The kit part numbers are listed in Table 1-2.

Table 1-2.   **Front Handle and Rack Mount Flange Kits**

Option	Description	HP Part Number
Option 1CN	Front Handle Kit	5063-9227
Option 1CM	Rack Mount Kit without Handles	5063-9214
Option 1CP	Rack Mount Kit with Handles	5063-9221

Providing Adequate Ventilation

CAUTION

Ventilation Requirements: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4° C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Cooling holes are located on the sides and bottom of the instrument cover and the rear panel of the instrument. Do not allow these holes to be obstructed as they allow air flow through the signal generator.

Meeting Electrical and Environmental Requirements

Line Settings

CAUTION: This product has an autoranging line voltage input. Be sure that the supply voltage is within the specified range.

The available AC power source must meet the following requirements:

Voltage:
- 100/115 volts nominal (90-132 volt range)
- 230/240 volts nominal (198-254 volt range)

Frequency:
- for 100/115 volts: 50/60/400 Hz nominal
- for 230/240 volts: 50/60 Hz nominal

Power:
- 200 watts maximum

Verify that the power cable is not damaged and that the power source socket outlet provides a protective earth contact.

WARNING **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

Environment

This product is designed for use in the following environmental conditions:

- indoor use
- < 15,000 feet (4,572 meters) altitude
- 0° to 55° C temperature, unless specified differently
- maximum relative humidity 80% for temperatures up to 31° C, decreasing linearly to 50% relative humitity at 40° C

CAUTION:	This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 1010 and 664 respectively.
WARNING	**If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition only (in which all means for protection are intact).**

Cleaning the Signal Generator

Clean the instrument cabinet using a damp cloth only.

Adjusting the Display Contrast

You can adjust the contrast of the display by pressing the decrease contrast key ⟨◐⇩⟩ or the increase contrast key ⟨◐⇧⟩. These keys are located on the front panel below the display.

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display. The minimum contrast setting is not a completely black display. Some contrast between the background and the text will still be visible.

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display. If the background does not appear to change, it is probably set to the maximum contrast.

Adjusting the Screen Saver

You can increase the life expectancy of the signal generator's display light by turning on the screen saver. Leaving the display lit for long periods of time or turning the display on and off frequently decreases the life of the bulb. With the screen saver on, the display light is turned off after a defined period of time with no input to the front panel. The display light turns on again when any front panel key is pressed or when a remote command is sent.

The screen saver is set to off at the factory. You can turn it on by pressing **Utility, Display, Screen Saver.** Each time you press **Screen Saver** the selection toggles between **Off** and **On.**

You can adjust the screen saver mode to turn the light on and off or to turn both the light and text on and off. Press **Utility, Display, Scrn Saver Mode**. You can toggle between **Light Only** and **Light&Text**. Setting the mode to **Light Only** turns the display light off but leaves the text visible at a low intensity. To prevent the text from burning the display if you are leaving the display unchanged for long periods of time, set the mode to **Light&Text**. This mode turns off the display light and the text.

The screen saver delay is set to 1 hour at the factory. You can view and change the delay by pressing **Scrn Saver Delay** in the same menu. The current screen saver delay is displayed in the softkey label and also in the active entry area. To change the delay, enter a new value using the numeric keypad and then press **Enter**, or rotate the front panel knob. The acceptable range of delay values is 1 through 12 hours in 1 hour increments.

The screen saver settings do not change when **Preset** is pressed, nor when power to the instrument is cycled.

Selecting the Signal Generator's HP-IB Address

The signal generator's HP-IB address is set to 19 at the factory. You can view and change the address by pressing **Utility, HP-IB/RS-232, HP-IB Address**. The current HP-IB address is displayed in the softkey label and also in the active entry area. To change the address, enter a new value using the numeric keypad and then press **Enter**, or rotate the front panel knob. The acceptable range of addresses is 0 through 30.

The HP-IB address is a persistent state (remains unchanged after an instrument preset or power cycle).

Selecting the Signal Generator's Programming Language

The default programming language for the signal generator is Standard Commands for Programmable Instruments (SCPI). You can change this language to any of four HP 8656/57-compatible programming languages by pressing **Utility, HP-IB/RS-232, Remote Language**. The Remote Language menu allows you to select between HP 8656/56-compatible language, HP 8657D language (NADC digital modulation capability), HP 8657D language (PDC digital modulation capability), HP 8657J (PHS digital modulation capability), or SCPI language. Press the softkey for the selection that you desire.

You can also change the language selection by sending the appropriate command over HP-IB. Refer to the programming guide for instructions for changing the language over HP-IB.

You can set the signal generator to default to either SCPI or to one of the
HP 8656/57-compatible programming languages as a persistent state (remains
unchanged after an instrument preset or power cycle). Press **Utility**,
Power On/Preset, **Preset Language**. The Preset Language menu allow you to select
between SCPI and the four HP 8656/57-compatible programming languages.
Press the softkey for the selection that you desire.

Verifying Signal Generator Operation

The operator's check is appropriate as a daily functional check by users, or whenever the integrity of the signal generator is in question .Use the operator's check to verify proper operation of the signal generator. The operator's check does not ensure performance to specifications. To verify specifications, refer to the calibration guide.

Operator's Check

Perform the following tasks in order:

1. Power On the Signal Generator and Check for Error Messages

This procedure verifies that the signal generator powers up and that the internal instrument check identifies no errors.

1. Turn power on to the signal generator by pressing the power switch. The green LED will light. Let the instrument warm up for one hour.

2. Cycle the power to the signal generator. The green LED should again be lit and the instrument will perform a check.

3. When the display is lit, check to see if the **ERR** annunciator is turned on.

4. If the **ERR** annunciator is turned on, review the error messages in the queue by pressing **Utility, Error Info, View Next Error Message**. The first error message in the queue will be shown in the text area of the display. Refer to the service guide for information about the error message.

   If there is more than one error message (each message will be designated as 1 of *n*), continue pressing the **View Next Error Message** softkey until you have seen all of the messages.

5. When you have resolved all of the error messages, press **Clear Error Queue(s)** to delete the messages. Then restart this procedure at step two.

   Note: For instruments with Option 1E5, **ERROR 514, Reference Oven Cold** will occur whenever the signal generator is first connected to AC line power. The **OVEN COLD** annunciator and the **ERR** annunciator will both turn on. The **OVEN COLD** annunciator will automatically clear after approximately 5 minutes. The error queue *cannot* be cleared, however, until the **OVEN COLD** annunciator has turned off.

2. Verify Maximum Specified Power is Available at the Maximum Frequency

This procedure verifies that there are no unleveled power indications or error messages at the maximum specified frequency and power level.

1. Calibrate the power meter with the power sensor. (Refer to the power meter's manual for assistance.)

2. Connect the power sensor to the signal generator's RF OUTPUT connector as shown in Figure 1-1.
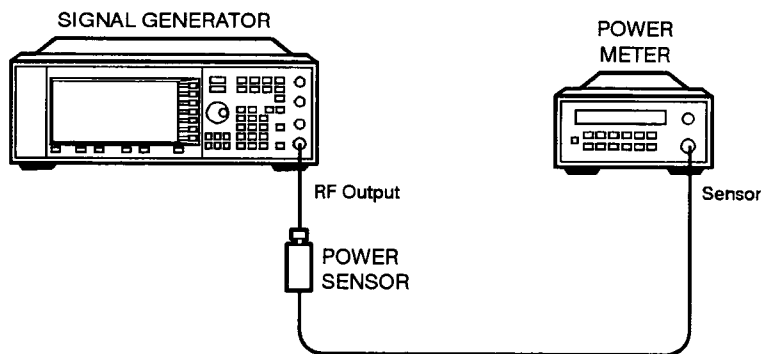
pk717a

Figure 1-1.   **Operator's Check Equipment Setup**

3. Preset the signal generator to the factory-defined conditions:

    a. Press **Utility, Power On/Preset** and toggle **Preset** until **Normal** is shaded.

    b. Press the front panel **Preset** key.

4. Set the signal generator to its maximum specified frequency:

    a. Press **Frequency**.

    b. Use the numeric keypad to enter the signal generator's maximum specified frequency as shown in Table 1-3.

    c. Terminate your entry by pressing the **GHz** softkey.

5. Set the signal generator to its maximum specified power level:

    a. Press **Amplitude**.

    b. Use the numeric keypad to enter the signal generator's maximum specified power level as shown in Table 1-3.

    c. Terminate your entry by pressing the **dBm** softkey.

6. Toggle the front panel **RF On/Off** key to turn on RF power to the RF OUTPUT connector. The display **RF ON** annunciator will turn on.

7. Verify that the power meter reads the maximum specified output power including the power level accuracy limits.

8. Check to see if the **UNLEVEL** or **ERR** display annunciators have turned on. If these annunciators are on, refer to the service guide for troubleshooting information.

Table 1-3.   **Frequency and Power Level Limits**

Instrument Model	Maximum Specified Frequency	Maximum Specified Power	Power Level Accuracy Limits
HP ESG-1000A	1 GHz	+13 dBm	±0.7 dB
HP ESG-2000A	2 GHz	+10 dBm	±0.7 dB
HP ESG-3000A	3 GHz	+10 dBm	±1.0 dB
HP ESG-4000A	4 GHz	+7 dBm	±1.0 dB

2 Using Functions

This chapter contains procedures that show you how to use some of the major functions of your signal generator including setting frequency and power levels, setting up modulations, creating step and list sweeps, and saving and recalling instrument states.

Setting Frequency and Power Levels

Using these procedures, you will learn how to:

• Set the RF frequency
• Set a frequency reference and a frequency offset
• Set the RF output power level
• Set an amplitude reference and an amplitude offset

To Set the RF Frequency

1. Turn power on to the signal generator: press the power switch, ⌾❘ , so that the green LED is on. The signal generator will perform an internal check.

2. Press the green **Preset** key. The signal generator will return to a set of factory-defined conditions.

NOTE:

You can change the preset conditions to a user-defined instrument state. However, for the purposes of these examples, use the factory-defined preset state (the **Preset Normal User** softkey in the **Utility** menu must be set to **Normal**).

3. Observe the frequency area of the display (in the upper left-hand corner). It should display the maximum specified frequency of your signal generator.

4. The signal generator is set to output an RF signal, however the **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Press **RF On/Off**. Notice that the display annunciator changes from RF OFF to RF ON. The maximum specified frequency is now being output at the RF OUTPUT connector.

5. Change the frequency to 700 MHz by pressing **Frequency**. The current RF frequency is now displayed in the active entry area of the display. Using the numeric keypad, enter **700** and then press the **MHz** terminator softkey. The new 700 MHz RF frequency is now displayed in the frequency area of the display and also in the active entry area.

6. Frequency is still the active function until you press another front panel function key. Change the frequency again by pressing the up arrow key once. Each press of the up arrow key increases the frequency by the value set for the **Incr Set** key. The increment value is displayed in the active entry area. The normal preset value for this key is 1 MHz. If you pressed the up arrow key once, your new frequency should be displayed as 701.000 000 00 MHz.

   The down arrow works like the up arrow. Practice stepping the frequency up and down in 1 MHz increments.

7. You can also adjust the RF frequency using the front panel knob. As long as frequency is the active function (the frequency is displayed in the active entry area) the front panel knob will increase and decrease the RF frequency. Use the front panel knob and reset the frequency back to 700 MHz.

To Set a Frequency Reference and a Frequency Offset

The following procedure sets the RF output frequency as a reference frequency to which all other frequency parameters are relative. The frequency initially shown on the display will be 0 Hz (the frequency output by the hardware minus the reference frequency.) Although the display changes, the frequency output does not change. Any subsequent frequency changes are shown as incremental or decremental to 0 Hz.

1. Press **Preset** to return the signal generator to the factory-defined instrument state.

2. Set the RF frequency to 700 MHz.

3. Turn on frequency reference mode and set the current output frequency (700 MHz) as the reference value. Press **Freq, Freq Ref Set** . The frequency displayed is 0 Hz (the frequency output by the hardware, 700 MHz, minus the reference value, 700 MHz). Notice that the **REF** indicator is turned on and the **Freq Ref** softkey has toggled to **On**.

4. Set the **RF On/Off** key to **On**. Notice that the display annunciator has changed from **RF OFF** to **RF ON**. The RF frequency at the RF OUTPUT connector is 700 MHz.

5. Increment the output frequency by 1 MHz. Press the up arrow key. The frequency display changes to show 1 MHz (the frequency output by the hardware, 700 MHz + 1 MHz, minus the reference frequency, 700 MHz) and the output frequency changes to 701 MHz.

6. Enter a 1 MHz offset. Press the **Freq Offset** softkey and enter 1 MHz using the numeric keypad and pressing the **MHz** terminator softkey. The frequency display shows 2 MHz (the frequency output by the hardware, 701 MHz, minus the reference frequency, 700 MHz, plus the offset, 1 MHz.) Notice that the **OFFSET** indicator is turned on. The frequency at the RF OUTPUT connector is still 701 MHz.

To Set the RF Output Power Level

1. Press **Preset** to return the signal generator to the factory-defined instrument state.

2. Observe the amplitude area of the display (in the upper middle of the display). It should display −135 dBm. This is the normal preset RF output power level.

3. The signal generator is set to output an RF signal, however the **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Press **RF On/Off**. Notice that the display annunciator changes from RF OFF to RF ON. The RF signal is now being output at a −135 dBm level at the RF OUTPUT connector.

4. Change the power level to −20 dBm. Press **Amplitude**. The current power level is now displayed in the active entry area of the display. Using the numeric keypad and the ⌊+/−←⌋ key, enter **−20** and then press the **dBm** softkey. The new −20 dBm RF output power is now displayed in the amplitude area of the display and also in the active entry area.

5. Amplitude is still the active function until you press another front panel function key. You can also change the amplitude using the up and down arrow keys and the front panel knob. Practice changing the amplitude using these methods also.

To Set an Amplitude Reference and an Amplitude Offset

The following procedure sets the RF output power as an amplitude reference to which all other amplitude parameters are relative. The amplitude initially shown on the display will be 0 dB (the power output by the hardware minus the reference power). Although the display changes, the output power does not change. Any subsequent power changes are shown as incremental or decremental to 0 dB.

1. Press **Preset** to return the signal generator to the factory-defined instrument state.

2. Set the RF output power to −20 dBm.

3. Turn on amplitude reference mode and set the current output power (−20 dBm) as the reference value. Press **Ampl, Ampl Ref Set** . The amplitude displayed is 0 dB (the power output by the hardware, −20 dBm, minus the reference value, −20 dBm.) Notice that the REF indicator is turned on and the **Ampl Ref** softkey has toggled to **On**.

4. Set the **RF On/Off** key to **On**. Notice that the display annunciator has changed from RF OFF to RF ON. The power at the RF OUTPUT connector is −20 dBm.

5. Increment the output power by 10 dB. Press the up arrow key. The amplitude display changes to show 10 dB (the power output by the hardware, −20 dBm + 10 dBm, minus the reference power, −20 dBm) and the output power changes to −10 dBm.

6. Enter a 10 dB offset. Press the **Ampl Offset** softkey and enter 10 dB using the numeric
keypad. The amplitude display shows 20 dB (the power output by the hardware,
−10 dBm, minus the reference power, −20 dBm, plus the offset, 10 dB). Notice that the
OFFSET indicator is turned on. The power at the RF OUTPUT connector is still
−10 dBm.

Setting Up Internally-Generated Amplitude Modulation

Using this procedure, you will learn how to generate an amplitude-modulated signal with the following characteristics:

- Carrier frequency set to 1340 kHz

- Power level set to 0 dBm

- AM depth set to 90%

- AM rate set to 10 kHz

Setting the Carrier Frequency

1. Preset the signal generator to normal preset conditions.

2. Press the front panel **Frequency** key. Frequency becomes the active function and the normal preset value for frequency is displayed in the active entry area.

3. Enter 1340 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new carrier frequency is shown in the frequency area of the display. You should see **1.340 000 00 MHz**.

Setting the Power Level

1. Press the front panel **Amplitude** key. Amplitude becomes the active function and the normal preset value for amplitude is displayed in the active entry area.

2. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey. The new power level is shown in the amplitude area of the display. You should see **0.00 dBm.**

Setting the AM Depth

1. Press the front panel **AM** key. The first level menu of softkeys is displayed.

2. Press the **AM Depth** softkey. AM depth becomes the active function and the normal preset value for AM depth is displayed in the active entry area.

3. Enter 90% using the numeric keypad and pressing the **%** terminator softkey. The new AM depth is displayed below the **AM Depth** softkey. You should see **90.0 %** in the second line of the softkey.

Setting the AM Rate

1. In the same AM menu, press the **AM Rate** softkey. AM rate becomes the active function and the normal preset value for AM rate is displayed in the active entry area.

2. Enter 10 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new AM rate is displayed below the **AM Rate** softkey. You should see **10.0000 kHz** in the second line of the softkey.

Turning On Amplitude Modulation

The signal generator is now configured to output a 0 dBm, amplitude-modulated carrier at 1340 kHz with the AM depth set to 90% and the AM rate set to 10 kHz. The shape of the waveform is a sinewave (notice that sine is the default for the **AM Waveform** softkey). Follow these remaining steps to output the amplitude-modulated signal.

1. In the same AM menu, press the **AM Off On** softkey. AM toggles from **Off** to **On**. Notice, also, that the **AM** display annunciator is turned on indicating that you have enabled amplitude modulation.

2. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The modulated signal is now available at the RF OUTPUT connector.

Setting Up Internally-Generated Frequency Modulation

Using this procedure you will configure the signal generator to output a frequency-modulated signal with the following characteristics:

- Carrier frequency set to 104.9 MHz

- Power level set to 0 dBm

- FM deviation set to 75 kHz

- FM rate set to 10 kHz

Setting the Carrier Frequency

1. Preset the signal generator to normal preset conditions.

2. Press the front panel **Frequency** key. Frequency becomes the active function and the normal preset value for frequency is displayed in the active entry area.

3. Enter 104.9 MHz using the numeric keypad and pressing the **MHz** terminator softkey. The new carrier frequency is shown in the frequency area of the display. You should see 104.900 000 00 MHz.

Setting the Power Level

1. Press the front panel **Amplitude** key. Amplitude becomes the active function and the normal preset value for amplitude is displayed in the active entry area.

2. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey. The new power level is shown in the amplitude area of the display. You should see 0.00 dBm.

Setting the FM Deviation

1. Press the front panel **FM/ΦM** key. The first level menu of FM softkeys is displayed.

2. Press the **FM Dev** softkey. FM deviation becomes the active function and the normal preset value for FM deviation is displayed in the active entry area.

3. Enter 75 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new FM deviation is displayed below the **FM Dev** softkey. You should see **75.0000 kHz** in the second line of the softkey.

Setting the FM Rate

1. In the same FM menu, press the **FM Rate** softkey. FM rate becomes the active function and the normal preset value for FM rate is displayed in the active entry area.

2. Enter 10 kHz using the numeric keypad and pressing the **kHz** terminator softkey. The new FM rate is displayed below the **FM Rate** softkey. You should see **10.0000 kHz** in the second line of the softkey.

Turning On Frequency Modulation

The signal generator is now configured to output a 0 dBm, frequency-modulated carrier at 104.9 MHz with the FM deviation set to 75 kHz and the FM rate set to 10 kHz. The shape of the waveform is a sinewave (notice that sine is the default for the **FM Waveform** softkey - press **More (1 of 2)** to see the softkey). Follow these remaining steps to output the frequency-modulated signal.

1. In the same FM menu, press the **FM Off On** softkey. FM toggles from **Off** to **On**. Notice, also, that the **FM** display annunciator is turned on indicating that you have enabled frequency modulation.

2. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from **RF OFF** to **RF ON**. The modulated signal is now available at the RF OUTPUT connector.

Creating a Step Sweep and a List Sweep

Using this procedure, you will learn two ways to set up the signal generator to sweep a defined set of points. You will create a step sweep and then you will use these points as the basis for a new list sweep.

In the first procedure, you will create a step sweep with the following ten equally spaced points:

* Frequency range from 525 MHz to 600 MHz

* Power level from −20 dBm to 0 dBm

* Dwell time 500 ms at each point

In the second procedure, you will take the step sweep points and edit several points to change the sweep information.

Configuring a Step Sweep

1. Preset the signal generator to normal preset conditions.

2. Press the front panel **Sweep/List** key. The first level of sweep softkeys is displayed. Toggle the **Sweep Type List Step** softkey to **Step**.

3. Press the **Configure Step Sweep** softkey. Another menu is displayed with softkeys that you will use to create the sweep points.

4. Observe the **Freq Start** key. The start frequency of the step sweep is currently set to 525 MHz. It does not need to be changed.

5. Change the stop frequency of the step sweep. Press the **Freq Stop** key. Enter 600 MHz using the numeric keypad and pressing the **MHz** terminator softkey.

6. Set the power level for the start of the step sweep. Press the **Ampl Start** softkey. Enter −20 dBm using the numeric keypad and pressing the **dBm** terminator softkey.

7. Set the power level for the end of the step sweep. Press the **Ampl Stop** softkey. Enter 0 dBm using the numeric keypad and pressing the **dBm** terminator softkey.

8. Set the number of sweep points. Press the **# Points** softkey. Enter 10 by rotating the front panel knob until the number 10 is displayed.

9. Set the dwell time at each point. Press the **Step Dwell** softkey. Enter 500 ms using the numeric keypad and pressing the **msec** terminator softkey.

Turning On Continuous Step Sweep

1. Press **Return** to move up one menu level.

2. Press the **Sweep** softkey. Another menu is displayed showing you choices for sweeping either the frequency, amplitude, or frequency and amplitude data. Press the **Freq&Ampl** softkey. Selecting this softkey returns you to the previous menu and turns the sweep function on.

3. Press the **Sweep Repeat Single Cont** softkey to toggle from **Single** to **Cont**. Notice that the SWEEP display annunciator is turned on indicating that the signal generator is sweeping.

4. Press the front panel **RF On/Off** key to toggle RF on. Notice that the display annunciator changes from RF OFF to RF ON. The swept RF signal is now available at the RF OUTPUT connector.

Configuring a List Sweep Using Step Sweep Data

1. Press the **Sweep Type List Step** softkey to toggle from **Step** to **List**.

2. Press the **Configure List Sweep** softkey. Another menu is displayed with softkeys that you will use to create the sweep points. Notice that the display shows the current list data (when no list has been previously created, the default is one point at 525 MHz, −135 dBm, with a dwell time of 2 ms).

3. Press the **Load List From Step Sweep** softkey. The points you defined in the step sweep are automatically loaded into the list.

Editing List Sweep Points

1. Change the dwell time for point 1 to 100 ms. Press the right arrow key twice until the dwell time is highlighted. Press the **Edit Item** softkey. The dwell time for point 1 becomes the active function. Enter 100 ms using the numeric keypad and pressing the **msec** terminator softkey.

2. Change the frequency for point 4 to 560 MHz. Press the left arrow key twice and the down arrow key three times until the frequency is highlighted. Press the **Edit Item** softkey. The frequency for point 4 becomes the active function. Enter 560 MHz by pressing the up arrow key until 560 MHz is displayed and then pressing the **Enter** terminator softkey.

3. Add a new point between points 7 and 8. Press the down arrow until any column in the point 8 row is highlighted. Press **More (1 of 2)**, **Copy Row**. A copy of point 8 has been placed between points 7 and 8, creating a new point 8, and renumbering the successive points.

4. Create a new point between points 10 and 11. Press the down arrow until the frequency for point 11 is highlighted. Press **More (2 of 2), Insert Item**. The frequency for the new item becomes the active function. Enter 700 MHz using the numeric keypad and pressing the **MHz** terminator softkey. Notice that a new frequency item is placed at point 11 and the frequency item previously occupying that position has shifted down to point 12. The power and dwell time items do not shift down. (An informational **ERR** annunciator is turned on here indicating that the frequency and power lists are of unequal size. You will correct that problem in the following steps. The annunciator will not turn off until you clear the error queue in the **Utility** menu.)

Press the right arrow key to highlight the power for point 11. Press the **Insert Item** softkey and enter 1 dBm using the numeric keypad and pressing the **dBm** terminator softkey. A new power item is placed at point 11 and the power item previously occupying that position has shifted down to point 12.

Press the right arrow key to highlight the dwell time for point 11. Press **More (1 of 2), Copy Item**. The dwell time from the previous point 11 has been copied into the new point 11. A new dwell time item is placed at point 11 and the dwell time item previously occupying that position has shifted down to point 12.

Turning On List Sweep for a Single Sweep

1. Press **Return** to move up one menu level.

2. Notice that the **Sweep** softkey is still set to sweep both frequency and amplitude data. You do not need to change it.

3. Press the **Sweep Repeat Single Cont** softkey to toggle from **Cont** to **Single**. Notice that the **SWEEP** display annunciator is turned off. The sweep will not occur until it is triggered.

4. Press **Single Sweep**. The signal generator will sweep the points in your list once. Notice that the **SWEEP** display annunciator is turned on during the sweep.

5. Change the sweep trigger to occur when you press the front panel **Trigger** key. Press **More (1 of 2), Sweep Trigger**. Another menu is displayed showing you choices for triggering a sweep. Press the **Trigger Key** softkey.

6. Press **More (1 of 2), Single Sweep** to arm the sweep. Notice that the **ARMED** display annunciator has turned on.

7. Press the front panel **Trigger** key. The signal generator will sweep the points in your list once and the **SWEEP** display annunciator is turned on during the sweep.

Saving and Recalling an Instrument State

Using this procedure, you will learn how to save instrument settings to a memory register and to recall the settings.

1. Preset the signal generator to normal preset conditions.

2. Set up the signal generator with the following changes:

    a. Set the frequency to 800 MHz.

    b. Set the amplitude to 0 dBm.

    c. Enable amplitude modulation (**AM** display annunciator is on).

3. Save this instrument state in the signal generator memory in sequence 1, memory register 01. Press the front panel **Save** key and then press the **Select Seq** softkey. The sequence number becomes the active function. The signal generator will display the last sequence that you have used. If you have never saved to a sequence and register combination, the sequence will default to 0. Set the sequence to 1 using the arrow keys.

    Press the **Select Reg** softkey. The register number in sequence 1 becomes the active function. The signal generator will either display the last register used [accompanied by the text: (**in use**)] or, if no registers are in use, will display register 00 [accompanied by the text: (**available**)]. Use the arrow keys to select register 01.

4. Press the **Save Seq[1] Reg[01]** softkey. The current instrument settings including the frequency, amplitude, and modulation changes you made have been stored in signal generator memory.

5. Preset the signal generator to normal preset conditions.

6. Recall your instrument state. Press the front panel **Recall** key. Notice that the **Select Seq** softkey shows sequence 1. (This is the last sequence that you have used.) You do not need to change the sequence. Press **RECALL Reg**. The register to be recalled in sequence 1 becomes the active function. Press the up arrow key once to select register 1. Notice that your stored instrument settings have been immediately recalled.

3 Troubleshooting

This chapter contains instructions for troubleshooting problems you may encounter during operation of the signal generator, it explains error messages you might see, and it explains how to return your signal generator to HP for service.

If You Encounter a Problem

If the signal generator is not operating as you expected, look for help in the following list of symptoms and possible solutions. If you do not find a solution here, refer to the service guide.

• No RF Output?

The front panel **RF On/Off** key must be set to **On** before the RF signal is available at the RF OUTPUT connector. Check the annunciator on the display. If it reads RF OFF, press the **RF On/Off** key once to toggle the RF output on.

• RF Output Power too Low?

If the RF output power seems too low, look for an OFFSET or REF indicator in the amplitude area of the display.

OFFSET tells you that an amplitude offset has been set. An amplitude offset changes the value shown in the amplitude area of the display but does not affect the output power. The amplitude displayed is equal to the current power output by the signal generator hardware plus the value for the offset. To eliminate the offset, press **Ampl, Ampl Offset**. Enter **0** using the numeric keypad and press the **dB** terminator softkey.

REF tells you that the amplitude reference mode is turned on. When this mode is on, the displayed amplitude value is *not* the output power level; rather, it is the current power output by the signal generator hardware minus the reference value set by the **Ampl Ref Set** softkey. To exit the reference mode, press **Ampl** and toggle the **Ampl Ref State** softkey to **Off**. You can then reset the output power to the desired level.

• No Modulation at the RF Output?

Although you can set up and enable various modulations, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**. Check the annunciator on the display. If it reads MOD OFF, press the **Mod On/Off** key once to toggle the modulation on.

• Can't Turn Off Sweep Mode?

In the sweep mode menu you can choose to set the sweep to various sweep types or to turn sweep off. Press **Sweep/List**, **Sweep** and choose **Off** from the sweep mode selections.

• Recalled a Register and Sweep List is Missing?

Sweep information is not stored as part of the instrument state in a storage register. Only the current step and list sweep is available to the signal generator and it cannot be stored nor will it survive a factory preset.

• All of the Registers Where You Previously Stored Instrument States are Empty?

The save/recall registers are backed-up by a battery when AC power to the signal generator is not connected. The battery may need to be replaced. To verify that the battery has failed, turn power off line power to the signal generator and unplug it. Then plug in the instrument and cycle power on. If either error message –311 or –700 is stored in the error message queue, your battery has failed. Refer to the service guide for battery replacement instructions.

• Saved an Instrument State in a Register but the Register is Empty or Contains the Wrong State?

If you have intentionally, or unintentionally, selected a register number that is greater than 99, the signal generator will automatically select register 99 to save your instrument state. If the register number you intended to use is empty or contains the wrong instrument state, recall register 99 as the instrument state may be saved there.

• The Power Supply has Shut Down

If the power supply is not working, it requires repair or replacement. There is no user-replaceable power supply fuse. Refer to the service guide for instructions.

• Incorrect List Sweep Dwell Time?

If the signal generator does not dwell for the correct period of time at each sweep list point, first check the sweep list dwell values for accuracy. Press **Sweep/List**, **Configure List Sweep** and the sweep list values will be displayed. Edit the dwell values if they are incorrect.

If the list dwell values are correct, check to see if the **Dwell Type List Step** softkey is set to **Step**. When **Step** is selected, the signal generator will sweep the list points using the dwell time set for step sweep rather than the sweep list dwell values. To view the step sweep dwell time, press **Configure Step Sweep** and observe the value set for the **Step Dwell** softkey.

• Can't Turn Off Help Mode?

There are two help modes (single and continuous) available on the signal generator. In single mode (the factory preset condition) when you press the **Help** key, help text is provided for your next key press. Press another key and you are returned to normal operation. If, however, you are in continuous mode, help text is provided for your next key press and that key's function is also executed (except for the **Preset** key). You will stay in this help mode until you press the **Help** key again. To change from continuous to single mode, press **Utility**, **Instrument Info/Help Mode** and toggle the **Help Mode Single Cont** softkey to **Single**.

