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# User's Guide

## Agilent Technologies
## E8663B Analog Signal Generator

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Agilent Technologies

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# Contents


**1. Signal Generator Overview . . . . . 1**

E8663B Signal Generator Features. . . . . 1

The E8663B includes the following standard features: . . . . . 1

Options . . . . . 3

Firmware Upgrades. . . . . 3

To Upgrade Firmware . . . . . 3

Modes of Operation . . . . . 4

Continuous Wave . . . . . 4

Swept Signal . . . . . 4

Analog Modulation . . . . . 4

Front Panel . . . . . 5

1. Display . . . . . 5

2. Softkeys. . . . . 6

3. Knob . . . . . 6

4. Amplitude . . . . . 6

5. Frequency . . . . . 6

6. Save . . . . . 6

7. Recall. . . . . 6

8. Trigger . . . . . 6

9. MENUS. . . . . 7

10. Help . . . . . 7

11. EXT 1 INPUT . . . . . 7

12. EXT 2 INPUT . . . . . 7

13. LF OUTPUT . . . . . 8

14. Mod On/Off. . . . . 8

15. ALC INPUT . . . . . 8

16. RF On/Off . . . . . 8

17. Numeric Keypad . . . . . 8

18. RF OUTPUT . . . . . 8

19. SYNC OUT . . . . . 8

20. VIDEO OUT . . . . . 9

21. Incr Set . . . . . 9

22. GATE/ PULSE/ TRIGGER INPUT . . . . . 9

23. Arrow Keys . . . . . 9

24. Hold. . . . . 9

25. Return . . . . . 9

26. Contrast Decrease . . . . . 9

27. Contrast Increase. . . . . 9

# Contents


28. Local . . . 9
29. Preset . . . 10
30. Line Power LED . . . 10
31. LINE . . . 10
32. Standby LED . . . 10
Front Panel Display . . . 11
1. Active Entry Area . . . 11
2. Frequency Area . . . 12
3. Annunciators . . . 12
4. Amplitude Area . . . 14
5. Error Message Area . . . 14
6. Text Area . . . 14
7. Softkey Label Area . . . 14
Rear Panel . . . 15
1. Source Module Interface . . . 17
2. 1 GHz Output . . . 17
3. AC Power Receptacle . . . 17
4. GPIB . . . 17
5. 10 MHz EFC . . . 17
6. 10 MHz IN . . . 17
7. AUXILIARY INTERFACE . . . 17
8. 10 MHz OUT . . . 18
9. LAN . . . 18
10. SWEEP OUT . . . 18
11. Z-AXIS BLANK/MKRS . . . 18
12. SWEEP OUT . . . 18
13. TRIGGER OUT . . . 19
14. TRIGGER IN . . . 19
15. SOURCE SETTLED . . . 19
16. RF OUT . . . 19
17. EXT 1 Input . . . 19
18. EXT 2 Input . . . 19
19. LF OUT . . . 19
20. PULSE SYNC OUT . . . 19
21. PULSE VIDEO OUT . . . 20
22. PULSE/TRIG GATE INPUT . . . 20
23. ALC INPUT . . . 20

# Contents


**2. Basic Operation . . . . . 21**

Using Table Editors . . . . . 22

Table Editor Softkeys . . . . . 23

Modifying Table Items in the Data Fields . . . . . 23

Configuring the RF Output . . . . . 23

Configuring a Continuous Wave RF Output . . . . . 24

Configuring a Swept RF Output . . . . . 26

Modulating a Signal . . . . . 31

Turning On a Modulation Format . . . . . 31

Applying a Modulation Format to the RF Output . . . . . 31

Using Data Storage Functions . . . . . 32

Using the Memory Catalog . . . . . 32

Using the Instrument State Registers . . . . . 34

Using Security Functions . . . . . 36

Understanding E8663B Memory Types . . . . . 36

Removing Sensitive Data from E8663B Memory . . . . . 38

Using the Secure Display . . . . . 40

Enabling Options . . . . . 41

Enabling a Software Option . . . . . 41

Using the Web Server . . . . . 42

Activating the Web Server . . . . . 43

**3. Optimizing Performance . . . . . 47**

Using the ALC . . . . . 47

Selecting ALC Bandwidth . . . . . 47

To Select an ALC Bandwidth . . . . . 47

Using External Leveling . . . . . 48

To Level with Detectors and Couplers/Splitters . . . . . 48

Creating and Applying User Flatness Correction . . . . . 51

Creating a User Flatness Correction Array . . . . . 52

Adjusting Reference Oscillator Bandwidth . . . . . 56

To Select the Reference Oscillator Bandwidth . . . . . 57

To Restore Factory Default Settings: . . . . . 57

**4. Analog Modulation . . . . . 59**

Analog Modulation Waveforms . . . . . 59

Configuring AM . . . . . 60

To Set the Carrier Frequency . . . . . 60

To Set the RF Output Amplitude . . . 60
To Set the AM Depth and Rate . . . 60
To Turn on Amplitude Modulation . . . 60
Configuring FM . . . 60
To Set the RF Output Frequency . . . 60
To Set the RF Output Amplitude . . . 60
To Set the FM Deviation and Rate . . . 61
To Activate FM . . . 61
Configuring ΦM . . . 61
To Set the RF Output Frequency . . . 61
To Set the RF Output Amplitude . . . 61
To Set the FM Deviation and Rate . . . 61
To Activate FM . . . 62
Configuring Pulse Modulation . . . 62
To Set the RF Output Frequency . . . 62
To Set the RF Output Amplitude . . . 62
To Set the Pulse Period, Width, and Triggering . . . 62
To Activate Pulse Modulation . . . 62
Configuring the LF Output . . . 63
To Configure the LF Output with an Internal Modulation Source . . . 63
To Configure the LF Output with a Function Generator Source . . . 64

**5. Troubleshooting . . . 65**
RF Output Power Problems . . . 65
No RF Output Power when Playing a Waveform File . . . 65
RF Output Power too Low . . . 66
The Power Supply has Shut Down . . . 66
Signal Loss While Working with a Mixer . . . 66
Signal Loss While Working with a Spectrum Analyzer . . . 68
No Modulation at the RF Output . . . 69
Sweep Problems . . . 70
Sweep Appears to be Stalled . . . 70
Cannot Turn Off Sweep Mode . . . 70
Incorrect List Sweep Dwell Time . . . 70
List Sweep Information is Missing from a Recalled Register . . . 71
Data Storage Problems . . . 71
Registers With Previously Stored Instrument States are Empty . . . 71
Saved Instrument State, but Register is Empty or Contains Wrong State . . . 71

Cannot Turn Off Help Mode . . . . . 72
Signal Generator Locks Up . . . . . 72
Fail-Safe Recovery Sequence . . . . . 72
Error Messages . . . . . 73
Error Message File . . . . . 74
Error Message Format . . . . . 74
Error Message Types . . . . . 74
Contacting Agilent Sales and Service Offices . . . . . 75
Returning a Signal Generator to Agilent Technologies . . . . . 75

# Contents

# Documentation Overview

**Installation Guide**

- Safety Information
- Getting Started
- Operation Verification
- Regulatory Information

**User's Guide**

- Signal Generator Overview
- Basic Operation
- Optimizing Performance
- Analog Modulation
- Troubleshooting

**Programming Guide**

- Getting Started with Remote Operation
- Using IO Interfaces
- Programming Examples
- Programming the Status Register System
- Creating and Downloading Waveform Files
- Creating and Downloading User-Data Files

**SCPI Reference**

- Using this Guide
- System Commands
- Basic Function Commands
- Analog Commands
- SCPI Command Compatibility

**Service Guide**

- Troubleshooting
- Replaceable Parts
- Assembly Replacement
- Post-Repair Procedures
- Safety and Regulatory

**Key Reference**

- Key function description

# 1 Signal Generator Overview

In the following sections, this chapter describes the models, options, and features available for Agilent E8663B signal generator. The modes of operation, front panel user interface, as well as front and rear panel connectors are also described.


- "E8663B Signal Generator Features" on page 1
- "Options" on page 3
- "Firmware Upgrades" on page 3
- "Modes of Operation" on page 4
- "Front Panel" on page 5
- "Front Panel Display" on page 11
- "Rear Panel" on page 15


**NOTE** For more information about the signal generator, such as data sheets, configuration guides, application notes, frequently asked questions, technical support, software and more, visit the Agilent web page at *http://www.agilent.com/find/e8663b*.

## E8663B Signal Generator Features

The E8663B includes the following standard features:

- ultra low phase noise
- step attenuator
- pulse modulation
  - internal pulse generator
  - external modulation inputs
  - selectable pulse modes: internal square, internal free-run, internal triggered, internal doublet, internal gated, and external pulse; internal triggered, internal doublet, and internal gated require an external trigger source
  - adjustable pulse rate, pulse period, pulse delay, and pulse width (150 ns minimum)
  - selectable external pulse triggering: positive or negative

- AM, FM, phase modulation, and LF output
  - open-loop or closed-loop AM
  - dc-synthesized FM to 10 MHz rates; maximum deviation depends on the carrier frequency
  - external modulation inputs for AM, FM, and ΦM
  - simultaneous modulation configurations (except: FM with ΦM or Linear AM with Exponential AM)
  - dual function generators that include the following:
    - 50-ohm low-frequency output, 0 to 3 Vp, available through the LF output
    - selectable waveforms: sine, dual-sine, swept-sine, triangle, positive ramp, negative ramp, square, uniform noise, Gaussian noise, and dc
    - adjustable frequency modulation rates
    - selectable triggering in list and step sweep modes: free run (auto), trigger key (single), bus (remote), and external
- CW output from 100 kHz to the highest operating frequency, depending on the option
- frequency resolution to 0.001 Hz
- list and step sweep of frequency and amplitude, with multiple trigger sources
- user flatness correction
- external diode detector leveling
- automatic leveling control (ALC) on and off modes; power calibration in ALC-off mode is available, even without power search
- 10 MHz reference oscillator with external output
- RS-232, GPIB, and 10Base-T LAN I/O interfaces
- Type-N female RF output connector

The E8663B also offers the following optional features:

*Option 503*—frequency range from 100 kHz to 3.2 GHz

*Option 509*—frequency range from 100 kHz to 9.0 GHz

*Option UNW*—narrow pulse modulation

- in addition to the standard pulse modulation features, generate narrow pulses (20 ns minimum) across the operational frequency band of the signal generator

*Option 1EM*—moves all front panel connectors to the rear panel

*Option 1EZ*—extended support life

## Options

E8663B signal generators have hardware, firmware, software, and documentation options. The *Data Sheet* shipped with your signal generator provides an overview of available options. For more information, visit the Agilent E8663B web page at *http://www.agilent.com/find/e8663b* and click the **Options** tab.

## Firmware Upgrades

You can upgrade the firmware in your signal generator whenever new firmware is released. New firmware releases, which can be downloaded from the Agilent website, may contain signal generator features and functionality not available in previous firmware releases.

To determine about the availability of new signal generator firmware, visit the Signal Generator Firmware Upgrade Center web page at *http://www.agilent.com/find/upgradeassistant*, or call the number listed at *http://www.agilent.com/find/assist*.

### To Upgrade Firmware

The following procedure shows you how to download new firmware to your signal generator using a LAN connection and a PC. For information on equipment requirements and alternate methods of downloading firmware, such as GPIB, refer to the *Firmware Upgrade Guide*, which can be accessed at *http://www.agilent.com/find/upgradeassistant*.

1. Note the IP address of your signal generator. To view the IP address on the signal generator, press **Utility** > **GPIB/RS-232 LAN** > **LAN Setup**.
2. Use an internet browser to visit *http://www.agilent.com/find/upgradeassistant*.
3. Scroll down to the "Documents and Downloads" table and click the link in the "Latest Firmware Revision" column for the E8663B.
4. In the File Download window, select **Run**.
5. In the Welcome window, click **Next** and follow the on-screen instructions. The firmware files download to the PC.
6. In the "Documents and Downloads" table, click the link in the "Upgrade Assistant Software" column for the E8663B to download the PSG/ESG Upgrade Assistant.
7. In the File Download window, select **Run**.
8. In the Welcome window, click **OK** and follow the on-screen instructions.
9. At the desktop shortcut prompt, click **Yes**.
10. Once the utility downloads, close the browser and double-click the **PSG/ESG Upgrade Assistant** icon on the desktop.

11. In the Upgrade Assistant, set the connection type you wish to use to download the firmware, and the parameters for the type of connection selected. For LAN, enter the instrument's IP address, which you recorded in step 1.

**NOTE** If the signal generator's dynamic host configuration protocol (DHCP) is enabled, the network assigns the instrument an IP address at power on. Because of this, when DHCP is enabled the IP address may be different each time you turn on the instrument. DHCP does *not* affect the hostname.

12. Click **Browse**, and double-click the firmware revision to upgrade your signal generator.
13. In the Upgrade Assistant, click **Next**.
14. Once connection to the instrument is verified, click **Next** and follow the on-screen prompts.

**NOTE** Once the download starts, it cannot be aborted.

**NOTE** When the User Attention message appears, you must *first* cycle the instrument's power, *then* click OK.

When the upgrade completes, the Upgrade Assistant displays a summary.

15. Click **OK** and close the Upgrade Assistant.

## Modes of Operation

Depending on the model and installed options, the signal generator provides several modes of operation: continuous wave (CW), swept signal, and analog modulation.

### Continuous Wave

In this mode, the signal generator produces a continuous wave signal. The signal generator is set to a single frequency and power level.

### Swept Signal

In this mode, the signal generator sweeps over a range of frequencies and/or power levels.

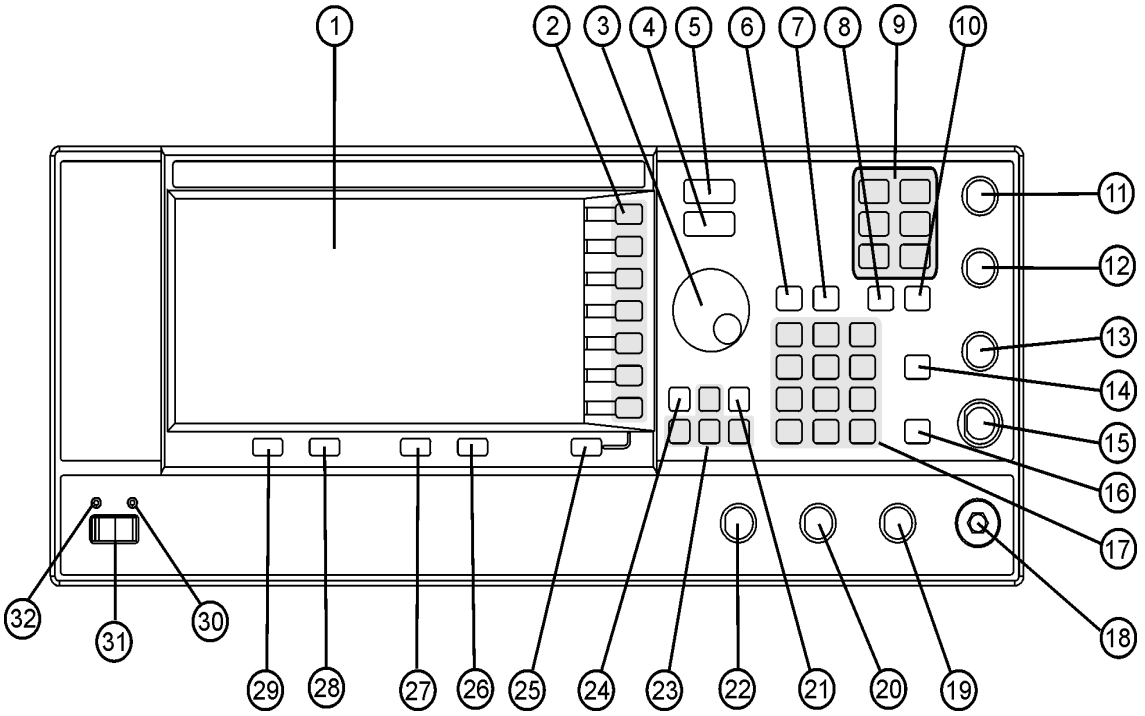
### Analog Modulation

In this mode, the signal generator modulates a CW signal with an analog signal. The analog modulation types available are standard pulse, AM, FM, and ΦM. Narrow pulse modulation capability is available with Option UNW.

# Front Panel

This section describes each item on the signal generator front panel. Figure 1-1 shows an E8663B front panel.

**Figure 1-1 Front Panel Diagram**




1. Display
2. Softkeys
3. Knob
4. Amplitude
5. Frequency
6. Save
7. Recall
8. Trigger
9. MENUS
10. Help
11. EXT 1 INPUT
12. EXT 2 INPUT
13. LF OUTPUT
14. Mod On/Off
15. ALC INPUT
16. RF On/Off
17. Numeric Keypad
18. RF OUTPUT
19. SYNC OUT
20. VIDEO OUT
21. Incr Set
22. GATE/ PULSE/ TRIGGER INPUT
23. Arrow Keys
24. Hold
25. Return
26. Contrast Decrease
27. Contrast Increase
28. Local
29. Preset
30. Line Power LED
31. LINE
32. Standby LED

## 1. Display

The LCD screen provides information on the current function. Information can include status indicators, frequency and amplitude settings, and error messages. Softkey labels are located on the right-hand side of the display. For more detail on the front panel display, see "Front Panel Display" on page 11.

### 2. Softkeys

Softkeys activate the displayed function to the left of each key.

### 3. Knob

Use the knob to increase or decrease a numeric value, change a highlighted digit or character, or step through lists or select items in a row.

### 4. Amplitude

Pressing this hardkey makes amplitude the active function. You can change the output amplitude or use the menus to configure amplitude attributes such as power search, user flatness, and leveling mode.

### 5. Frequency

Pressing this hardkey makes frequency the active function. You can change the output frequency or use the menus to configure frequency attributes such as frequency multiplier, offset, and reference.

### 6. Save

Pressing this hardkey accesses a menu of choices that enable you to save data in the instrument state register. The instrument state register is a section of memory divided into 10 sequences (numbered 0 through 9), each containing 100 registers (numbered 00 through 99). It is used to store and recall frequency, amplitude, and modulation settings.

The **Save** hardkey provides a quick alternative to reconfiguring the signal generator through the front panel or SCPI commands when switching between different signal configurations. Once an instrument state has been saved, all of the frequency, amplitude, and modulation settings can be recalled with the **Recall** hardkey. For more information on saving and recalling instrument states, refer to "Using the Instrument State Registers" on page 34.

### 7. Recall

Restores an instrument state saved in a memory register. To recall an instrument state, press Recall and enter the desired sequence number and register number. To save a state, use the Save hardkey. For more information on saving and recalling instrument states, refer to "Using the Instrument State Registers" on page 34.

### 8. Trigger

Initiates an immediate trigger event for a function such as a list or step. Before this hardkey can be used to initiate a trigger event, the trigger mode must be set to Trigger Key. For example: press the Sweep/List hardkey, then one of the following sequences of softkeys:

- **More (1 of 2) > Sweep Trigger > Trigger Key**
- **More (1 of 2) > Point Trigger > Trigger Key**

## 9. MENUS

These keys open softkey menus for configuring various functions. For descriptions, see the *E8663B Signal Generator Key Reference*.

**Table 1-1 Hardkeys in Front Panel MENUS Group**

| E8663B Signal Generator |
|---|
| AM<br>Sweep / List<br>FM / ΦM<br>Utility<br>Pulse<br>LF Out |

**NOTE** Some menus are optional. Refer to "Options" on page 3 for more information.

## 10. Help

Pressing this hardkey accesses a short description of any hardkey or softkey and, in most cases, a listing of related remote-operation SCPI commands. There are two help modes available on the signal generator: single and continuous. The single mode is the factory preset condition. Toggle between single and continuous mode by pressing Utility > Instrument Info/Help Mode > Help Mode Single Cont.

- In single mode, help text is provided for the next key you press without activating the key's function. Any key pressed afterward exits the help mode and its function is activated.
- In continuous mode, help text is provided for each subsequent key press until you press the **Help** hardkey again or change to single mode. In addition, each key is active, meaning that the key function is executed (except for the Preset key).

## 11. EXT 1 INPUT

This female BNC input connector accepts a ±1 $V_p$ signal for AM, FM, and ΦM. For these modulations, ±1 $V_p$ produces the indicated deviation or depth. When ac-coupled inputs are selected for AM, FM, or ΦM and the peak input voltage differs from 1 $V_p$ by more than 3 percent, the HI/LO display annunciators light. The input impedance is selectable as either 50 or 600 ohms; the damage levels are 5 $V_{rms}$ and 10 $V_p$. On signal generators with Option 1EM, this connector is relocated to the rear panel.

## 12. EXT 2 INPUT

This female BNC input connector accepts a ±1 $V_p$ signal for AM, FM, and ΦM. With AM, FM, or ΦM, ±1 $V_p$ produces the indicated deviation or depth. When ac-coupled inputs are selected for AM, FM, or ΦM and the peak input voltage differs from 1 $V_p$ by more than 3 percent, the HI/LO annunciators light on the display. The input impedance is selectable as either 50 or 600 ohms and damage levels are 5 $V_{rms}$ and 10 $V_p$. On signal generators with Option 1EM, this input is relocated to the rear panel.

### 13. LF OUTPUT

This female BNC output connector outputs modulation signals generated by the low frequency (LF) source function generator. This output is capable of driving $3V_p$ (nominal) into a 50-ohm load. On signal generators with Option 1EM, this output is relocated to the rear panel.

### 14. Mod On/Off

This hardkey enables or disables all active modulation formats (AM, FM, ΦM, Pulse, or I/Q) applied to the output carrier signal available through the RF Output connector. This hardkey does not set up or activate an AM, FM, ΦM, Pulse, or I/Q format; each modulation format must still be set up and activated (for example, AM > AM On) or nothing is applied to the output carrier signal when the Mod On/Off hardkey is enabled. The MOD ON/OFF annunciator indicates whether active modulation formats have been enabled or disabled with the Mod On/Off hardkey.

### 15. ALC INPUT

This female BNC input connector is used for negative external detector leveling. This connector accepts an input of –0.2 mV to –0.5 V. The nominal input impedance is 120 kohms and the damage level is ±15 V. On signal generators with Option 1EM, this input is relocated to the rear panel.

### 16. RF On/Off

Pressing this hardkey toggles the operating state of the RF signal present at the RF OUTPUT connector. Although you can set up and enable various frequency, power, and modulation states, the RF and microwave output signal is not present at the RF OUTPUT until RF On/Off is set to On. The RF On/Off annunciator is always visible in the display to indicate whether the RF is turned on or off.

### 17. Numeric Keypad

The numeric keypad consists of the 0 through 9 hardkeys, a decimal point hardkey, and a backspace hardkey ( +/– ⬅ ). The backspace hardkey enables you to backspace or alternate between a positive and a negative value. When specifying a negative numeric value, the negative sign must be entered prior to entering the numeric value.

### 18. RF OUTPUT

This connector outputs RF and microwave signals. The nominal output impedance is 50 ohms. The reverse-power damage levels are 0 Vdc, 0.5 watts nominal. On signal generators with Option 1EM, this output is relocated on the rear panel. The connector type varies according to frequency option.

### 19. SYNC OUT

This female BNC output connector outputs a synchronizing TTL-compatible pulse signal that is nominally 50 ns wide during internal and triggered pulse modulation. The nominal source impedance is 50 ohms. On signal generators with Option 1EM, this output is relocated to the rear panel.

### 20. VIDEO OUT

This female BNC output connector outputs a TTL-level compatible pulse signal that follows the output envelope in all pulse modes. The nominal source impedance is 50 ohms. On signal generators with Option 1EM, this output is relocated to the rear panel.

### 21. Incr Set

This hardkey enables you to set the increment value of the current active function. The increment value of the current active function appears in the active entry area of the display. Use the numeric keypad, arrow hardkeys, or the knob to adjust the increment value.

### 22. GATE / PULSE / TRIGGER INPUT

This female BNC input connector accepts an externally supplied pulse signal for use as a pulse or trigger input. With pulse modulation, +1 V is on and 0 V is off (trigger threshold of 0.5 V with a hysteresis of 10 percent; so 0.6 V would be on and 0.4 V would be off). The damage levels are $\pm 5$ $V_{rms}$ and 10 $V_p$. The nominal input impedance is 50 ohms. On signal generators with Option 1EM, this input is relocated to the rear panel.

### 23. Arrow Keys

These up and down arrow hardkeys are used to increase or decrease a numeric value, step through displayed lists, or to select items in a row of a displayed list. Individual digits or characters may be highlighted using the left and right arrow hardkeys. Once an individual digit or character is highlighted, its value can be changed using the up and down arrow hardkeys.

### 24. Hold

Pressing this hardkey blanks the softkey label area and text areas on the display. Softkeys, arrow hardkeys, the knob, the numeric keypad, and the **Incr Set** hardkey have no effect once this hardkey is pressed.

### 25. Return

Pressing this hardkey returns you to the softkey menu you were at previously. It enables you to step back through the menus until you reach the first menu you selected.

### 26. Contrast Decrease

Pressing this hardkey causes the display background to darken.

### 27. Contrast Increase

Pressing this hardkey causes the display background to lighten.

### 28. Local

Pressing this hardkey deactivates remote operation and returns the signal generator to front-panel control.

### 29. Preset

Pressing this hardkey sets the signal generator to a known state (factory or user-defined).

### 30. Line Power LED

This green LED indicates when the signal generator power switch is set to the on position.

### 31. LINE

In the on position, this switch activates full power to the signal generator; in standby, it deactivates all signal generator functions. In standby, the signal generator remains connected to the line power and power is supplied to some internal circuits.

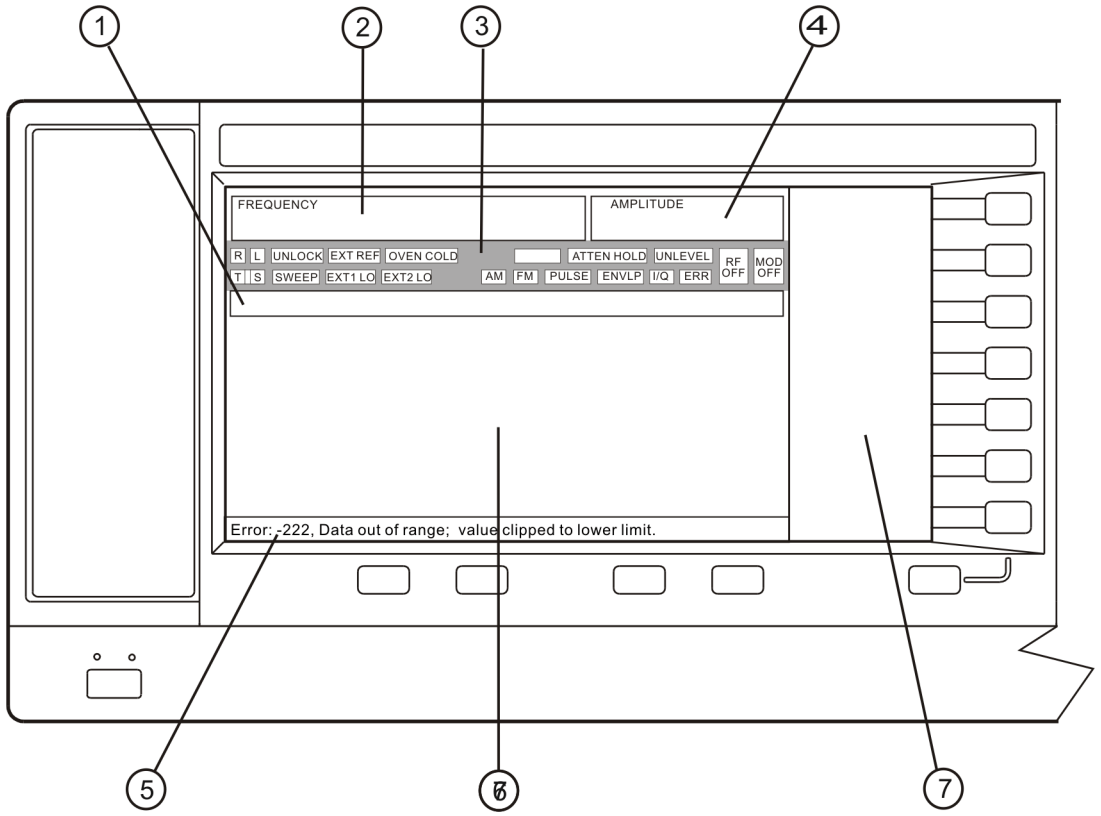
### 32. Standby LED

This yellow LED indicates when the signal generator power switch is set to the standby condition.