• LF OUTPUT Signal is a Sinewave but the RF OUTPUT Signal is a Pulse Squarewave?

The LF OUTPUT connector will output a signal where the frequency and shape is set by the internal source as it is being used by a modulation. However, if you are generating a pulse squarewave, the LF OUTPUT signal is correctly output as a sinewave. That sinewave is later squared by the modulator to generate the pulse modulation.

Error Messages

If an error condition occurs in the signal generator, it will always be reported to both the front panel display error queue and the SCPI (remote interface) error queue. These two queues are viewed and managed separately.

The Front Panel Error Queue

This queue is designed in a circular (rotating) fashion. It can hold up to 30 error messages. After an error message is read, the queue rotates to the next message in line. The previously read messages are not cleared from the queue; they remain in the queue until they are overwritten by a new error message.

The front panel error queue information can be accessed by pressing **Utility, Error Info**. From the Error Info menu, you may choose from **View Previous Error Message, View Next Error Message,** or **Clear Error Queue(s).**

If there are any messages in the front panel error queue, the **ERR** annunciator will be activated on the signal generator's display. To empty the queue, press **Utility, Error Info, Clear Error Queue(s).**

There are some special error types called permanent errors. These include **unlock, ovencold, hi/lo,** etc. Permanent errors remain in the error queues until the error condition is cleared. Pressing **Utility, Error Info, Clear Error Queue(s)** will empty the front panel error queue, but the permanent errors will be re-reported if the error condition(s) still exist.

The SCPI Remote Interface Error Queue

This queue is constructed in a linear first-in/first-out fashion. It can hold up to 30 error messages. As errors and events are detected, they are placed in the queue. Unlike the front panel error queue, errors in this queue are not overwritten by the latest incoming error messages. If the queue overflows, the last error in the queue is replaced with the error:

-350,Queue overflow

When the queue overflows, the least recent errors remain in the queue, and the most recent error is discarded. Reading an error from the head of the queue removes that error from the queue, and opens a position in the tail of the queue for a new error, if one is subsequently detected.

When all the errors have been read from the queue, further error queries will return:

0,No error

The HP-IB query **SYSTem:ERRor?** is used to view messages in the SCPI error queue. The error queue will be cleared when any of the following occur (IEEE 488.2, section 11.4.3.4):

- Upon power up

- Upon receipt of a ***CLS** command

- Upon reading the last item from the queue

In the SCPI error queue, the permanent errors are re-reported after the message **0, No error** is read using the **SYSTem:ERRor?** query after the ***CLS** command is executed.

Querying the Error Queue

The queue query message is a request for the next entry from the instrument's error queue. This queue contains an integer that can range from -32768 to 32767. Negative error numbers are reserved by the SCPI standard and are defined in this section. Positive error numbers are instrument-dependent. An error value of zero indicates that no error or event has occurred.

The signal generator responds to the **SYSTem:ERRor?** (or **STATus:QUEue?**) query using the following form:

<error number>, <error description>

The <error number> is a unique error descriptor. Certain standard error numbers are described in this section. The <error description> is a short description of the error, (optionally) followed by additional information regarding the error. Short descriptions of the standard error numbers are described in this section. The information that follows the error message may contain corrective actions that should be followed to correct the error condition.

The <device-dependent info> section of the response may contain information which will allow you to determine the exact error and context. For example:

```
-131, Invalid suffix;FREQuency:CENT 2.0E+5 dBmV
```

The maximum string length of <error description> plus <device-dependent info> is 255 characters. The <error description> will be sent exactly as indicated in this document, including case.

If there has been no error, that is, if the queue is empty, the signal generator will respond with:

```
0, No error
```

If there has been no more than one error, the instrument will respond with the first one in its queue. Subsequent responses to **SYSTem:ERRor?** should continue with the queue until it is empty.

Error Numbers

The system-defined error numbers are chosen on an enumerated ("1 of N") basis. The SCPI-defined error numbers and the <error_description> portions of the error query response are listed here. The first error described in each class (for example, -100, -200, -300, -400) is a "generic" error. In selecting the proper error number to report, more specific error codes are preferred. The generic error code is used only if the others are inappropriate.

No Error

This message indicates that the error queue contains no errors.

Error Number   Error Description [description/explanation/examples]

0   No error

The queue is empty. Every error in the queue has been read or the queue was purposely cleared by power-on or *CLS.

SCPI Standard Error Messages

Error Message Description

The list of error messages in this chapter describes all of the SCPI error messages associated with signal generator operation. A sample error message description is provided below to help you understand how information will be presented in this section.

-222   **Data out of range;value clipped to lower limit.**

Indicates that the user has entered a deviation, depth or internal source frequency that is beyond the specified limits.

The following list explains each element of the sample error message listing shown above.

- SCPI Error Number - The standard SCPI error number (-222 in this example). Standard SCPI error numbers are always negative, with the exception of **0, No error**.

- SCPI Error Message - The SCPI error message is **Data out of range;** in this example.

- Detailed Description - The information that appears after the semicolon (**;**) provides more detail as to the exact nature of the error. In this example, **value clipped to lower limit** tells you that you have entered a value outside the allowable range and the signal generator has changed the value so that it falls within the allowable limits. If no detailed description exists, it will be omitted from the error message.

- Explanation/Action Required - The text that appears below each error message listing contains an explanation of the error message and, in some cases, corrective actions that should be followed in order to correct the error condition. Though this information is not shown on the signal generator's display, it can be found in the following section.

Command Error

An error number in the range [-199 to -100] indicates that an IEEE 488.2 syntax error has been detected by the instrument's parser. The occurrence of any error in this class will cause the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1) to be set. If this bit is set, one of the following events has occurred:

*   An IEEE 488.2 syntax error has been detected by the parser. That is, a control-to-device message was received which is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.

*   An unrecognized header was received. Unrecognized headers include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

Events that generate command errors will not generate execution errors, device-specific errors, or query errors; see the error definitions in this chapter.

Command Error Message Descriptions

This section lists the signal generator's command error messages and their associated descriptions.

Error Number	Error Description [description/explanation/examples]
-100	**Command error**
	This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that a command error as defined in IEE 488.2, 11.5.1.1.4 has occurred.
-101	**Invalid character**
	A syntactic command contains a character which is invalid for that type. For example, a header containing an ampersand, SETUP&. This error might be used in place of error numbers -114, -121, -141 and some others.
-102	**Syntax error**
	An unrecognized command or data type was encountered. For example, a string was received when the device does not accept strings.

-103   Invalid separator

The parser was expecting a separator and encountered an illegal character. For example, the semicolon was omitted after a program message unit.

-104   Data type error

The parser recognized a data element that is not allowed. For example, numeric or string data was expected, but block data was encountered.

-105   GET not allowed

A Group Execute Trigger was received within a program message (see IEEE 488.2, 7.7). Correct the HP-IB controller program so that the GET does not occur within a line of HP-IB program code.

-108   Parameter not allowed

More parameters were received than expected for the header. For example, the *ESE common command only accepts one parameter, so receiving *ESE 0,1 is not allowed.

-109   Missing parameter

Fewer parameters were received than required for the header. For example, the *ESE common command requires one parameter, so receiving *ESE is not allowed.

-110   Command header error

An error was detected in the header. This message is used when the device cannot detect the more specific errors described for errors -111 through -119.

-111   Header separator error

A character which is not a legal header separator was encountered while parsing the header.

-112   Program mnemonic too long

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

-113   **Undefined header**

The header is syntactically correct, but it is undefined for this specific device. For example, *XYZ is not defined for any device.

-114   **Header suffix out of range**

The value of a header suffix attached to a program mnemonic makes the header invalid.

-120   **Numeric data error**

This error, as well as errors -121 through -129, are generated when parsing a data element which appears to be numeric, including non-decimal numeric types. This particular error message is used if the device cannot detect a more specific error.

-121   **Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha in a decimal numeric or a "9" in octal data.

-123   **Exponent too large**

The magnitude of an exponent was greater than 32000 (see IEEE 488.2, 7.7.2.4.1).

-124   **Too many digits**

The mantissa of a decimal-numeric data element contained more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

-128   **Numeric data not allowed**

A legal numeric data element was received, but the device does not accept one in this position for the header.

-130   **Suffix error**

This error, as well as errors -131 through -139, are generated when parsing a suffix. This particular error message is used if the device cannot detect a more specific error.

-131   Invalid suffix

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for this device.

-134   Suffix too long

The suffix contained more than twelve characters (see IEEE 488.2, 7.7.3.4).

-138   Suffix not allowed

A suffix was encountered after a numeric element which does not allow suffixes.

-140   Character data error

This error, as well as errors -141 through -149, are generated when parsing a character data element. This particular error message is used if the device cannot detect a more specific error.

-141   Invalid character data

Either the character data element contains an invalid character or the particular element received is not valid for the header.

-144   Character data too long

The character data element contains more that twelve characters (see IEEE 488.2, 7.7.1.4).

-148   Character data not allowed

A legal character data element was encountered where prohibited by the device.

-150   String data error

This error, as well as errors -151 through -159, are generated when parsing a string data element. This particular error message is used if the device cannot detect a more specific error.

-151   Invalid string data

A string data element was expected, but was invalid (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.

-158   String data not allowed

A string data element was encountered, but not allowed by the device at this point in the parsing.

-160   Block data error

This error, as well as errors -161 through -169, are generated when parsing a block data element. This particular error message is used if the device cannot detect a more specific error.

-161   Invalid block data

A block data element was expected, but was invalid (see IEEE 488.2, 7.7.6.2). For example, an END message was received before the end length was satisfied.

-168   Block data not allowed

A legal block data element was encountered, but not allowed by the device at this point in the parsing.

-170   Expression data error

This error, as well as errors -171 through -179, are generated when parsing an expression data element. This particular error message is used if the device cannot detect a more specific error.

-171   Invalid expression

The expression data element was invalid, but was invalid (see IEEE 488.2, 7.7.7.2). For example, unmatched parentheses or an illegal character.

-178   Expression data not allowed

A legal expression data was encountered, but was not allowed by the device at this point in parsing.

-180   Macro error

This error, as well as errors -181 through -189, are generated when defining a macro or executing a macro. This particular error message is used if the device cannot detect a more specific error.

-181   `Invalid outside macro definition`

Indicates that a macro parameter placeholder (`$<number`) was encountered outside of a macro definition.

-183   `Invalid inside macro definition`

Indicates that the program message unit sequence, sent with a `*DDT` or a `*DMC` command, is syntactically invalid (see IEEE 488.2, 10.7.6.3).'

-184   `Macro parameter error`

Indicates that a command inside the macro definition had the wrong number or type of parameters.

Execution Error

An error number in the range [-299 to -200] indicates that an error has been detected by the instrument's execution control block. The occurrence of any error in this class will cause the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1) to be set. If this bit is set, one of the following events has occurred:

- A <PROGRAM DATA> element following a header was evaluated by the device as outside of its legal input range or is otherwise inconsistent with the device's capabilities.

- A valid program message could not be properly executed due to some device condition.

Execution errors will be reported by the device after rounding and expression evaluation operations have been completed. Rounding a numeric data element, for example, will not be reported as an execution error. Events that generate execution errors will not generate command errors, device-specific errors, or query errors; see the error definitions in this chapter.

Execution Error Message Descriptions

This section lists the signal generator's execution error messages and their associated descriptions.

Error Number   Error Description [description/explanation/examples]

-200   **Execution Error**

This is a generic syntax error for devices that cannot detect more specific errors. The code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

-201   **Invalid while in local**

Indicates that a command is not executable while the device is in local mode due to a hard local control (see IEEE 488.2, 5.6.1.5). For example, a device with a rotary switch receives a message which would change the switch's state, but the device is in local so the message cannot be executed.

-202   Settings lost due to rtl

Indicates that a setting associated with a hard local control (see IEEE 488.2, 5.6.15) was lost when the device changed to LOCS from REMS or to LWLS from RWLS.

-210   Trigger error

Indicates that a GET, *TRG, or a triggering signal could not be executed due to an error.

-211   Trigger ignored

Indicates that a GET, *TRG, or triggering signal was received and recognized by the device, but was ignored because of device timing considerations. For example, the device was not ready to respond.

-212   Arm ignored

Indicates that an arming signal was received and recognized by the device but was ignored.

-213   Init ignored

Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.

-214   Trigger deadlock

Indicates that a trigger source for the initiation of a measurement is set to GET and a subsequent measurement query is received. The measurement cannot begin until a GET is received, but the GET would cause an INTERRUPTED error.

-215   Arm deadlock

Indicates that the arm source for the initiation of a measurement is set to GET and a subsequent measurement query is received. The measurement cannot begin until a GET is received, but the GET would cause an INTERRUPTED error.

-220   Parameter error

Indicates that a program data element related error has occurred. This particular error message is used if the device cannot detect a more specific errors described for errors -221 through -229.

-221   `Settings conflict`

Indicates that a legal program data element was parsed but could not be executed due to the current device state (see IEEE 488.2 11.5.1.1.5).

-222   `Data out of range`

Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range defined by the device (see IEEE 488.2 11.5.1.1.5).

-223   `Too much data`

Indicates that a legal program data element of block, expression or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.

-224   `Illegal parameter value`

Used where exact value, from a list of possibilities, was expected.

-225   `Out of memory`

The device has insufficient memory to perform the requested operation.

-226   `Lists not same length`

Attempted to use LIST structure having individual LISTs of unequal length.

-230   `Data corrupt or stale`

Possibly invalid data. A new reading was started but not completed since last access.

-231   `Data questionable`

Indicates that the measurement accuracy is questionable.

-232   `Invalid format`

Indicates that a legal program data element was parsed but could not be executed because the data format or structure is inappropriate. For example, when loading memory tables or when sending a `SYSTem:SET` parameter for an unknown instrument.

-233   `Invalid version`

Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device. This particular error is used when file or block data elements are recognized by the instrument, but cannot be executed for reasons of version incompatibility. For example, a non- supported file version or a non- supported instrument version.

-240   `Hardware error`

Indicates that a legal program command or query could not be executed because of a hardware problem in the device. The definition of what constitutes a hardware problem is completely device-specific. This error is used when the device cannot detect the more specific errors described for errors -241 through -249.

-241   `Hardware missing`

Indicates that a legal program command or query could not be executed because of missing device hardware. For example, an option was not installed.

-250   `Mass storage error`

Indicates that a mass storage error has occurred. This message is used when a device cannot detect the more specific errors described for errors -251 through -259.

-252   `Missing media`

Indicates that a legal program command or query could not be executed because of missing media, for instance no disk in the disk drive. The definition of what constitutes missing media is device-specific.

-253   **Corrupt media**

Indicates that a legal program command or query could not be
executed because of corrupt media, for instance a bad disk or
incorrect disk format. The definition of what constitutes corrupt
media is device-specific.

-254   **Media full**

Indicates that a legal program command or query could not be
executed because the media was full. For example, there is was
no space left on the disk. The definition of what constitutes full
media is device-specific.

-255   **Directory full**

Indicates that a legal program command or query could not be
executed because the media directory was full. The definition
of what constitutes a full media directory is device-specific.

-256   **File name not found**

Indicates that a legal program command or query could not be
executed because the file name on the device media could not
be found. For Example, an attempt was made to read or copy a
nonexistant file. The definition of what constitutes a file not
being found is device-specific.

-257   **File name error**

Indicates that a legal program command or query could not be
executed because a file name on the device media was in error.
For example, an attempt was made to copy to a duplicate
filename. The definition of what constitutes a file name error is
device-specific.

-258   **Media protected**

Indicates that the device or user has attempted to write to a
read-only memory subsystem (msus). The definition of a media
protected is device-specific.

-260   **Expression error**

Indicates that an expression data element-related error
occurred. This error message is used when the device cannot
detect the more specific errors described for errors -261 through
-269.

-261   **Math error in expression**

Indicates that a syntactically legal expression program data
element could not be executed due to a math error. For
example, a divide-by-zero was attempted. The definition of a
math error is device-specific.

-270   **Macro error**

Indicates that a macro-related execution error occurred. This
error message is used when the device cannot detect the more
specific errors described for errors -271 through -279.

-271   **Macro syntax error**

Indicates that a syntactically legal macro program data
sequence, written in accordance with IEEE 488.2, 10.7.2, could
not be executed due to a syntax error within the macro
definition (see IEEE 488.2, 10.7.6.3).

-272   **Macro execution error**

Indicates that a syntactically legal macro program data
sequence could not be executed due to an error within the
macro definition (see IEEE 488.2, 10.7.6.3).

-273   **Illegal macro label**

Indicates that the macro label defined in the *DMC command
was a legal string syntax, but could not be accepted by the
device (see IEEE 488.2, 10.7.3 and 10.7.6.2). For example, the
label was too long, the same as a common command header, or
contained invalid header syntax.

-274   **Macro parameter error**

Indicates that the macro definition improperly used a macro
parameter placeholder (see IEEE 488.2, 10.7.3).

-275   **Macro definition too long**

Indicates that a syntactically legal macro program data
sequence could not be executed because the string or block
contents were too long for the device to handle (see IEEE
488.2, 10.7.6.1).

-276   **Macro recursion error**

Indicates that a syntactically legal macro program data
sequence could not be executed because the device found it to
be recursive (see IEEE 488.2, 10.7.6.4).

-277   **Macro redefinition not allowed**

Indicates that the macro label defined in the *DMC command
could not be executed because the macro label was already
defined (see IEEE 488.2, 10.7.6.4).

-278   **Macro header not found**

Indicates that a syntactically legal macro label in the *GMC?
query could not be executed because the header was not
previously defined.

-280   **Program error**

Indicates that a downloaded program-related execution error
occurred. This error message is used when the device cannot
detect the more specific errors described for errors -281 through
-289. The syntax used in a program and the mechanism for
downloading a program is device-specific.

-281   **Cannot create program**

Indicates that an attempt to create a program was unsuccessful.
This may be due to insufficient memory.

-282   **Illegal program name**

Indicates that the name used to reference a program was
invalid. For example, redefining an existing program, deleting a
nonexistent program, or in general, referencing a nonexistent
program.

-283   **Illegal variable name**

Indicates that an attempt was made to reference a nonexistent
variable.

-284   **Program currently running**

Indicates that certain operation related to programs may be
illegal while the program is running. For example, deleting a
running program may be illegal.

-285   `Program syntax error`

Indicates that a syntax error appears within a downloaded program. The syntax used when parsing a downloaded program is device-specific.

-286   `Program runtime error`

Indicates that a runtime error was detected in a downloaded program.

-290   `Memory use error`

Indicates that a user request has directly or indirectly caused an error related to memory or <data_handles>. This is not the same as "bad" memory.

-291   `Out of memory`

A downloaded program required more memory than was available in the instrument.

-292   `Referenced name does not exist`

A downloadecd program attempted to access an undefined element (a variable, constant, filename, etc.).

-293   `Referenced name already exists`

A downloadecd program attempted to define an element (a variable, constant, filename, etc.) that had already been defined.

-294   `Incompatible type`

Indicates that the type or structure of a memory item is inadequate.

Device-specific Error

An error number in the range [-399 to -300] or [1 to 32767] indicates that the instrument has detected an error which is not a command error, a query error, or an execution error; some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. The occurrence of any error in this class will cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set.

NOTE:

For positive error number descriptions see the section titled "ESG Series Signal Generator Instrument-Specific Error Messages."

The meaning of positive error codes is device-dependent and may be enumerated or bit mapped. The <error_message> string for positive error codes is not defined by SCPI, and is therefore left to the discretion of the designer. Note that the string is not optional. If the designer does not wish to implement a string for a particular error, the null string is sent (for example, `42," "`). The occurrence of any error in this class should cause the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1) to be set. Events that generate device-specific errors will not generate command errors, or query errors; see the other error definitions in this section.

Device-specific Error Message Descriptions

This section lists the signal generator's device-specific error messages and their associated descriptions.

Error Number   Error Description [description/explanation/examples]

-300   **Device-specific error**

This is a generic device-dependent error for devices that cannot detect more specific errors. The code indicates only that a device-dependent error as defined in IEEE 488.2, 11.5.1.1.6 has occurred.

-310   **System error**

Indicates that an error, termed "system error" by the device, has occurred. This code is device-dependent.

-311   `Memory error`

Indicates that an error was detected in the device's memory. The scope of this error is device-dependent.

-312   `PUD memory lost`

Indicates that the protected user data saved by the `*PUD` command has been lost.

-313   `Calibration memory lost`

Indicates that the non-volatile calibration data used by the `*CAL?` command has been lost.

-314   `Save/recall memory loss`

Indicates that the non-volatile data saved by the `*SAV?` command has been lost.

-315   `Configuration memory lost`

Indicates that non-volatile configuration data saved by the device has been lost. The meaning of this error is device-dependent.

-320   `Storage fault`

Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.

-321   `Out of memory`

Indicates that an internal operation needed more memory than was available.

-330   `Self-test failed`

Indicates that the device has detected a failure during its self-test procedure. The meaning of this error is device-dependent.

-340   `Calibration failed`

Indicates that the device has detected a failure during its calibration procedure. The meaning of this error is device-dependent.

-350   `Queue overflow`

This is a specific code entered into the queue in lieu of the code
that caused the error. This message indicates that there is no
more room in the queue and an error occurred but was not
recorded.

-360   `Communication error`

This is the generic communication error for devices that cannot
detect the more specific errors described for errors -361 through
-363.

-361   `Parity error in program message`

Indicates that the parity bit was not correct when data was
received. For example, an incorrect parity bit on a serial port.

-362   `Framing error in program message`

Indicates that a stop bit was not detected when data was
received. For example, a baud rate mismatch.

Query Error

An error number in the range [-499 to -400] indicates that the output queue control of the instrument has detected a problem with the message exchange protocol described in IEEE 4888.2, chapter 6. The occurrence of any error in this class will cause the query error bit (bit 2) to be set in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. If a query error occurs one of the following is true:

- An attempt is being made to read data from the output queue when no output is either present or pending.

- Data in the output queue has been lost.

Events that generate query errors will not generate command errors, execution errors, or device-specific errors; see the other error definitions in this section.

Query Error Message Descriptions

This section lists the signal generator's query error messages and their associated descriptions.

Error Number   Error Description [description/explanation/examples]

-400   **Query Error**

This is a generic query error for devices that cannot detect more specific errors. The code indicates only that a query error as defined in IEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

-410   **Query INTERRUPTED**

Indicates that a condition causing an INTERRUPTED query error occurred (see IEEE 488.2, 6.3.2.7). For example, a query was followed by **DAB** or **GET** before a response was completely sent.

-420   **Query UNTERMINATED**

Indicates that a condition causing an UNTERMINATED query error occurred (see IEEE 488.2, 6.3.2.2). For example, the device was addressed to talk and an incomplete program message was received.

-430   **Query DEADLOCKED**

Indicates that a condition causing a DEADLOCKED query error occurred (see IEEE 488.2, 6.3.1.7). For example, both the input buffer and the output buffer are full and the device cannot continue.

-440   **Query UNTERMINATED after indefinite response**

Indicates that a query was received in the same program message after a query requesting an indefinite response was executed (see IEEE 488.2, 6.3.7.5).

ESG Series Signal Generator Instrument-Specific Error Messages

Some instrument-specific error messages incorporate the negative or "generic" SCPI error number with the addition of device-dependent/instrument-specific (ESG Series Signal Generator-specific) information following the semicolon in the error message.

A positive error number indicates that the instrument has detected an error within the HP-IB system, within the instrument's firmware or hardware, during the transfer of block data, or during calibration.

Error Number Error Description [description/explanation/examples]

-100   `Command error;R0:No standby mode allowed.`

Indicates that in HP 8656/57 compatibility mode, `R0` was received via HP-IB. This command is not supported by the compatibility mode.

`Command error;Remote active function DN/UP not available.`

Indicates that in HP 8656/57 compatibility mode, either `DN` or `UP` was received via HP-IB. These commands are not supported by the compatibility mode.

`Command error;LO: No low bandwidth ALC mode allowed.`

Indicates that in HP 8656/57 compatibility mode, `LO` was received via HP-IB. This command is not supported by the compatibility mode.

-102   `Syntax error;Bad HP 8656/57 language character <character>.`

Indicates that in HP 8656/57 compatibility mode, illegal language input was received.

`Syntax error;Bad HP 8656/57 language token <token>.`

Indicates that in HP 8656/57 compatibility mode, a known command or termination specifier was received when it was not expected. For example, a termination specifier was received with no currently active function.

-213

`Init ignored;Unable to sweep due to sweep being in an error state. The sweep error should be fixed.`

Indicates that the number of list, power, and/or dwell points are in conflict, or a serious system error has occurred in list/sweep. A previous error report should have described the error that is stalling list/sweep.

`Init ignored;Cannot initiate sweep in manual mode.`

Indicates that the manual mode is on and therefore the instrument cannot sweep.

`Init ignored;Sweep is already initiated.`

Indicates that the list/sweep is currently initiated and sweeping, therefore the command is not legal according to SCPI.

`Init ignored;Sweep is already continuously initiated.`

Indicates that the list/sweep is continuously initiated and sweeping, therefore the command is not legal according to SCPI.

-221

`Settings conflict;Frequency list and dwell list are of unequal size. Set one list equal to size one, or make their sizes equal.`

Indicates that the frequency list has more than one element and the dwell list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;Frequency list and power list are of unequal size. Turn one list off, set one to size one, or make their sizes equal.

Indicates that the frequency list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;Power list and dwell list are of unequal size. Set one to size one, or make their sizes equal.

Indicates that the dwell list has more than one element and the power list has more than one element, and they are not of equal size. If any of the frequency, power, or dwell lists have more than one element, they must all have the same number. A list of a single element is the same as a list of equal size with the single element repeated the necessary number of times.

Settings conflict;The selected external trigger setting conflicts with the previous setting.

Indicates that the external trigger has been set to positive edge for one trigger source and negative edge for another trigger source.

Settings conflict;FM2/PM2 value set greater than FM1/PM1 value. FM1/PM1 changed to match FM2/PM2 value.

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM1/PM1 is enabled and FM2/PM2 is also enabled and an adjustment to either FM2/PM2 deviation causes the FM2 or PM2 deviation to be greater than the FM1 or PM1 deviation. It will also be reported when FM2/PM2 is being turned on, and the last FM1/PM1 deviation setting is less than the current FM2/PM2 deviation setting. In both cases the FM1/PM1 deviation will be adjusted to match the FM2/PM2 deviation.

`Settings conflict;FM1/PM1 value set less than FM2/PM2 value. FM2/PM2 changed to match FM1/PM1 value.`

The deviation of FM2/PM2 must always be less than or equal to the deviation settings for FM1/PM1. This error will be reported to the queue when FM2/PM2 is enabled and FM1/PM1 is also enabled and an adjustment to either FM1/PM1 deviation causes the FM1 or PM1 deviation to be less than the FM2 or PM2 deviation. It will also be reported when FM1/PM1 is being turned on, and the last FM2/PM2 deviation setting is greater than the current FM1/PM1 deviation setting. In both cases the FM2/PM2 deviation will be adjusted to match the FM1/PM1 deviation.

`Settings conflict;Enabled mod source conflicts with previously enabled mod source. Previous mod disabled.`

The signal generator has three sources: INT, EXT1, and EXT2 that are shared by the FM1/PM1, AM1/AM2, FM2/PM2, pulse (INT and EXT2), and burst envelope (EXT1 only). Each source can only be used by one of the modulations at a time. If a source is being used by an active modulation, and a request for the source is made by another modulation, the first modulation will be turned off, the second modulation will be turned on, and this error will be reported to the queue.

`Settings conflict;FM & PM not allowed.`

Indicates that there is a hardware conflict between FM and PM. The most recently requested modulation will be turned on, the previous modulation will be turned off, and this error will be reported to the queue.

`Settings conflict;Pattern repeat is changed to continuous because data source is external.`

Indicates that, while in non-bursted data generation, Pattern Repeat was in Single mode and data source has selected to be External.For non-bursted data generation using an external data source, Pattern Repeat must be in Continuous mode. To continue data transmission, Pattern repeat has been changed to Continuous mode.

-222   `Data out of range;Value clipped to lower limit.`

Indicates that an input value is below the minimum value
allowed. Examples are: frequency setting, reference, or offset;
output power; power reference and offset; modulation depth,
deviation, or modulation source frequency; number of points
and start/stop values for list mode; sequence or register values
(save/recall); dwell time.

`Data out of range;Value clipped to upper limit.`

Indicates that an input value is above the maximum value
allowed. Examples are: frequency setting, reference, or offset;
output power; power reference and offset; modulation depth,
deviation, or modulation source frequency; number of points
and start/stop values for list mode; sequence or register values
(save/recall); dwell time.

`Data out of range;Synthesizer: Frequency out of`
`bounds.`

Indicates that the instrument received an internal request for a
frequency outside of its supported frequency range. Report the
circumstances to the factory.

`Data out of range;Manual point exceeds list`
`sizes. Limiting to maximum point.`

Indicates that the sweep/list manual point has been reassigned
to a smaller number value due to the longest list decreasing in
size or being turned off. Its new value is the length of the
longest enabled list (frequency or power).

`Data out of range;Manual point exceeds`
`frequency list size. Limiting to maximum point.`

Indicates that the sweep/list manual point has been reassigned
to a smaller number value due to the longest list decreasing in
size or being turned off. Its new value is the length of the
frequency list which is the longest enabled list.

`Data out of range;Manual point exceeds power list size. Limiting to maximum point.`

Indicates that the sweep/list manual point has been reassigned to a smaller number value due to the longest list shrinking, or being turned off. Its new value is the length of the power list, which is the longest enabled list.

-223   `Too Much Data;The number of list points exceeds the maximum allowed.`

Indicates that a SCPI list has been entered that is longer than the maximum allowed length, which is also the maximum number of step points. This error can also be caused by attempting to copy items in the list editor when the list is already at its maximum length.

-230   `Data corrupt or stale;RAM copy of <filename>.`

The non-volatile RAM copy of a file is either corrupt or is out of date with the EEPROM master copy (if one exists). The system automatically re-initializes the file from EEPROM (if appropriate) or from a default algorithm. A potential cause is a failing backup battery.

`Data corrupt or stale;EEPROM copy of <filename>.`

The EEPROM copy of a file is either corrupt or otherwise unusable. The system automatically updates the non-volatile RAM copy of the EEPROM copy using a default initialization. The actual EEPROM file is left as it is. Report this problem to the factory.

-231   `Data questionable;RAM copy of <filename>.`

Indicates that the non-volatile RAM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing backup battery.

`Data questionable;EEPROM copy of <filename>.`

Indicates that the EEPROM copy of a file has a correctable error. The system automatically performs the correction. A potential cause is a failing EERPOM. Report this problem to the factory.

-241   `Hardware missing; <card_name>`

Indicates that a test communication to a hardware card failed. The instrument is most likely not functional. Contact the nearest HP sales and service office.

-250   `Mass storage error; EEPROM write timeout on <filename>.`

Indicates that the system was not able to program new data to an EEPROM. The system is still functional, but files written to EEPROM (such as updated calibration data) may be lost when the instrument's line power is cycled. Contact the nearest HP sales and service office.

-253   `Corrupt media;User File System`

Indicates that the main memory area used for storing instrument states and sequences as well as other data files is corrupt. The system will automatically clear and reconfigure this memory area. A potential cause is a failing backup battery. Another potential cause could be the loss of line power to the instrument in the middle of a write operation.

`Corrupt media;<media_name>`

Indicates that a source media (possibly EEPROM) for a data file is corrupt. This error is usually seen in conjunction with errors concerning a certain file.

-254   `Media full; Unable to delete saved state from non-volatile memory. No instrument state change.`

Indicates that the state memory subsystem **STATE:** was unable to delete a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

`Media full; Save a state register ignored.`

Indicates that the state memory subsystem **STATE:** did not have enough room to save a register. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

Media full; Save a state register failed. State marked available.

Indicates that the state memory subsystem **STATE:** did not have enough room to save a register, so the register was lost and is now marked available. You must free some memory by deleting a file or register using Catalog. Afterwards, try again.

-256 **File name not found;The internal list file was not found. There is no list data to return**

Indicates that the **DWEL_FILE, FREQ_FILE, POW_FILE,** or **SEQ_FILE** has been lost, so a new one will have to be created. These files are the persistent information for list/sweep mode. They contain the dwell list, the frequency list, the power list, and the sequence list.

-257 **File name error;Delete empty sequence <sequence_name>. Delete sequence ignored.**

Indicates that the user has attempted to delete a sequence which is empty (all registers unused). This is informational only. Typically this error is reported (several times) when the "Delete All Sequences" command is executed.

File name error;Delete a non-saved state register. Delete register ignored.

Indicates that the user has attempted to delete a state which is empty (unused). This is informational only.

File name error;Directory does not support extenders.

Indicates that an extender, which is specified by an @ sign followed by an memory subsystem name, has been specified for an explicit memory subsystem which does not allow the @ notation. Only the default (:) memory subsystem allows extenders.

File name error;Empty filename

Indicates that a filename of " " was specified. This is not a legal filename.

File name error;Illegal extender

Indicates that an illegal memory subsystem name was used after the @. A supported value is @STATE.

File name error;Illegal filename character

Indicates that an illegal character was used within a filename. \, :, @ and all non-printable ASCII characters are illegal in filenames.

File name error;Only one ":" is allowed.

Indicates that only one colon is allowed in any filename specification. The text before the colon is a user memory subsystem. The valid user choices are :, DEFAULT:, and STATE:.

File name error;Only one "@" is allowed.

Indicates that only one @ is allowed in any filename specification. It specifies the memory subsystem that a user file actually resides in.

-286   **Program runtime error;Floating-Point Exception**

Indicates that a floating-point math error (such as a divide by zero) has been detected. The system will attempt to recover automatically. Report the circumstances to the nearest HP sales and service office.

-310   **System error;RS232 buffer overflow: character lost.**

Indicates that the RS232 buffer has been exceeded. The most recent character has been dropped.

System error;Cannot change manual point until list mode error condition cleared.

An error is keeping the sweep/list from being able to set the frequency and/or power. Until the problem is addressed, the manual point cannot be changed.

-311   **Memory error;Unable to configure Save Recall registers from non-volatile memory. Save Recall registers re-initialized.**

Indicates that saved states are no longer usable. Delete explicitly using Catalog. Delete **SAV_RCL_CONFIG@STATE** also.

-321   **Out of memory;Unable to verify instrument state file.**

Indicates that an instrument state file could not be accessed and verified because of insufficient memory. Reduce list size and try again.

Out of memory;Memory catalog failed.

Indicates that there is not enough memory to complete a catalog listing. Reduce list size and try again.

Out of memory;Cannot uncompress file.

Indicates that a **STATE:** file cannot be uncompressed because there is not enough memory to run the decompression algorithm. Recall will fail and there will be no instrument state change. Reduce list size and try again.

Out of memory;Cannot precalculate frequencies. Try fewer frequencies.

Indicates that memory was exhausted during frequency precalculation (used to speed the process of sweep/list mode). List mode cannot run until either fewer frequencies have been supplied, more memory becomes available and the same set of frequencies are sent again, **FREQ:MODE CW** is executed, or **:FREQ:MODE LIST** is executed.

Out of memory;Object Memory Area

Indicates that memory was exhausted during instrument power-on. Report the circumstances to the factory.

`Out of memory;List formation`

The device was unable to allocate space for a lookup table, such as for list mode precalculation. List mode cannot run until either fewer frequencies have been supplied, more memory becomes available and the same set of frequencies are sent again, `FREQ:MODE CW` is executed, or `:FREQ:MODE LIST` is executed.

`Out of memory;Display system out of memory. An abonormal display may result. Memory consumption should be reduced.`

There was not enough memory in the system to properly update the display. Some inconsistencies may be seen. The size of any list/sweep should be reduced, and the source should be preset to clear up any inconsistencies. Report the circumstances to the nearest HP sales and service office.

-330
`Self-test failed;Power supply self-test failure`

Indicates that the self-test for a particular power supply voltage has failed. The instrument is likely not functional. Contact the nearest HP sales and service office.

`Self-test failed;EEPROM header checksum error <card_name>.`

Indicates that the card identification header for a hardware card is incorrect. If the card is not properly identified, the instrument is likely to be non-functional. Schedule repairs.

208
`I/O error;Unable to delete saved state from non-volatile memory. No instrument state change.`

Indicates that a `STATe:` file could not be deleted due to the file not being found, file corruption, or another file-related problem. If file is displayed by catalog, delete it explicitly.

`I/O error;Save a state register ignored.`

Indicates that a `STATe:` file could not be saved due to insufficient space, file corruption, or another related problem.

`I/O error;Delete empty sequence`
`<sequence_name>. Delete sequence ignored.`

Indicates that the user has attempted to delete a sequence that is empty. This error message is informational only. Typically, this error is reported several times when the "Delete All Sequences" command is executed. If the file is displayedby Catalog, delete explicitly.

`I/O error;Delete a non-saved state register.`
`Delete register ignored.`

Indicates that the user has attempted to delete an unused (empty) state. This error message is informational only.

`I/O error;Trailing zero found in <filename>.`
`Fixing...`

Indicates that a compressed state file has a zero at its end. This is a sign of file corruption. The device fixes the problem by concealing the zero such that it no longer triggers an error message.

`I/O error;Unable to recall from non-volatile`
`memory. No instrument state change.`

Indicates that the state file is not readable and the recall was aborted.

214   `Not owner;Unable to delete saved state from`
            `non-volatile memory. No instrument state`
            `change.`

Indicates that the user has attempted to write to a read-only memory subsystem.

501   `Attenuator hold setting over range;Frequency`
            `change forced attenuator adjust.`

Indicates that the firmware has changed the attenuator setting because, while in attenuator hold mode, a change in frequency setting has forced the ALC beyond its range.

Attenuator hold setting over range;Power set to lower limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is below the ALC range for the attenuator setting. The power has been set to the lower limit.

Attenuator hold setting over range;Power set to upper limit.

Indicates that the firmware has changed the power setting to a value other than the requested value due to the fact that, while in attenuator hold mode, the user has requested a power setting that is above the ALC range for the attenuator setting.

517   **Calibration failure;DCFM DC overrange**

Indicates that the instrument was unable to perform a DCFM calibration due to the input signal being outside of the offset range that can be calibrated for.

Calibration failure;Upgrade calibration failed. Data not stored.

Indicates that the calibration stage of the instrument upgrade was not executed successfully. The calibration data has not been stored. The upgrade is not functional. Contact the nearest HP sales and service office.

600   **RPP has tripped.**

Indicates that the reverse power protection circuit has been triggered. Repeated tripping of this circuit can cause damage to the instrument.

601   **Power search failed.**

Indicates that, while executing power search, the level meter circuit failed to return a meaningful value. This event indicates that the power is in a range that the leveling loop cannot properly level. The power will be set to the last properly leveled power.

605   `DSP FW download failed.`

Indicates that the instrument's firmware was unable to successfully initialize the internal DSP. Report the circumstances to the nearest HP sales and service office.

606   `DSP times out.`

Indicates that the DSP failed to respond within the appropriate amount of time. Report the circumstances to the nearest HP sales and service office.

607   `DSP returns error`

Indicates that the DSP is in an indeterminate state. Report the circumstances to the nearest HP sales and service office.

608   `DSP in use by other process.`

Indicates that the DSP is in an indeterminate state. Report the circumstances to the nearest HP sales and service office.

615   `New wave shape changes limit for internal frequency;frequency changed to new limit.`

When using the internal modulation source, the upper limit varies for the different waveforms. If the user changes the waveform when the internal source frequency is higher than that allowed for the new waveform, the frequency for the source will be changed, and the user informed of that change with this message.

700   `State Save Recall Error;Recall aborted. Unable to recall the state from non-volatile memory.`

This indicates that the state file was not readable, so the recall was aborted. If state file exists, delete explicitly using catalog.

`State Save Recall Error;Recalled state has a bad checksum. No instrument state change.`

This indicates that the state file was corrupt or out-of-date, so the recall was ignored. If state file exists, delete explicitly using catalog.

State Save Recall Error;Recall data different from FW revision. No instrument state change.

Indicates that the state file was corrupt or out-of-date, so the recall was ignored. If state file exists, delete explicitly using catalog.

State Save Recall Error;Recall non-saved state register. Recall ignored.

Indicates that a recall was attempted for a state register that is unused. If state file exists, delete explicitly using catalog.

State Save Recall Error;Delete sequence <sequence_name> ignored.

Indicates that a **STATE:** file in a sequence that is being deleted could not be deleted due to the file not being found, data corruption, etc. If state file exists, delete explicitly using catalog.

Returning Your Signal Generator to HP

If you are returning your signal generator to HP for servicing, fill out and attach a blue repair tag to the instrument. Repair tags are located at the end of this chapter.

Include as much information as possible about the problem: record any error messages that appeared on the display, and include performance test results or any other specific data on the performance of the signal generator.

Ship the instrument in the original factory packaging materials, if they are available. If not, use similar packaging to properly protect the instrument.

Return the instrument to the nearest HP sales and service office. A list of sales and service offices follows on the next page.

HP Sales and Service Offices

US FIELD OPERATIONS			
Headquarters Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014, USA (800) 752-0900	**California, Northern** Hewlett-Packard Co. 301 E. Evelyn Mountain View, CA 94041 (415) 694-2000	**California, Southern** Hewlett-Packard Co. 1421 South Manhattan Ave. Fullerton, CA 92631 (714) 999-6700	**Colorado** Hewlett-Packard Co. 24 Inverness Place, East Englewood, CO 80112 (303) 649-5512
Atlanta Annex Hewlett-Packard Co. 2124 Barrett Park Drive Kennesaw, GA 30144 (404) 648-0000	**Illinois** Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 255-9800	**New Jersey** Hewlett-Packard Co. 150 Green Pond Road Rockaway, NJ 07866 (201) 586-5400	**Texas** Hewlett-Packard Co. 930 E. Campbell Rd. Richardson, TX 75081 (214) 231-6101

EUROPEAN FIELD OPERATIONS			
Headquarters Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (41 22) 780.8111	**France** Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courta- boeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	**Germany** Hewlett-Packard GmbH Hewlett-Packard Strasse 61352 Bad Homburg v.d.H Germany (49 6172) 16-0	**Great Britain** Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG41 5DZ England (44 734) 696622

INTERCON FIELD OPERATIONS			
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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO.   EXT.

MODEL NO.   SERIAL NO.

MODEL NO.   SERIAL NO.

P.O. NO.   DATE

Accessories returned with unit

☐ NONE   ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER _____
over

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

_____

_____

_____

_____

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_____

If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

9320-3896   Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

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If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

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Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

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If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

9320-3896   Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

_____

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_____

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_____

If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

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Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

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If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

9320-3896   Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL
CONTROL SETTINGS_____

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If unit is part of system list model
number(s) of other interconnected in-
struments. _____

_____

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4   Front and Rear Panel

This chapter contains descriptions of the keys and connectors and other hardware on the front and rear panels. It also describes which information is displayed in the various parts of the display.

Front Panel Overview
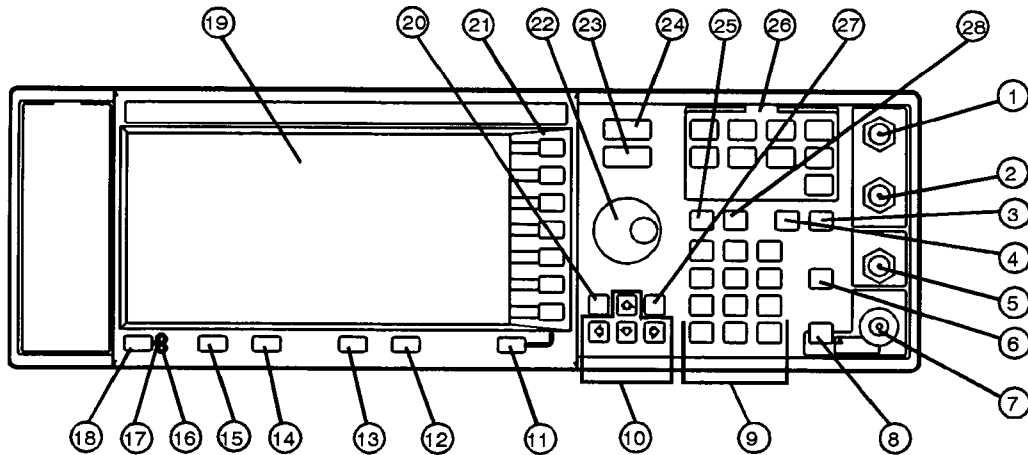
pk724a

1. EXT 1 INPUT Connector

This female BNC input connector accepts a 1 Vpeak signal for FM, ΦM, and AM. For all these modulations, ±1 Vpk produces the indicated deviation or depth. When AC-coupled inputs are selected for FM, ΦM, or AM, HI/LO annunciators will light if the peak input voltage differs from 1.0 V by more than 3%. The input impedance is 50Ω. The damage levels are 5 V_{rms} and 10 Vpk. If you configure your signal generator with Option 1EM, this input is relocated to a rear panel, female BNC connector.

2. EXT 2 INPUT Connector

This female BNC input connector accepts a 1 Vpeak signal for FM, ΦM, AM, and pulse modulation. With FM, ΦM, or AM, ±1 Vpk produces the indicated deviation or depth. With pulse modulation, +1 V is on and 0 V is off. When AC-coupled inputs are selected for FM, ΦM, or AM, HI/LO annunciators will light if the peak input voltage differs from 1.0 V by more than 3%. The input impedance is 50Ω. The damage levels are 5 V_{rms} and 10 Vpk. If you configure your signal generator with Option 1EM, this input is relocated to a rear panel, female BNC connector.

3. Help Key

Press this hardkey for a short textual description of the function of the front panel hardkeys and softkeys. Press any other key and you will be returned to normal instrument operation.

4. Trigger Key

Press this hardkey to trigger a step or list sweep.

5. LF OUTPUT Connector

This female BNC connector is the output connector for modulation signals generated by the LF source function generator. You can also output signals where the frequency and shape are set by the internal source as it is being used by a modulation. For pulse modulation, however, the internal source is a sinewave which is later squared by the modulator to generate the pulse squarewave. This output is capable of driving 3.5 Vpk into a 50Ω load. If you configure your signal generator with Option 1EM, this input is relocated to a rear panel, female BNC connector.

6. Mod On/Off Key

This hardkey toggles all modulation signals on and off. Although you can set up and enable various modulation states, the RF carrier is not modulated until **Mod On/Off** is set to **On**. An annunciator is always turned on in the display to indicate whether modulation is turned on or off.

7. RF OUTPUT Connector

This female Type-N connector is the output connector for RF signals. The source impedance is 50Ω. The damage levels are 50 Vdc, 50 W at ≤ 2 GHz, and 25 W at > 2 GHz maximum. The reverse power protection circuit will trip, however, at nominally 1 watt. If you configure your signal generator with Option 1EM, this output is relocated to a rear panel female Type-N connector.

8. RF On/Off Key

This hardkey toggles the RF signal on and off at the RF OUTPUT connector. An annunciator is always turned on in the display to indicate whether RF is turned on or off.

9. Numeric Keypad

The numeric keypad consists of the digit keys (0 through 9), a decimal point key, and a backspace key, $\boxed{+/-\!\leftarrow}$. The backspace key has dual functions for both backspacing and for changing the sign of a value to positive or negative. Use these keys at any time when the active function requires a value input.

10. Arrow Keys

The up and down arrow keys increase or decrease a numeric value. You can also use these keys to scroll through displayed lists to select items. The left and right arrow keys choose the highlighted digit in the active function display, which is modified by the up and down arrow keys. You can also use these keys in a list to select items in a row.

11. Return Key

The **Return** key moves you from your current softkey menu to the softkey menu that precedes it. It will back up through the menus of the current hardkey until you reach the first menu of that key.

12. Display Contrast Decrease Key

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display.

13. Display Contrast Increase Key

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display.

14. Local Key

Press this key to return the signal generator to local (front panel) control from remote operation.

15. Preset Key

Press this key to set the signal generator to a known state (either the factory-defined state or a user-defined state).

16. Standby LED

This yellow LED lights when the instrument is in standby condition. In standby, the power switch is off but the instrument is still connected to the mains circuit by way of the power cord.

17. Line Power LED

This green LED lights when power is cycled on to the signal generator.

18. Power Switch

Pressing this hardkey turns power to the signal generator either on (green LED on) or to standby (yellow LED on).

19. Display

The LCD display provides information on the current instrument state such as modulation status, frequency and amplitude settings, status indicators, and error messages. Softkey labels corresponding to their adjacent keys are located on the right-hand side of the display.

20. Hold Key

Press this hardkey to de-activate the current active function and blank the softkey menu. Once **Hold** is pressed, the front panel knob, the arrow keys, and the numeric keypad have no effect. To return to normal operation, press any front panel hardkey.

21. Softkeys

Press a softkey to activate the function indicated by the label on the display directly to the left of the softkey.

22. Knob

The knob increases or decreases a numeric value. Any of the values that can be set through the numeric keypad or the step keys can also be set using the knob.

23. Amplitude Key

Press this hardkey to activate the power level amplitude function so that you can change the amplitude of the RF output.

24. Frequency Key

Press this hardkey to activate the frequency function so that you can change the frequency of the RF output.

25. Save Key

This hardkey lets you save up to 100 different instrument states in a combination of 100 memory registers and 10 register sequences.

26. Menu Keys

These hardkeys provide access to the signal generator's primary functionality. Press these keys for access to softkey menus where you can configure modulations, step and list sweeps, and various frequency and power capabilities.

27. Incr Set Key

Press this hardkey to cancel the highlighted digit in the active function display which allows you to enter an arbitrary increment size.

28. Recall Key

This hardkey lets you restore any instrument state that you previously saved in a memory register. You can save up to 100 different instrument states in a combination of 100 memory registers and 10 register sequences.

Display Annotation

FREQUENCY

AMPLITUDE
ALC OFF
or

R L UNLOCK EXT REF OVEN COLD   ATTEN HOLD UNLEVEL   RF   MOD
T S SWEEP EXT1 LO EXT2 HI AM FM PULSE   ERR   OFF   OFF
—or—   —or—
ARMED   ΦM

ERROR: -222, Data out of range
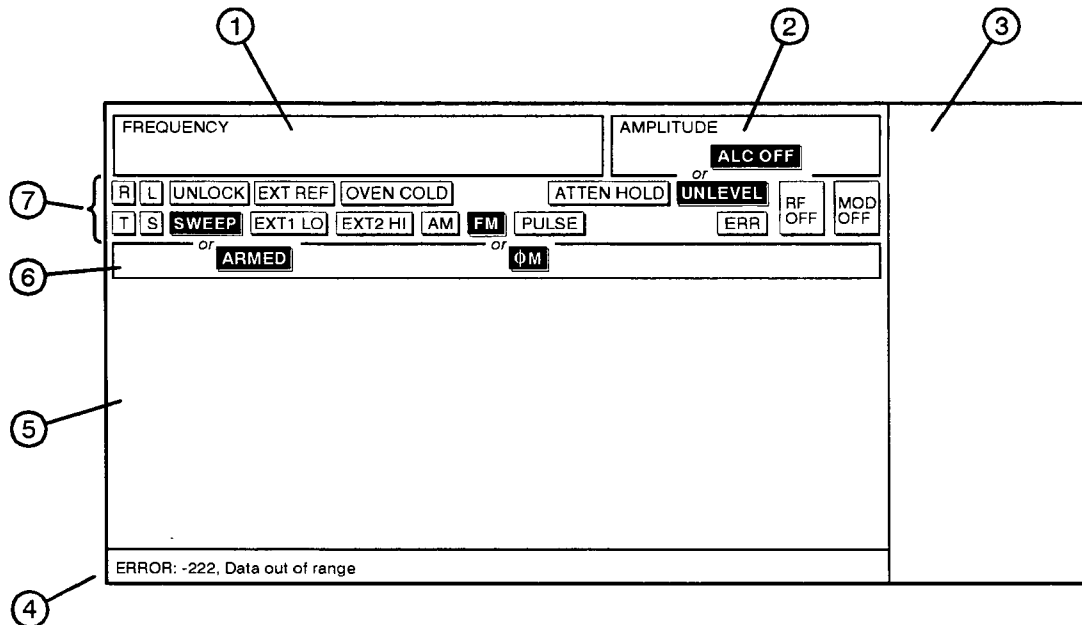
pk764a

1. **Frequency Area**

> The current CW frequency setting is shown in this portion of the display.
> Indicators are also displayed in this area when a frequency offset or multiplier is
> set or if frequency reference mode is turned on.

2. **Amplitude Area**

> The current output power level setting is shown in this portion of the display.
> Indicators are also displayed in this area when an amplitude offset is set or if
> amplitude reference mode is turned on.

3. Softkey Labels

These labels define the function of the corresponding softkeys immediately to the right of the label.

4. Error Messages Area

Error messages are reported in this space. When multiple error messages occur, only the most recent message remains displayed. All of the reported error messages can be viewed by pressing **Utility, Error Info, View Next Error Message**.

5. Text Area

This area is used to display status information about the signal generator such as the modulation status, to enter information such as creating sweep lists, and to manage information such as displaying the catalog of files and deleting unwanted files.

6. Active Entry Area

The current active function is shown in this area. For example, if frequency is the active function, the current setting will be displayed in the active entry area and that setting will change as you enter a new value. If the active function has an increment value associated with it, that value is displayed here also.

7. Annunciators

The display annunciators show the status of some of the signal generator functions and indicate error conditions of the instrument. The following annunciators are available:

ΦM	This annunciator is turned on when phase modulation is turned on. A second annunciator, **FM**, will appear in the same position if frequency modulation is turned on. Frequency modulation and phase modulation cannot be turned on at the same time so the two annunciators will never conflict.
ALC OFF	This annunciator is turned on when the automatic leveling control circuit is disabled. A second annunciator, **UNLEVEL**, will appear in the same position if the signal generator's automatic level control is unable to maintain the output level. When the ALC is disabled, the unleveled annunciator has no meaning so these annunciators will never conflict.
AM	This annunciator is turned on when amplitude modulation is turned on.

ARMED	This annunciator is turned on when a sweep has been initiated and the signal generator is waiting for the sweep trigger event.
ATTEN HOLD	This annunciator is turned on when the attenuator hold function is turned on. When this function is on, the attenuator is frozen at its current setting.
ERR	This annunciator is turned on when an error message is placed in the error queue. This annunciator will not turn off until you clear the error queue of all error messages. You can view and delete error messages using the **Utility** menu.
EXT1 LO/HI	This annunciator toggles between **EXT1 LO** and **EXT1 HI**. This annunciator is turned on if the AC-coupled signal to the EXT 1 input is less than 0.97 Vpk or greater than 1.03 Vpk.
EXT2 LO/HI	This annunciator toggles between **EXT2 LO** and **EXT2 HI**. This annunciator is turned on if the AC-coupled signal to the EXT 2 input is less than 0.97 Vpk or greater than 1.03 Vpk.
EXT REF	This annunciator is turned on when an external 1, 2, 5, or 10 MHz frequency reference is in use.
FM	This annunciator is turned on when frequency modulation is turned on. A second annunciator, **ΦM**, will appear in the same position if phase modulation is turned on. Frequency modulation and phase modulation cannot be turned on at the same time so the two annunciators will never conflict.
L	The **L** annunciator is turned on when the signal generator is in the listen mode and receiving information or commands over the HP-IB.
MOD OFF	This annunciator toggles between **MOD OFF** and **MOD ON** and is always visible in the display. This annunciator indicates whether the modulations which you have enabled are modulating the RF carrier.
OVEN COLD	This annunciator is turned on when the temperature of the internal ovenized reference oscillator has dropped below an acceptable level. When this annunciator is turned on, frequency accuracy will be degraded. This condition should only occur if the signal generator has been disconnected from the mains for a long period of time.
PULSE	This annunciator is turned on when pulse modulation is turned on.

R	The R annunciator is turned on when the signal generator is in remote HP-IB operation.
RF OFF	This annunciator toggles between RF OFF and RF ON and is always visible in the display. This annunciator indicates whether the RF signal is present at the RF OUTPUT connector.
S	The S annunciator is turned on when the signal generator is receiving a service request (SRQ) over the HP-IB.
SWEEP	This annunciator is turned on when the signal generator is sweeping in list or step mode.
T	The T annunciator is turned on when the signal generator is in the talk mode and is transmitting information over the HP-IB.
UNLEVEL	This annunciator is turned on when the signal generator is unable to maintain the correct output level. The UNLEVEL annunciator is not necessarily an indication of instrument failure. Unleveled conditions can occur during normal operation. A second annunciator, ALC OFF, will appear in the same position when the automatic leveling control circuit is disabled. When the ALC is disabled, the UNLEVEL annunciator has no meaning so these annunciators will never conflict.
UNLOCK	This annunciator is turned on when any of the signal generator's phase locked loops are unable to maintain phase lock. You can determine which loop is unlocked by interrogating the error messages.

Rear Panel Overview
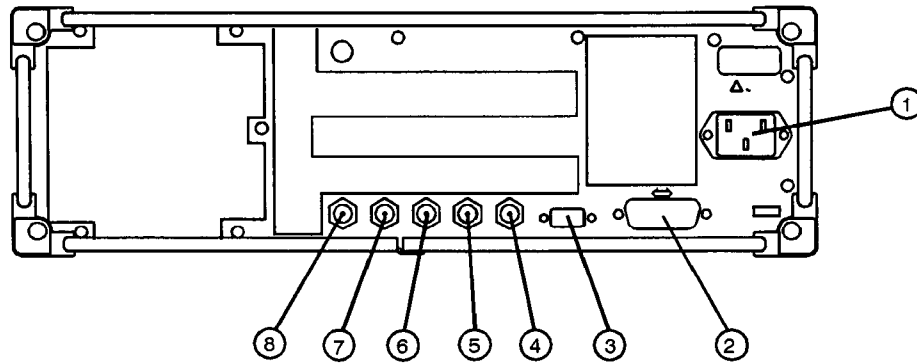
pk704a

1. AC Power Receptacle

The power cord receptacle accepts a three-pronged cable that is shipped with the instrument. The line voltage is connected here.

2. HP-IB Connector

The HP-IB connector allows communications with compatible devices such as power meters and external controllers.

3. AUXILIARY INTERFACE Connector

This male DB-9 connector is an RS-232 serial port which can be used for remotely controlling the signal generator. The following table shows the description of the pinouts.

Pin Number	Signal Description	Signal Name
1	No Connection	
2	Receive Data	RECV
3	Transmit Data	XMIT
4	+5 V	
5	Ground, 0 V	
6	No Connection	
7	Request to Send	RTS
8	Clear to Send	CTS
9	No Connection	

```
5●  4●  3●  2●  1●
  9●  8●  7●  6●
```
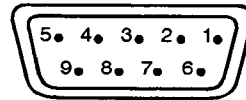
View looking into
rear panel connector

pk763a

4. SWEEP OUT Connector

This female BNC connector provides a voltage range of 0 to +10 V. When the signal generator is sweeping, the SWEEP OUT signal ranges from 0 V at the beginning of the sweep to +10 V at the end of the sweep regardless of the sweep width. In CW mode this connector has no output. The output impedance is less than 1Ω and can drive $2\ k\Omega$.

5. TRIGGER OUT Connector

This female BNC connector outputs a TTL signal that is asserted high at the start of a dwell sequence, or at the start of waiting for the point trigger in manual sweep mode, and low when the dwell is over, or when the point trigger is received. The logic can be reversed.

6. TRIGGER IN Connector

This female BNC connector accepts a TTL signal for triggering point-to-point in manual sweep mode. Triggering can occur on either the positive or negative edge. The damage level is $\geq$ +10 V or $\leq$ –4 V.

7. 10 MHz IN Connector

This female BNC connector accepts a –3.5 to +20 dBm signal from an external timebase reference which is within ±10 ppm (standard timebase) or ±1 ppm (high stability timebase). The nominal input impedance is 50Ω. The signal generator detects when a valid reference signal is present at this connector and automatically switches from internal to external reference operation.

8. 10 MHz OUT Connector

This female BNC connector provides a nominal signal level of +7 dBm ±2 dB, and output impedance of 50Ω. The accuracy is determined by the timebase used.

5 Hardkey and Softkey Reference

This chapter describes each front panel hardkey and each softkey associated with the hardkey. The SCPI programming commands are listed in addition to normal preset and power-on conditions. The chapter is organized alphabetically by front panel hardkey.