# Front Panel Display

Figure 1-2 shows the various regions of the signal generator display. This section describes each region.

**Figure 1-2 Front Panel Display Diagram**




1. Active Entry Area
2. Frequency Area
3. Annunciators
4. Amplitude Area
5. Error Message Area
6. Text Area
7. Softkey Label Area

## 1. Active Entry Area

The current active function is shown in this area. For example, if frequency is the active function, the

current frequency setting will be displayed here. If the current active function has an increment value associated with it, that value is also displayed.

## 2. Frequency Area

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

## 3. Annunciators

The display annunciators show the status of some of the signal generator functions and indicate any error conditions. An annunciator position may be used by more than one function. This does not create a problem, because only one function that shares an annunciator position can be active at a time.

| | |
|---|---|
| ΦM | This annunciator appears when phase modulation is on. If frequency modulation is on, the FM annunciator replaces ΦM. |
| ALC OFF | This annunciator appears when the ALC circuit is disabled. A second annunciator, UNLEVEL, appears in the same position if the ALC is enabled and cannot maintain the output level. |
| AM | This annunciator appears when amplitude modulation is on. |
| ARMED | This annunciator appears when a sweep has been initiated and the signal generator is waiting for the sweep trigger event. |
| ATTEN HOLD | This annunciator appears when the attenuator hold function is on. When this function is on, the attenuator is held at its current setting. |
| ENVLP | This annunciator appears if a burst condition exists, such as when marker 2 is set to enable RF blanking in the Dual ARB format. |
| ERR | This annunciator appears when an error message is in the error queue. This annunciator does not turn off until you either view all the error messages or cleared the error queue. To access error messages, press **Utility > Error Info**. |
| EXT | This annunciator appears when external leveling is on. |
| EXT1 LO/HI | This annunciator appears as either EXT1 LO or EXT1 HI, when the ac-coupled signal to the EXT 1 INPUT is <0.97 $V_p$ or >1.03 $V_p$. |
| EXT2 LO/HI | This annunciator is displayed as either EXT2 LO or EXT2 HI. This annunciator appears when the ac-coupled signal to the EXT 2 INPUT is <0.97 $V_p$ or >1.03 $V_p$. |
| EXT REF | This annunciator appears when an external frequency reference is applied. |
| FM | This annunciator appears when frequency modulation is turned on. If phase modulation is turned on, the ΦM annunciator will replace FM. |

| | |
|---|---|
| L | This annunciator appears when the signal generator is in listener mode and is receiving information or commands over the RS-232, GPIB, or VXI-11 LAN interface. |
| MOD ON/OFF | This annunciator indicates whether active modulation formats have been enabled or disabled. Pressing the **Mod On/Off** hardkey enables or disables all active modulation formats (AM, FM, ΦM, Pulse, or I/Q) that are applied to the output carrier signal available through the RF Output connector. The **Mod On/Off** hardkey does not set up or activate an AM, FM, ΦM, Pulse, or I/Q format; each individual modulation format must still be set up and activated (for example, **AM > AM On**) or nothing will be applied to the output carrier signal when the **Mod On/Off** hardkey is enabled. |
| OVEN COLD | This annunciator appears when the temperature of the internal oven reference oscillator has dropped below an acceptable level. When this annunciator is on, frequency accuracy is degraded. This condition should occur for several minutes after the signal generator is first connected to line power. |
| PULSE | This annunciator appears when pulse modulation is on. |
| R | This annunciator appears when the signal generator is remotely controlled over the GPIB, RS-232, or VXI-11/Sockets LAN interface (TELNET operation does not activate the R annunciator). When the R annunciator is on, the front panel keys are disabled, except for the Local key and the line power switch. For information on remote operation, refer to the *E8663B Signal Generator Programming Guide*. |
| RF ON/OFF | This annunciator indicates when the RF and microwave signal is present (RF ON) at the RF OUTPUT, or if the RF and microwave signal is not present (RF OFF) at the RF OUTPUT. Either condition of this annunciator is always visible in the display. |
| S | This annunciator appears when the signal generator has generated a service request (SRQ) over the RS-232, GPIB, or VXI-11 LAN interface. |
| SWEEP | This annunciator appears when the signal generator is in list or step sweep mode. List mode is when the signal generator can jump from point to point in a list (hop list); the list is traversed in ascending or descending order. The list can be a frequency list, a power level list, or both. Step mode is when a start, stop, and step value (frequency or power level) are defined and the signal generator produces signals that start at the start value and increment by the step value until it reaches the stop value. |
| T | This annunciator appears when the signal generator is in talker mode and is transmitting information over the GPIB, RS-232, or VXI-11 LAN interface. |

| | |
|---|---|
| UNLEVEL | This annunciator appears 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 ALC circuit is disabled. |
| UNLOCK | This annunciator appears when any of the phase locked loops are unable to maintain phase lock. You can determine which loop is unlocked by examining the error messages. |

### 4. Amplitude Area

The current output power level setting is shown in this portion of the display. Indicators are also displayed in this area when amplitude offset is used, amplitude reference mode is turned on, external leveling mode is enabled, and when user flatness is enabled.

### 5. Error Message Area

Abbreviated error messages are reported in this space. When multiple error messages occur, only the most recent message remains displayed. Reported error messages with details can be viewed by pressing Utility > Error Info.

### 6. Text Area

This text area of the display:

- shows signal generator status information, such as the modulation status, sweep lists, and file catalogs
- displays the tables
- enables you to perform functions such as managing information, entering information, and displaying or deleting files

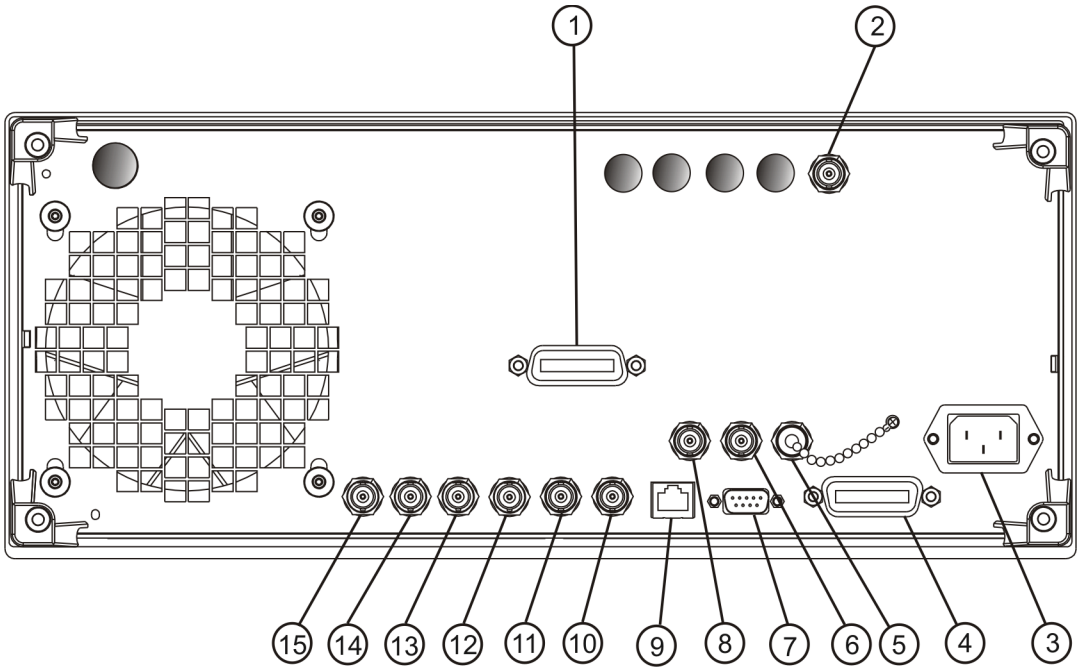
### 7. Softkey Label Area

The labels in this area define the function of the softkeys located immediately to the right of the label. The softkey label may change depending upon the function selected.

## Rear Panel

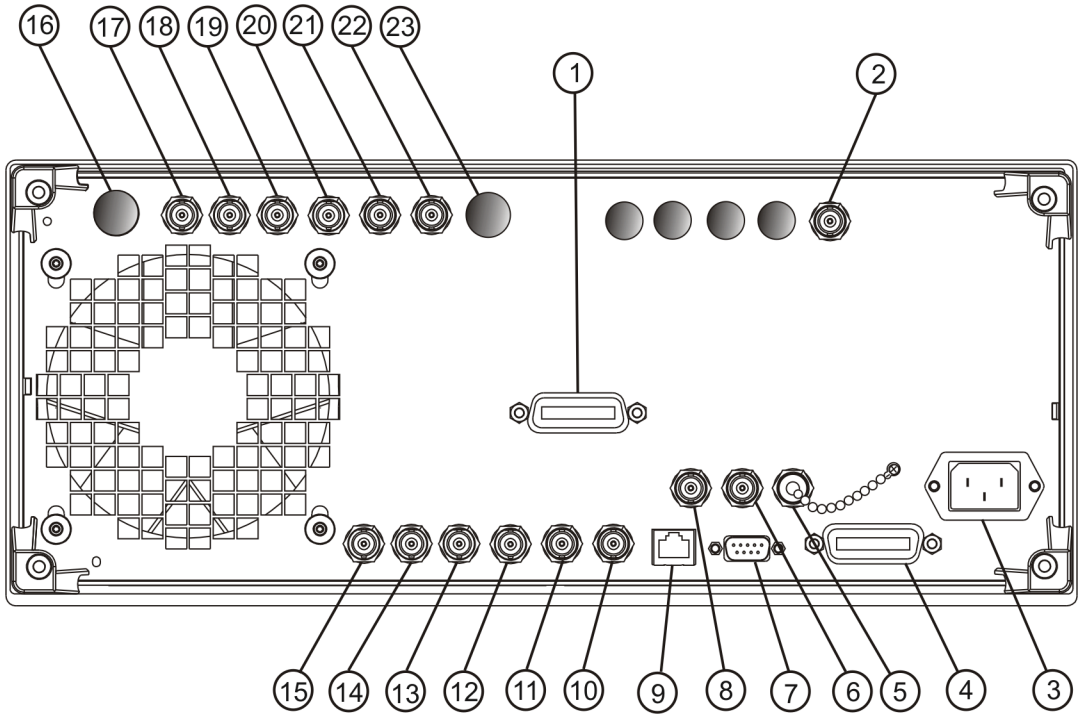
This section describes each item on the signal generator rear panel. Figure 1-3 shows a standard E8663B rear panel. Figure 1-4 on page 16 shows an E8663B rear panel with Option 1EM. Option 1EM moves all front panel connectors to the real panel.

**Figure 1-3 Standard Rear Panel Diagram**




1. Source Module Interface
2. 1 GHz Output
3. AC Power Receptacle
4. GPIB
5. 10 MHz EFC
6. 10 MHz IN
7. AUXILIARY INTERFACE
8. 10 MHz OUT
9. LAN
10. SWEEP OUT
11. Z-AXIS BLANK/MKRS
12. SWEEP OUT
13. TRIGGER OUT
14. TRIGGER IN
15. SOURCE SETTLED

**Figure 1-4 Option 1EM Rear Panel Diagram**




1. Source Module Interface
2. 1 GHz Output
3. AC Power Receptacle
4. GPIB
5. 10 MHz EFC
6. 10 MHz IN
7. AUXILIARY INTERFACE
8. 10 MHz OUT
9. LAN
10. SWEEP OUT
11. Z-AXIS BLANK/MKRS
12. SWEEP OUT
13. TRIGGER OUT
14. TRIGGER IN
15. SOURCE SETTLED
16. RF OUT
17. EXT 1 Input
18. EXT 2 Input
19. LF OUT
20. PULSE SYNC OUT
21. PULSE VIDEO OUT
22. PULSE/TRIG GATE INPUT
23. ALC INPUT

## 1. Source Module Interface

Inactive.

## 2. 1 GHz Output

This female BNC connector provides a 1 GHz low noise frequency reference output signal.

## 3. AC Power Receptacle

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

## 4. GPIB

This GPIB interface allows listen and talk capability with compatible IEEE 488.2 devices.

## 5. 10 MHz EFC

This female BNC input connector accepts an external dc voltage, ranging from –5 V to +5 V, for electronic frequency control (EFC) of the internal 10 MHz reference oscillator. This voltage inversely tunes the oscillator about its center frequency approximately –0.0025 ppm/V. The nominal input impedance is greater than 1 Mohms. When not in use, this connector should be shorted using the supplied shorting cap to assure a stable operating frequency.

## 6. 10 MHz IN

This female BNC connector accepts an external timebase reference input signal level of > –3 dBm. The reference must be 1, 2, 2.5, 5, or 10 MHz, within ±1 ppm. The signal generator detects when a valid reference signal is present at this connector and automatically switches from internal to external reference operation.

The nominal input impedance is 50 ohms with a damage level of ≥ 10 dBm.

## 7. AUXILIARY INTERFACE

This 9-pin D-subminiature female connector is an RS-232 serial port that can be used for serial communication and Master/Slave source synchronization.