AM

Pressing the front panel **AM** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.

pk736a
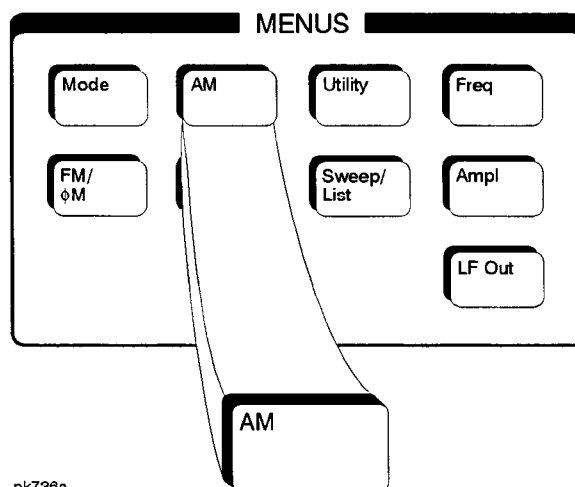
AM Depth

This softkey sets the amplitude modulation depth, in percent, for the **AM Path 1** and **AM Path 2** configurations. To change the value of the AM depth, press the softkey once. The current value for AM depth is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **%** terminator softkey. The range of values allowed is 0.1 to 100%. Notice that the new value of AM depth applies only to whichever AM path configuration (**AM Path 1** or **AM Path 2**) you have currently selected.

Softkey Location: Press **AM**, **AM Depth**

Status after Normal Preset: 0.1%

SCPI Commands:

    [:SOURce]:AM[1]|2[:DEPTh] <val><PCT>

    [:SOURce]:AM[1]|2[:DEPTh]?

AM Depth Couple Off On

This softkey toggles the AM depth coupling on and off. AM depth coupling links the AM depth values of **AM Path 1** and **AM Path 2**. When the values are coupled, any change you make to one AM depth value is applied to both AM depth values.

Softkey Location: Press **AM, AM Depth Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:AM[1]|2:[DEPTh]:TRACk ON|OFF|1|0

[:SOURce]:AM[1]|2:[DEPTh]:TRACk?

AM Off On

This softkey enables the amplitude modulation for whichever AM path configuration (**AM Path 1, AM Path 2,** or **AM Path WB**) you have selected. Notice, however, that although you can enable amplitude modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

There are two paths for AM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **AM, AM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:AM[1]|2:STATe ON|OFF|1|0

[:SOURce]:AM[1]|2:STATe?

AM Path 1 2

Use **AM Path 1** and **AM Path 2** to define two unique amplitude modulation configurations. For example, select **AM Path 1**. (**AM Path 1** is the default after a normal preset. If **AM Path 1** is not highlighted, press the **AM Path 1 2** softkey until the selection toggles to **AM Path 1**.) Configure the modulation characteristics (such as depth, source, rate, and waveform) using the remaining softkeys in the AM menu. Then enable AM by setting **AM Off On** to **On**.

To configure a second amplitude modulation configuration, toggle to **AM Path 2**. Define the modulation characteristics for this second configuration and enable AM by setting **AM Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

AM Path 1 and **AM Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

Softkey Location: Press **AM**, **AM Path 1 2**

Status after Normal Preset: AM Path 1

AM Rate

Use this softkey to change the internal modulation frequency for the **AM Path 1** and **AM Path 2** configurations. To change the value, press the softkey once. The current value for AM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) Notice that the new value of AM rate applies only to whichever AM configuration (**AM Path 1** or **AM Path 2**) you have currently selected.

Softkey Location: Press **AM, AM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:AM[1]|2:INTernal[1]:FREQuency?

AM Source

Pressing this softkey reveals a menu of choices for amplitude modulation sources. You can choose internally-generated amplitude modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated AM depth settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

The internal and external 1 and 2 sources have multiple uses. You can use them for amplitude, frequency, and phase modulation. For pulse modulation you must use the external 2 source. However, any given source can only be routed to one enabled modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes the external 1 AC-coupled source is the same as the external 1 DC-coupled source and the external 2 AC-coupled source is the same as the external 2 DC-coupled source.

Softkey Location: Press **AM, AM Source**

Status after Normal Preset: INT

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce?

AM Waveform

Pressing this softkey reveals a menu of AM waveform choices for your **AM Path 1** and **AM Path 2** configurations. Select from sine, triangle, square, ramp, and noise waveforms. Notice that your waveform selection applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:AM[1]|2:INTernal[1]:FUNCTion SHAPe?

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, amplitude modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes, the external 1 AC-coupled source is the same as the external 1 DC-coupled source.

Softkey Location: Press **AM, AM Source, Ext 1 AC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXT[1]

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, amplitude modulation signal to the EXT 1 INPUT connector.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration.

Softkey Location: Press **AM, AM Source, Ext 1 DC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXT[1]

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:AM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, amplitude modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 2 source, the signal generator would turn off **FM Path 1** and assign the external 2 source to your **AM Path 2** configuration.

Softkey Location: Press **AM, AM Source, Ext 2 AC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXT2

[:SOURce]:AM[1]|2:EXTernal[2]:COUPling AC

[:SOURce]:AM[1]|2:EXTernal[2]:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, amplitude modulation signal to the EXT 2 INPUT connector.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 2 source, the signal generator would turn off **FM Path 1** and assign the external 2 source to your **AM Path 2** configuration.

Softkey Location: Press **AM, AM Source, Ext 2 DC-Coupled**

Status after Normal Preset: AM Source is set to Internal

SCPI Commands:

[:SOURce]:AM[1]|2:SOURce EXT2

[:SOURce]:AM[1]|2:EXTernal[2]:COUPling DC

[:SOURce]:AM[1]|2:EXTernal[2]:COUPling?

Internal

This softkey lets you connect an internally-generated, calibrated signal to the AM modulator. The default state of the internal waveform generator is a 400 Hz sinewave with 0.1% depth.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the internal source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the internal source, the signal generator would turn off **FM Path 1** and assign the internal source to your **AM Path 2** configuration.

Softkey Location: Press **AM, AM Source, Internal**

SCPI Commands:

[:SOURce]:AM[1]l2:SOURce INT[1]

[:SOURce]:AM[1]l2:SOURce?

Noise

This softkey lets you specify noise as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform, Noise**

SCPI Commands:

[:SOURce]:AM[1]l2:INTernal[1]:FUNCtion:SHAPe NOISe

[:SOURce]:AM[1]l2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform, Ramp**

SCPI Commands:

[:SOURce]:AM[1]l2:INTernal[1]:FUNCtion:SHAPe RAMP

[:SOURce]:AM[1]l2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform, Sine**

SCPI Commands:

> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe SINE
>
> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform, Square**

SCPI Commands:

> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe SQUare
>
> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the amplitude modulation waveform for the **AM Path 1** and **AM Path 2** configurations. Notice that the selected waveform applies only to whichever AM path configuration you have currently selected.

Softkey Location: Press **AM, AM Waveform, Triangle**

SCPI Commands:

> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe TRIangle
>
> [:SOURce]:AM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ampl

Pressing the front panel **Ampl** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.

pk742a
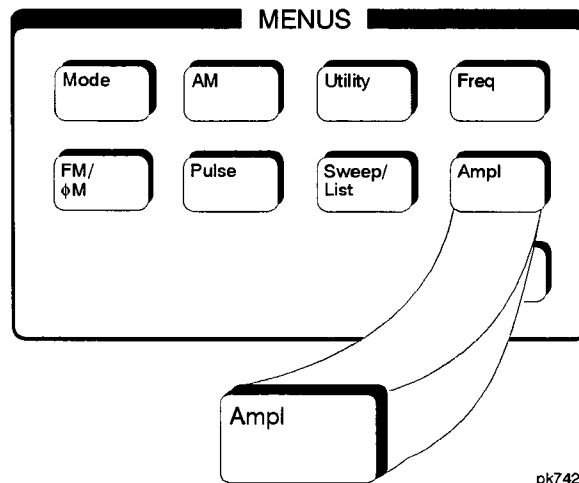
ALC Off On

This softkey toggles the automatic leveling control (ALC) circuit off and on.

The ALC is normally on. The RF output power of the signal generator is constantly monitored and controlled by the ALC circuit. Its purpose is to hold output power at its desired level in spite of drift due to temperature and time.

There are some modulation conditions which the ALC circuit cannot handle properly which lead to output level errors. In these conditions, better power level accuracy can be obtained by turning the ALC off and using power search. (Refer to the **Power Search Manual Auto** softkey documented in this section for more information about power search.) ALC Off is useful with pulse modulation with a pulse width narrower than 2 μs and with certain external I/Q modulation.

Pulse modulation is accomplished using a modulator which precedes the ALC detector. The ALC must, therefore, measure a pulsed signal, and it is able to do this if the pulse width exceeds 2 μs. For narrower pulses, set the **ALC** softkey to **Off**.

With external I/Q modulation, the ALC loop acts to hold the signal generator's average output power constant, in spite of variations in the I/Q input power ($I^2 +$ Q^2). Rapid variations of ($I^2 + Q^2$) propagate to the output, while slow variations are removed by the ALC loop, with a high-pass corner of 1 kHz. If you do not want this high-pass filtering, set the **ALC Off On** softkey to **Off**. With ALC off, the I/Q modulation will be DC-coupled. Using power search, power level accuracy is preserved if $\sqrt{I^2+Q^2} = 0.5 \text{ V}_{\text{rms}}$.

When ALC is off, the **ALC OFF** display annunciator will turn on.

NOTE:

An alternative to setting the ALC off is set the ALC bandwidth to narrow. See the **Ext I/Q ALC BW Normal Narrow** softkey in the I/Q section.

Softkey Location: Press **Ampl, ALC Off On**

Status after Normal Preset: On

SCPI Commands:

[:SOURce]:POWer:ALC:[:STATe] ON|OFF|1|0

[:SOURce]:POWer:ALC:[:STATe]?

Ampl Offset

Press this softkey to set a value for amplitude offset. An amplitude offset changes the value shown in the amplitude area of the display but does not affect the output power. For example, if the current output power is 0 dBm and you enter an amplitude offset of –3 dBm, the output power will remain at 0 dBm but the display will show an amplitude of –3 dBm. This feature lets you simulate the power level at a test point beyond the RF OUTPUT connector.

An amplitude offset can be entered at any time during normal operation and also when you are operating in amplitude reference mode. To enter an offset, press **Ampl Offset** and enter the desired offset value using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **dB** terminator softkey. When a non-zero offset has been entered, the **OFFSET** indicator is turned on in the amplitude area of the display.

Softkey Location: Press **Ampl, Ampl Offset**

Status after Normal Preset: 0.00 dB

SCPI Commands:

[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet <val><unit>

[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet?

Ampl Ref Set

This softkey sets the current output power as an amplitude reference value. It also causes the **Ampl Ref Off On** softkey to toggle to the **On** position, turning on amplitude reference mode. All amplitude parameters are then set as relative to the reference value.

Softkey Location: **Ampl, Ampl Ref Set**

Status after Normal Preset: 0.0 dBm

SCPI Commands:

[:SOURce]:POWer:REFerence <val><unit>

[:SOURce]:POWer:REFerence?

Ampl Ref Off On

This softkey toggles the amplitude reference mode on and off. When amplitude reference mode is turned on, the amplitude value displayed is equal to the current hardware output power minus the reference value set by the **Ampl Ref Set** softkey. (The **Ampl Ref Set** softkey sets the reference value equal to the current output power. If you have not yet set the reference value, the normal preset value for amplitude reference is 0 dBm.) The **REF** indicator is turned on in the amplitude area of the display. All amplitude parameters will now be set as relative to the reference value.

Amplitude offsets can be used with amplitude reference mode. In this situation, the display will show the amplitude calculated as the current hardware output power minus the reference value plus the amplitude offset.

Amplitude reference mode only changes the display; it does not change the RF output power. For example, if you set your RF output power to –20 dBm, set your reference value, and then turn amplitude reference mode on, your display shows your amplitude as 0 dB but your output power remains at –20 dBm.

Softkey Location: Press **Ampl, Ampl Ref Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:POWer:REFerence:STATe ON|OFF|1|0

[:SOURce]:POWer:REFerence:STATe?

Atten Hold Off On

This softkey toggles the attenuator hold function on and off. Turn attenuator hold on to freeze the attenuator at it's current setting. The **ATTN HOLD** display annunciator will turn on. Use this function at any time you want to guarantee that there will be no power discontinuities normally associated with the attenuator switching. (During power adjustments, only a frequency change can force the attenuator to change.) With attenuator hold on, the maximum power adjustment range will vary. However, you will have at least +4 dB and at least –13 dB of range.

Softkey Location: Press **Ampl, Atten Hold Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:POWer[:LEVel]:ATTen:AUTO ON|OFF|1|0

[:SOURce]:POWer[:LEVel]:ATTen:AUTO?

Do Power Search

Press this softkey to execute the power search routine one time. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. You can execute a power search at any time by pressing this softkey. You do not need to disconnect modulation inputs, however modulation is disabled during power search. If you are using external I/Q modulation, the power search routine assumes that the I/Q input level is $\sqrt{I^2+Q^2}$ = 0.5 V_{rms}. Actual output amplitude will scale directly with $\sqrt{I^2+Q^2}$.

The following conditions must be met in order to execute the power search routine:

*   **ALC Off On** is set to **Off**

*   **RF On/Off** is set to **On**

Softkey Location: Press **Ampl, Do Power Search**

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ONCE

Power Search Manual Auto

This softkey toggles between the auto and manual modes of power search mode. Power search is an internal calibration routine used to achieve calibrated output power when the ALC is off. When you set **Power Search Manual Auto** to **Auto**, power search will execute automatically with each change to the AM or pulse modulation state. You do not need to disconnect modulation inputs, however modulation is disabled during power search.

When you set **Power Search Manual Auto** to **Manual**, the power search routine is not run until the **Do Power Search** softkey is pressed. As with auto mode, you do not need to disconnect modulation inputs during power search, however modulation is disabled during the power search.

The following conditions must be met in order to engage either power search mode:

- **ALC Off On** is set to **Off**
- **RF On/Off** is set to **On**

Softkey Location: Press **Ampl, Power Search Manual Auto**

Status after Normal Preset: Manual

SCPI Commands:

[:SOURce]:POWer:ALC:SEARch ON|OFF|1|0

[:SOURce]:POWer:ALC:SEARch?

Amplitude

pk745a
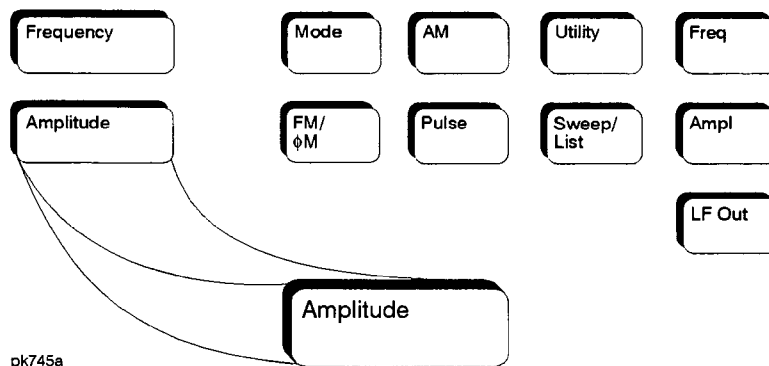
The current RF output power level is always shown in the amplitude area of the display (unless you have altered the display by turning on amplitude reference mode or entering an offset, or you are using sweep or list mode to change the output power). Press this front panel hardkey to change the RF output power. Amplitude becomes the active function and the current value is shown in the active entry area of the display. To enter a new value for amplitude, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm, dBuV, dBuVemf, mV, uV, mVemf,** or **uVemf** terminator softkey.

The output power range allowed depends on your instrument model. Refer to Chapter 9, "Specifications."

Status after Normal Preset: –135 dBm

SCPI Commands:

    [:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] <val><unit>

    [:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?
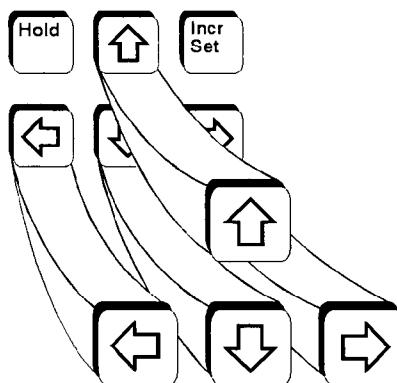
Arrow Keys

pk750a

Use the up and down arrow keys to increase and decrease the value of a numeric parameter by the increment value. For example, when frequency is the active function, if the current frequency setting is 1 MHz and the increment value set is 1 kHz, pressing the up and down arrow keys will increase and decrease the 1 MHz frequency in 1 kHz steps.

In addition, you can use the up and down arrow keys to scroll through displayed lists to select items.

The left and right arrow keys choose the highlighted digit in the active entry area, which is modified by the up and down arrow keys. When a digit is highlighted it overrides the increment value used with the up and down arrow keys. This override remains in effect until the **Incr Set** key is pressed, an instrument preset occurs, or power is cycled. For example, if frequency is the active parameter and you press the right arrow key until the 1 kHz position is highlighted, the up and down arrow keys will increase and decrease the frequency in 1 kHz increments no matter where the **Incr Set** key has been set.

Display Contrast Keys
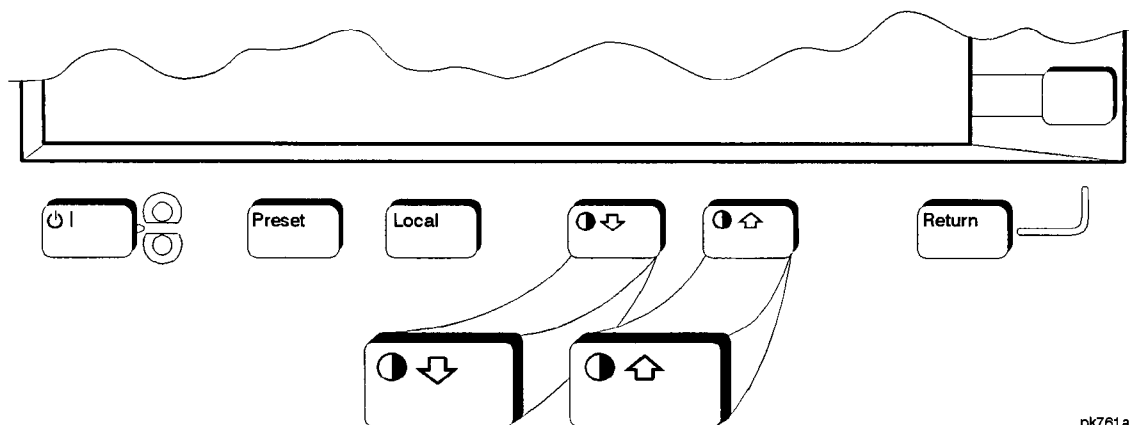
pk761a

You can adjust the contrast of the display by pressing the decrease contrast key ◐⇩ or the increase contrast key ◐⇧ .

Pressing the decrease contrast key and holding it down causes the display background to gradually darken in comparison to the text on the display. The minimum contrast setting is not a completely black display. Some contrast between the background and the text will still be visible.

Pressing the increase contrast key and holding it down causes the display background to gradually brighten in comparison to the text on the display. If the background does not appear to change, it is probably set to the maximum contrast.

Display contrast is a persistent state; it is not affected by an instrument preset or by a power cycle.

FM

Pressing the front panel **FM/ΦM** key reveals a menu of softkeys. The softkeys for FM are described in this section in alphabetical order. For a description of the ΦM softkeys, refer to the "Phase Modulation" section in this chapter.

pk739a
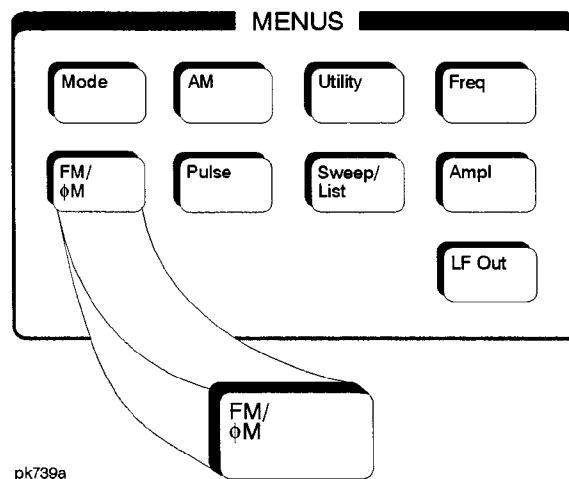
DCFM/DCΦM Cal

Pressing this softkey initiates a DCFM calibration. This calibration eliminates the offset in DC FM so that the carrier frequency remains the same with no modulation applied. External, DC-coupled FM must be active when this calibration is executed.

Softkey Location: Press **FM/ΦM, More (1 of 2), DCFM/DCΦM Cal**

SCPI Commands:

[SOURce:]CALibration:DCFM

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, frequency modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 1 source, the signal generator would turn off **AM Path 1** and assign the external 1 source to your **FM Path 2** configuration. Notice that for these purposes, the external 1 AC-coupled source is the same as the external 1 DC-coupled source.

Softkey Location: Press **FM/ΦM, FM Source, Ext 1 AC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXT[1]

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, frequency modulation signal to the EXT 1 INPUT connector.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 1 source, the signal generator would turn off **AM Path 1** and assign the external 1 source to your **FM Path 2** configuration.

Softkey Location: Press **FM/ΦM, FM Source, Ext 1 DC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXT[1]

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:FM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, frequency modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 2 source, the signal generator would turn off **AM Path 1** and assign the external 2 source to your **FM Path 2** configuration.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 2 AC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXT2

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling AC

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, frequency modulation signal to the EXT 2 INPUT connector.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the external 2 source, the signal generator would turn off **AM Path 1** and assign the external 2 source to your **FM Path 2** configuration.

Softkey Location: Press **FM/ΦM**, **FM Source**, **Ext 2 DC-Coupled**

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce EXT2

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling DC

[:SOURce]:FM[1]|2:EXTernal[2]:COUPling?

FM/ΦM

This softkey toggles between the menus for FM, normal ΦM, and wideband ΦM. Refer to the "Phase Modulation" section for a discussion of the differences between normal ΦM, and wideband ΦM.

Softkey Location: Press **FM/ΦM, FM/ΦM**

Status after Normal Preset: FM

FM Dev

Use this softkey to set the frequency modulation deviation for the **FM Path 1** and **FM Path 2** configurations. To change the value of the FM deviation, press the softkey once. The current value for FM deviation is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz, kHz, MHz**, or **GHz** terminator softkey. The range of values allowed depends on the carrier frequency. The maximum peak deviation for a frequency is calculated by multiplying N times 10 MHz. (The following table lists the values for N and the resulting maximum peak deviations.)

Carrier Frequency	N	Maximum Peak Deviation
250 kHz to ≤ 249.999 MHz	1	10 MHz
> 249.999 MHz to ≤ 500 MHz	0.5	5 MHz
> 500 MHz to ≤ 1 GHz	1	10 MHz
> 1 GHz to ≤ 2 GHz	2	20 MHz
> 2 GHz to 4 GHz	4	40 MHz

For example, if you choose a carrier frequency of 400 MHz, multiply 0.5 times 10 MHz resulting in a 5 MHz maximum peak deviation.

Notice that the new value of FM deviation applies only to whichever FM path configuration you have currently selected. Also, whenever **FM Path 1** is used with **FM Path 2**, the deviation for **FM Path 1** must be greater than or equal to the deviation for **FM Path 2**.

Softkey Location: Press **FM/ΦM, FM Dev**

Status after Normal Preset: 100 Hz

SCPI Commands:

[:SOURce]:FM[1]|2[:DEViation] <val><unit>

[:SOURce]:FM[1]|2[:DEViation]?

FM Dev Couple Off On

This softkey toggles the FM deviation coupling on and off. Turning on FM deviation coupling links the FM deviation values of **FM Path 1** and **FM Path 2**. When the values are coupled, any change you make to one FM deviation value is applied to both FM deviation values.

Softkey Location: Press **FM/ΦM, More (1 of 2) FM Dev Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FM[1]|2:[DEViation]:TRACk ON|OFF|1|0

[:SOURce]:FM[1]|2:[DEViation]:TRACk?

FM Off On

This softkey toggles the frequency modulation on or off for whichever FM path configuration (**FM Path 1** or **FM Path 2**) you have selected. Notice, however that although you can turn on frequency modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On.**

There are two paths for FM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). **FM Path 2** is limited to a maximum rate of 1 MHz. **FM Path 2** must be set to a deviation less than or equal to **FM Path 1**. The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **FM/ΦM, FM Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:FM[1]|2:STATe ON|OFF|1|0

[:SOURce]:FM[1]|2:STATe?

FM Path 1 2

Use **FM Path 1** and **FM Path 2** to define two unique frequency modulation configurations. For example, select **FM Path 1**. (**FM Path 1** is the default after a normal preset. If **FM Path 1** is not highlighted, press the softkey until the selection toggles to **FM Path 1**.) Configure the modulation characteristics (such as deviation, source, rate, and waveform) using the remaining softkeys in the FM menu. Then enable FM by setting **FM Off On** to **On**.

To configure a second frequency modulation configuration, toggle to **FM Path 2**. Define the modulation characteristics for this second configuration and enable FM by setting **FM Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

FM Path 1 and **FM Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

Softkey Location: Press **FM/ΦM, FM Path 1 2**

Status after Normal Preset: FM Path 1

FM Rate

Use this softkey to change the internal modulation frequency for the **FM Path 1** and **FM Path 2** configurations. To change the value, press the softkey once. The current value for FM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) Notice that the new value of FM rate applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM, FM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:FM[1]|2:INTernal[1]:FREQuency?

FM Source

Pressing this softkey reveals a menu of choices for frequency modulation sources. You can choose internally-generated frequency modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated FM deviation settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

The internal and external 1 and 2 sources have multiple uses. You can use them for amplitude, frequency, and phase modulation. For pulse modulation you must use the external 2 source. However, any given source can only be routed to one enabled modulation at a time. If, for example, you were using the external 1 source in a frequency modulation configuration for **FM Path 1**, and then you configured **AM Path 2** to also use the external 1 source, the signal generator would turn off **FM Path 1** and assign the external 1 source to your **AM Path 2** configuration. Notice that for these purposes the external 1 AC-coupled source is the same as the external 1 DC-coupled source and the external 2 AC-coupled source is the same as the external 2 DC-coupled source.

Softkey Location: Press **FM/ΦM, FM Source**

Status after Normal Preset: Internal

SCPI Commands:

[:SOURce]:FM[1]|2:SOURce?

FM Waveform

Pressing this softkey reveals a menu of FM waveform choices for your **FM Path 1** and **FM Path 2** configurations. Select from sine, triangle, square, ramp, and noise waveforms. Notice that your waveform selection applies only to which ever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM, More (1 of 2), FM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe??

Internal

This softkey lets you internally generate an AC-coupled, frequency modulation signal.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example you were using the internal source in an amplitude modulation configuration for **AM Path 1**, and then you configured **FM Path 2** to also use the internal source, the signal generator would turn off **AM Path 1** and assign the internal source to your **FM Path 2** configuration.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Internal**

SCPI Commands:

    [:SOURce]:FM[1]|2:SOURce INT[1]

    [:SOURce]:FM[1]|2:SOURce?

Noise

This softkey lets you specify noise as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Noise**

SCPI Commands:

    [:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe NOISe

    [:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the frequency modulation waveform for the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM**, **More (1 of 2)**, **FM Waveform**, **Ramp**

SCPI Commands:

    [:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe RAMP

    [:SOURce]:FM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the frequency modulation waveform for the
FM Path 1 and **FM Path 2** configurations. Notice that the selected waveform applies
only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM, More (1 of 2), FM Waveform, Sine**

SCPI Commands:

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe SINE

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the frequency modulation waveform for
the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform
applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM, More (1 of 2), FM Waveform, Square**

SCPI Commands:

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe SQUare

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the frequency modulation waveform for
the **FM Path 1** and **FM Path 2** configurations. Notice that the selected waveform
applies only to whichever FM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM, More (1 of 2), FM Waveform, Triangle**

SCPI Commands:

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe TRIangle

[:SOURce]:FM[1]|2:INT[1]:FUNCtion:SHAPe?

Freq

Pressing the front panel **Freq** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.
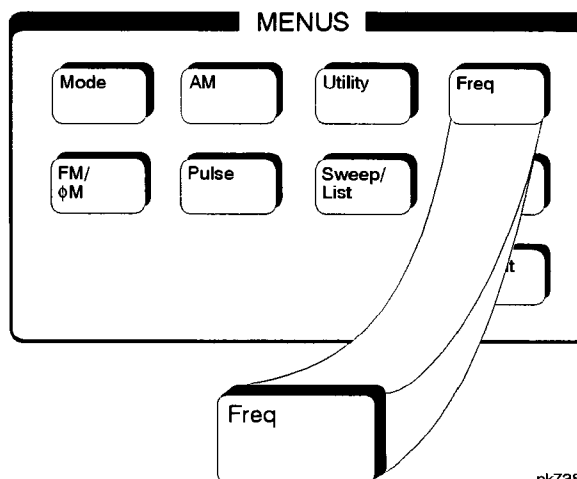
pk738a

Adjust Phase

Use this softkey to change the phase of the RF OUTPUT signal. You can change the phase relative to whatever phase the signal generator locked to the last time it changed frequency. For this reason, the phase adjustment does not survive changes in frequency and must be readjusted. Phase adjustment also cannot be used with frequency or phase modulation.

To change the phase, press the softkey once. Phase adjustment becomes the active function. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **rad** or **deg** terminator softkey. The range of values allowed is ±3.141 radians or ±180 degrees.

Softkey Location: Press **Freq, Adjust Phase**

Status after Normal Preset: 0 radians

SCPI Commands:

[:SOURce]:PHASe:[ADJust] <val><unit>

[:SOURce]:PHASe:[ADJust]?

Freq Multiplier

You can multiply the frequency shown on the display without changing the frequency output at the RF OUTPUT connector (simulating the frequency at the output of a harmonic multiplier). Press this softkey and enter a value from 1 through 50. Use the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **Enter** terminator softkey. For example, set the output frequency to 1 MHz. Then press **Freq, Freq Multiplier, 3, Enter.** The display will now show an output frequency of 3 MHz but the actual output frequency will remain at 1 MHz. For any multiplier greater than 1, the **MULT** indicator is shown in the frequency area of the display.

Softkey Location: Press **Freq, Freq Multiplier**

Status after Normal Preset: 1

SCPI Commands:

[:SOURce]:FREQuency:MULTiplier <val>

[:SOURce]:FREQuency:MULTiplier?

Freq Offset

Press this softkey to set a value for frequency offset. A frequency offset changes the value shown in the frequency area of the display but does not affect the output frequency. For example, if the current output frequency is 1 MHz and you enter a frequency offset of 3 MHz, the output frequency will remain at 1 MHz but the display will show a frequency of 4 MHz. This feature lets you simulate the frequency at the output of a frequency translating device.

A frequency offset can be entered at any time during normal operation and also when you are operating in frequency reference mode. To enter an offset, press **Freq Offset** and enter the desired frequency value using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **Hz, kHz, MHz,** or **GHz** terminator softkey. When an offset has been entered, the **OFFSET** indicator is turned on in the frequency area of the display.