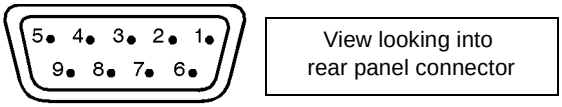
**Table 1-2 Auxiliary Interface Connector**

| Pin Number | Signal Description | Signal Name |
|---|---|---|
| 1 | No Connection (default operation)/ Retrace (Master/Slave operation) | |
| 2 | Receive Data | RECV |
| 3 | Transmit Data | XMIT |
| 4 | +5V (Default operation)/ Sweep Stop (Master/Slave operation) | |

**Table 1-2 Auxiliary Interface Connector**

| Pin Number | Signal Description | Signal Name |
|---|---|---|
| 5 | Ground, 0V | |
| 6 | No Connection | |
| 7 | Request to Send | RTS |
| 8 | Clear to Send | CTS |
| 9 | No Connection | |

**Figure 1-5**




## 8. 10 MHz OUT

This female BNC connector outputs a nominal signal level of > +4 dBm and has an output impedance of 50 ohms. The accuracy is determined by the timebase used.

## 9. LAN

This LAN interface allows ethernet local area network communication through a 10Base-T LAN cable. The yellow LED on the interface illuminates when data transmission (transfer/receive) is present. The green LED illuminates when there is a delay in data transmission or no data transmission is present.

## 10. SWEEP OUT

This female BNC connector outputs a voltage proportional to the RF power or frequency sweep ranging from 0 V at the start of sweep and goes to +10 V (nominal) at the end of sweep, regardless of sweep width.

The nominal output impedance is less than 1 ohm and can drive a 2-kohm load.

## 11. Z-AXIS BLANK / MKRS

This female BNC connector supplies a +5 V (nominal) level during retrace and band-switch intervals of a step or list sweep. This signal is derived from an operational amplifier output so the load impedance should be greater than or equal to 5 kohms.

## 12. SWEEP OUT

This female BNC connector outputs a voltage proportional to the RF power or frequency sweep ranging from 0 V at the start of sweep and goes to +10 V (nominal) at the end of sweep, regardless of sweep width.

The nominal output impedance is less than 1 ohm and can drive a 2-kohm load.

### 13. TRIGGER OUT

This female BNC connector, in step/list sweep mode, outputs a TTL signal that is high at the start of a dwell sequence or when waiting for a point trigger in manual sweep mode. The signal is low when the dwell is over or when a point trigger is received. When using LF Out, the output provides a 2 µs pulse at the start of LF sweep. The nominal impedance for this connector is less than 10 ohms.

On signal generators with Option 1EM, this output is changed from a BNC to an SMB connector.

### 14. TRIGGER IN

This female BNC connector accepts a 3.3V CMOS signal, which is used for point-to-point triggering in manual sweep mode, or in an low-frequency (LF output) or analog (AM, FM, and ΦM) external sweep trigger setup. Triggering can occur on either the positive or negative edge of the signal start. The damage level is ≤ –4 V or ≥ +10 V. The nominal input impedance for this connector is approximately 4.2 kohms.

### 15. SOURCE SETTLED

This female BNC connector provides a 3-volt CMOS output trigger, indicating when the signal generator has settled to a new frequency or power level. A high indicates that the source has not settled. A low indicates that the source has settled. The nominal output impedance for this connector is less than 10 ohms.

### 16. RF OUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “18. RF OUTPUT” on page 8.

### 17. EXT 1 Input

On standard instruments, this connector resides on the front panel. For a description of this connector, see “11. EXT 1 INPUT” on page 7.

### 18. EXT 2 Input

On standard instruments, this connector resides on the front panel. For a description of this connector, see “12. EXT 2 INPUT” on page 7.

### 19. LF OUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “13. LF OUTPUT” on page 8.

### 20. PULSE SYNC OUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “19. SYNC OUT” on page 8.

## 21. PULSE VIDEO OUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “20. VIDEO OUT” on page 9.

## 22. PULSE / TRIG GATE INPUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “22. GATE/ PULSE/ TRIGGER INPUT” on page 9.

## 23. ALC INPUT

On standard instruments, this connector resides on the front panel. For a description of this connector, see “15. ALC INPUT” on page 8.

# 2 Basic Operation

In the following sections, this chapter describes the operation of the Agilent E8663B analog signal generator:


- "Using Table Editors" on page 22
- "Configuring a Continuous Wave RF Output" on page 24
- "Configuring a Swept RF Output" on page 26
- "Turning On a Modulation Format" on page 31
- "Applying a Modulation Format to the RF Output" on page 31
- "Using Data Storage Functions" on page 32
- "Using the Instrument State Registers" on page 34
- "Using Security Functions" on page 36
- "Enabling Options" on page 41
- "Using the Web Server" on page 42

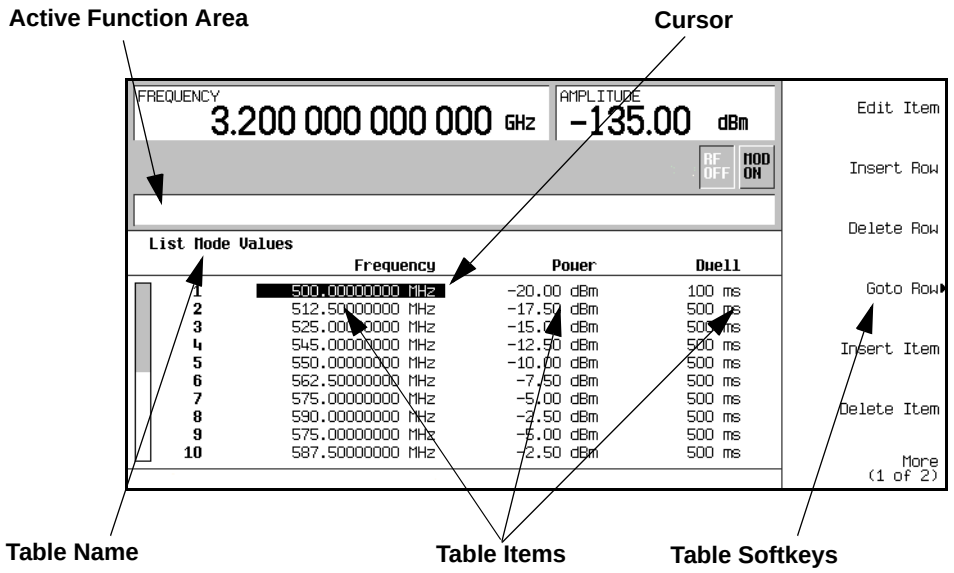
## Using Table Editors

Table editors simplify configuration tasks, such as creating a list sweep. This section provides information to familiarize you with basic table editor functionality using the List Mode Values table editor as an example.

Press **Preset** > **Sweep/List** > **Configure List Sweep**.

The signal generator displays the List Mode Values table editor, as shown below.

**Figure 2-1**




| | |
|---|---|
| Active Function Area | displays the active table item while its value is edited |
| Cursor | an inverse video identifier used to highlight specific table items for selection and editing |
| Table Softkeys | select table items, preset table values, and modify table structures |
| Table Items | values arranged in numbered rows and titled columns (The columns are also known as data fields. For example, the column below the Frequency title is known as the Frequency data field). |

### Table Editor Softkeys

The following table editor softkeys are used to load, navigate, modify, and store table item values.

| | |
|---|---|
| **Edit Item** | displays the selected item in the active function area of the display where the item's value can be modified |
| **Insert Row** | inserts an identical row of table items above the currently selected row |
| **Delete Row** | deletes the currently selected row |
| **Goto Row** | opens a menu of softkeys (**Enter**, **Goto Top Row**, **Goto Middle Row**, **Goto Bottom Row**, **Page Up**, and **Page Down**) used to quickly navigate through the table items |
| **Insert Item** | inserts an identical item in a new row below the currently selected item |
| **Delete Item** | deletes the item from the bottom row of the currently selected column |
| **Page Up** and **Page Down** | displays table items that occupy rows outside the limits of the ten-row table display area |
| **More (1 of 2)** | accesses **Load / Store** and its associated softkeys |
| **Load / Store** | opens a menu of softkeys (**Load From Selected File**, **Store To File**, **Delete File**, **Goto Row**, **Page Up**, and **Page Down**) used to load table items from a file in the memory catalog, or to store the current table items as a file in the memory catalog |

### Modifying Table Items in the Data Fields

1. If not already displayed, open the List Mode Values table editor (Figure 2-1 on page 22): Press **Preset** > **Sweep / List** > **Configure List Sweep**
2. Use the arrow keys or the knob to move the table cursor over the desired item.

   In Figure 2-1, the first item in the Frequency data field is selected.
3. Press **Edit Item**.

   The selected item is displayed in the active function area of the display.
4. Use the knob, arrow keys, or the numeric keypad to modify the value.
5. Press **Enter**.

   The modified item is now displayed in the table.

## Configuring the RF Output

This section provides information on how to create continuous wave and swept RF (page 26) outputs.

## Configuring a Continuous Wave RF Output

These procedures demonstrate how to set the following parameters:

- RF output frequency
- frequency reference and frequency offset (page 25)
- RF output amplitude (page 25)
- amplitude reference and amplitude offset (page 26)

### Setting the RF Output Frequency

Set the RF output frequency to 700 MHz, and increment or decrement the output frequency in 1 MHz steps.

1. Return the signal generator to the factory-defined state: Press **Preset**.

**NOTE** You can change the preset condition of the signal generator to a user-defined state. For these examples, however, use the factory-defined preset state (set the **Preset Normal User** softkey in the Utility menu to Normal).

2. Observe the FREQUENCY area of the display (in the upper left corner).

   The value displayed is the maximum specified frequency of the signal generator.

3. Press **RF On/Off**.

   The **RF On/Off** hardkey must be pressed before the RF signal is available at the RF OUTPUT connector. The display annunciator changes from RF OFF to RF ON. The maximum specified frequency should be output at the RF OUTPUT connector (at the signal generator's minimum power level).

4. Press **Frequency** > **700** > **MHz**.

   The 700 MHz RF frequency should be displayed in the FREQUENCY area of the display and also in the active entry area.

5. Press **Frequency** > **Incr Set** > **1** > **MHz**.

   This changes the frequency increment value to 1 MHz.

6. Press the up arrow key.

   Each press of the up arrow key increases the frequency by the increment value last set with the **Incr Set** hardkey. The increment value is displayed in the active entry area.

7. The down arrow decreases the frequency by the increment value set in the previous step. Practice stepping the frequency up and down in 1 MHz increments.

   You can also adjust the RF output frequency using the knob. As long as frequency is the active function (the frequency is displayed in the active entry area), the knob will increase and decrease the RF output frequency.

8. Use the knob to adjust the frequency back to 700 MHz.

### Setting the Frequency Reference and Frequency Offset

The following procedure sets the RF output frequency as a reference frequency to which all other frequency settings are relative. When the frequency reference is set, the display will read 0.00 Hz (the frequency output of the signal generator's hardware minus the reference frequency). Although the display changes, the actual frequency output is 700 MHz (from step 8 above). Any subsequent frequency changes are shown as increments or decrements to the 0 Hz reference.

The Frequency Reference Set function is not an active function. Once it is set, any change to the frequency setting appears as a frequency reading on the signal generator's front-panel display. For example,

1. Preset the signal generator: Press **Preset**.
2. Set the frequency reference to 700 MHz:
   Press: **Frequency** > **700** > **MHz** > **More (1 of 3)** > **Freq Ref Set**.

   This activates the frequency reference mode, sets the output frequency (700 MHz) as the reference value, and toggles the **Freq Ref** softkey On. The FREQUENCY area displays 0.000 Hz. This reading is the frequency output of the signal generator's hardware (700 MHz) minus the reference value (700 MHz). The signal generator's true output frequency is 700 MHz. If the **Freq Ref** softkey is toggled to Off, the front-panel will indicate the actual frequency: 700 MHz. The REF indicator appears on the front-panel display and the **Freq Ref Off On** softkey toggles to On.
3. Turn on the RF output: Press **RF On/Off**.

   The display annunciator changes from RF OFF to RF ON. The RF frequency at the RF OUTPUT connector is 700 MHz.
4. Set the frequency increment value to 1 MHz: Press **Frequency** > **Incr Set** > **1** > **MHz**.
5. Increment the output frequency by 1 MHz: Press the up arrow key.

   The FREQUENCY area display changes to show 1.000 000 000 MHz, which is the frequency output by the hardware (700 MHz + 1 MHz) minus the reference frequency (700 MHz). The frequency at the RF OUTPUT changes to 701 MHz.
6. Enter a 1 MHz offset: Press **More (1 of 3)** > **Freq Offset** > **1** > **MHz**.

   The FREQUENCY area displays 2.000 000 00 MHz, which is the frequency output by the hardware (701 MHz) minus the reference frequency (700 MHz) plus the offset (1 MHz). The OFFS indicator activates. The frequency at the RF OUTPUT connector is still 701 MHz.

### Setting the RF Output Amplitude

1. Preset the signal generator: Press **Preset**.

   The AMPLITUDE area of the display shows the minimum power level of the signal generator. This is the normal preset RF output amplitude.
2. Turn on the RF output: Press **RF On/Off**.
   The display annunciator changes to RF ON. At the RF OUTPUT connector, the RF signal is output at the minimum power level.

3. Change the amplitude to –20 dBm: Press **Amplitude** > **–20** > **dBm**.

   The new output power displays in the AMPLITUDE area of the display and in the active entry area. Until you press a different front panel function key, amplitude remains the active function. You can also change the amplitude using the up and down arrow keys or the knob.

#### Setting the Amplitude Reference and 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 is 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**.
2. Set the amplitude to –20 dBm: Press **Amplitude** > **-20** > **dBm**.
3. Activate the amplitude reference mode and set the current output power (–20 dBm) as the reference value: Press **More (1 of 2)** > **Ampl Ref Set**.

   The AMPLITUDE area displays 0.00 dB, which is the power output by the hardware (–20 dBm) minus the reference value (–20 dBm). The REF indicator activates and the **Ampl Ref Off On** softkey toggles On.
4. Turn the RF output on: Press **RF On / Off**.
   The display annunciator changes to RF ON. The power at the RF OUTPUT connector is –20 dBm.
5. Change the amplitude increment value to 10 dB: Press **Incr Set** > **10** > **dB**.
6. Use the up arrow key to increase the output power by 10 dB.

   The AMPLITUDE area displays 10.00 dB, which is the power output by the hardware (-20 dBm plus 10 dBm) minus the reference power (–20 dBm). The power at the RF OUTPUT connector changes to –10 dBm.
7. Enter a 10 dB offset: Press **Ampl Offset** > **10** > **dB**.