Softkey Location: Press **Freq, Freq Offset**

Status after Normal Preset: 0 Hz

SCPI Commands:

[:SOURce]:FREQuency:OFFset <val><unit>

[:SOURce]:FREQuency:OFFset?

Freq Ref Off On

This softkey toggles the frequency reference mode on and off. When frequency reference mode is turned on, the frequency value displayed is equal to the current hardware output frequency minus the reference value set by the **Freq Ref Set** softkey. (The **Freq Ref Set** softkey sets the reference value equal to the current output frequency. If you have not yet set the reference value, the preset value for frequency reference is 0 Hz.) The REF indicator is turned on in the frequency area of the display. All frequency parameters will now be set as relative to the reference value.

Frequency offsets can be used with frequency reference mode. In this situation, the display will show the frequency calculated as the current hardware output frequency minus the reference value plus the frequency offset.

Frequency reference mode only changes the display; it does not change the RF output frequency. For example, if you set your RF output frequency to 700 MHz, set your reference value, and then turn frequency relative mode on, your display shows your frequency as 0 Hz but your output frequency remains at 700 MHz.

Softkey Location: Press **Freq, Freq Ref Off On**

Status after Normal Preset: Off

SCPI Commands:

> [:SOURce]:FREQuency:REFerence:STATe ON|OFF|1|0
>
> [:SOURce]:FREQuency:REFerence:STATe?

Freq Ref Set

This softkey sets the current output frequency as a frequency reference value. It also causes the **Freq Ref Off On** softkey to toggle to the **On** position, turning on frequency reference mode. All frequency parameters are then set as relative to the reference value.

Softkey Location: Press **Freq, Freq Ref Set**

Status after Normal Preset: Off

SCPI Commands:

> [:SOURce]:FREQuency:REFerence <val><unit>
>
> [:SOURce]:FREQuency:REFerence?

Mode 1 Optimize <10kHz Offset

Press this softkey to set the signal generator to mode 1 which optimizes phase noise at offsets below 10 kHz.

Softkey Location: Press **Freq, Optimize Φ Noise, Mode 1 Optimize <10kHz Offset**

SCPI Commands:

[:SOURce]:FREQuency:SYNThesis 1

[:SOURce]:FREQuency:SYNThesis?

Mode 2 Optimize >10kHz Offset

Press this softkey to set the signal generator to mode 2 which optimizes phase noise at offsets above 10 kHz.

Softkey Location: Press **Freq, Optimize Φ Noise, Mode 2 Optimize >10kHz Offset**

SCPI Commands:

[:SOURce]:FREQuency:SYNThesis 2

[:SOURce]:FREQuency:SYNThesis?

Optimize Φ Noise

Press this softkey for two choices in optimizing phase noise. You can choose to set the phase-lock loop bandwidth to optimize phase noise for offsets below or above 10 kHz offsets as shown in Figure 5-1.


```
                              750MHZ
        [hp] 3048A   Carrier: 750.E+6 Hz   25 Jan 1996    11:43:05 - 11:46:16
   -60
   -70
   -80
   -90
  -100
  -110
  -120
  -130
  -140
  -150
  -160
              100          1K          10K         100K          1M
        10                                                               10M
                      L(f)  [dBc/Hz]  vs  f[Hz]
```
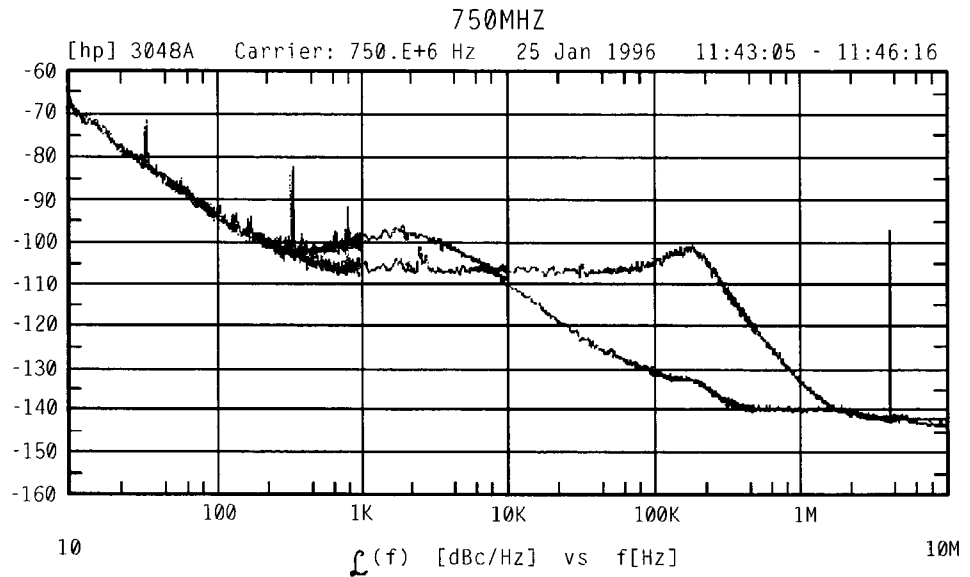
Figure 5-1.   **Phase Noise Performance Mode 1 Versus Mode 2**

Softkey Location: Press **Freq, Optimize Φ Noise**

Status after Normal Preset: Mode 2

Frequency

pk744a
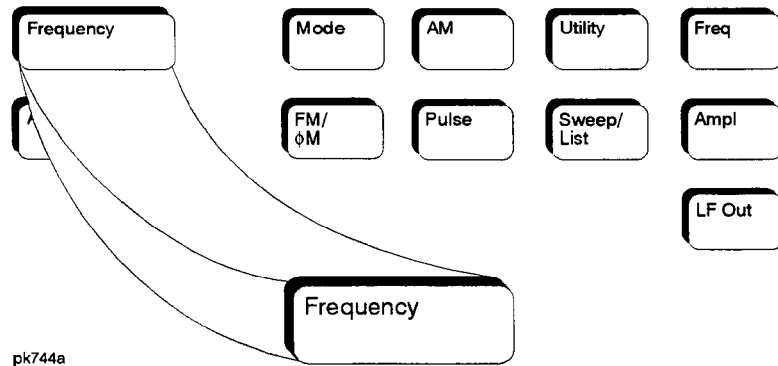
The current RF output frequency is always shown in the frequency area of the display (unless you have altered the display by turning on frequency reference mode or entering an offset or a multiplier). Press this front panel hardkey to change the RF output frequency. Frequency becomes the active function and the current value is also shown in the active entry area of the display. To enter a new value for frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz, MHz, kHz,** or **Hz** terminator softkey.

The output frequency range allowed depends on your instrument model. Refer to Chapter 9, "Specifications."

Status after Normal Preset: Maximum specified output frequency

SCPI Commands:

[:SOURce]:FREQuency[:CW] <val><unit>

[:SOURce]:FREQuency[:CW]?

Help
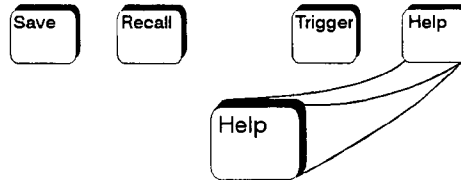
pk754a

Press this hardkey for a short description of the function of any front panel hardkey or softkey. When you press the **Help** key, the following message is displayed:

Press a key for help on that key.

Press a front panel hardkey or a softkey and a short description of that key's function will be displayed. Press any other key and you will be returned to normal instrument operation.

The **Help** key is preset to single mode (when normal preset is selected). In single mode, when you press the **Help** key, help text is provided only for the next key that you press and then you are returned to normal operation.

You can also set the **Help** key to continuous mode. In this mode, when you press the **Help** key, help text is provided for the next key that you press and that key's function is also executed (except for the **Preset** key). This help mode remains active until you press the **Help** key again.

Refer to the description of the **Help Mode** softkey in the **Utility** section for instructions on changing the help mode from single to continuous.

Hold
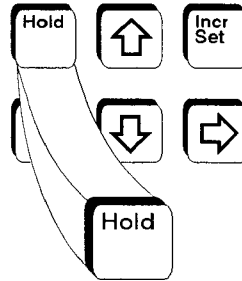
pk748a

Press this front panel hardkey to de-activate the current active function and blank the softkey menu. Once **Hold** is pressed, the front panel knob, the arrow keys, and the numeric keypad have no effect.

To return to normal operation, press any front panel hardkey.

Incr Set
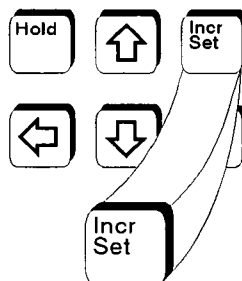
pk749a

Press this front panel hardkey to change the incremental value of the up and down arrow keys for the current active function. For example, press **Frequency** to make it the active function. The current frequency is shown in the active entry area. The incremental value for frequency is set to 1 MHz at the factory. Press **Incr Set** and the incremental value of the up and down arrow keys for frequency becomes the active function. You can change the value by using three different methods:

- Use the up and down arrow keys.

  The arrow keys will change the incremental value in steps equal to the current incremental value (in this example, these are 1 MHz steps.)

- Use the front panel knob.

- Use the numeric keypad and complete your entry with a terminator softkey.

Press **Incr Set** again and the active function toggles, making frequency the active function again.

Incremental values are persistent states; they are not affected by an instrument preset or by a power cycle.

LF Out

Pressing the front panel **LF Out** key reveals a menu of softkeys for configuring the internal low frequency generator. These softkeys are described in this section in alphabetical order.

pk743a
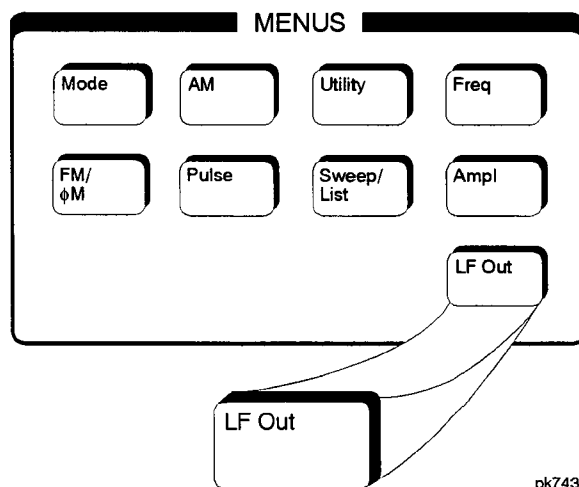
DC

This softkey lets you specify DC as the waveform for the LF output signal. The signal shape can only be specified when you have selected the **LF Out Source** to be a function generator.

Softkey Location: Press **LF Out, LF Out Source, Function Generator, LF Out Waveform, DC**

Status after Normal Preset: LF Out Waveform is set to DC

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe DC

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Function Generator

This softkey lets you set the **LF Out Source** to be a function generator. You can select a frequency and shape in addition to selecting the amplitude for a signal that is output at the LF OUTPUT front panel connector. When you use the internal source in this capacity, any modulation with the internal source selected is turned off.

Softkey Location: Press **LF Out, LF Out Source, Function Generator**

Status after Normal Preset: LF Out Source is set to Internal

SCPI Commands:

[:SOURce]:LFOutput:SOURce FUNCtion

[:SOURce]:LFOutput:SOURce?

Internal

This softkey lets you output a signal at the LF OUTPUT connector where the frequency and shape of the signal is set by the internal source as it is being used by a modulation. For pulse modulation, however, the internal source is a sinewave which is later squared by the modulator to generate the pulse squarewave. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal. You can scale the amplitude of the output signal using the **LF Out Amplitude** softkey.

Softkey Location: Press **LF Out, LF Out Source, Internal**

Status after Normal Preset: LF Out Source is set to Internal

SCPI Commands:

[:SOURce]:LFOutput:SOURce INT[1]

[:SOURce]:LFOutput:SOURce?

LF Out Amplitude

Use this softkey to scale the output of the signal at the LF OUTPUT connector. To change the value, press the softkey once. The current value for LF output amplitude is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **V**, or **mV** terminator softkey. The range of values allowed is 0 to 5 Vpk in increments from 1 mV to 5 V.

Softkey Location: Press **LF Out**, **LF Out Amplitude**

Status after Normal Preset: 0V

SCPI Commands:

[:SOURce]:LFOutput:AMPLitude <val><unit>

[:SOURce]:LFOutput:AMPLitude?

LF Out Mod Freq

Use this softkey to set the modulating frequency for the LF output signal when you have selected the internal source as a function generator. To change the frequency, press the softkey once. The current modulating frequency is displayed in the active entry area. To enter a new frequency, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of frequencies allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) When the internal LF output source is selected, this softkey is disabled.

Softkey Location: Press **LF Out**, **LF Out Mod Freq**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:FREQuency <val><unit>

[:SOURce]:LFOutput:FUNCtion:FREQuency?

LF Out Off On

This softkey toggles on and off the output of the selected source at the
LF OUTPUT front panel connector. You can choose either the modulation signal
generated by the internal source or you can use the low frequency source as a
function generator and select that signal to output at the LF OUTPUT connector.
Refer to the description of the **LF Out Source** softkey in this section for more
information on choosing the source.

Once you have toggled this state on, the signal is immediately available at the
LF OUTPUT connector. The **Mod On/Off** and **RF On/Off** keys do not apply to this
state.

Softkey Location: Press **LF Out, LF Out Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:LFOutput:STATe ON|OFF|1|0

[:SOURce]:LFOutput:STATe?

LF Out Source

Pressing this softkey reveals a menu of choices for LF output sources. You can choose to output the signal from the internal source as it is being used by a modulation or you can use the internal source as a function generator and select that signal to output at the LF OUTPUT connector.

If you choose the internal source, the frequency and shape of the signal at the LF OUTPUT connector is set by the internal source as it is being used by a modulation. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal. You can scale the amplitude of the output signal using the **LF Out Amplitude** softkey.

If you choose to set the internal source as a function generator, you can select a frequency and shape in addition to selecting the amplitude for the LF output signal. When you use the internal source in this capacity, any modulation with the internal source selected is turned off.

Softkey Location: Press **LF Out**, **LF Out Source**

Status after Normal Preset: Internal

SCPI Commands:

    [:SOURce]:LFOutput:SOURce?

LF Out Waveform

Pressing this softkey reveals a menu of LF output waveform choices for your LF function generator. Select from sine, triangle, square, ramp, noise, and DC waveforms. When you select **Internal** for the **LF Out Source**, this softkey is disabled.

Softkey Location: Press **LF Out**, **LF Out Waveform**

Status after Normal Preset: Sine

SCPI Commands:

    [:SOURce]:LFOutput:FUNCtion:SHAPe?

Noise

This softkey lets you specify noise as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out, LF Out Waveform, Noise**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe NOISe

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out, LF Out Waveform, Ramp**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe RAMP

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out, LF Out Waveform, Sine**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

[:SOURce]:LFOutput:FUNCtion:SHAPe SINe

[:SOURce]:LFOutput:FUNCtion:SHAPe?

Square

This softkey lets you specify square as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out, LF Out Waveform, Square**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

    [:SOURce]:LFOutput:FUNCtion:SHAPe SQUare

    [:SOURce]:LFOutput:FUNCtion:SHAPe?

Triangle

This softkey lets you specify triangle as the waveform for the LF output signal. The signal shape can only be specified when you have selected the internal source to operate as a function generator.

Softkey Location: Press **LF Out, LF Out Waveform, Triangle**

Status after Normal Preset: LF Out Waveform is set to Sine

SCPI Commands:

    [:SOURce]:LFOutput:FUNCtion:SHAPe TRIangle

    [:SOURce]:LFOutput:FUNCtion:SHAPe?

Local
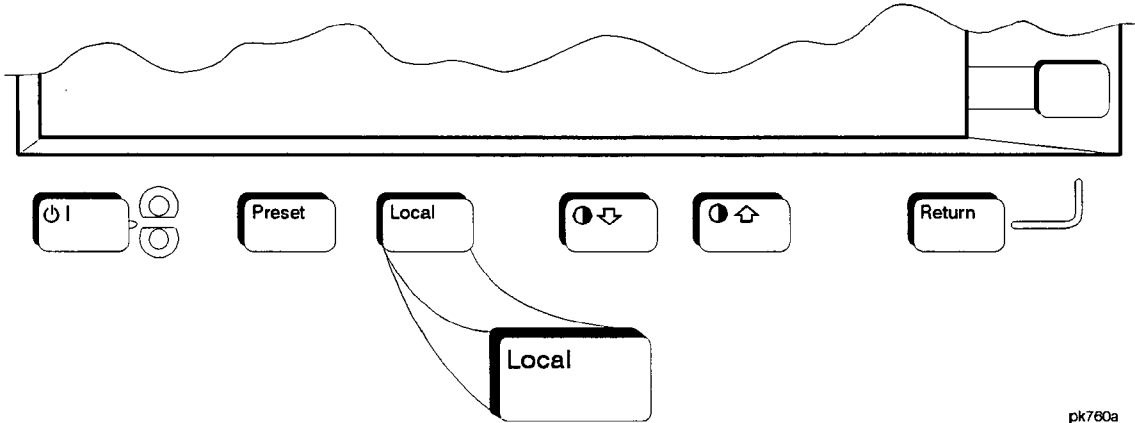
pk760a

Press this key to return the signal generator to local (front panel) control from remote operation or to restore the front panel menu and status area display after RS-232 control. You can also press this key to restore the display once the screen saver has started.

Status after Normal Preset: Local (unless a LOCAL LOCKOUT command has been sent)
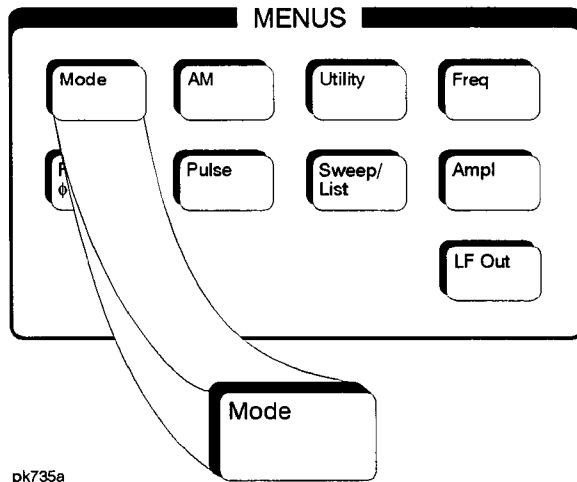
Mode

pk735a

This front panel key is reserved for future use.

Mod On/Off
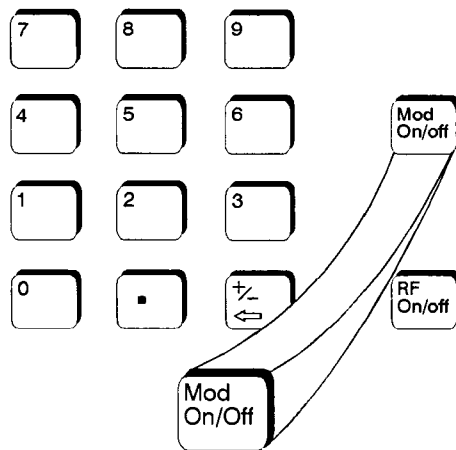
pk756a

Set this front panel hardkey to **On** to modulate the RF carrier with the modulations that you have enabled. All modulation types can be simultaneously enabled except FM with ΦM. An annunciator is always turned on in the display to indicate whether modulation is turned on or off.

Status after Normal Preset: Mod Off

Numeric Keypad
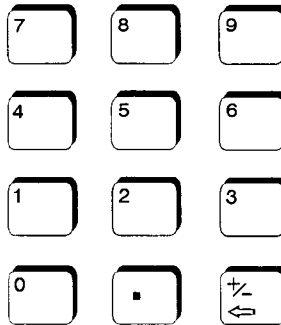
```
 ┌─────┐  ┌─────┐  ┌─────┐
 │ 7   │  │ 8   │  │ 9   │
 └─────┘  └─────┘  └─────┘

 ┌─────┐  ┌─────┐  ┌─────┐
 │ 4   │  │ 5   │  │ 6   │
 └─────┘  └─────┘  └─────┘

 ┌─────┐  ┌─────┐  ┌─────┐
 │ 1   │  │ 2   │  │ 3   │
 └─────┘  └─────┘  └─────┘

 ┌─────┐  ┌─────┐  ┌─────┐
 │ 0   │  │  .  │  │ +/- │
 └─────┘  └─────┘  │  ⇐  │
                   └─────┘      pk755a
```

The numeric keypad consists of the digit keys (0 through 9), a decimal point key, and a backspace key, $\boxed{+/-\!\Leftarrow}$ The backspace key has dual functions for both backspacing and for changing the sign of a value to positive or negative. Use these keys at any time when the active function requires a value input. The backspace key function changes with the situation.

If you are modifying a previously entered value:

• If the value is negative, pressing the backspace key deletes the entire value and leaves the negative sign. Subsequent key presses change the sign between positive and negative states.

• If the value is positive, pressing the backspace key deletes the entire value and also changes the sign to a negative state. Subsequent key presses change the sign between positive and negative states.

If you are entering a new value:

• If the cursor is to the right of the digits, pressing the backspace key deletes the digit immediately to the left. When no digits remain, subsequent key presses change the sign between positive and negative states.

• If the cursor is on a digit, pressing the backspace key deletes the digit immediately to the left. When a single digit remains, pressing the backspace key changes the negative sign (if present) to positive and then subsequent key presses have not effect.

Phase Modulation

Pressing the front panel phase modulation key (ΦM) reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.

pk739a

ΦM Dev
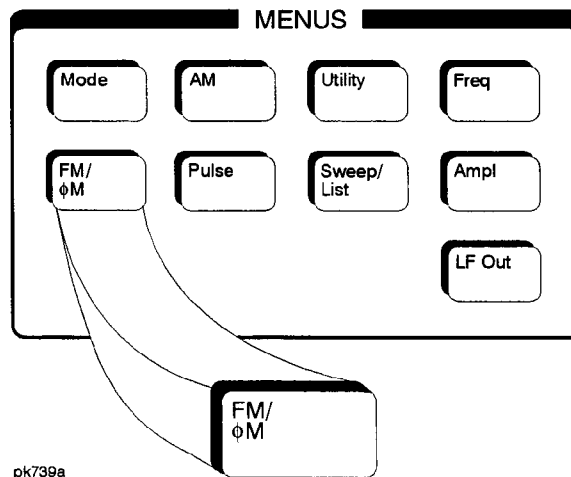
Use this softkey to set the phase modulation deviation for the **ΦM Path 1** and **ΦM Path 2** configurations. To change the value of the ΦM deviation, press the softkey once. The current value for ΦM deviation is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **pi rad, rad,** or **deg** terminator softkey. The range of values allowed depends on the carrier frequency and the rate selected. Refer to Table 5-1.

Table 5-1.   **Maximum Deviation Values for Phase Modulation**

Mode	Maximum Deviation	Maximum Rates (3 dB BW)	
		ΦM Path 1	ΦM Path 2
Normal	N[1] x 90 radians	100 kHz	100 kHz
High Bandwidth	N x 2π radians	1.5 MHz (typical)	1 MHz (typical)
	N x π/2 radians	6 MHz (typical)	1 MHz (typical)

1. For the value of N, refer to Table 5-2.

Table 5-2.   **Carrier Frequency Bands versus Value of N**

Carrier Frequency	N
250 kHz to ≤ 249.999 MHz	1
> 249.999 MHz to ≤500 MHz	0.5
> 500 MHz to ≤1 GHz	1
> 1 GHz to ≤2 GHz	2
> 2 GHz to 4 GHz	4

For example, if you set up **ΦM Path 1** for normal phase modulation with a carrier frequency of 400 MHz, and a rate of 100 kHz, the maximum peak deviation that you can set is 0.5 (value of N) times 90 radians resulting in a maximum peak deviation of 45 radians.

Notice that the new value of ΦM deviation applies only to whichever ΦM path configuration you have currently selected. Also, **ΦM Path 2** is limited to a maximum rate of 1 MHz. The **ΦM Path 2** must be set to a deviation less the **ΦM Path 1**.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **ΦM Path 1 2**

Status after Normal Preset: 100 Hz

SCPI Commands:

[:SOURce]:PM[1]|2[:DEViation] <val><unit>

[:SOURce]:PM[1]|2[:DEViation]?

ΦM Dev Couple Off On

This softkey toggles the ΦM deviation coupling on and off. Turning on ΦM deviation coupling links the ΦM deviation values of ΦM **Path 1** and ΦM **Path 2**. When the values are coupled, any change you make to one ΦM deviation value is applied to both ΦM deviation values.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, ΦM **Dev Couple Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PM[1]|2:[DEViation]:TRACk ON|OFF|1|0

[:SOURce]:PM[1]|2:[DEViation]:TRACk?

ΦM Off On

This softkey toggles the phase modulation on or off for whichever ΦM configuration (ΦM **Path 1** or ΦM **Path 2**) you have selected. Notice, however that although you can turn on phase modulation with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

There are two paths for ΦM modulation which can be simultaneously enabled as long as they use different sources (Int, Ext1, or Ext2). ΦM **Path 2** is limited to a maximum rate of 1 MHz. ΦM **Path 2** must be set to a deviation less than ΦM **Path 1**. The modulation signals from both paths are summed internally for composite modulation.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press ΦM **Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PM[1]|2:STATe ON|OFF|1|0

[:SOURce]:PM[1]|2:STATe?

ΦM Path 1 2

Use ΦM **Path 1** and ΦM **Path 2** to define two unique phase modulation configurations. For example, select ΦM **Path 1** (ΦM **Path 1** is the default after a normal preset. If ΦM **Path 1** is not highlighted, press the softkey once and the selection will toggle from ΦM **Path 2** to ΦM **Path 1**.) Configure the modulation characteristics (such as deviation, source, rate, and waveform) using the remaining softkeys in the ΦM menu. Then enable ΦM by setting ΦM **Off On** to **On**.

To configure a second phase modulation configuration, toggle to ΦM **Path 2**. Define the modulation characteristics for this second configuration and enable ΦM by setting ΦM **Off On** to **On**.

The RF carrier is available at the RF OUTPUT connector when you set **RF On/Off** to **On**. Set **Mod On/Off** to **On** to modulate the RF carrier with the modulations that you have enabled.

ΦM **Path 1** and ΦM **Path 2** are summed internally for composite modulation. Either path can be switched to any one of the modulation sources: Int, Ext1, or Ext2. All modulation types can be simultaneously enabled, except FM with ΦM. AM, FM, and ΦM can sum simultaneous inputs from any two sources (Int, Ext1, and Ext2). Any given source (Int, Ext1, or Ext2) can only be routed to one activated modulation type.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press ΦM **Path 1 2**

ΦM Rate

Use this softkey to change the internal modulation frequency for the ΦM **Path 1** and ΦM **Path 2** configurations. To change the value, press the softkey once. The current value for ΦM rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 10 kHz. (0.1 Hz to 50 kHz is the range allowed if sinewave is selected as the internal waveform.) Notice that the new value of ΦM rate applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **ΦM Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency <val><unit>

[:SOURce]:PM[1]|2:INTernal[1]:FREQuency?

ΦM Source

Pressing this softkey reveals a menu of choices for phase modulation sources. You can choose internally-generated phase modulation or select an externally-applied signal from either the EXT 1 INPUT or EXT 2 INPUT connectors. The internal modulation is always AC-coupled. For the externally-applied signals, you can choose between AC- and DC-coupled modulation. A 1.0 Vpk input is required for calibrated ΦM deviation settings. The **EXT 1 LO/HI** and **EXT 2 LO/HI** display annunciators will turn on if the peak input voltage differs from 1.0 Vpk by more than 3%. (The LO/HI annunciators only function for AC-coupled external inputs.)

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **ΦM Source**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce?

ΦM Waveform

Pressing this softkey reveals a menu of ΦM waveform choices for your **ΦM Path 1** and **ΦM Path 2** configurations. Select from sine, triangle, square, ramp, and noise waveforms. Notice that your waveform selection applies only to which ever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, **ΦM Waveform**

Status after Normal Preset: Sine

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

DCFM/DCΦM Cal

Pressing this softkey initiates a DCΦM calibration. This calibration eliminates the offset in phase modulation so that the carrier phase remains the same with no modulation applied. External, DC-coupled ΦM must be active when this command is executed.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, **DCFM/DCΦM Cal**

SCPI Commands:

[SOURce:]CALibration:DCFM

Ext 1 AC-Coupled

This softkey lets you input an external, AC-coupled, phase modulation signal to the EXT 1 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in an amplitude modulation configuration for **AM Path 1**, and then you configured ΦM **Path 2** to also use the external 1 source, the signal generator would turn off **AM Path 1** and assign the external 1 source to your ΦM **Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press ΦM **Source, Ext 1 AC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXT[1]

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling AC

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling?

Ext 1 DC-Coupled

This softkey lets you input an external, DC-coupled, phase modulation signal to the EXT 1 INPUT connector.

The external 1 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 1 source in an amplitude modulation configuration for **AM Path 1**, and then you configured ΦM **Path 2** to also use the external 1 source, the signal generator would turn off **AM Path 1** and assign the external 1 source to your ΦM **Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press ΦM **Source, Ext 1 DC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXT[1]

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling DC

[:SOURce]:PM[1]|2:EXTernal[1]:COUPling?

Ext 2 AC-Coupled

This softkey lets you input an external, AC-coupled, phase modulation signal to the EXT 2 INPUT connector. The modulation signal is tested for voltage and a display annunciator will report a high or low condition if the voltage is > ±3% of 1 Vpk.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in an amplitude modulation configuration for **AM Path 1**, and then you configured ΦM **Path 2** to also use the external 2 source, the signal generator would turn off **AM Path 1** and assign the external 2 source to your ΦM **Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **ΦM Source, Ext 2 AC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXT2

[:SOURce]:PM[1]|2:EXTernal2:COUPling AC

[:SOURce]:PM[1]|2:EXTernal2:COUPling?

Ext 2 DC-Coupled

This softkey lets you input an external, DC-coupled, phase modulation signal to the EXT 2 INPUT connector.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the external 2 source in an amplitude modulation configuration for **AM Path 1**, and then you configured ΦM **Path 2** to also use the external 2 source, the signal generator would turn off **AM Path 1** and assign the external 2 source to your ΦM **Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **ΦM Source, Ext 2 DC-Coupled**

SCPI Commands:

[:SOURce]:PM[1]|2:SOURce EXT2

[:SOURce]:PM[1]|2:EXTernal2:COUPling DC

[:SOURce]:PM[1]|2:EXTernal2:COUPling?

FM/ΦM

This softkey toggles between the menus for FM, normal ΦM, and wideband ΦM. Normal ΦM lets you set the phase deviation as high as N x 90 radians with a 3 dB bandwidth of 100 kHz. Wideband ΦM provides increased bandwidth while restricting the maximum deviation to deviation settings up to $\pi/2$ radians (90°). The modulation bandwidth is typically 6 MHz. For deviation settings between $\pi/2$ and 2π radians (360°), the modulation bandwidth is typically 1.5 MHz. (These increased bandwidths are only available using ΦM **Path 1**. ΦM **Path 2** is limited to 1 MHz.)

Softkey Location: Press **FM/ΦM** hardkey, press **FM/ΦM** softkey

Status after Normal Preset: FM

Internal

This softkey lets you internally generate an AC-coupled, phase modulation signal.

The internal source has multiple uses but can be used for only one modulation at a time. If, for example, you were using the internal source in an amplitude modulation configuration for **AM Path 1**, and then you configured ΦM **Path 2** to also use the internal source, the signal generator would turn off **AM Path 1** and assign the internal source to your ΦM **Path 2** configuration.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, ΦM **Source, Internal**

Status after Normal Preset: Internal

SCPI Commands:

    [:SOURce]:PM[1]|2:SOURce INT[1]

    [:SOURce]:PM[1]|2:SOURce?

Noise

This softkey lets you specify noise as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, **ΦM Waveform**, **Noise**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe NOISe

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Ramp

This softkey lets you specify ramp as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, **ΦM Waveform**, **Ramp**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe RAMP

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Sine

This softkey lets you specify sine as the phase modulation waveform for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected waveform applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press **More (1 of 2)**, **ΦM Waveform**, **Sine**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe SINe

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Square

This softkey lets you to specify square as the phase modulation waveform for the
ΦM Path 1 and **ΦM Path 2** configurations. Notice that the selected waveform
applies only to whichever ΦM path configuration you have currently selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press
More (1 of 2), **ΦM Waveform, Square**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe SQUare

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?

Triangle

This softkey lets you to specify triangle as the frequency modulation waveform
for the **ΦM Path 1** and **ΦM Path 2** configurations. Notice that the selected
waveform applies only to whichever ΦM path configuration you have currently
selected.

Softkey Location: Press **FM/ΦM** hardkey, toggle **FM/ΦM** softkey to ΦM, press
More (1 of 2), **ΦM Waveform, Triangle**

SCPI Commands:

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe TRIangle

[:SOURce]:PM[1]|2:INTernal[1]:FUNCtion:SHAPe?
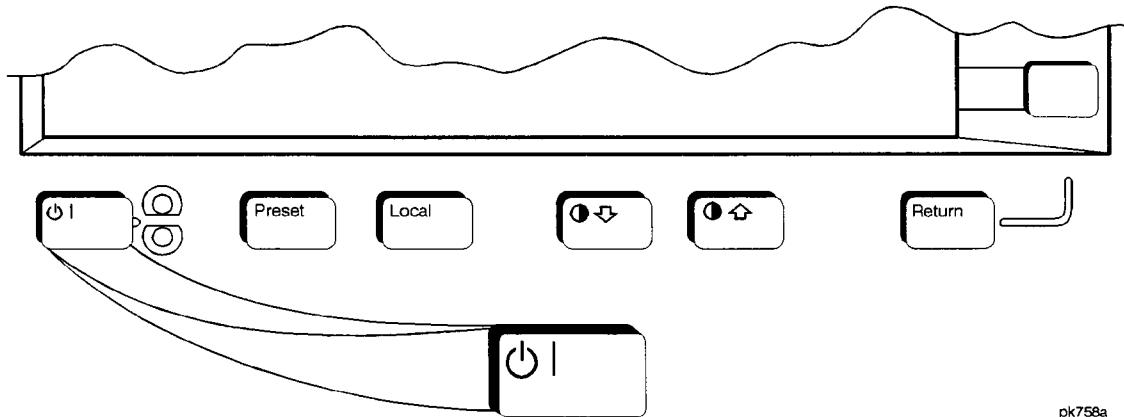
Power Switch

pk758a

Pressing this front panel key toggles power to the signal generator either on (green LED on) or to standby (yellow LED on). In standby mode, the power switch is off but the instrument is still connected to the mains circuit by way of the power cord. The detachable power cord is the instrument disconnecting device. The front panel power switch, therefore, is not, and should not be used as, a line switch.

CAUTION: Avoid turning off power to the signal generator unless it is quiescent (not currently changing state as a result of front panel operation or remote control).

Preset

pk759a
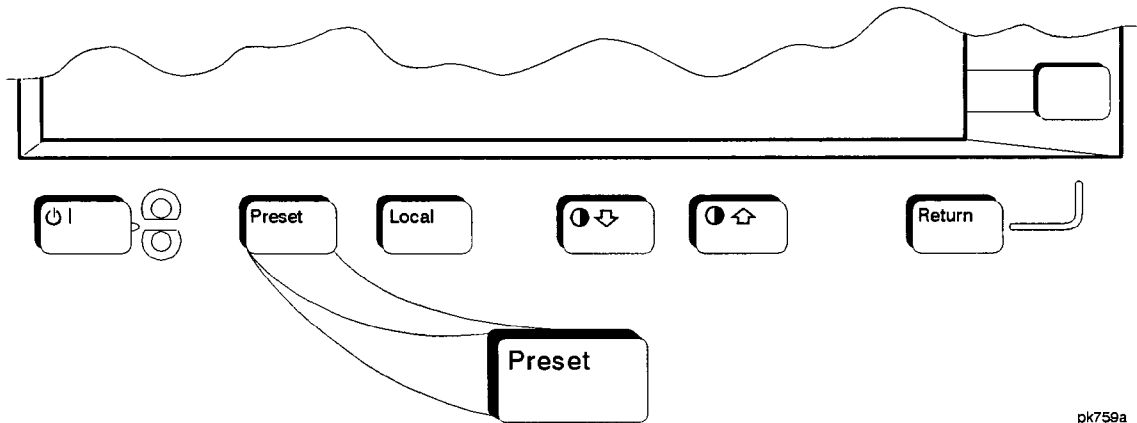
This key sets the signal generator to a known state (either the factory-defined state or a user-defined state). The factory-defined preset conditions are shown in the following table. To set your signal generator to default to these conditions, set the **Preset Normal User** softkey to **Normal**. Or you can define your own preset conditions and set your signal generator to preset to that unique state. Refer to the **Preset Normal User** softkey description which is part of the **Utility** key section.

SCPI Commands:

:SYSTem:PRESet

Table 5-3. **Factory-Defined Preset Conditions**

Parameter	Condition	Parameter	Condition
Frequency Parameters		**Amplitude Parameters**	
Frequency	Max. Specified	Amplitude	-135 dBm
Frequency Increment	Persistent State	Amplitude Increment	Persistent State
Frequency Reference	Off	Amplitude Reference	Off
Frequency Offset	0.0 Hz	Amplitude Offset	0.0 dB
Frequency Offset Increment	Persistent State	Amplitude Offset Increment	Persistent State
Frequency Multiplier	1	Attenuator Hold	Off
Phase Adjustment	0.0 Radians	ALC	On
Phase Adjustment Increment	Persistent State	Power Search	Manual
Phase Noise Optimization	Mode 2	**Frequency Modulation Parameters**	
Amplitude Modulation Parameters		FM Path	1
AM Path	1	FM	Off
AM	Off	FM Deviation	1.0 kHz
AM Depth	0.1%	FM Deviation Increment	Persistent State
AM Depth Increment	1.0%	FM Source	Internal
AM Source	Internal	FM Rate	400 Hz
AM Rate	400 Hz	FM Rate Increment	Persistent State
AM Rate Increment	Persistent State	FM Waveform	Sine
AM Waveform	Sine	FM Deviation Coupling	Off
AM Depth Coupling	Off	**Pulse Modulation Parameters**	
Phase Modulation Parameters		Pulse Modulation	Off
ΦM Bandwidth	Normal	Pulse Source	Internal
ΦM Path	1	Pulse Rate	400 Hz
ΦM	Off	Pulse Rate Increment	Persistent State
ΦM Deviation	0.0 Radians	**Sweep/List**	
ΦM Deviation Increment	Persistent State	Sweep	Off
ΦM Source	Internal	Sweep Type	List

Table 5-3.   **Factory-Defined Preset Conditions**

Parameter	Condition	Parameter	Condition
(Phase Modulation continued)		**(Sweep/List continued)**	
ΦM Rate	400 Hz	Sweep Repeat	Single
ΦM Rate Increment	Persistent State	Step Sweep Start Frequency	525 MHz
ΦM Waveform	Sine	Step Sweep Stop Frequency	525 MHz
ΦM Deviation Coupling	Off	Step Sweep Frequency Increment	Persistent State
LF Output		Step Sweep Start Amplitude	−135 dBm
LF Out	On	Step Sweep Stop Amplitude	−135 dBm
LF Out Amplitude	0.0 V	Step Sweep Amplitude Increment	Persistent State
LF Out Amplitude Increment	Persistent State	Step Sweep Number of Points	2
LF Out Source	Internal	Step Sweep Dwell Time	2.0 ms
LF Out Modulation Frequency	400 Hz	Step Sweep Dwell Time Incr.	Persistent State
LF Out Modulation Freq. Incr.	Persistent State	List Sweep Dwell Type	List
LF Out Waveform	Sine	**HP-IB/RS-232**	
Instrument Adjustments		HP-IB Address	Persistent State
Step/Knob Ratio	Persistent State	Remote Language	SCPI
Display		RS-232 Baud Rate	Persistent State
Brightness	Persistent State	Echo	Persistent State
Screen Saver (Off/On)	Persistent State	Transmit Pace	Persistent State
Screen Saver Mode	Persistent State	Receive Pace	Persistent State
Screen Saver Delay	Persistent State	RTS	Persistent State
Memory Catalog		**Power On/Preset**	
Catalog Type	Persistent State	Power On (Last/Preset)	Persistent State
Instrument Information		Preset (Normal/User)	Persistent State
Modulation Status Information	On	Preset Language	Persistent State
Help Mode		Reverse Power Protection (Normal/HP8648)	Persistent State
Help Mode (Single/Continuous)	Persistent State		

Pulse

Pressing the front panel **Pulse** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.

pk740a
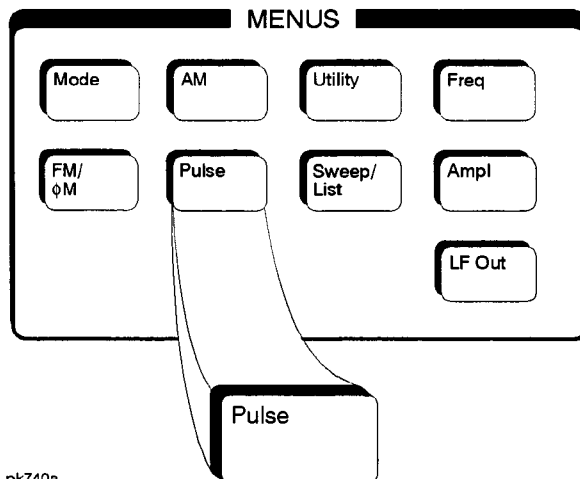
Ext2 DC-Coupled

This softkey lets you input an external, DC-coupled, pulse modulation signal to the EXT 2 INPUT connector.

The external 2 source has multiple uses but can be used for only one modulation at a time. If, for example you were using the external 2 source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the external 2 source, the signal generator would turn off **FM Path 1** and assign the external 2 source to your pulse configuration.

Softkey Location: Press **Pulse, Pulse Source, Ext2 DC-Coupled**

Status after Normal Preset: Pulse Source is set to Internal Square

SCPI Commands:

[:SOURce]:PULM:SOURce EXT2

[:SOURce]:PULM:SOURce?

Internal Square

This softkey lets you internally generate squarewave pulse modulation. The duty cycle is set at 50% and you can set the pulse rate from 0.1 Hz to 50 kHz. For additional specifications, refer to Chapter 9, "Specifications."

The internal source has multiple uses but can be used for only one modulation at a time. If, for example you were using the internal source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the internal source, the signal generator would turn off **FM Path 1** and assign the internal source to your pulse configuration.

Softkey Location: Press **Pulse, Pulse Source, Internal Square**

Status after Normal Preset: Pulse Source is set to Internal Square

SCPI Commands:

[:SOURce]:PULM:SOURce INT

[:SOURce]:PULM:SOURce?

Pulse Off On

This softkey enables the pulse modulation for whichever pulse source you have selected. Notice, however, that although you can enable the pulse modulation state with this softkey, the RF carrier is modulated by the enabled modulation only when you have also set **Mod On/Off** to **On**.

Softkey Location: Press **Pulse, Pulse Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:PULM:STATe ON|OFF|1|0

[:SOURce]:PULM:STATe?

Pulse Rate

Use this softkey to change the pulse rate for internally-generated pulse modulation. To change the rate, press the softkey once. The current value for pulse rate is displayed in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Hz** or **kHz** terminator softkey. The range of values allowed is 0.1 Hz to 50 kHz. Notice that the new value of pulse rate applies only to internally-generated pulse modulation; when externally-generated pulse modulation is selected, this softkey is disabled.

Softkey Location: Press **Pulse, Pulse Rate**

Status after Normal Preset: 400 Hz

SCPI Commands:

[:SOURce]:PULM:INTernal[1]FREQuency <val><unit>

[:SOURce]:PULM:INTernal[1]:FREQuency?

Pulse Source

Pressing this softkey reveals a menu of choices for pulse modulation sources. You can choose internally-generated pulse modulation or select an externally-applied, DC-coupled signal from the EXT 2 INPUT connector.

The internal and external 2 sources have multiple uses. However, you can use each source for only one modulation type at a time. If, for example, you were using the external 2 source in a frequency modulation configuration for **FM Path 1**, and then you configured the pulse modulation source to also use the external 2 source, the signal generator would turn off **FM Path 1** and assign the external 2 source to your pulse configuration.

Softkey Location: Press **Pulse, Pulse Source**

Status after Normal Preset: Internal Square

Recall

Pressing the front panel **Recall** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.
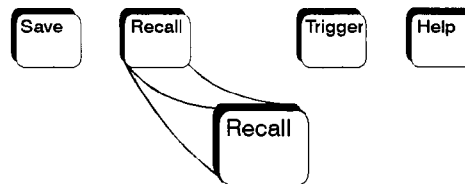
pk752a

Delete All Regs in Seq [n]

Press this softkey to delete the data saved in all of the registers of the selected sequence. Do not press this softkey until you have selected the correct sequence using the **Select Seq** softkey. For example, if you want to delete the data in all of the registers that are saved in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now press **Delete All Regs in Seq [4]** and the data in all of the registers stored in sequence 4 will be deleted. Be certain that you want to delete this data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall, Delete All Regs in Seq [n]**

Delete All Sequences

Press this softkey to delete all of the data in all saved registers of all sequences. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall, Delete All Sequences**

Delete Seq[n] Reg[nn]

Press this softkey to delete the contents of a specified register in a specified sequence. Do not press this softkey until you have selected the correct sequence and register using the **Select Seq** and **Recall Reg** softkeys. For example, if you want to delete the contents of register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now select register 5. (Remember, you must first have saved an instrument state to this register in sequence 4.) Press **Recall Reg**. The recall register number becomes the active function. Enter the number 5 using the numeric keypad and press the **Enter** terminator softkey. The instrument state is restored from this register and register 5 is now displayed in all softkeys which specify a register number in this menu. Now press **Delete Seq [4] Reg[05]** and register 5, stored in sequence 4, will be deleted. The instrument state that you had recalled from this register remains, however, until you change it. If you deleted this register in error, you can immediately resave it using the **Save Seq[n] Reg[n]** softkey in the **Save** menu.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Save** key menu.

Softkey Location: Press **Recall, Delete Seq[n] Reg[nn]**

Recall Reg

Press this softkey to recall an instrument state from a saved register. Recalling a register also selects that register number for all softkeys which specify a register number in this menu. For example, if you want to select register 5, press **Recall Reg**. (Remember, you must first have saved an instrument state to this register in the current sequence identified by the **Select Seq** softkey. If there is nothing saved, you cannot recall it.) The recall register number becomes the active function. Enter the number 5 using the numeric keypad and press the **Enter** terminator softkey. The instrument state is restored from this register and register 5 is now displayed in all softkeys which specify a register in this menu. You can also use the front panel knob and the up and down arrow keys to scroll through all saved registers for the selected sequence, recalling each instrument state.

Softkey Location: Press **Recall, Recall Reg**

IEEE 488.2 Common Commands:

*RCL <reg>, <seq>

Select Seq

Press this softkey to choose a sequence for all softkeys which specify a sequence in this menu. For example, if you want to select sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

NOTE:

The actual number of states that can be saved may be less if the user file system has non-instrument state files stored such as sweep/list sequences.

Softkey Location: Press **Recall, Select Seq**

Return

pk762a

This front panel hardkey moves you from your current softkey menu to the softkey menu that precedes it. For example, press the **LF Out** front panel hardkey. The LF Out menu is displayed. Now press the **LF Out Source** softkey. (The arrow indicates that pressing this softkey will display another menu.) You should now see the LF Out Source menu. Press **Return**, and you are moved back to the LF Out menu.

When you are at the top level of the menus the **Return** key has no function.

While you are entering data with the numeric keypad, pressing the **Return** key cancels the data input and leaves the original value unchanged.
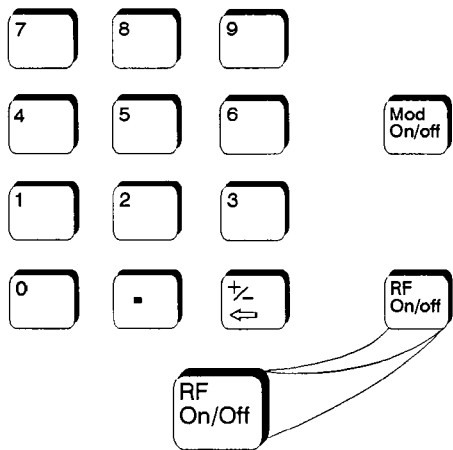
RF On/Off

pk757a

This front panel hardkey toggles the RF signal on and off at the RF OUTPUT connector. Although you can configure and engage various modulations, no signal is available at the RF OUTPUT connector until **RF On/Off** is set to **On**. An annunciator is always turned on in the display to indicate whether RF is turned on or off.

Status after Normal Preset: RF Off

Save

Pressing the front panel **Save** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.
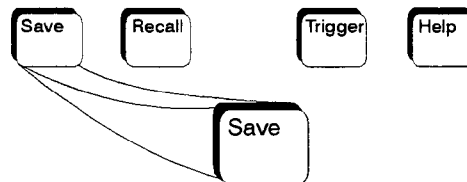
pk751a

Delete All Regs in Seq [n]

Press this softkey to delete the data saved in all of the registers of the selected sequence. Do not press this softkey until you have selected the correct sequence using the **Select Seq** softkey. For example, if you want to delete all of the registers that are saved in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now press **Delete All Regs in Seq [4]** and the data in all of the registers stored in sequence 4 will be deleted. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save, Delete All Regs in Seq [n]**

Delete All Sequences

Press this softkey to delete all of the data in all saved registers of all sequences. Be certain that you want to delete the data; you cannot recover it once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save, Delete All Sequences**

Delete Seq[n] Reg[nn]

Press this softkey to delete the contents of a specified register in a specified sequence. Do not press this softkey until you have selected the correct sequence and register using the **Select Seq** and **Select Reg** softkeys. For example, if you want to delete register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence number in this menu. Now select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 in the same way that you changed the sequence number. Register 5 is now displayed in all softkeys which specify a register number in this menu. Now press **Delete Seq [4] Reg[05]** and register 5, stored in sequence 4, will be deleted. Be certain that you want to delete the data; you cannot recover the data once deleted.

NOTE: This softkey has exactly the same function as the softkey with the identical name in the front panel **Recall** key menu.

Softkey Location: Press **Save, Delete Seq[n] Reg[nn]**

Save Seq[n] Reg[nn]

Press this softkey to save the current instrument state in the specified register and sequence. The instrument state includes all of your setup selections except list and step sweep data and functions which are identified in this manual as persistent states.

Do not press this softkey until you have specified the correct sequence and register using the **Select Seq** and **Select Reg** softkeys. For example, if you want to save to register 5 in sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu. Now select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 in the same way that you changed the sequence number. Register 5 is now displayed in all softkeys which specify a register in this menu. Now press **Save Seq [4] Reg[05]** and the current instrument state will be stored in register 5 of sequence 4.

There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

Softkey Location: Press **Save, Save Seq[n] Reg[nn]**

IEEE 488.2 Common Commands:

*SAV <reg>, <seq>

Select Reg

Press this softkey to choose a register for all softkeys which specify a register in this menu. For example, if you want to select register 5, press **Select Reg**. The currently selected register is displayed in the active entry area. Change the number to 5 using the up and down arrow keys, the front panel knob, or enter a 5 using the numeric keypad and press the **Enter** terminator softkey. If you use the numeric keypad, the Enter terminator softkey will automatically save the current instrument state into the selected register number. The front panel knob and the arrow keys will select the register, but to save the data you must press the **Save Seq[n] Reg[nn]** softkey. Register 5 is now displayed in all softkeys which specify a register in this menu.

There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

Softkey Location: Press **Save, Select Reg**

Select Seq

Press this softkey to choose a sequence for all softkeys which specify a sequence in this menu. For example, if you want to select sequence 4, press **Select Seq**. The currently selected sequence is displayed in the active entry area. Change the number to 4 using the up and down arrow keys, the front panel knob, or enter a 4 using the numeric keypad and press the **Enter** terminator softkey. Sequence 4 is now displayed in all softkeys which specify a sequence in this menu.

There are 100 registers available (0 through 99) in each of 10 (0 through 9) sequences. You can use these registers in any combination so long as the total number of registers used does not exceed 100.

NOTE: The actual number of states that can be saved may be less if the user file system has non-instrument state files stored such as sweep/list sequences.

Softkey Location: Press **Save, Select Seq**

Sweep/List

Pressing the front panel **Sweep/List** key reveals a menu of softkeys. Using these softkeys you can define a series of points containing frequency, amplitude and dwell time information for the signal generator to sweep. The softkeys are described in this section in alphabetical order.
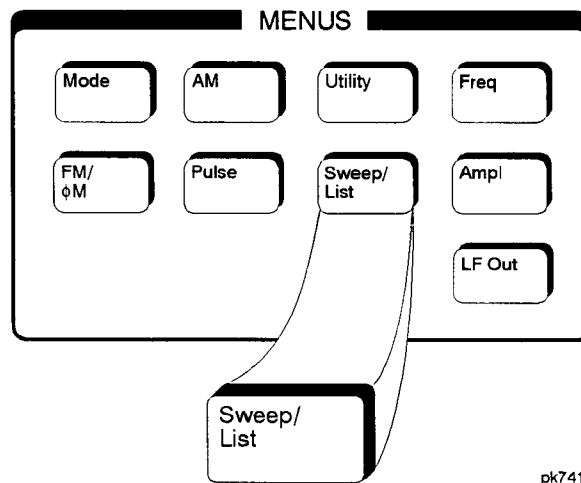
pk741a

Points

Press this softkey to define the number of points in a step sweep. To enter the number of points in the sweep, press **# Points**. The number of step sweep points becomes the active function and the current value is shown in the active entry area. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. A step sweep must always have a minimum of 2 points and can be configured to have as many as 401 points.

Softkey Location: Press **Sweep/List, Configure Step Sweep, # Points**

Status after Normal Preset: 2

SCPI Commands:

[:SOURce]:SWEep:POINts <val>

[:SOURce]:SWEep:POINts?

Ampl

Press this softkey to set the signal generator to sweep amplitude data only. The frequency is set at a constant value determined by the **Frequency** front panel key. You can define a sweep containing both amplitude and frequency information and still choose to sweep amplitude only.

Softkey Location: Press **Sweep/List, Sweep, Ampl**

Status after Normal Preset: Sweep is set to Off

Ampl Start

Press this softkey to set the amplitude of the first point in the sweep. You can set the value anywhere in the range of the signal generator's specified output power. Press **Ampl Start** and amplitude becomes the active function for the first point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm, dBuV, dBuVemf, mV, uV, mVemf,** or **uVemf** terminator softkey.

Softkey Location: Press **Sweep/List, Configure Step Sweep, Ampl Start**

Status after Normal Preset: –135 dBm

SCPI Commands:

[:SOURce]:POWer:STARt <val><unit>

[:SOURce]:POWer:STARt?

Ampl Stop

Press this softkey to set the amplitude of the last point in the sweep. You can set the value anywhere in the range of the signal generator's specified output power. Press **Ampl Stop** and amplitude becomes the active function for the last point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **dBm, dBuV, dBuVemf, mV, uV, mVemf,** or **uVemf** terminator softkey.

Softkey Location: Press **Sweep/List, Configure Step Sweep, Ampl Stop**

Status after Normal Preset: −135 dBm

SCPI Commands:

[:SOURce]:POWer:STOP <val><unit>

[:SOURce]:POWer:STOP?

Bus

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Bus** in the Sweep Trigger menu allows you to trigger a list or step sweep using the HP-IB. Choosing **Bus** in the Point Trigger menu allows you to trigger a sweep point-by-point using the HP-IB.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Trigger, Bus**
or press **Sweep/List, More (1 of 2), Point Trigger, Bus**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce BUS

[:SOURce]:LIST:TRIGger:SOURce?

Configure List Sweep

Pressing this softkey reveals a menu of softkeys for defining a list sweep. In this menu you can insert and delete points in a sweep. Each point can contain frequency, amplitude, and dwell time information. You can also edit existing points in the sweep using this menu. This menu selection is disabled until you have set **Sweep Type** to **List.**

Softkey Location: Press **Sweep/List, Configure List Sweep**

Configure Step Sweep

Pressing this softkey reveals a menu of softkeys for defining a step sweep. In this menu you can set the start and stop frequencies for a sweep, set the start and stop power levels, and you can set the number of points in the sweep with the dwell time at each point.

Softkey Location: Press **Sweep/List, Configure Step Sweep**

Copy Item

Press this softkey to place a copy of the selected item directly below that item in the sweep list. First use the arrow keys until the item is selected that you wish to copy. Press **Copy Item** and an identical copy of the selected item is placed in a new row below the selected item.

Softkey Location: Press **Sweep/List, Configure List Sweep, More (1 of 2), Copy Item**

Copy Row

Press this softkey to place a copy of the selected row directly below that row in the sweep list. First use the up and down arrow keys until any item is selected in the row you wish to copy. Press **Copy Row** and an identical copy of the selected row is placed below it.

Softkey Location: Press **Sweep/List, Configure List Sweep, More (1 of 2), Copy Row**

Delete Item

Press this softkey to delete an item in the displayed list of sweep points. Use the arrow keys until the desired item is highlighted. Then press **Delete Item** to eliminate this item from the sweep list. Be certain that you want to delete this item; you cannot recover it once you have deleted it. If the last item in a list is deleted, it is replaced by the default value.

Softkey Location: Press **Sweep/List, Configure List Sweep, Delete Item**

Delete Row

Press this softkey to delete a selected row in the sweep list. Use the up and down arrow keys until any item is selected in the row you wish to delete. Press **Delete Row** and the entire row is deleted. Be certain that you want to delete the row; you cannot recover this sweep data once you press **Delete Row**. If the last row in a list is deleted, it is replaced by the default value.

Softkey Location: Press **Sweep/List, Configure List Sweep, More (1 of 2), Delete Row**

Dwell Type List Step

Press this softkey to toggle the dwell time for the list sweep points between the values defined in the list sweep and the value set for step sweep. Choose **List** to sweep with dwell times that you have defined in the list sweep. Choose **Step** and you will sweep each point in the list with a dwell time set by the **Step Dwell** softkey in the Configure Step Sweep menu. Notice that even though you are sweeping using the step sweep dwell time, the dwell time values in the list do not visually change to the step dwell value.

Softkey Location: Press **Sweep/List, Configure List Sweep, Dwell Type List Step**

Edit Item

Press this softkey to change an item in the displayed list of sweep points. Use the arrow keys until the correct item is highlighted. Press **Edit Item** and the item is displayed in the active entry area. Change the value using the up and down arrow keys, or the front panel knob and press the **Enter** terminator softkey. Or enter a new value using the numeric keypad and then press a units terminator softkey.

Softkey Location: Press **Sweep/List, Configure List Sweep, Edit Item**

Ext Neg

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Ext Neg** in the Sweep Trigger menu allows you to trigger a list or step sweep on the negative edge of a signal applied to the TRIGGER IN rear panel connector. Choosing **Ext Neg** in the Point Trigger menu allows you to trigger a sweep point-by-point on the negative edge of a signal applied to the TRIGGER IN rear panel connector. Use this selection when you have **Manual Mode** set to **On**.

The **Ext Neg** (and **Ext Pos**) selections in the Sweep Trigger and Point Trigger menus are coupled; you cannot choose **Ext Neg** for one and **Ext Pos** for the other. The first selection will follow the second. For example, if you choose **Ext Neg** for the sweep trigger and then choose **Ext Pos** for the point trigger, the sweep trigger selection will automatically change to **Ext Pos**.

Softkey Location: Press **Sweep/List**, **More (1 of 2)**, **Sweep Trigger**, **Ext Neg** or press **Sweep/List**, **More (1 of 2)**, **Point Trigger**, **Ext Neg**

Status after Normal Preset: Immediate

SCPI Commands:

    [:SOURce]:LIST:TRIGger:SOURce EXTernal

    [:SOURce]:LIST:TRIGger:SOURce?

    :TRIGger[:SEQuence]:SOURce EXTernal

    :TRIGger[:SEQuence]:SOURce?

    :TRIGger[:SEQuence]:SLOPe NEGative

    :TRIGger[:SEQuence]:SLOPe?

Ext Pos

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Ext Pos** in the Sweep Trigger menu allows you to trigger a list or step sweep on the positive edge of a signal applied to the TRIGGER IN rear panel connector. Choosing **Ext Pos** in the Point Trigger menu allows you to trigger a sweep point-by-point on the positive edge of a signal applied to the TRIGGER IN rear panel connector. Use this selection when you have **Manual Mode** set to **On**.

The **Ext Pos** (and **Ext Neg**) selections in the Sweep Trigger and Point Trigger menus are coupled; you cannot choose **Ext Neg** for one and **Ext Pos** for the other. The first selection will follow the second. For example, if you choose **Ext Neg** for the sweep trigger and then choose **Ext Pos** for the point trigger, the sweep trigger selection will automatically change to **Ext Pos**.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Trigger, Ext Pos**
or press **Sweep/List, More (1 of 2), Point Trigger, Ext Pos**

Status after Normal Preset: Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce EXTernal

[:SOURce]:LIST:TRIGger:SOURce?