   The AMPLITUDE area displays 20.00 dB, which is the power output by the hardware (–10 dBm) minus the reference power (–20 dBm) plus the offset (10 dB). The OFFS indicator activates. The power at the RF OUTPUT connector is still –10 dBm.

## Configuring a Swept RF Output

An E8663B signal generator has two sweep types: step sweep and list sweep.

The signal generator indicates the sweep advance in a progress bar on the front-panel display. If the sweep time is greater than one second, the progress bar sweep advances according to the frequency span of each segment. For each segment in the span, the progress bar displays the full segment and then the sweep is taken. With sweep times less than one second, the progress bar is drawn, the sweep taken, and the progress bar is then blanked.

**NOTE** List sweep data cannot be saved within an instrument state, but *can* be saved to the memory catalog. For instructions on saving list sweep data, see "Storing Files to the Memory Catalog" on page 33.

During swept RF output, the FREQUENCY and AMPLITUDE areas of the signal generator's display are deactivated, depending on what is being swept.

Step sweep (see page 27) provides a linear progression through the start-to-stop frequency and/or amplitude values, while list sweep enables you to create a list of arbitrary frequency, amplitude, and dwell time values and sweep the RF output based on that list.

The list sweep example uses the points created in the step sweep example as the basis for a new list sweep.

The signal generator provides a softkey, Sweep Retrace Off On, that lets you configure single sweep behavior. When sweep retrace is on, the signal generator will retrace the sweep to the first point of the sweep. If the sweep retrace is off, the sweep will stop and remain on the last point in the sweep.

### Using Step Sweep

Step sweep provides a linear progression through the start-to-stop frequency and/or amplitude values. You can toggle the direction of the sweep, up or down. When the **Sweep Direction Down Up** softkey is set to Up, values are swept from the start amplitude/frequency to the stop amplitude/frequency. When set to Down, values are swept from the stop amplitude/frequency to the start amplitude/frequency.

When a step sweep is activated, the signal generator sweeps the RF output based on the values entered for RF output start and stop frequencies and amplitudes, a number of equally spaced points (steps) to dwell upon, and the amount of dwell time at each point; dwell time is the minimum period of time after the settling time that the signal generator will remain at its current state. The frequency, amplitude, or frequency *and* amplitude of the RF output will sweep from the start amplitude/frequency to the stop amplitude/frequency, dwelling at equally spaced intervals defined by the **# Points** softkey value.

### To Configure a Single Step Sweep

In this procedure, you create a step sweep with nine, equally-spaced points, and the following parameters:

- frequency range from 500 MHz to 600 MHz
- amplitude from –20 dBm to 0 dBm
- dwell time 500 ms at each point

1. Press **Preset**.
2. Press **Sweep / List**.
   This opens a menu of sweep softkeys.
3. Press **Sweep Repeat Single Cont**.
   This toggles the sweep repeat from continuous to single.
4. Press **Configure Step Sweep.**
5. Press **Freq Start > 500 > MHz**.
   This changes the start frequency of the step sweep to 500 MHz.
6. Press **Freq Stop > 600 > MHz**.
   This changes the stop frequency of the step sweep to 600 MHz.
7. Press **Ampl Start > -20 > dBm**.

This changes the amplitude level for the start of the step sweep.

8. Press **Ampl Stop** > **0** > **dBm**.
   This changes the amplitude level for the end of the step sweep.
9. Press **# Points** > **9** > **Enter**.
   This sets the number of sweep points to nine.
10. Press **Step Dwell** > **500** > **msec**.
    This sets the dwell time at each point to 500 milliseconds.
11. Press **Return** > **Sweep** > **Freq & Ampl**.

    This sets the step sweep to sweep both frequency and amplitude data. Selecting this softkey returns you to the previous menu and turns on the sweep function.
12. Press **RF On / Off**.
    The display annunciator changes from RF OFF to RF ON.
13. Press **Single Sweep**.

    A single sweep of the frequencies and amplitudes configured in the step sweep is executed and available at the RF OUTPUT connector. On the display, the SWEEP annunciator appears for the duration of the sweep and a progress bar shows the progression of the sweep. The **Single Sweep** softkey can also be used to abort a sweep in progress. To see the frequencies sweep again, press **Single Sweep** to trigger the sweep.

#### To Configure a Continuous Step Sweep

Press **Sweep Repeat Single Cont**.

This toggles the sweep from single to continuous. A continuous repetition of the frequencies and amplitudes configured in the step sweep are now available at the RF OUTPUT connector. The SWEEP annunciator appears on the display, indicating that the signal generator is sweeping and progression of the sweep is shown by a progress bar.

### Using List Sweep

List sweep enables you to create a list of arbitrary frequency, amplitude, and dwell time values and sweep the RF output based on the entries in the List Mode Values table.

Unlike a step sweep that contains linear ascending/descending frequency and amplitude values, spaced at equal intervals throughout the sweep, list sweep frequencies and amplitudes can be entered at unequal intervals, nonlinear ascending/descending, or random order.

For convenience, the List Mode Values table can be copied from a previously configured step sweep. Each step sweep point's associated frequency, amplitude and dwell time values are entered into a row in the List Mode Values table, as the following example illustrates.

### To Configure a Single List Sweep Using Step Sweep Data

In this procedure, you will leverage the step sweep points and change the sweep information by editing several points in the List Mode Values table. For information on using tables, see "Using Table Editors" on page 22.

1. Press **Sweep Repeat Single Cont**.

   This toggles the sweep repeat from continuous to single. The SWEEP annunciator is turned off. The sweep will not occur until it is triggered.

2. Press **Sweep Type List Step**.

   This toggles the sweep type from step to list.

3. Press **Configure List Sweep**.

   This opens another menu displaying softkeys that you will use to create the sweep points. The display shows the current list data. (When no list has been previously created, the default list contains one point set to the signal generator's maximum frequency, minimum amplitude, and a dwell time of 2 ms.)

4. Press **More (1 of 2)** > **Load List From Step Sweep** > **Confirm Load From Step Data**.

   The points you defined in the step sweep are automatically loaded into the list.

### To Edit List Sweep Points

1. Press **Return** > **Sweep** > **Off**.

   Turning the sweep off allows you to edit the list sweep points without generating errors. If sweep remains on during editing, errors occur whenever one or two point parameters (frequency, power, and dwell) are undefined.

2. Press **Configure List Sweep**.

   This returns you to the sweep list table.

3. Use the arrow keys to highlight the dwell time in row 1.

4. Press **Edit Item**.

   The dwell time for point 1 becomes the active function.

5. Press **100** > **msec**.

   This enters 100 ms as the new dwell time value for row 1. Note that the next item in the table (in this case, the frequency value for point 2) becomes highlighted after you press the terminator softkey.

6. Using the arrow keys, highlight the frequency value in row 4.

7. Press **Edit Item** > **545** > **MHz**.

   This changes the frequency value in row 4 to 545 MHz.

8. Highlight any column in the point 7 row and press **Insert Row**.

   This adds a new point between points 7 and 8. A copy of the point 7 row is placed between points 7 and 8, creating a new point 8, and renumbering the successive points.

9. Highlight the frequency item for point 8, then press **Insert Item**.

   Pressing **Insert Item** shifts frequency values down one row, beginning at point 8. Note that the original frequency values for both points 8 and 9 shift down one row, creating an entry for point 10 that contains only a frequency value (the power and dwell time items do not shift down).

   The frequency for point 8 is still active.

10. Press **590** > **MHz**.

11. Press **Insert Item** > **-2.5** > **dBm**.

    This inserts a new power value at point 8 and shifts down the original power values for points 8 and 9 by one row.

12. Highlight the dwell time for point 9, then press **Insert Item**.

    A duplicate of the highlighted dwell time is inserted for point 9, shifting the existing value down to complete the entry for point 10.

#### To Configure a Single List Sweep

1. Press **Return** > **Sweep** > **Freq & Ampl**

   This turns the sweep on again. No errors should occur if all parameters for every point have been defined in the previous editing process.

2. Press **Single Sweep**.

   The signal generator will single sweep the points in your list. The SWEEP annunciator activates during the sweep.

3. Press **More (1 of 2)** > **Sweep Trigger** > **Trigger Key**.

   This sets the sweep trigger to occur when you press the **Trigger** hardkey.

4. Press **More (2 of 2)** > **Single Sweep**.

   This arms the sweep. The ARMED annunciator is activated.

5. Press the **Trigger** hardkey.

   The signal generator will single sweep the points in your list and the SWEEP annunciator will be activated during the sweep.

#### To Configure a Continuous List Sweep

Press **Sweep Repeat Single Cont**.

This toggles the sweep from single to continuous. A continuous repetition of the frequencies and amplitudes configured in the list sweep are now available at the RF OUTPUT connector. The SWEEP annunciator appears on the display, indicating that the signal generator is sweeping and progression of the sweep is shown by a progress bar.

# Modulating a Signal

This section describes how to turn on a modulation format, and how to apply it to the RF output.

## Turning On a Modulation Format

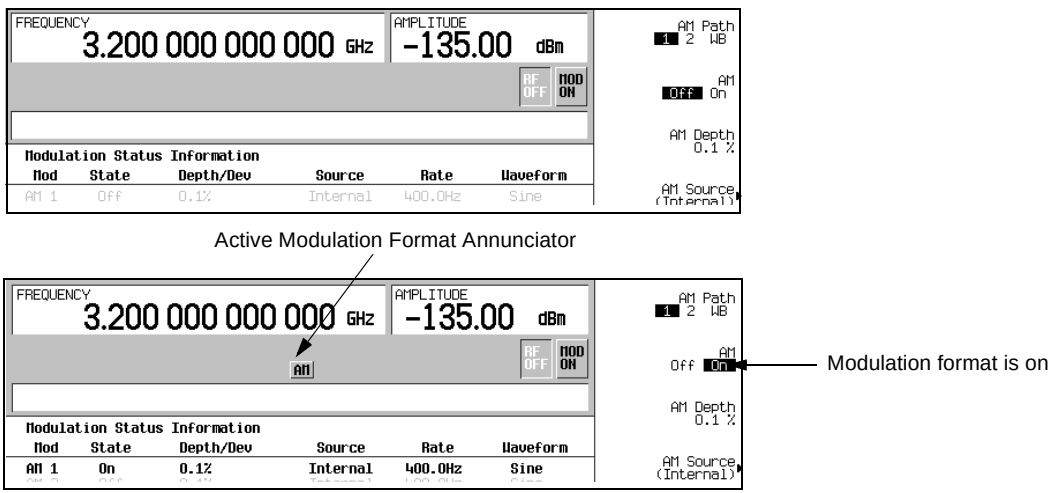
A modulation format can be turned on prior to or after setting the signal parameters.

1. Access the first menu within the modulation format.
   This menu displays a softkey that associates the format's name with off and on. For example, **AM > AM Off On**. For some formats, the off/on key may appear in additional menus other than the first one.
2. Press the modulation format off/on key until On highlights.
   Figure 2-2 shows the portion of the AM modulation format's first menu that displays the state of the modulation format, as well as the active modulation format annunciator.

   The modulation format generates, but the carrier signal is not modulated until you apply it to the RF output (see page 31).

Depending on the modulation format, the signal generator may require a few seconds to build the signal.

**Figure 2-2 Example of AM Modulation Format Off and On**




## Applying a Modulation Format to the RF Output

The carrier signal is modulated when the Mod On/Off key is set to On, *and* an individual modulation format is active.

When the **Mod On/Off** key is set to Off, the MOD OFF annunciator appears on the display. When the key is set to On, the MOD ON annunciator shows in the display, whether or not there is an active modulation format. The annunciators simply indicate whether the carrier signal will be modulated when a modulation format is turned on.

#### To Turn RF Output Modulation On

Press the **Mod On/Off** key until the MOD ON annunciator appears in the display.

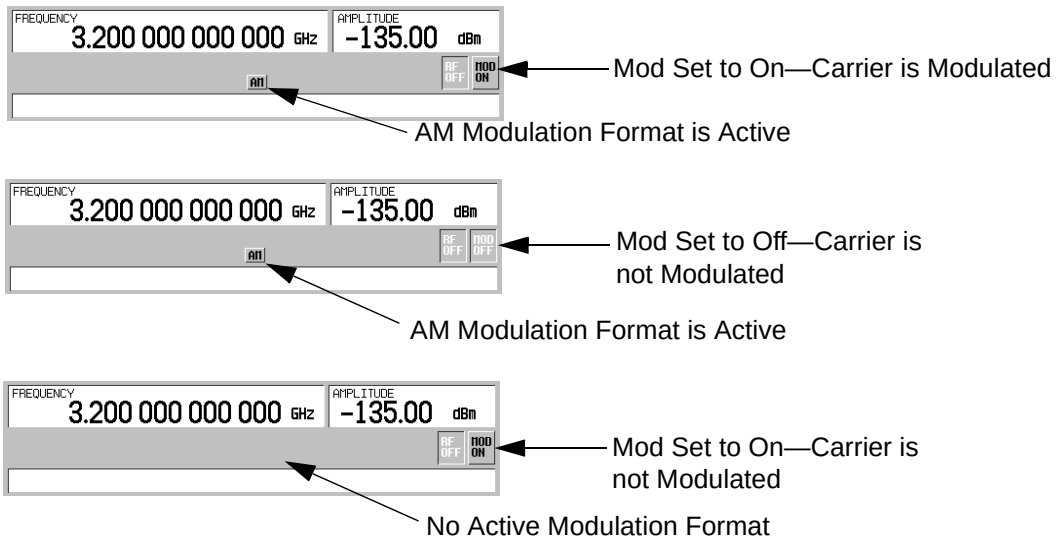
The carrier signal should be modulated with all active modulation formats. This is the factory default.

#### To Turn RF Output Modulation Off

Press the **Mod On/Off** key until the MOD OFF annunciator appears in the display.

The carrier signal is no longer modulated or capable of being modulated when a modulation format is active.

**Figure 2-3 Carrier Signal Modulation Status**




## Using Data Storage Functions

This section explains how to use the two forms of signal generator data storage: the memory catalog and the instrument state register.

### Using the Memory Catalog

The Memory Catalog is the signal generator's interface for viewing, storing, and saving files; it can be accessed through the signal generator's front panel or a remote controller. (For information on performing these tasks remotely, see the *E8663B Analog Signal Generator Programming Guide*.)

**Table 2-1 Memory Catalog File Types and Associated Data**

| | |
|---|---|
| Binary | binary data |
| State | instrument state data (controlling instrument operating parameters, such as frequency, amplitude, and mode) |
| LIST | sweep data from the List Mode Values table including frequency, amplitude, and dwell time |
| User Flatness | user flatness calibration correction pair data (user-defined frequency and corresponding amplitude correction values) |
| FIR | Finite Impulse Response (FIR) filter coefficients |
| Shape | burst shape of a pulse |
| Bit | Bit |

### Storing Files to the Memory Catalog

To store a file to the memory catalog, first create a file. For this example, use the default list sweep table.

1. Press **Preset**.
2. Press **Sweep/List** > **Configure List Sweep** > **More (1 of 2)** > **Load/Store**.

   This opens the "Catalog of List Files".
3. Press **Store to File**.

   This displays a menu of alphabetical softkeys for naming the file. `Store to:` is displayed in the active function area.
4. Enter the file name `LIST1` using the alphabetical softkeys and the numeric keypad (for the numbers 0 to 9).
5. Press **Enter**.

   The file should be displayed in the "Catalog of List Files", showing the file name, file type, file size, and the date and time the file was modified.

### Viewing Stored Files in the Memory Catalog

1. Press **Utility** > **Memory Catalog** > **Catalog Type**.

   All files in the memory catalog are listed in alphabetical order, regardless of which catalog type you select. File information appears on the display and includes the file name, file type, file size, and the date and time the file was modified.
2. Press **List**.

   The "Catalog of List Files" is displayed.
3. Press **Catalog Type** > **State**.

   The "Catalog of State Files" is displayed.

4. Press **Catalog Type** > **All**.

   The "Catalog of All Files" is displayed. For a complete list of file types, refer to Table 2-1 on page 33.

## Using the Instrument State Registers

The instrument state register is a section of memory divided into 10 sequences (numbered 0 through 9) with each sequence consisting of 100 registers (numbered 00 through 99). Instrument state sequences and registers are used to store and recall instrument settings and provide a quick way to reconfigure the signal generator when switching between different instrument and signal configurations. The signal generator has 20 MB available for data and instrument state storage. The signal generator Instrument state files can vary in length depending on the signal generator's configuration.

File data, such as modulation formats and table entries, are not stored with the save function. Only setups such as frequency, attenuation, power and other user-defined settings that do not survive a power cycle or instrument reset can be saved to a sequence and register. Any data file associated with the instrument state will only be referenced by its file name. Once an instrument state has been saved, recalling that state will set up the generator with the saved settings and load the associated file data.

For more information on storing file data such as modulation formats and table entries refer to "Storing Files to the Memory Catalog" on page 33. Refer to the *E8663B Analog Signal Generator Programming Guide* and the *E8663B Analog Signal Generator Key Reference* for more information on the save and recall function.

**NOTE** A reference to a file is saved along with the instrument state. However, no data is saved with the save function. You must store file data, using store commands, in a different memory location.

### Saving an Instrument State

1. Preset the signal generator, then turn on amplitude modulation (the AM annunciator will turn on):

   a. Press **Frequency** > **800** > **MHz**.
   b. Press **Amplitude** > **0** > **dBm**.
   c. Press **AM** > **AM Off On**.

2. Press **Save** > **Select Seq**.

   The sequence number becomes the active function. The signal generator displays the last sequence used. Using the arrow keys, set the sequence to 1.

3. Press **Select Reg**.

   The register number in sequence 1 becomes the active function. The signal generator displays either the last register used accompanied by the text: (in use), or (if no registers are in use) register 00 accompanied by the text: (available). Use the arrow keys to select register 01.

4. Press **Save Seq[1] Reg[01]**.

   This saves this instrument state in sequence 1, register 01 of the instrument state register.

5. Press **Add Comment to Seq[1] Reg[01]**.

   This enables you to add a descriptive comment to sequence 1 register 01.

6. Using the alphanumeric softkeys or the knob, enter a comment and press **Enter**.

7. Press **Edit Comment In Seq[1] Reg[01]**.

   If you wish, you can now change the descriptive comment for sequence 1 register 01.

After making changes to an instrument state, you can save it back to a specific register by highlighting that register and pressing **Re-SAVE Seq[n] Reg[nn]**.

### Recalling an Instrument State

Using this procedure, you will learn how to recall instrument settings saved to an instrument state register.

1. Press **Preset**.
2. Press the **Recall** hardkey.

   Notice that the **Select Seq** softkey shows sequence 1. (This is the last sequence that you used.)

3. 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. Your stored instrument state settings should have been recalled.

### Deleting Registers and Sequences

These procedures describe how to delete registers and sequences saved to an instrument state register.

### Deleting a Specific Register within a Sequence

1. Press **Preset**.
2. Press the **Recall** or **Save** hardkey.

   Notice that the **Select Seq** softkey shows the last sequence that you used.

3. Press **Select Seq** and enter the sequence number containing the register you want to delete.
4. Press **Select Reg** and enter the register number you want to delete.

   Notice that the **Delete Seq[n] Reg[nn]** should be loaded with the sequence and register you want to delete.

5. Press **Delete Seq[n] Reg[nn]**.

   This deletes the chosen register.

### Deleting All Registers within a Sequence

1. Press **Preset**.
2. Press the **Recall** or **Save** hardkey.

   Notice that the **Select Seq** softkey shows the last sequence that you used.

3. Press **Select Seq** and enter the sequence number containing the registers you want to delete.
4. Press **Delete all Regs in Seq[n]**.

   This deletes all registers in the selected sequence.

### Deleting All Sequences

**CAUTION** Be sure you want to delete the contents of *all* registers and *all* sequences in the instrument state register.

1. Press **Preset**.
2. Press the **Recall** or **Save** hardkey.

   Notice that the **Select Seq** softkey shows the last sequence that you used.
3. Press **Delete All Sequences**.

   This deletes all of the sequences saved in the instrument state register.

## Using Security Functions

This section describes how to use the signal generator's security functions to protect and remove classified proprietary information stored or displayed in the instrument. All security functions described in this section also have an equivalent SCPI command for remote operation. (Refer to the "System Commands" chapter of the *E8663B Analog Signal Generator SCPI Command Reference* for more information.)

### Understanding E8663B Memory Types

The E8663B signal generator comprises several memory types, each used for storing a specific type of data. Before removing sensitive data, it is important to understand how each memory type is used in the signal generator. The following tables describe each memory type used in the base instrument.

**Table 2-2 Base Instrument Memory**

| Memory Type and Size | Writable During Normal Operation? | Data Retained When Powered Off? | Purpose/Contents | Data Input Method | Location in Instrument and Remarks |
|---|---|---|---|---|---|
| Main Memory (SDRAM)<br>64 MB | Yes | No | firmware operating memory | operating system (not user) | CPU board, not battery backed. |
| Main Memory (Flash)<br>20 MB | Yes | Yes | factory calibration/configuration data<br>user file system, which includes instrument status backup, flatness calibration, IQ calibration, instrument states, waveforms (including header and marker data), modulation definitions, and sweep lists | firmware upgrades and user-saved data | CPU board (same chip as firmware memory, but managed separately)<br>Because this 32-MB memory chip contains 20 MB of user data (described here) and 12 MB of firmware memory, a selective chip erase is performed. User data areas are selectively and completely sanitized when you perform the **Erase and Sanitize** function. |

**Table 2-2 Base Instrument Memory (Continued)**

| Memory Type and Size | Writable During Normal Operation? | Data Retained When Powered Off? | Purpose/Contents | Data Input Method | Location in Instrument and Remarks |
|---|---|---|---|---|---|
| Firmware Memory (Flash)<br><br>12 MB | No | Yes | main firmware image | factory installed or firmware upgrade | CPU board (same chip as main flash memory, but managed separately)<br><br>During normal operation, this memory cannot be overwritten except for LAN configuration. It is only overwritten during the firmware installation or upgrade process.<br><br>Because this 32-MB memory chip contains 20 MB of user data and 12 MB of firmware memory (described here), a selective chip erase is performed. User data areas are selectively and completely sanitized when you perform the **Erase and Sanitize** function. |
| | Yes | Yes | LAN configuration | front panel entry | |
| Battery Backed Memory (SRAM)<br><br>512 kB | Yes | Yes | user-editable data (table editors)<br><br>last instrument state, last instrument state backup, and persistent instrument state and instrument status | firmware operations | CPU board<br><br>The battery can be removed to sanitize the memory, but must be reinstalled for the instrument to operate. The battery is located on the CPU board. |
| Bootrom Memory (Flash)<br><br>128 kB | No | Yes | CPU bootup program and firmware loader/updater | factory programmed | CPU board<br><br>During normal operation, this memory cannot be overwritten or erased. This read-only data is programmed at the factory. |
| Calibration Backup Memory (Flash)<br><br>512 KB | No | Yes | factory calibration/configuration data backup<br><br>no user data | factory or service only | motherboard |
| Boards Memory (Flash)<br><br>512 Bytes | No | Yes | factory calibration and information files, code images, and self-test limits<br><br>no user data | factory or service only | all RF boards, baseband generator, and motherboard |
| Micro-processor Cache (SRAM)<br><br>3 kB | Yes | No | CPU data and instruction cache | memory is managed by CPU, not user | CPU board, not battery backed. |

## Removing Sensitive Data from E8663B Memory

When moving the E8663B signal generator from a secure development environment, you can remove any classified proprietary information stored in the instrument. This section describes several security functions you can use to remove sensitive data from your instrument.

### Erase All

This function removes all user files, user flatness calibrations, user I/Q calibrations, and resets all table editors with original factory values, ensuring that user data and configurations are not accessible or viewable. The instrument appears as if it is in its original factory state, however, the memory is not sanitized. This action is relatively quick, taking less than one minute (the exact time depends on the number of files).

To carry out this function, press **Utility** > **Memory Catalog** > **More (1 of 2)** > **Security** > **Erase All** > **Confirm Erase.**

**NOTE** This function is different than pressing **Utility** > **Memory Catalog** > **More (1 of 2)** > **Delete All Files**, which deletes all user files, but does not reset the table editors.

#### Erase and Overwrite All

This function performs the same actions as Erase All and then clears and overwrites the various memory types in accordance with Department of Defense (DoD) standards, as described below.

| | |
|---|---|
| SRAM | All addressable locations are overwritten with random characters. |
| CPU Flash | All addressable locations are overwritten with random characters and then the flash blocks are erased. This accomplishes the same purpose of a chip erase, however, only the areas that are no longer in use are erased and the factory calibration files are left intact. System files are restored after erase. |

To carry out this function, press **Utility** > **Memory Catalog** > **More (1 of 2)** > **Security** > **Erase and Overwrite All** > **Confirm Overwrite.**

#### Erase and Sanitize All

This function performs the same actions as Erase and Overwrite All and then adds more overwriting actions. After executing this function, you must manually perform some additional steps for the sanitization to comply with Department of Defense (DoD) standards. These actions and steps are described below.

| | |
|---|---|
| SRAM | All addressable locations are overwritten with random characters. |

To carry out this function, press **Utility** > **Memory Catalog** > **More (1 of 2)** > **Security** > **Erase and Sanitize All** > **Confirm Sanitize.**

#### Removing Persistent State Information Not Removed During Erase

#### Persistent State

The persistent state settings contain instrument setup information that can be toggled within predefined limits such as display intensity, contrast and the GPIB address. In vector models, the user IQ Cal is also

saved in this area.

The following key presses or SCPI commands can be used to clear the IQ cal file and to set the operating states that are not affected by a signal generator power-on, preset, or *RST command to their factory default:

#### Instrument Setup

- On the front panel, press: **Utility** > **Power On / Preset** > **Restore System Defaults** > **Confirm Restore Sys Defaults**
- Or send the command: `:SYSTem:PRESet:PERSistent`

#### LAN Setup

The LAN setup (hostname, IP address, subnet mask, and default gateway) information is not defaulted with a signal generator power-on or *RST command. This information can only be changed or cleared by entering new data.

#### User IQ Cal File (Vector Models Only)

When a user-defined IQ calibration has been performed, the cal file data is removed by setting the cal file to default, as follows:

1. On the front panel, press: **I/Q** > **I/Q Calibration** > **Revert to Default Cal Settings**
2. Send these commands:
   - `:CAL:IQ:DEF`
   - `:CAL:WBIQ:DEF`

### Using the Secure Mode

The secure mode automatically applies the selected **Security Level** action the next time the instrument's power is cycled.

### Setting the Secure Mode Level

1. Press **Utility** > **Memory Catalog** > **More (1 of 2)** > **Security** > **Security Level**.
2. Choose from the following selections:

   **None** – equivalent to a factory preset, no user information is lost
   **Erase** – equivalent to **Erase All**
   **Overwrite** – equivalent to **Erase and Overwrite All**
   **Sanitize** – equivalent to **Erase and Sanitize All**

### Activating the Secure Mode

**CAUTION** Once you activate secure mode (by pressing **Confirm)**, you cannot deactivate or decrease the security level; the erasure actions for that security level execute at the next power cycle. Once you activate secure mode, you can only increase the security level until you cycle power. For example, you can change **Erase** to **Overwrite**, but not the reverse.

After the power cycle, the security level selection remains the same, but the secure mode is not activated.

Press **Utility** > **Memory Catalog** > **More (1 of 2)** > **Security** > **Enter Secure Mode** > **Confirm**.

The **Enter Secure Mode** softkey changes to **Secure Mode Activated**.

### If Your Instrument is Not Functioning

If the instrument is not functioning and you cannot use the security functions, the storage media must be physically removed from the instrument. This requires removal of the processor board, which should then be rendered unusable and discarded. The instrument can then be sent to a repair facility for new parts, repair, and calibration.