:TRIGger[:SEQuence]:SOURce EXTernal

:TRIGger[:SEQuence]:SOURce?

:TRIGger[:SEQuence]:SLOPe POSitive

:TRIGger[:SEQuence]:SLOPe?

Freq

Press this softkey to set the signal generator to sweep frequency data only. The amplitude is set at a constant level determined by the **Amplitude** front panel key. You can define a sweep containing both amplitude and frequency information and still choose to sweep frequency only.

Softkey Location: Press **Sweep/List, Sweep, Freq**

Status after Normal Preset: Sweep is set to Off

Freq&Ampl

Press this softkey to set the signal generator to sweep both frequency and amplitude data. If your list is missing either the frequency or amplitude data, the signal generator supplies a default value.

Softkey Location: Press **Sweep/List, Sweep, Freq&Ampl**

Status after Normal Preset: Sweep is set to Off

SCPI Commands:

[:SOURce]:POWer:MODE LIST

[:SOURce]:FREQuency:MODE LIST

Freq Start

Press this softkey to set the frequency of the first point in the sweep. You can set the value anywhere in the range of the signal generator's specified output frequency. Press **Freq Start** and frequency becomes the active function for the first point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz, MHz, kHz,** or **Hz** terminator softkey.

Softkey Location: Press **Sweep/List, Configure Step Sweep, Freq Start**

Status after Normal Preset: 525 MHz

SCPI Commands:

[:SOURce]:FREQuency:STARt <val><unit>

[:SOURce]:FREQuency:STARt?

Freq Stop

Press this softkey to set the frequency of the last point in the sweep. You can set the value anywhere in the range of the signal generator's specified output frequency. Press **Freq Stop** and frequency becomes the active function for the last point in the sweep. To enter the value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **GHz**, **MHz**, **kHz**, or **Hz** terminator softkey.

Softkey Location: Press **Sweep/List, Configure Step Sweep, Freq Stop**

Status after Normal Preset: 525 MHz

SCPI Commands:

[:SOURce]:FREQuency:STOP <val><unit>

[:SOURce]:FREQuency:STOP?

Immediate

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Immediate** in the Sweep Trigger menu immediately triggers the current sweep when you press the **Single Sweep** softkey. Choosing **Immediate** in the Point Trigger menu causes the sweep to pause for the dwell time at each point after the hardware has been set up for that point's frequency and amplitude.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Trigger, Immediate** or press **Sweep/List, More (1 of 2), Point Trigger, Immediate**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce IMMediate

[:SOURce]:LIST:TRIGger:SOURce?

Insert Item

Press this softkey to insert an item in the displayed list of sweep points. Use the arrow keys until you have highlighted the item directly below where you want to insert a new item. Press **Insert Item** and the current item is displayed in the active entry area. Change the current value of the item to the value for the item you are inserting. Use the up and down arrow keys or the front panel knob and press the **Enter** terminator softkey. Or enter a new value using the numeric keypad and then press a units terminator softkey. The new item is inserted above the item you previously selected.

Softkey Location: Press **Sweep/List, Configure List Sweep, Insert Item**

Load List From Step Sweep

Press this softkey to eliminate the existing sweep list data and replace it with the step sweep data points. You can only have one sweep list at a time so be certain that you wish to delete the existing list. You cannot recover the sweep list data once you press **Load List From Step Sweep.**

Softkey Location: Press **Sweep/List, Configure List Sweep, Load List From Step Sweep**

Manual Mode Off On

This softkey toggles manual selection of the current sweep point on and off. When **Manual Mode** is **On**, the selected sweep/list point controls the frequency and amplitude according to the sweep type. The current point in the sweep is displayed in the active entry area and also below the **Manual Point** softkey. This softkey is disabled when **Sweep** is set to **Off.**

Softkey Location: Press **Sweep/List, More (1 of 2), Manual Mode Off On**

Status after Normal Preset: Off

SCPI Commands:

[:SOURce]:LIST:MODE AUTO|MANual

[:SOURce]:LIST:MODE?

Manual Point

Press this softkey to choose a point in the sweep list. When **Manual Mode** is **On**, the selected sweep/list point controls the frequency and amplitude according to the sweep type. The current point number is shown in the active entry area when you press **Manual Point**. The frequency of the point is shown in the frequency area of the display. The amplitude of the point is shown in the amplitude area of the display. You can choose which point to sweep using the up and down arrow keys, the front panel knob, or by entering the point number desired using the numeric keypad and pressing the **Enter** terminator softkey. This softkey is disabled when **Manual Mode Off On** is set to **Off**.

Softkey Location: Press **Sweep/List, More (1 of 2), Manual Point**

Status after Normal Preset: 1

SCPI Commands:

[:SOURce]:LIST:MANual <val>

[:SOURce]:LIST:MANual?

Off

This softkey turns off all sweep functions. The output signal is then set according to the current frequency and amplitude settings defined by the front panel **Frequency** and **Amplitude** keys.

Softkey Location: Press **Sweep/List, Sweep, Off**

Page Down

Press this softkey to view the next page of list sweep points.

Softkey Location: Press **Sweep/List, Configure List Sweep, More (1 of 2), Page Down**

Page Up

Press this softkey to view the previous page of list sweep points.

Softkey Location: Press **Sweep/List, Configure List Sweep, More (1 of 2), Page Up**

Point Trigger

Pressing this softkey reveals a menu of choices for triggering a sweep point-by-point. You can choose triggering that occurs immediately once a sweep is armed, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **Sweep/List, More (1 of 2), Point Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce?

Preset List

Press this softkey to eliminate the current sweep list and replace it with a new list consisting of the following: one point at a frequency of 525 MHz, with an amplitude of –135 dBm, and a dwell time of 2 ms. Be certain that you want to delete the current sweep list; you cannot recover the information once you press **Preset List**.

Softkey Location: Press **Sweep/List, Configure List Sweep, Preset List**

Single Sweep

Press this softkey to arm the sweep. The **ARMED** annunciator will turn on in the display. The signal generator will begin the sweep as soon as the trigger is received. If you have set the trigger to **Immediate**, a sweep is initiated as soon as you arm the sweep.

Softkey Location: Press **Sweep/List, Single Sweep**

SCPI Commands:

:INITiate:CONTinuous[:ALL] ON|OFF|1|0

:INITiate[:IMMediate][:ALL]

Step Dwell

Press this softkey to set the dwell time for each point of a step sweep. To set the dwell time, press **Step Dwell**. The current dwell time is displayed in the active entry area. Enter the desired dwell time using the up and down arrow keys, the front panel knob, or enter a value using the numeric keypad and press the **sec** or **msec** terminator softkey. The range of values allowed is 2 ms through 60 s in 1 ms increments. Dwell time is used when the point trigger is **Immediate**. The dwell time is the amount of time the sweep is guaranteed to pause after setting the frequency and power for the current sweep/list point.

Softkey Location: Press **Sweep/List, Configure Step Sweep, Step Dwell**

SCPI Commands:

[:SOURce]:LIST:DWEL1 <val> {,<val>}

[:SOURce]:LIST:DWEL1:POINts?

Sweep Direction Down Up

This softkey changes the direction of the sweep. Choose **Up** to sweep from the first point in the list to the last point, or from the step sweep start frequency and amplitude to the stop frequency and amplitude. Choose **Down** to reverse the direction of the sweep.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Direction Down Up**

Status after Normal Preset: Up

SCPI Commands:

[:SOURce]:LIST:DIRection UP|DOWN

[:SOURce]:LIST:DIRection?

Sweep

Pressing this softkey reveals a menu of choices for determining the sweep parameters. In this menu you can choose to sweep frequency only, amplitude only, or both frequency and amplitude. You can also choose to turn off all sweep functions.

Softkey Location: Press **Sweep/List, Sweep**

Status after Normal Preset: Off

Sweep Repeat Single Cont

This softkey toggles the sweep repetition between a single sweep or continuous sweeping.

Softkey Location: Press **Sweep/List, Sweep Repeat Single Cont**

Status after Normal Preset: Single

SCPI Commands:

:INITiate:CONTinuous[:ALL] ON|OFF|1|0

:INITiate:CONTinuous[:ALL]?

Sweep Trigger

Pressing this softkey reveals a menu of choices for triggering a full sweep. You can choose triggering that occurs immediately once a sweep is armed, triggering that is supplied by the HP-IB, triggering on either the positive or negative edge of a signal supplied to the TRIGGER IN connector, or triggering by the front panel **Trigger** key.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Trigger**

Status after Normal Preset: Immediate

SCPI Commands:

:TRIGger[:SEQuence]:SOURce?

Sweep Type List Step

This softkey toggles the sweep type from list sweep to step sweep. You create a list sweep by supplying the frequency, amplitude, and dwell time for each point in the sweep. You create a step sweep by supplying the start and stop frequency and amplitude, the number of points, and a dwell time. The signal generator then calculates the points between the first and last point in a linear manner.

Softkey Location: Press **Sweep/List, Sweep Type List Step**

Status after Normal Preset: List

SCPI Commands:

[:SOURce]:LIST:TYPE LIST|STEP

[:SOURce]:LIST:TYPE?

Trigger Key

This softkey is one of the choices in both the Sweep Trigger menu and the Point Trigger menu. Press either the **Sweep Trigger** softkey or the **Point Trigger** softkey to view these menus. Choosing **Trigger Key** in the Sweep Trigger menu immediately triggers an armed sweep when you press the **Trigger** front panel key. Choosing **Trigger Key** in the Point Trigger menu immediately triggers the next point in a running sweep.

Softkey Location: Press **Sweep/List, More (1 of 2), Sweep Trigger, Trigger Key** or press **Sweep/List, More (1 of 2), Point Trigger, Trigger Key**

Status after Normal Preset: Sweep and point trigger are set to Immediate

SCPI Commands:

[:SOURce]:LIST:TRIGger:SOURce KEY

[:SOURce]:LIST:TRIGger:SOURce?

Trigger Out Polarity Neg Pos

This softkey toggles the polarity of the TTL signal that is output at the rear panel TRIGGER OUT connector. When **Trigger Out Polarity Neg Pos** is set to **Pos** the output signal is asserted high (+5 V) at the start of a dwell sequence, or at the start of waiting for the point trigger, and low (0 V) when the dwell is over, or when the point trigger is received. Setting **Trigger Out Polarity Neg Pos** to **Neg** reverses the polarity where a high is 0 V and a low is +5 V.

Softkey Location: Press **Sweep/List, More (1 of 2), Trigger Out Polarity Neg Pos**

Status after Normal Preset: Pos

SCPI Commands:

:TRIGger:OUTPut:POLarity POSitive|NEGative

:TRIGger:OUTPut:POLarity?
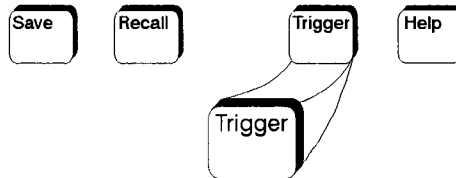
Trigger

pk753a

Press this front panel hardkey to trigger a specified event or series of events.

With the sweep mode configured and turned on, the TRIGGER key can initiate a step sweep that you can configure as either a single sweep between two end points or as a continuous sweep which repeats the sweep until you turn the mode off.

*   The TRIGGER key can start a step or list sweep or cause the sweep to step to the next point in the step or list sweep under the following conditions:

    *   Sweep mode is configured and turned on

    *   The **Point Trigger** softkey, in the Sweep/List menu, is set to **Trigger Key**

SCPI Commands:

:TRIGger[:SEQuence][:IMMediate]

Utility

Pressing the front panel **Utility** key reveals a menu of softkeys. These softkeys are described in this section in alphabetical order.

pk737a
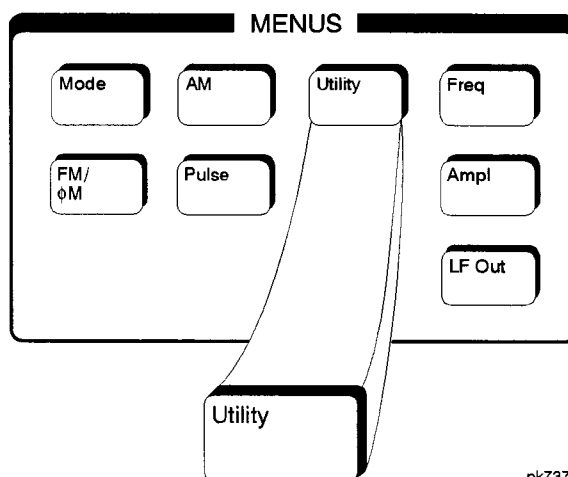
All

This softkey lets you specify that all types of files (including instrument state files, binary user data, and the current sweep list) are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Memory Catalog, Catalog Type, All**

SCPI Commands:

:MEMory:CATalog[:ALL]?

Binary

This softkey lets you specify that only binary files are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Memory Catalog, Catalog Type, Binary**

SCPI Commands:

:MEMory:CATalog[:BINary]?

Black Pixels Screen Test

This softkey is provided for factory use in testing the display. Pressing this softkey sets all the pixels on the display to black. Pressing the **Local** front panel key returns the display to normal signal generator operation.

Softkey Location: Press **Utility, Display, Black Pixels Screen Test**

Brightness

Use this softkey to adjust the display brightness (intensity). The display is set to maximum brightness at the factory. To change the brightness, press **Utility, Display, Brightness**. The current value shown in the active entry area is a relative value for brightness. Increasing the number increases the brightness; decreasing the number decreases the brightness. You can adjust the brightness value to any number from 1 through 50. Use the front panel knob, the up and down arrow keys, or enter a value using the numeric keypad and press the **Enter** terminator softkey.

Brightness is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Display, Brightness**

Catalog Type

Pressing this softkey reveals a menu of choices for displaying files. You can choose to display all files (including instrument state files, binary user data, and the current sweep list), binary files only, or instrument state files only. When you have made your selection, the display is updated and your choice displayed below the **Catalog Type** softkey.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Memory Catalog, Catalog Type**

SCPI Commands:

> :MEMory:CATalog[:ALL]?
>
> :MEMory:CATalog:BINary?
>
> :MEMory:CATalog:STATe?

Clear Error Queue(s)

Press this softkey to delete any messages that are stored in the error message queues. (There are separate error queues for front panel operation and for SCPI. Pressing this softkey clears both.) You cannot recover from this action; once the messages are deleted, they are permanently gone. When the error message queue is empty, the **ERR** annunciator is turned off.

Softkey Location: Press **Utility, Error Info, Clear Error Queue(s)**

IEEE 488.2 Common Commands:

> *CLS

Copy File

Press this softkey to copy and rename a file in the displayed catalog of files. To copy a file, first select the file from the displayed list by scrolling through the list using the front panel knob or up and down arrow keys. When the desired file is highlighted, press **Copy File**. The message `Copy to: <filename>` is displayed in the active entry area where <filename> is the name of the currently selected file. Give the file a new name. Use the left and right arrow keys to select a character to change. Use the front panel knob to change the character to an alphabetic character, numeral, or special character. When you have entered the new file name, press the **Enter** terminator softkey. If you have changed your mind, press the **Return** hardkey. Once you press **Enter**, the new file is stored and displayed immediately in the catalog list.

Softkey Location: Press **Utility, Memory Catalog, Copy File**

Delete File

Press this softkey to delete a file in the displayed catalog of files. To delete a file, first select the file from the displayed list by scrolling through the list using the front panel knob or up and down arrow keys. When the desired file is highlighted, press **Delete File**. Then press the **Confirm Delete** terminator softkey and the file is deleted. You cannot recover the file after this step. If you have changed your mind and do not wish to delete the file, press the **Return** front panel hardkey instead.

Softkey Location: Press **Utility, Memory Catalog, Delete File**

Diagnostic Info

Press this softkey for a display of diagnostic information about the signal generator. This information included in the display is:

- Instrument model

- Instrument serial number

- Current firmware revision

- Current firmware date

- Number of hours the signal generator has been powered on

- Number of hours the display has been lit

- Number of power cycles

- Number of attenuator cycles

- Number of reverse power protection trips

Softkey Location: Press **Utility, Instrument Info/Help Mode, Diagnostic Info**

Display

Pressing this softkey reveals a menu of choices for adjusting and testing the display. In this menu you are able to set up the screen saver, change the display brightness, and perform black and white pixel screen tests.

Softkey Location: Press **Utility, Display**

Error Info

Pressing this softkey reveals a menu of choices for viewing error messages. In this menu you can view any of the error messages in the queue, and you can clear all of the error messages in the queue.

Softkey Location: Press **Utility, Error Info**

Help Mode Single Cont

This softkey toggles the help mode between single (the normal preset condition) and continuous. In single mode, when you press the **Help** key, help text is provided for the next front panel hardkey or softkey that you press. Your next key press returns you to normal operation. In continuous mode, when you press the **Help** key, help text is provided for the next front panel hardkey or softkey that you press and that key's function is also executed. You will stay in this help mode until you press the **Help** key again.

Softkey Location: Press **Utility, Instrument Info/Help Mode, Help Mode Single Cont**

SCPI Commands:

:SYSTem:HELP:MODE SINGle|CONT

:SYSTem:HELP:MODE?

HP8656B,8657A/B

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. The **HP8656B,8657A/B** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8656B and the HP 8657A/B. Choosing **HP8656B,8657A/B** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8656B,8657A/B** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility, Power On/Preset, Preset Language, HP8656B,8657A/B**
or press **Utility, HP-IB/RS-232, Remote Language, HP8656B,8657A/B**

SCPI Commands:

:SYSTem:LANGuage "COMP"

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage "COMP"

:SYSTem:PRESet:LANGuage?

HP8657D NADC

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. The **HP8657D NADC** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8657D with NADC digital modulation capabilities. Choosing **HP8656D NADC** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8656D NADC** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility, Power On/Preset, Preset Language, HP8657D NADC** or press **Utility, HP-IB/RS-232, Remote Language, HP8657D NADC**

SCPI Commands:

   :SYSTem:LANGuage "NADC"

   :SYSTem:LANGuage?

   :SYSTem:PRESet:LANGuage "NADC"

   :SYSTem:PREset:LANGuage?

HP8657D PDC

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. The **HP8657D PDC** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8656D with PDC digital modulation capabilities. Choosing **HP8657D PDC** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8657D PDC** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility, Power On/Preset, Preset Language, HP8657D PDC** or press **Utility, HP-IB/RS-232, Remote Language, HP8657D PDC**

SCPI Commands:

   :SYSTem:LANGuage "PDC"

   :SYSTem:LANGuage?

   :SYSTem:PRESet:LANGuage "PDC"

   :SYSTem:PREset:LANGuage?

HP8657J PHS

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. The **HP8657J PHS** softkey is a language choice for the signal generator that is compatible with the remote language commands used by the HP 8657J with PHS digital modulation capabilities. Choosing **HP8657J PHS** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **HP8657J PHS** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility, Power On/Preset, Preset Language, HP8657J PHS** or press **Utility, HP-IB/RS-232, Remote Language, HP8657J PHS**

SCPI Commands:

:SYSTem:LANGuage "PHS"

:SYSTem:LANGuage?

:SYSTem:PRESet:LANGuage "PHS"

:SYSTem:PRESet:LANGuage?

HP-IB Address

Press this softkey to change the signal generator's HP-IB address. The HP-IB address is set to 19 at the factory. You can change the address to any number between 0 and 30. To enter a new value, press **Utility, HP-IB/RS-232, HP-IB Address** and rotate the front panel knob, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

The HP-IB address setting is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, HP-IB Address**

SCPI Commands:

:SYSTem:COMMunicate:GPIB:ADDRess <number>

:SYSTem:COMMunicate:GPIB:ADDRess?

HP-IB/RS-232

Pressing this softkey reveals a menu of choices for HP-IB and RS-232 configuration. In this menu, you have the following options:

- Change the HP-IB address of the signal generator.

- Change the remote language of the signal generator.

- Set the baud rate for the RS-232 serial port (AUXILIARY INTERFACE connector).

- Reset the RS-232 serial I/O.

- Turn the RS-232 echo on or off.

- Set the RS-232 handshake protocol.

- Control RS-232 RTS and CTS behavior.

Softkey Location: Press **Utility**, **HP-IB/RS-232**

Instrument Adjustments

Pressing this softkey reveals a menu of front panel adjustments for the signal generator. The softkeys in this menu provide the following capabilities:

- Adjust the ratio between the front panel knob and the step size for the arrow keys

- Adjust the internal reference oscillator (for use by service personnel only)

Softkey Location: Press **Utility**, **Instrument Adjustments**

Instrument Info/Help Mode

Pressing this softkey reveals a menu of softkeys for the following functions:

- Display diagnostic information about your signal generator

- Turn on and off the display of information about the status of the modulation modes

- Toggle the help mode between single and continuous

Softkey Location: Press **Utility**, **Instrument Info/Help Mode**

Memory Catalog

Pressing this softkey displays the catalog of user files. In addition, it reveals a menu for choosing the type of files that are displayed and for file management. In this menu you can choose to display files by type (all files, instrument state files only, or binary files only), and you can copy and delete files.

Softkey Location: Press **Utility, Memory Catalog**

Mod Status Info Off On

Press this softkey to toggle on and off the modulation status display. When the modulation status is set to on, information about the status of all of the modulations available is shown at any time that you have accessed one of the modulation menus. When the modulation status is set to off, the information about the status of all the modulations is never displayed.

Softkey Location: Press **Utility, Instrument Info/Help Mode, Mod Status Info Off On**

Status after Normal Preset: On

Off

Press this softkey to turn the RTS line off. In this mode, the instrument will ignore the state of the CTS line (3-wire connection). This setting is not compatible with the HP 83300A Remote Interface.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, RTS/CTS, Off**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS OFF

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

Page Down

Press this softkey to move down in the displayed catalog of files one page at a time.

Softkey Location: **Utility, Memory Catalog, Page Down**

Page Up

Press this softkey to move up in the displayed catalog of files one page at a time.

Softkey Location: **Utility, Memory Catalog, Page Up**

Power On Last Preset

This softkey toggles the power-on state of the signal generator between **Last** and **Preset**.

*   If you choose **Last**, each time you cycle power to the signal generator it will turn on in the same condition as when you turned power off. The signal generator must not receive commands for a second before the power is turned off to guarantee that the most recent state is saved.

*   If you choose **Preset**, each time you cycle power to the signal generator it will turn on in either the factory-defined preset condition or in a user-defined preset condition. You make the choice between factory- and user-defined preset with the **Preset Normal User** softkey.

The power-on state is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Power On/Preset, Power On Last Preset**

SCPI Commands:

:SYSTem:PON:TYPE PRESet|LAST

:SYSTem:PON:TYPE?

Power On/Preset

Pressing this softkey reveals a menu of choices for preset conditions. In this menu, you have the following options:

- Set the signal generator to power on in the same state as it was when you powered off, or to power on in the instrument preset state. (Refer to the **Power On Last Preset** softkey description, in this section.)

- Set the signal generator to preset to a factory-defined state or to a user-defined state. (Refer to the **Preset Normal User** softkey description, in this section.)

- Set up your own user-defined preset state. (Refer to the **Save Use Preset** softkey description, in this section.)

- Set the signal generator to preset to the SCPI programming language or to a 8656/57-compatible language. (Refer to the **Preset Language** softkey description, in this section.)

- Set the signal generator's reverse power protection to the factory-defined state or to an HP 8648-equivalent state. (Refer to the **Reverse Power Protection Normal HP8648** softkey description.)

Softkey Location: Press **Utility, Power On/Preset**

Preset Language

Pressing this softkey reveals a menu of choices for selecting the programming language that is implemented after the **Preset** key is pressed. You can choose between SCPI, which is the language chosen for the signal generator for remote implementation of all features, and four versions of HP 8656/57-compatible languages. The HP 8656/67-compatible languages are provided for remote implementation of some features so that this signal generator can be compatible with systems that use the HP 8656/57. Refer to the programming guide for specifics on which commands are implemented.

The preset language is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Power On/Preset, Preset Language**

SCPI Commands:

:SYSTem:PRESet:LANGuage?

Preset Normal User

This softkey toggles the preset state between the factory-defined and the user-defined states. The instrument state conditions for the factory-defined preset state are described in the **Preset** section. You choose the instrument state conditions for the user-defined preset state. Refer to the **Save User Preset** softkey description in this section.

The preset state is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Power On/Preset, Preset Normal User**

SCPI Commands:

:SYSTem:PRESet:TYPE NORMal|USER

:SYSTem:PRESet:TYPE?

Recall Ref Osc Setting

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility, Instrument Adjustments, Reference Oscillator Adjustment, Recall Ref Osc Setting**

Receive Pace None Xon

This softkey in the RS-232 Pace menu determines whether any pacing is acknowledged by the RS-232 receive channel. If Xon pacing is used, the system will send an Xoff character to suspend the transmitting of data when its buffer is nearly full. When the system is ready to receive further input, an Xon character is sent to the transmitting device. Xon pacing is not recommended if binary data will be queried from the signal generator via RS-232. Toggle **Receive Pace None Xon** to **None** to turn off Xon pacing.

Pace is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, Receive Pace None Xon**

SCPI Commands:

:SYSTem:COMMunicate:SERial:RECeive:PACE XON|NONE

:SYSTem:COMMunicate:SERial:RECeive:PACE?

Reference Oscillator Adjustment

Pressing this softkey reveals a menu of softkeys for adjusting the internal reference oscillator. This adjustment is for use by service personnel only.

Softkey Location: Press **Utility, Instrument Adjustments, Reference Oscillator Adjustment**

Ref Osc Coarse

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility, Instrument Adjustments, Reference Oscillator Adjustment, Ref Osc Coarse**

Ref Osc Fine

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility, Instrument Adjustments, Reference Oscillator Adjustment, Ref Osc Fine**

Remote Language

Pressing this softkey reveals a menu of choices for immediately changing the signal generator's remote language. You can choose between SCPI, which is the language chosen for the signal generator for remote implementation of all features, and four versions of HP 8656/57-compatible languages. The HP 8656/67-compatible languages are provided for remote implementation of some features so that this signal generator can be compatible with systems that use the HP 8656/57. Refer to the programming guide for specifics on which commands are implemented.

Softkey Location: Press **Utility, HP-IB/RS-232, Remote Language**

Status after Normal Preset: SCPI

SCPI Commands:

:SYSTem:LANGuage?

Reset RS-232

Press this softkey to perform a clean-up on the RS-232 buffer which will discard any unprocessed SCPI input received over RS-232 and places the RS-232 connection in a mode which can detect the optional remote interface. All other RS-232 communication parameters (such as baud rate) are unaffected.

Softkey Location: Press **Utility, HP-IB/RS-232, Reset RS-232**

SCPI Commands:

:SYSTem:COMMunicate:SERial:RESet

Reverse Power Protection Normal HP8648

This softkey toggles the reverse power protection mode between the normal mode for the signal generator and the HP 8648-compatible mode.

When you have selected **Normal** and you trip the reverse power protection circuit, a caution message is displayed and the front panel is locked. Eliminate the source of the excess reverse power detected at the RF OUTPUT connector. Then press the **Reset RPP** softkey to continue normal signal generator operation.

When you have selected **HP8648** and you trip the reverse power protection circuit, a caution message is displayed and the front panel is locked. However, any command sent over HP-IB will reset the RPP circuit and return you to normal signal generator operation. This mode is provided for compatibility with systems that use the HP 8648. Operate in this mode with *caution*. Repeatedly tripping the RPP can cause damage to the signal generator. It is still best to eliminate the source of the excess reverse power and then reset the reverse power protection circuit by pressing the **Reset RPP** softkey.

The RPP reset mode is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Power On/Preset, Reverse Power Protection Normal HP8648**

SCPI Commands:

    :OUTPut:PROTection:MODE "NORMAL"|"HP8648"

    :OUTPut:PROTection:MODE?

    :OUTPut:PROTection:TRIPped?

    :OUTPut:PROTection:CLEar

RS-232 Baud Rate

Press this softkey to set the baud rate in bits per second for the rear panel RS-232 connector (this connector is labeled AUXILIARY INTERFACE). To change the baud rate press the softkey. A menu is displayed of baud rates that are allowed. Press the softkey for the desired value. The baud rate is now set to the new value and the value is displayed below the
RS-232 Baud Rate softkey.

Baud rate is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Baud Rate**

SCPI Commands:

> :SYSTem:COMMunicate:SERial:BAUD <number>

> :SYSTem:COMMunicate:SERial:BAUD?

RS-232 Echo Off On

This softkey toggles the echo function on and off for the RS-232 serial port (AUXILIARY INTERFACE connector). When echo is set to on, every character sent to the signal generator is immediately sent back. No editing capability is available.

Echo is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Echo Off On**

SCPI Commands:

> :SYSTem:COMMunicate:SERial:ECHO ONIOFFI1I0

> :SYSTem:COMMunicate:SERial:ECHO?

RS-232 Pace

Pressing this softkey reveals a menu of choices for setting the RS-232 handshake protocol. In this menu you can choose transmit pacing, receive pacing, and RTS/CTS protocol.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace**

RTS/CTS

Pressing this softkey reveals a menu of choices for controlling the RTS/CTS behavior. This feature is used with RS-232 connections that use RTS/CTS for hardware handshaking.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, RTS Off On**

SCPI Commands:

> :SYSTem:COMMunicate:SERial:CONTrol:RTS?

RTS/CTS Pacing

Press this softkey to turn the RTS line on and instruct the signal generator to monitor the state of the CTS line (hardware handshaking). The signal generator monitors CTS and suspends transmission if this line transitions to its logically low state. Up to 16 characters may still be transmitted after the low transition. This setting is not compatible with an HP 83300A Remote Interface. Do not attempt to use this setting with a 3-wire connection.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, RTS/CTS, RTS/CTS Pacing**

SCPI Commands:

> :SYSTem:COMMunicate:SERial:CONTrol:RTS STANdard

> :SYSTem:COMMunicate:SERial:CONTrol:RTS?

RTS On

Press this softkey to turn the RTS line on. In this mode, the instrument will ignore the state of the CTS line (3-wire connection). This setting is intended for use with an HP 83300A Remote Interface, but it will also work with a 3-wire connection. **RTS On** is the default setting for the signal generator.

RTS is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, RTS/CTS, Off**

SCPI Commands:

:SYSTem:COMMunicate:SERial:CONTrol:RTS ON

:SYSTem:COMMunicate:SERial:CONTrol:RTS?