Refer to the *E8663B Analog Signal Generator Service Guide* for disassembly procedures.

Either

- Discard the processor board and send the instrument to a repair facility. A new processor board will be installed and the instrument will be repaired and calibrated. If the instrument is still under warranty, you will not be charged for the new processor board.

  or

- If you have another working instrument, install the processor board into that instrument and erase the memory. Then reinstall the processor board back into the non-working instrument and send it to a repair facility for repair and calibration. If you discover that the processor board does not function in the working instrument, discard the processor board and note that it caused the instrument failure on the repair order. If the instrument is still under warranty, you will not be charged for the new processor board.

## Using the Secure Display

This function prevents unauthorized personnel from reading the instrument display and tampering with the current configuration through the front panel. The display is blanked, except for the message `*** SECURE DISPLAY ACTIVATED ***`, and the front panel keys are disabled. Once this function is activated, the power must be cycled to re-enable the display and front panel keys.

To apply this function, press **Utility** > **Display** > **More (1 of 2)** > **Activate Secure Display** > **Confirm Secure Display**

**Figure 2-4 E8663B Screen with Secure Display Activated**




## Enabling Options

You can retrofit your signal generator after purchase to add new capabilities. Some new optional features are implemented in hardware that you must install. Some options are implemented in software, but require the presence of optional hardware in the instrument. This example shows you how to enable software options.

### Enabling a Software Option

A license key (provided on the license key certificate) is required to enable each software option.

1. Access the Software Options menu:
   **Utility** > **Instrument Adjustments** > **Instrument Options** > **Software Options**.
   The following is an example of the signal generator display, which lists any enabled software options, and any software options that can be enabled:




2. Verify that the host ID shown on the display matches the host ID on the license key certificate. The host ID is a unique number for every instrument. If the host ID on the license key certificate does not match your instrument, the license key cannot enable the software option.
3. Verify that any required hardware is installed. Because some software options are linked to specific hardware options, before the software option can be enabled, the appropriate hardware option must be installed. If the software option that you intend to install is listed in a grey font, the required hardware may not be installed (look for an X in the "Selected" column of the appropriate hardware option in the Hardware Options menu).
4. Enable the software option:
   a. Highlight the desired option.
   b. Press **Modify License Key**, and enter the 12-character license key (from the license key certificate).
   c. Verify that you want to reconfigure the signal generator with the new option:
      **Proceed With Reconfiguration > Confirm Change**

      The instrument enables the option and reboots.

## Using the Web Server

You can communicate with the signal generator using the Web Server. This service uses TCP/IP (Transmission Control Protocol/Internet Protocol) to communicate with the signal generator over the internet.

The Web Server uses a client/server model where the client is the web browser on your PC or workstation and the server is the signal generator. When you enable the Web Server, you can access a web page that resides on the signal generator.

The Web-Enabled E8663B web page, shown in Figure 2-5, provides general information on your signal generator and a means to control the instrument either by using a remote front-panel interface or using SCPI (Standard Communication for Programmable Instruments) commands. The web page also has links to Agilent's products, support, manuals, and website.

**NOTE** The Web Server service is compatible with the latest version of the Microsoft© Internet Explorer web browser.[1]

The Signal Generator Web Control menu button on the Web-Enabled signal generator web page will access a second web page. This web page, shown in Figure 2-6, provides a virtual instrument interface that can be used to control the signal generator. You can use the mouse to click on the signal generator's front panel hardkeys, softkeys and number pad. There is also a text box that can be used to send SCPI commands to the instrument.

## Activating the Web Server

Perform the following steps to access the Web Server.

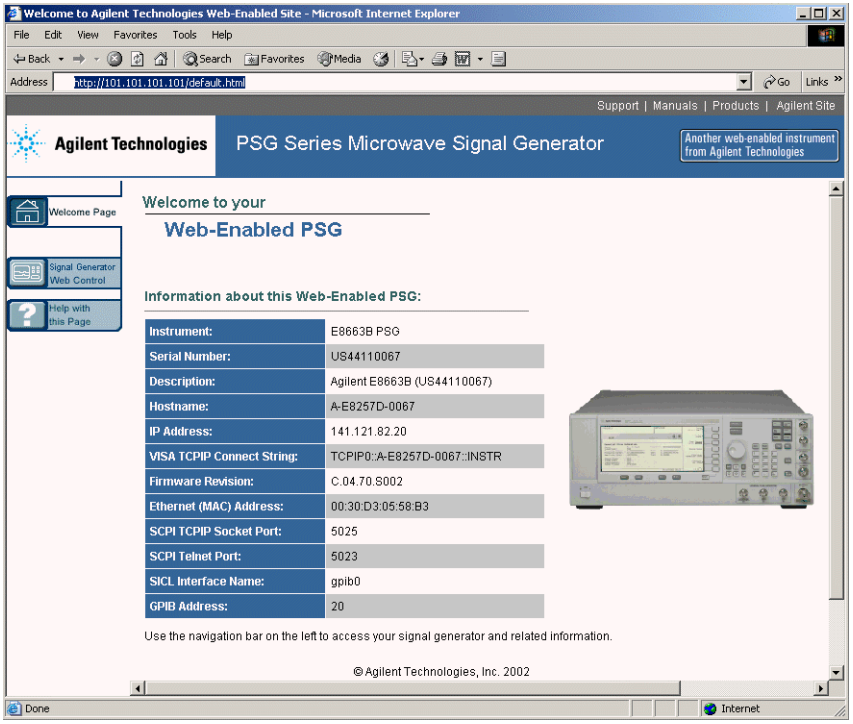
1. Turn on the Web Server by pressing **Utility** > **GPIB/RS-232 LAN** > **LAN Services Setup** > **Web Server On**.
2. Press the **Proceed With Reconfiguration** softkey.
3. Press the **Confirm Change** (Instrument will Reboot) softkey. The signal generator will reboot.
4. Launch your PC or workstation web browser.
5. Enter the IP address of the signal generator in the web browser address field. For example, http://101.101.101.101. Replace 101.101.101.101 with your signal generator's IP address. Press the Enter key on the computer's keyboard.

**NOTE** The IP (Internet Protocol) address can change depending on your LAN configuration. Use the **LAN Config Manual DHCP** softkey to select a Manual or DHCP (dynamic host communication protocol) LAN configuration. Refer to *E8663B Analog Signal Generator Key Reference* for more information.

6. Press the enter key on the computer's keyboard. The web browser will display the signal generator's homepage as shown below in Figure 2-5. This web page displays information about the signal generator and provides access to Agilent's website.

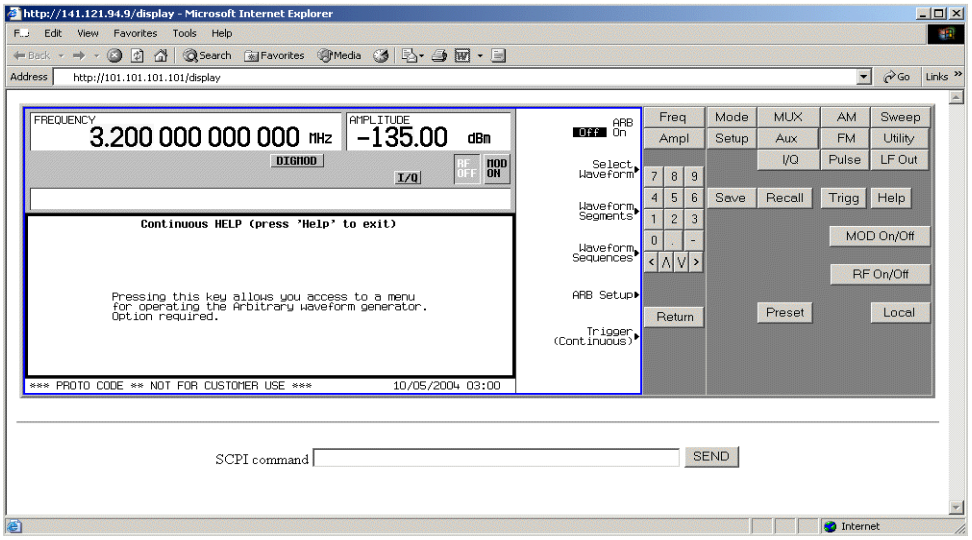
1. Microsoft is a registered trademark of Microsoft Corp.

**Figure 2-5 Signal Generator Web Page**



7. Click the Signal Generator Web Control menu button on the left of the page. A new web page will be displayed as shown below in Figure 2-6.

**Figure 2-6 Web Page Front Panel**




This web page remotely accesses all signal generator functions and operations. Use the mouse pointer to click on the signal generator's hardkeys and softkeys. The results of each mouse click selection will be displayed on the web page. For example, click on the Frequency hardkey then use the front-panel key pad to enter a frequency. You can also use the up and down arrow keys to increase or decrease the frequency.

You can use the SCPI Command text box at the bottom of the front-panel display to send commands to the signal generator. Enter a valid SCPI command, then click the SEND button. The results of the command will be displayed on a separate web page titled, "SCPI Command Processed". You can continue using this web page to enter SCPI commands or you can return to the front panel web page.

**NOTE** It may be necessary to use the web browser Refresh function if the web page does not update with new settings.

# 3 Optimizing Performance

In the following sections, this chapter describes procedures that improve the performance of the Agilent signal generator.

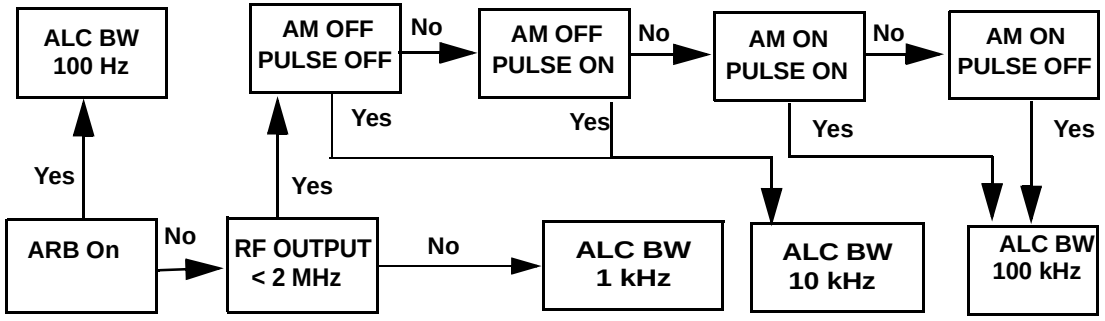

- "Using the ALC" on page 47
- "Using External Leveling" on page 48
- "Creating and Applying User Flatness Correction" on page 51
- "Adjusting Reference Oscillator Bandwidth" on page 56


## Using the ALC

### Selecting ALC Bandwidth

For internal leveling, the signal generator uses automatic leveling control (ALC) circuitry prior to the RF output. ALC bandwidth has five selections: automatic, 100 Hz, 1 kHz, 10 kHz, and 100 kHz. In automatic mode (the preset selection), the signal generator automatically selects the ALC bandwidth depending on the configuration and settings (see Figure 3-1).

**Figure 3-1 Decision Tree for Automatic ALC Bandwidth Selection**




### To Select an ALC Bandwidth

Press **Amplitude** > **ALC BW** > **100 Hz**, **1 kHz**, **10 kHz**, or **100 kHz**.
This overrides the signal generator's automatic ALC bandwidth selection with your specific selection.

For waveforms with varying amplitudes, high crest factors, or both, the recommended ALC loop bandwidth is 100 Hz. Limiting the loop bandwidth of the ALC circuit will prevent the ALC from

sampling the fast rising edges of pulsed waveforms with high crest factors found in formats such as 802.11b, CDMA, and OFDM. A limited, or narrow bandwidth will result in a longer ALC sample time and a more accurate representation of the signal's level.

## Using External Leveling

The signal generator can be externally leveled by connecting an external sensor at the point where leveled RF output power is desired. This sensor detects changes in RF output power and returns a compensating voltage to the signal generator's ALC input. The ALC circuitry raises or lowers (levels) the RF output power based on the voltage received from the external sensor, ensuring constant power at the point of detection.

### To Level with Detectors and Couplers / Splitters

### External Leveling the Signal Generator

The signal generator contains a step attenuator prior to the RF output connector. During external leveling, the signal generator automatically holds the present attenuator setting (to avoid power transients that may occur during attenuator switching) as the RF amplitude is changed. A balance must be maintained between the amount of attenuation and the optimum ALC level to achieve the required RF output amplitude. For optimum accuracy and minimum noise, the ALC level should be greater than –10 dBm.

For example, leveling the CW output of a 30 dB gain amplifier to a level of –10 dBm requires the output of the signal generator to be approximately –40 dBm when leveled. This is beyond the amplitude limits of the ALC modulator alone, resulting in an unleveled RF output. Inserting 45 dB of attenuation results in an ALC level of +5 dBm, well within the range of the ALC modulator.

Figure 3-2 illustrates a typical external leveling setup. The power level feedback to the ALC circuitry is taken from the external negative detector, rather than the internal signal generator detector. This feedback voltage controls the ALC system, leveling the RF output power at the point of detection.

To use detectors and couplers/splitters for external leveling at an RF output frequency of 10 GHz and an amplitude of 0 dBm, follow the instructions in this section.

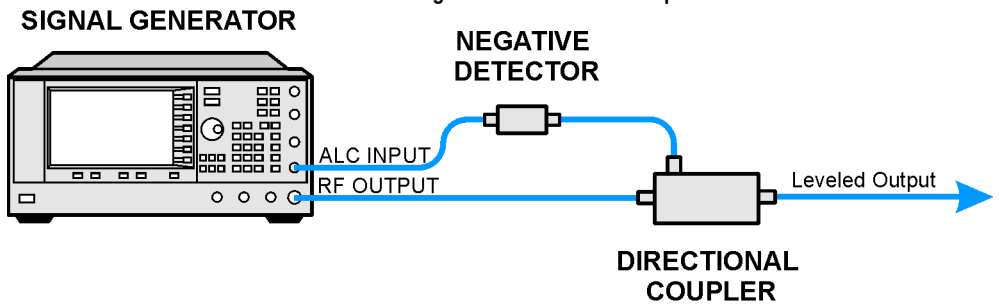
#### Required Equipment

- Agilent 8474E negative detector
- Agilent 87301D directional coupler
- cables and adapters, as required

#### Connect the Equipment

Set up the equipment as shown in Figure 3-2.