Save User Preset

Use this softkey to establish your user-defined preset state. Set up all of the instrument state conditions that you want for your unique preset state. When you have defined the instrument state to suit your needs, press **Save User Preset**. Only one user-defined preset state is allowed, so when you save the instrument state you will save over any previously-saved state. Your instrument state will be recalled by the signal generator any time you press **Preset** as long as you have set the **Preset Normal User** softkey to **User**. For additional information about the **Preset Normal User** softkey, refer to its description in this section.

The user's state definition is a state file; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Power On/Preset, Save User Preset**

SCPI

This softkey is one of the choices in both the Preset Language menu and the Remote Language menu. Press either the **Preset Language** softkey or the **Remote Language** softkey to view these menus. SCPI (Standard Commands for Programmable Instruments) is the language chosen for remote implementation of all supported instrument features. Choosing **SCPI** in the Preset Language menu allows you to select this remote language as the default after a normal preset. Choosing **SCPI** in the Remote Language menu allows you to immediately change the signal generator to use this remote language.

Softkey Location: Press **Utility, Power On/Preset, Preset Language, SCPI**
or press **Utility, HP-IB/RS-232, Remote Language, SCPI**

SCPI Commands:

:SYSTem:PRESet:LANGuage "SCPI"

:SYSTem:PRESet:LANGuage?

:SYSTem:LANGuage "SCPI"

:SYSTem:LANGuage?

Screen Saver Delay

This softkey sets the period of time before the screen saver is activated. The screen saver delay is set to 1 hour at the factory. You can change the delay by pressing **Utility, Display, Screen Saver Delay**. The current value for delay is displayed in the active entry area. To enter a new value, rotate the front panel knob, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey. The range of values allowed is 1 through 12 hours in 1 hour increments.

Screen saver delay is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Display, Screen Saver Delay**

SCPI Commands:

:SYSTem:SSAVer:DELay <val>

:SYSTem:SSAVer:DELay?

Screen Saver Mode

This softkey toggles between **Light Only** and **Light & Text** mode for the screen saver. When you set the screen saver to **Light Only**, only the display light is turned on and off. When you set the screen saver to **Light & Text**, the display light and the text are turned on and off.

Screen saver mode is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Display, Screen Saver Mode**

SCPI Commands:

   :SYSTem:SSAVer:MODE LIGHt|TEXT

   :SYSTem:SSAVer:MODE?

Screen Saver Off On

This softkey toggles the signal generator's screen saver on and off. With the screen saver on, the display light is turned off after a period of time with no input from the front panel. The display light turns back on when any front panel key is pressed. The screen saver is set to **Off** at the factory. You can turn it on by pressing **Utility, Display Screen Saver**. Each time you press **Screen Saver Off On** the selection toggles between **Off** and **On**.

You can adjust the screen saver mode to turn the light on and off or to turn both the light and text on and off. Refer to the **Screen Saver Mode** softkey description in this section.

The screen saver delay is set to 1 hour at the factory. You can change the delay time. Refer to the **Screen Saver Delay** softkey description in this section.

Screen saver is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Display, Screen Saver Off On**

SCPI Commands:

   :SYSTem:SSAVer:STATe ON|OFF|1|0

   :SYSTem:SSAVer:STATe?

State

This softkey lets you specify that only instrument state files are to be listed on the display when **Memory Catalog** is selected.

Catalog type is a persistent state; it is not changed by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Memory Catalog, Catalog Type, State**

SCPI Commands:

:MEMory:CATalog:STATe?

Step/Knob Ratio

This softkey sets the ratio between the increment value of the step keys and the front panel knob. For example, if you set the increment value for frequency to 1 MHz and set the step/knob ratio to 10/1, when frequency is the active function the up and down arrow keys will change the frequency in 1 MHz steps and the front panel knob will change the frequency in 1/10th of 1 MHz steps. This ratio only applies when you have a function active that has an associated increment value.

To change the step/knob ratio, press **Utility, Instrument Adjustments, Step/Knob Ratio**. The number displayed in the active entry area represents the arrow keys step size in the ratio. To enter a new value, rotate the front panel knob until the desired value is displayed, use the up and down arrow keys, or enter the value using the numeric keypad and press the **Enter** terminator softkey.

The step/knob ratio is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, Instrument Adjustments, Step/Knob Ratio**

Store Ref Osc Setting

This softkey is provided for adjusting the internal reference oscillator. This adjustment is for use by service personnel only. Refer to the calibration guide for more information.

Softkey Location: Press **Utility, Instrument Adjustments, Reference Oscillator Adjustment, Store Ref Osc Setting**

Transmit Pace None Xon

This softkey in the RS-232 Pace menu determines whether any pacing is acknowledged by the RS-232 transmit channel. If Xon pacing is used, the system will suspend transmitting data upon receiving an Xoff character until an Xon character is received. The signal generator may not be responsive to other channels while transmission is suspended. Xon pacing is not recommended if binary data will be sent to the signal generator via RS-232. Toggle **Transmit Pace None Xon** to **None** to turn off Xon pacing.

Pace is a persistent state; it is not affected by an instrument preset or by a power cycle.

Softkey Location: Press **Utility, HP-IB/RS-232, RS-232 Pace, Transmit Pace None Xon**

SCPI Commands:

:SYSTem:COMMunicate:SERial:TRANsmit:PACE XON|NONE

:SYSTem:COMMunicate:SERial:TRANsmit:PACE?

View Next Error Message

If the **ERR** annunciator is turned on in the display, you have at least one error message stored in the error message queue. Use this softkey to display the first error message in the queue. (The first error message is the oldest error.) There may be more than one error message in the queue; the number of error messages is displayed along with the first message. If there is more than one message, continue pressing this softkey to view the rest of the error messages. If you wish to back up and view a message you have already seen, press **View Previous Error Message**. Press any front panel key to remove the error message from the display and return to normal signal generator operation.

The error queue can contain up to 30 error messages. When the error queue overflows, error messages are deleted beginning with the oldest ones first.

You can scroll through the error messages in reverse order. Refer to the **View Previous Error Message** softkey description.

Softkey Location: Press **Utility, Error Info, View Next Error Message**

View Previous Error Message

If the ERR annunciator is turned on in the display, you have at least one error message stored in the error message queue. Use this softkey to display the newest error message first. Continue pressing this softkey to view additional error messages in order of newest to oldest. To view the most recent error message first, press **View Next Error Message**. Press any front panel key to remove the error message from the display and return to normal signal generator operation.

Softkey Location: Press **Utility, Error Info, View Previous Error Message**

White Pixels Screen Test

This softkey is provided for factory use in testing the display. Pressing this softkey sets all of the pixels on the display to white. Pressing the front panel Local key returns the display to normal operation.

Softkey Location: Press **Utility, Display, White Pixels Screen Test**

6   Options and Accessories

This chapter describes the options that can be ordered for your signal generator at the time of shipment, the options that can be retrofitted to your existing signal generator, and the accessories that you can order.

Signal Generator Options

This section describes the options available for your signal generator. You can order these options with your signal generator by ordering the option number shown, or you can order these options post-sales by requesting the HP part number that is provided.

Front Handles (Option 1CN)

This kit contains two handles and the necessary hardware to attach the handles to the front of the signal generator. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9227.

Rack Mount Flanges without Handles (Option 1CM)

This kit contains two flanges and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9214.

Rack Mount Flanges with Handles (Option 1CP)

This kit contains two handles, two flanges, and the necessary hardware to rack mount the signal generator in an HP System II or System II Plus cabinet. Instructions for assembling the parts are included with the kit. To order this kit after receipt of your signal generator, order HP part number 5063-9221.

Three Year Warranty (Option W30)

If you order Option W30 at the point of sale, you will receive a service contract that extends your return-to-HP repair benefits beyond the end of the warranty period for an additional two years. This additional support is not available as a post-sales option.

Move All Front Panel Connectors to Rear Panel (Option 1EM)

If you order Option 1EM at the point of sale, all of the front panel connectors will be moved to the rear panel.

A post-sales retrofit kit is available to move your signal generator's front panel connectors to the rear panel. To order this kit after receipt of your signal generator, request HP part number E4400-60027.

If you order Option 1EM at the point of sale, all of the front panel connectors will be moved to the rear panel. If you order Option 1EM in combination with Option 1EH, all of the front panel connectors will be moved to the rear panel and, in addition, some of the connectors will be changed from BNC to SMB connectors (for details on the connectors, see Chapter 4).

High Stability Timebase (Option 1E5)

If you order Option 1E5 at the point of sale, the standard timebase reference assembly will be replaced with a high-stability timebase reference assembly. The high-stability timebase reference assembly has improved specifications over the standard assembly including warranted specifications for aging rate (the aging rate specification is typical for the standard assembly). Refer to Chapter 9, "Specifications," for more information.

Delete Standard Manual Set (Option 0B0)

All instruments are supplied with one complete manual set (HP part number E4400-90003) which includes the following documents:

- User's Guide (HP part number E4400-90004)
- Programming Guide (HP part number E4400-90005)
- Quick Reference Guide (HP part number E4400-90006)
- Calibration Guide (HP part number E4400-90007)

If you order Option 0B0 at the point of sale, you will receive your signal generator with no documentation. If you later decide to purchase the documentation, you can order individual manuals by requesting the individual part numbers, or you can order the complete manual set by ordering HP part number E4400-90003.

Extra Manual Set (Option 0B1)

All instruments are supplied with one complete manual set (HP part number E4400-90003) which includes the following documents:

- User's Guide (HP part number E4400-90004)
- Programming Guide (HP part number E4400-90005)
- Quick Reference Guide (HP part number E4400-90006)
- Calibration Guide (HP part number E4400-90007)

If you order Option 0B1 at the point of sale, you will receive an additional set of this documentation. After shipment of your order, you can order additional manuals by requesting the individual part numbers or you can order the complete manual set by ordering HP part number E4400-90003.

NOTE

Service documentation is not part of the standard manual set. The service documentation is available as Options 0BW, 0BV, and 0BX.

Assembly-Level Service Guide (Option 0BW)

All instruments are supplied with one complete manual set (HP part number E4400-90003) which includes the following documents:

- User's Guide (HP part number E4400-90004)
- Programming Guide (HP part number E4400-90005)
- Quick Reference Guide (HP part number E4400-90006)
- Calibration Guide (HP part number E4400-90007)

If you order Option 0BW, at the point of sale, you will also receive the service guide (HP part number E4400-90008). This document provides the information required to troubleshoot and repair the signal generator to the assembly level. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

Component-Level Information Package (Option 0BV)

All instruments are supplied with one complete manual set (HP part number E4400-90003) which includes the following documents:

- User's Guide (HP E4400-90004)
- Programming Guide (HP part number E4400-90005)
- Quick Reference Guide (HP part number E4400-90006)
- Calibration Guide (HP part number E4400-90007)

If you order Option 0BV, at the point of sale, you will also receive the component-level information package (HP part number E4400-90015). This document provides schematics, component locator diagrams, and part lists for the signal generator. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

Assembly-Level Service Guide and Component-Level Information Package (Option 0BX)

All instruments are supplied with one complete manual set HP part number E4400-90003) which includes the following documents:

- User's Guide (HP E4400-90004)
- Programming Guide (HP part number E4400-90005)
- Quick Reference Guide (HP part number E4400-90006)
- Calibration Guide (HP part number E4400-90007)

If you order Option 0BX, at the point of sale, you will also receive the service guide (HP part number E4400-90008) and the component-level information package (HP part number E4400-90015). These documents provide you with the information required to troubleshoot and repair the signal generator to the assembly level, and also with schematics, component locator diagrams, and parts lists for the signal generator. After shipment of your order, you can order additional copies of any of these documents by requesting the individual part numbers.

User's Guide - Traditional Chinese for Taiwan (Option AB0)

In addition to the standard English language manual set, if you order Option AB0, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into traditional Chinese for Taiwan. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90024. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - Korean (Option AB1)

In addition to the standard English language manual set, if you order Option AB1, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Korean. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90023. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - Chinese (Option AB2)

In addition to the standard English language manual set, if you order Option AB2, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Chinese. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90022. This document is not free of charge when you order it after shipment of your signal generator.

User's Guide - German (Option ABD)

In addition to the standard English language manual set, if you order Option ABD, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into German. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90027. This document is not free of charge when you order it after shipment of your signal generator.

Quick Reference Guide - Spanish (Option ABE)

In addition to the standard English language manual set, if you order Option ABE, at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Spanish. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90026. This document is not free of charge when you order it after shipment of your signal generator.

Quick Reference Guide - Japanese (Option ABJ)

In addition to the standard English language manual set, if you order Option ABJ at the point of sale, you will receive, at no charge, a subset of the user's guide translated into Japanese. After shipment of your order, you can order additional copies of this document by requesting HP part number E4400-90025. This document is not free of charge when you order it after shipment of your signal generator.

Signal Generator Accessories

This section describes the accessories for the signal generator that can be ordered at any time.

Transit Case (HP Part Number 9211-1296)

The transit case is a sturdy, carrying container designed to protect your signal generator from physical damage during transportation. The interior of the container is lined with compressible foam that is form-fitting to the exterior shape of the signal generator.

Remote Interface (HP 83300A)

The remote interface is an accessory to the signal generator consisting of a keypad which is connected by a 1 meter cable to the AUXILIARY INTERFACE rear panel connector (RS232). This keypad lets you recall instrument states. (This is the same recall function provided by the front panel keys.) The remote interface is a convenient accessory for use in production environments where multiple instrument states are repetitively utilized.

7 Application Notes

This chapter is reserved for future use.

8 Safety and Regulatory

This chapter provides product warranty information, regulatory declarations, and explanations of caution and warning statements marked on the instrument.

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

CAUTION

Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING

Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

Instrument Markings

The following markings and caution and warning labels are used on the instrument. Be sure to observe all cautions and warnings.

WARNING	**No user serviceable parts inside. Refer servicing to qualified personnel.**

⚠   The instruction manual symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the manual.

CE   The CE mark is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven).

CSA   The CSA mark is the Canadian Standards Association safety mark.

| This symbol is used to mark the on position of the power line switch.

⏻   This symbol is used to mark the standby position of the power line switch.

∼   This symbol indicates that the input power required is AC.

ISM 1-A   This is a symbol of an Industrial Scientific and Medical Group 1 Class A product. (CISPER 11, Clause 4)

General Safety Considerations

WARNING	**No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**
CAUTION	Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

Statement of Compliance

This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.
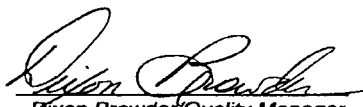
Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products. For any assistance, contact your nearest Hewlett-Packard sales and service office. Refer to the list of sales and service offices in Chapter 3.

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Declaration of Conformity

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Co.

Manufacturer's Address: Microwave Instruments Division
1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA

declares that the product

    Product Name: Signal Generator

    Model Number: HP ESG-1000A, HP ESG-2000A,
HP ESG-2000A, HP ESG-4000A,
HP ESG-D1000A, HP ESG-D2000A,
HP ESG-D3000A, HP ESG-D4000A,

    Product Options: This declaration covers all options of the
above products.

conforms to the following Product specifications:

    Safety: IEC 1010-1:1990+A1 / EN 61010-1:1993
              CAN/CSA-C22.2 No. 1010.1-92

    EMC: CISPR 11:1990/EN 55011:1991   Group 1, Class A
            IEC 801-2:1984/EN 50082-1:1992   4 kV CD, 8 kV AD
            IEC 801-3:1984/EN 50082-1:1992   3 V/m, 27-500 MHz
            IEC 801-4:1988/EN 50082-1:1992   0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:
The products herewith comply with the requirements of the Low Voltage Directive
73/23/EEC and the EMC Directive 89/336/EEC and is marked accordingly.

Santa Rosa, California, USA   3 June 1996

Dixon Browder/Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department
HQ-TRE, Herrenberger Strasse 130, D-71034 Böblingen, Germany (FAX +49-7031-14-3143)

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung -3.GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA < 70 dB	LpA < 70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
per ISO 7779	nach DIN 45635 t.19

9 Specifications

This chapter lists the specifications and supplemental characteristics for the HP ESG Series Signal Generators whose serial prefixes are listed on the title page.

HP ESG Series Signal Generators Specifications

Specifications describe the instrument's warranted performance and apply after a 45 minute warm-up. All specifications are valid over the signal generator's entire operating and environmental range while in phase noise mode 2, unless otherwise noted.

Supplemental characteristics (shown in italics and denoted typical or nominal) provide additional, non-warranted, information useful in applying the signal generator.

Frequency

Range:

HP ESG-1000A:	250 kHz to 1000 MHz
HP ESG-2000A:	250 kHz to 2000 MHz
HP ESG-3000A:	250 kHz to 3000 MHz
HP ESG-4000A:	250 kHz to 4000 MHz

Underrange: 100 kHz

Resolution: 0.01 Hz

Accuracy: Same as timebase

Switching Speed[1]:

    Modulation On: *< 45 ms, typical*

    Modulation Off: *< 35 ms, typical*

1. To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.

Phase Offset: *Phase is adjustable via HP-IB or from the front panel in nominal 0.1 degree increments.*

Frequency Bands:		
Band	**Frequency Range**	**N #**
1	250 kHz to ≤ 249.999 MHz	1
2	> 249.999 to ≤ 500 MHz	0.5
3	> 500 MHz to ≤ 1 GHz	1
4	> 1 to ≤ 2 GHz	2
5	> 2 to 4 GHz	4

Sweep Modes

Operating Modes: Frequency Step, Amplitude Step, and Arbitrary List

Dwell Time: 2 ms to 60 s

Number of Points: 2 to 401

Internal Reference Oscillator

Stability:		
	Standard (typical)	**High Stability** (Option 1E5)
Aging Rate	< ±2 ppm/year	< ±0.1 ppm/year or < ±0.0005 ppm/day after 45 days
Temperature (0 to 55°C)	< ±1 ppm	< ±0.05 ppm, typical
Line Voltage	< ±0.1 ppm (+5%, −10%)	< ±0.002 ppm, typical (+5%, −10%)

Timebase Reference Output:

   Frequency: 10 MHz

   Amplitude: > 0.35 V_{rms} into 50Ω load

External Reference Input:

   Frequency: 1, 2, 5, 10 MHz ±10 ppm (±1 ppm, Option 1E5), typical

   Amplitude: > 0.15 V_{rms}

   Input Impedance: 50Ω

Output

Range:

   250 kHz to 1000 MHz: +13 to −136 dBm

   > 1000 MHz to 3000 MHz: +10 to −136 dBm

   > 3000 MHz to 4000 MHz: +7 to −136 dBm
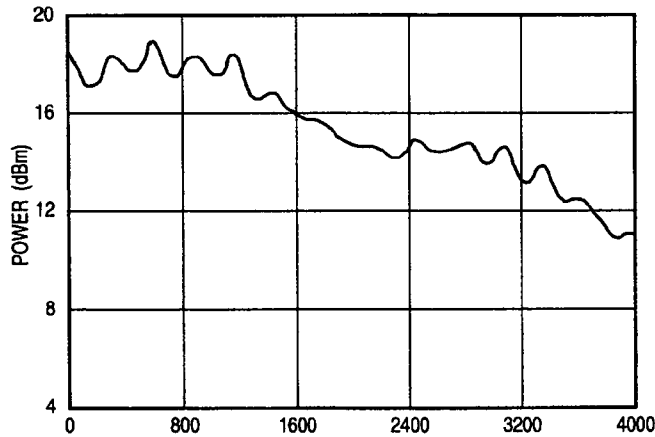
pk786a

Typical Maximum Available Power

Resolution: 0.02 dB

Attenuator Hold Level Range:

250 kHz to 1000 MHz: 23 dB

> 1000 MHz to 3000 MHz: 20 dB

> 3000 MHz to 4000 MHz: 17 dB

Level Accuracy[1]:		
	+7 to −127 dBm	**< −127 dBm**
250 kHz to 2 GHz:	±0.5 dB	±1.5 dB
> 2 to 4 GHz:	±0.9 dB	±2.5 dB

1. From +7 to −127 dBm and 23° ±5°C. Accuracy degrades by
0.02 dB per degree C over the full temperature range and by
0.3 dB above +7 dBm.

Amplitude Switching Speed: *< 25 ms, typical*

When Using Power Search: *< 210 ms, typical*

Reverse Power Protection[1]:

250 kHz to 2000 MHz: 50 watts

> 2000 MHz to 4000 MHz: 25 watts

Maximum DC Voltage: 50 V

1. The reverse power protection circuitry triggers at nominally 1 watt.

SWR (typical):

250 kHz to 2000 MHz: *< 1.4:1*

> 2000 to 4000 MHz: *< 1.9:1*

Output Impedance: 50Ω

Spectral Purity

SSB Phase Noise *(typical, at 20 kHz offset)*:

at 500 MHz: *< −120 dBc/Hz*

at 1000 MHz: *< −116 dBc/Hz*

at 2000 MHz: *< −110 dBc/Hz*

at 3000 MHz: *< −104 dBc/Hz*

at 4000 MHz: *< −104 dBc/Hz*
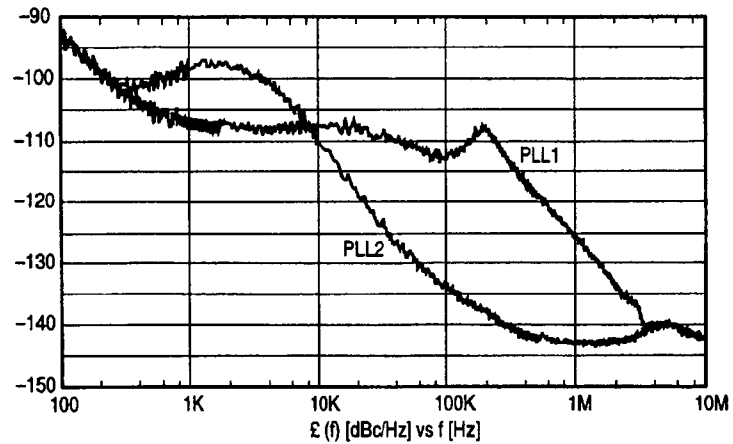
pk787a

Typical PLL BW 1 and PLL BW 2 Single Sideband Phase Noise at 1 GHz

Residual FM (CW mode, 0.3 to 3 kHz BW, CCITT, rms):

Phase Noise Mode 1:   < N x 2 Hz

Phase Noise Mode 2:   < N x 4 Hz

Harmonics ($\leq$ +4 dBm output level):   < −30 dBc

Nonharmonics (> 3 kHz offset, < +7 dBm output level)[1]:

250 kHz to 1000 MHz: < −65 dBc

> 1000 to 2000 MHz: < −59 dBc

> 2000 MHz: < −53 dBc

1. Performance is typical out-of-band and is −60 dBc between 225 and
   249.999 MHz. Specifications apply for FM deviations < 100 kHz and are not
   valid for ΦM.

Subharmonics:

≤ **1000 MHz:**   None

> **1000 MHz:**   < −40 dBc

Frequency Modulation

Maximum Deviation: N x 10 MHz

Resolution: 0.1% of deviation or 1 Hz, whichever is greater

Modulation Frequency Response (deviation = 100 kHz):		
Path	**Rates**	
	1 dB Bandwidth	**3 dB Bandwidth** *(typical)*
FM 1:	(dc/20 Hz to 100 kHz)	*dc/5 Hz to 10 MHz*
FM 2:	(dc/20 Hz to 100 kHz)	*dc/5 Hz to 1 MHz*
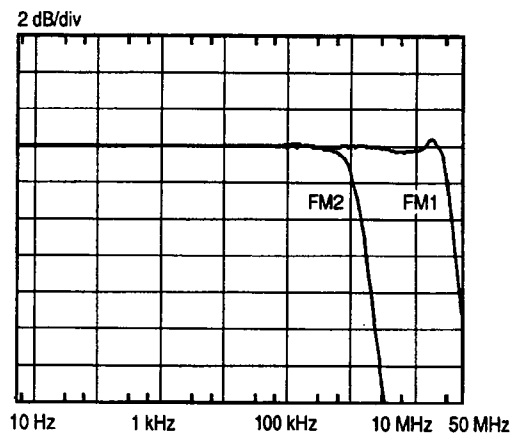
pk788a

Typical FM 1 and FM 2 Frequency Response

Deviation Accuracy: < ±(3.5% of FM deviation setting + 20 Hz)
(1 kHz rate, deviation < N x 100 kHz)

Carrier Frequency Accuracy Relative to CW in DCFM[1]: ±0.1% of set
deviation + (N x 1 Hz)

1. At the calibrated deviation, carrier frequency, and within 5° C of ambient
   temperature at time of calibration.

Distortion (1 kHz rate, THD, Deviations = N x 100 kHz): < 1%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated deviation

Input Impedance: *50Ω, nominal*

Paths: FM 1 and FM 2 are summed internally for composite modulation.
Either path may be switched to any one of the modulation sources:
Int, Ext 1, Ext 2. The FM 2 path is limited to a maximum rate of
1 MHz. The FM 2 path must be set to a deviation less than FM 1.

Phase Modulation

Maximum Deviation: N x 90 radians

Resolution: 0.1% of set deviation

Modulation Frequency Response:			
Phase Modulation Mode	Maximum Deviation	Rates (3 dB BW)	
		ΦM1	ΦM2
Normal	N x 90 radians:	dc - 100 kHz	dc - 100 kHz
High Bandwidth	N x 2π radians:	*dc - 1.5 MHz, typical*	*dc - 1 MHz, typical*
	N x π/2 radians:	*dc - 4 MHz, typical*	*dc - 0.9 MHz, typical*

Deviation Accuracy (1 kHz rate):   < ±(5% of deviation + 0.01 radians)

Distortion (1 kHz rate, THD, deviations < N x 90 radians):   < 1%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated deviation

Input Impedance: *50Ω , nominal*

Paths: ΦM 1 and ΦM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ex t2. The ΦM 2 path is limited to a maximum rate of 1 MHz. The ΦM 2 path must be set to a deviation less than ΦM 1.

Amplitude Modulation at fc > 500 kHz

AM is typical above 3 GHz.

Range (envelope peak ≤ maximum specified power):   0 to 100%

Resolution: 0.1%

Rates (3 dB bandwidth):   dc/10 Hz to 10 kHz

Accuracy (1 kHz rate):   < ±(5% of setting + 1%)

Distortion (1 kHz rate, THD):

  30% AM: < 1.5%

  90% AM: < 4%

External Inputs: Ext 1 or Ext 2

Sensitivity: 1 Vpk for indicated depth

Input Impedance: *50Ω, nominal*

Paths: AM 1 and AM 2 are summed internally for composite modulation. Either path may be switched to any one of the modulation sources: Int, Ext 1, Ext 2.

Pulse Modulation

On/Off Ratio:

  ≤ 3 GHz: > 80 dB

  < 3 GHz: > 60 dB

Rise/Fall Times: *150 ns, typical*

Minimum Width:

  ALC On: *2 μs, typical*

  ALC Off: *0.4 μs, typical*

Pulse Repetition Frequency:

    ALC On: *10 Hz to 250 kHz, typical*

    ALC Off: *dc to 1.0 MHz, typical*

Level Accuracy (relative to CW)[1]:   *±0.5 dB, typical*

1. With ALC off, specifications apply after the execution of power search. With ALC on, specifications apply for repetition rates < 10 kHz and pulse widths ≥5 µs.

External Input: Ext 2

Input Voltage:

    RF On: *> +0.5 V, nominal*

    RF Off: *< +0.5 V, nominal*

Input Impedance: *50Ω, nominal*

Internal Pulse Generator (Squarewave Only):

    Rates: 0.1 Hz to 50 kHz

Internal Modulation Source

Provides FM, ΦM, and AM modulation signals and LF Out.

Waveforms: Sine, Square, Ramp, Triangle, and Noise

Rate Range:

    Sine: 0.1 Hz to 50 kHz

    Square, Ramp, Triangle: 0.1 Hz to 10 kHz

Resolution: 0.1 Hz

Frequency Accuracy: 0.005%

LF Out (Internal Modulation Source)

Amplitude: 0 to 3 Vpk into 50Ω

Output Impedance: < 1Ω

External Modulation Inputs

Modulation Types:

    Ext 1: FM, ΦM, and AM

    Ext 2: FM, ΦM, AM, and Pulse

High/Low Indicator: *Indicator is activated when input level error exceeds 3%*
(100 Hz to 10 MHz BW, *(nominal)*
AC-coupled inputs only)

Simultaneous Modulation

All modulation types may be simultaneously enabled, except FM with ΦM. AM, FM and ΦM can sum simultaneous inputs from any two sources (Int, EXT 1, and EXT 2.) Any given source (Int, EXT 1, or EXT 2) may only be routed to one activated modulation type.

Remote Programming

Interface: HP-IB (IEEE-488.2-1987) with Listen and Talk. RS-232

Control Languages: SCPI version 1992.0, also compatibile with HP 8656B and 8657A/B/C/D/J[1] mnemonics.

1. HP ESG series does not implement HP 8657A/B 'Standby' or 'On' (R0 or R1, respectively) mnemonics.

Functions Controlled: All front panel functions except power switch and knobs.

IEEE-488 Functions: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2

ISO Compliant

The HP ESG Series Signal Generators are manufactured in an ISO 9001 registered facility in concurrence with Hewlett-Packard's commitment to quality.

General

Power Requirements: 90 to 254 V; 50, 60, or 400 Hz; 200 W maximum

Operating Temperature Range: 0 to 55° C

Storage Temperature Range: −40 to +71 ° C

Shock and Vibration: Meets MIL STD 28800E Type III, Class 3

Leakage: Conducted and radiated interference meets MIL STD 461B RE02 Part 2 and CISPR 11. *Leakage is typically < 1 μV (nominally 0.1 μV with a 2-turn loop) at ≤ 1000 MHz, measured with a resonant dipole antenna one inch from any surface with output level < 0 dBm (all inputs/outputs properly terminated).*

Storage Registers: Up to 100 storage registers with sequence and register
number displayed. Up to 10 sequences available.

Weight: < 12.7 kg (28 lb.) net, < 21 kg (46 lb.) shipping

Dimensions: 133 mm H x 426 mm W x 432 mm D
(5.25 in. H x 16.8 in. W x 17 in. D)

Accessories

Transit Case, HP Part Number 9211-1296

HP 83300A Remote Interface

Options

0B0	Delete Manual Set
0B1	Extra Manual Set
0BV	Add Service Documentation (Component Level Repair)
0BW	Add Service Documentation (Assembly Level Repair)
0BX	Add Service Documentation (Assembly Level and Component Level)
1CM	Rack Flange Kit (without handles)
1CN	Front Handle Kit
1CP	Rack Flange Kit (with handles)
1E5	Add High Stability timebase
1EM	Move All Front Panel Connectors to Rear Panel
W30	Three Year Warranty

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