Figure 3-2 External Detector Leveling with a Directional Coupler




### Configure the Signal Generator

1. Press **Preset**.
2. Press **Frequency** > **10** > **GHz**.
3. Press **Amplitude** > **0** > **dBm**.
4. Press **RF On/Off**.
5. Press **Leveling Mode** > **Ext Detector**.

   This deactivates the internal ALC detector and switches the ALC input path to the front panel ALC INPUT connector. The EXT indicator is activated in the AMPLITUDE area of the display.

**NOTE** Notice that the ATTN HOLD (attenuator hold) annunciator is displayed. During external leveling, the signal generator automatically uncouples the attenuator from the ALC system for *all* external leveling points. While in this mode, the RF output amplitude adjustment is limited to –20 to +25 dBm, the adjustment range of the ALC circuitry.

6. Observe the coupling factor printed on the directional coupler at the detector port. Typically, this value is –10 to –20 dB.

   Enter the *positive* dB value of this coupling factor into the signal generator.

7. Press **More (1 of 2)** > **Ext Detector Coupling Factor** > **16** (or the positive representation of the value listed at the detector port of the directional coupler) > **dB**.

   Leveled output power is now available at the output of the directional coupler.

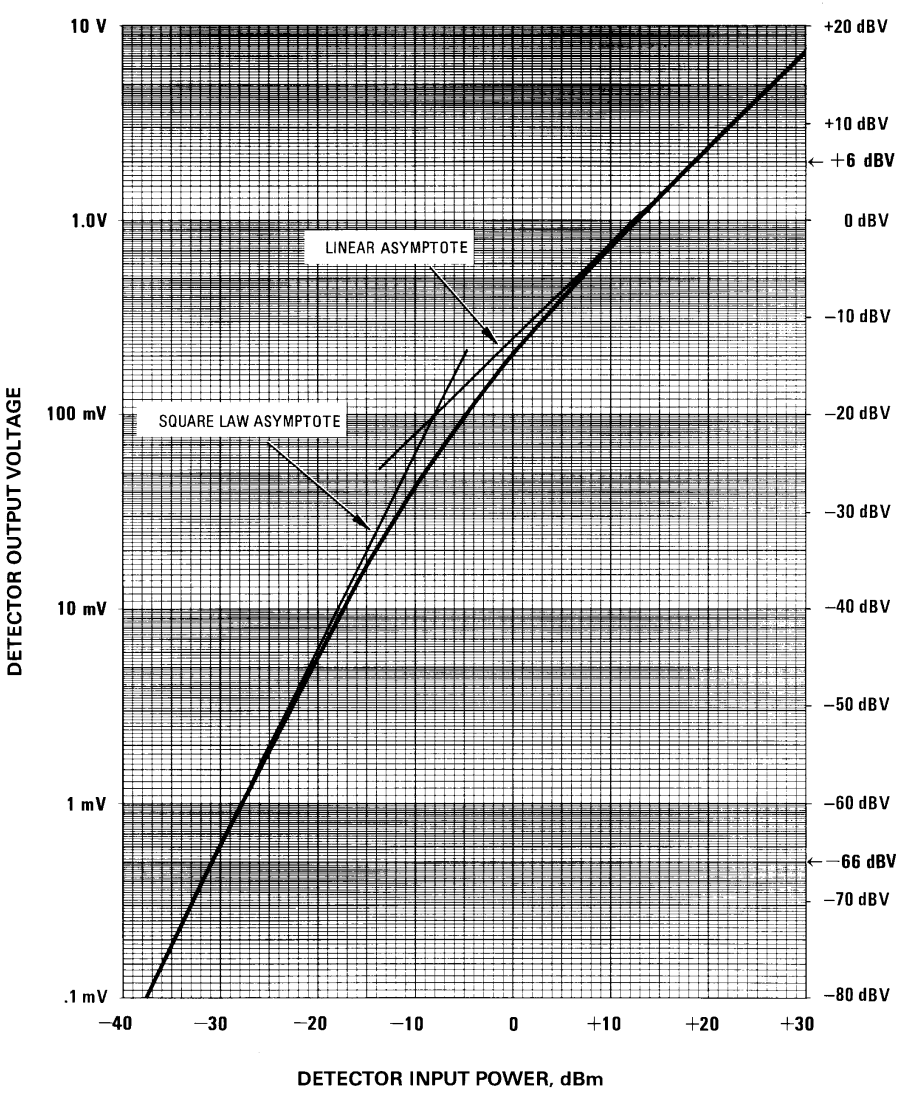
**NOTE** While operating in external leveling mode, the signal generator's displayed RF output amplitude is affected by the coupling factor value, resulting in a calculated approximation of the actual RF output amplitude. To determine the actual RF output amplitude at the point of detection, measure the voltage at the external detector output and refer to Figure 3-3 or measure the power directly with a power meter.

### Determining the Leveled Output Power

Figure 3-3 shows the input power versus output voltage characteristics for typical Agilent Technologies diode detectors. Using this chart, you can determine the leveled power at the diode detector input by measuring the external detector output voltage. You must then add the coupling

factor to determine the leveled output power. The range of power adjustment is approximately -20 to +25 dBm.

**Figure 3-3 Typical Diode Detector Response at 25° C**



**NOTE** In the example above, 55 dB is the preferred attenuation choice, resulting in an ALC level of +15 dBm. This provides adequate dynamic range for AM or other functions that vary the RF output amplitude.

To achieve the optimum ALC level at the signal generator RF output of –40 dBm for an unmodulated carrier, follow these steps:

1. Press **Amplitude** > **Set Atten** > **45** > **dB.**
2. Press **Set ALC Level** > **5** > **dBm**.

This sets the attenuator to 45 dB and the ALC level to +5 dBm, resulting in an RF output amplitude of -40 dBm, as shown in the AMPLITUDE area of the display.

To obtain flatness-corrected power, refer to "Creating and Applying User Flatness Correction" on page 51.

## Creating and Applying User Flatness Correction

User flatness correction allows the digital adjustment of RF output amplitude for up to 1601 frequency points in any frequency or sweep mode. Using an Agilent E4416A/17A or E4418B/19B power meter (controlled by the signal generator through GPIB) to calibrate the measurement system, a table of power level corrections is created for frequencies where power level variations or losses occur. These frequencies may be defined in sequential linear steps or arbitrarily spaced.

To allow different correction arrays for different test setups or different frequency ranges, you may save individual user flatness correction tables to the signal generator's memory catalog and recall them on demand.

Use the steps in the next sections to create and apply user flatness correction to the signal generator's RF output.

Afterward, use the steps in "Recalling and Applying a User Flatness Correction Array" on page 55 to recall a user flatness file from the memory catalog and apply it to the signal generator's RF output.

## Creating a User Flatness Correction Array

In this example, you create a user flatness correction array. The flatness correction array contains ten frequency correction pairs (amplitude correction values for specified frequencies), from 1 to 10 GHz in 1 GHz intervals.

An Agilent E4416A/17A/18B/19B power meter (controlled by the signal generator via GPIB) and E4413A power sensor are used to measure the RF output amplitude at the specified correction frequencies and transfer the results to the signal generator. The signal generator reads the power level data from the power meter, calculates the correction values, and stores the correction pairs in a user flatness correction array.

If you do not have the required Agilent power meter, or if your power meter does not have a GPIB interface, you can enter correction values manually.

### Required Equipment

- Agilent E4416A/17A/18B/19B power meter
- Agilent E4413A E Series CW power sensor
- GPIB interface cable
- adapters and cables, as required

**NOTE** If the setup has an external leveling configuration, the equipment setup in Figure 3-4 assumes that the steps necessary to correctly level the RF output have been followed. If you have questions about external leveling, refer to "Using External Leveling" on page 48.

### Configure the Power Meter

1. Select SCPI as the remote language for the power meter.
2. Zero and calibrate the power sensor to the power meter.
3. Enter the appropriate power sensor calibration factors into the power meter as appropriate.
4. Enable the power meter's cal factor array.

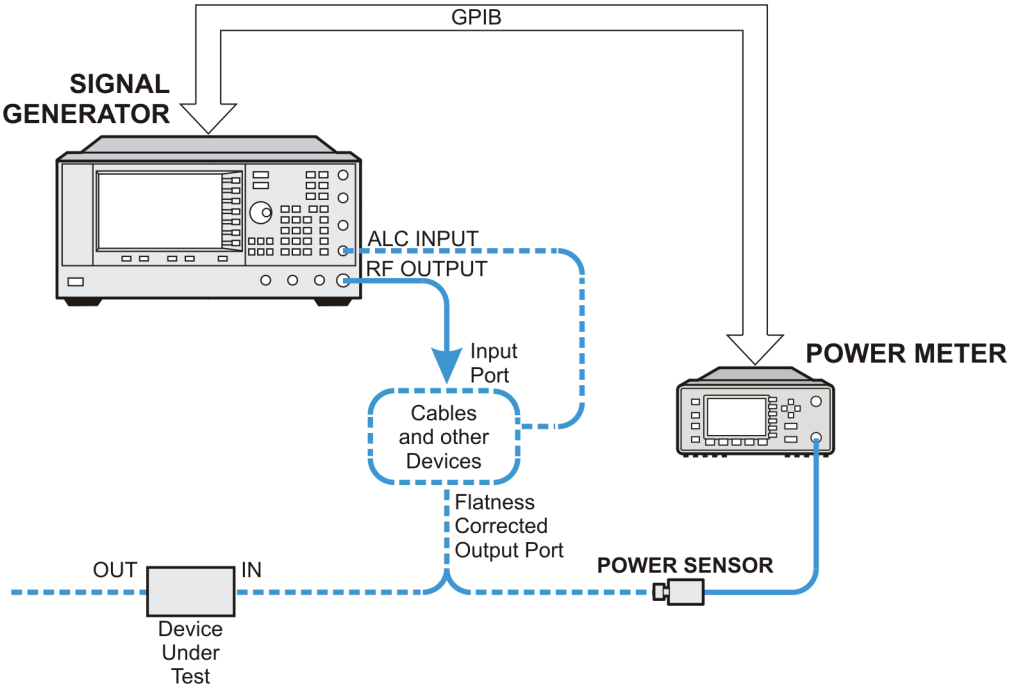
**NOTE** For operating information on a particular power meter/sensor, refer to its operating guide.

### Connect the Equipment

Connect the equipment as shown in Figure 3-4.

**NOTE** During the process of creating the user flatness correction array, the power meter is slaved to the signal generator via GPIB. No other controllers are allowed on the GPIB interface.

**Figure 3-4** **User Flatness Correction Equipment Setup**




### Configure the Signal Generator

1. Press **Preset**.
2. Configure the signal generator to interface with the power meter.
   a. Press **Amplitude** > **More (1 of 2)** > **User Flatness** > **More (1 of 2)** > **Power Meter** > **E4416A**, **E4417A**, **E4418B**, or **E4419B**.
   b. Press **Meter Address** > enter the power meter's GPIB address > **Enter**.
   c. For E4417A and E4419B models, press **Meter Channel A B** to select the power meter's active channel.
   d. Press **Meter Timeout** to adjust the length of time before the instrument generates a timeout error if unsuccessfully attempting to communicate with the power meter.
3. Press **More (2 of 2)** > **Configure Cal Array** > **More (1 of 2)** > **Preset List** > **Confirm Preset**.

   This opens the User Flatness table editor and presets the cal array frequency/correction list.
4. Press **Configure Step Array**.

   This opens a menu for entering the user flatness step array data.
5. Press **Freq Start** > **1** > **GHz**.
6. Press **Freq Stop** > **3** > **GHz**.

7. Press **# of Points** > **10** > **Enter**.

   Steps 4, 5, and 6 enter the desired flatness-corrected frequencies into the step array.

8. Press **Return** > **Load Cal Array From Step Array** > **Confirm Load From Step Data**.

   This populates the user flatness correction array with the frequency settings defined in the step array.

9. Press **Amplitude** > **More (1 of 2)** > **Ampl Offset**.

   Enter a nominal (average) value for the gain or loss of any cables or other devices connected between the signal generator's RF output and the power sensor. Refer to figure Figure 3-4 on page 53. Gain is entered as a positive number while loss is entered as a negative number.

10. Press **RF On/Off**.

    This activates the RF output and the `RF ON` annunciator is displayed on the signal generator.

### Perform the User Flatness Correction

**NOTE** If you are not using an Agilent E4416A/17A/18B/19B power meter, or if your power meter does not have a GPIB interface, you can perform the user flatness correction manually. For instructions, see "Performing the User Flatness Correction Manually" on page 54.

1. Press **More (1 of 2)** > **User Flatness** > **Do Cal**.

   Pressing the **Do Cal** softkey causes the signal generator to perform the user flatness correction routine. A progress bar is shown on the front panel display as the routine runs. The routine generates a table of correction points with each correction point consisting of a frequency and amplitude correction value for that frequency. The correction value at each point is the difference between the power level, as measured by the power meter, and the output power of the signal generator.

**NOTE** A power meter timeout may occur at low power levels. If a power meter timeout error message appears, increase the timeout value by pressing **Amplitude** > **More (1 of 2)** > **User Flatness** > **More (1 of 2)** > **Meter Timeout**.

2. Press **Done**.

   Pressing the **Done** softkey loads the amplitude correction values into the user flatness correction array.

   If desired, press **Configure Cal Array**.

   This opens the user flatness correction array, where you can view the stored amplitude correction values. The user flatness correction array title displays `User Flatness: (UNSTORED)` indicating that the current user flatness correction array data has not been saved to the memory catalog.

### Performing the User Flatness Correction Manually

If you are not using an Agilent E4416A/17A/18B/19B power meter, or if your power meter does not have a GPIB interface, complete the steps in this section and then continue with the user flatness correction tutorial.

1. Press **More (1 of 2)** > **User Flatness** > **Configure Cal Array**.

   This opens the User Flatness table editor and places the cursor over the frequency value (1 GHz) for row 1. The RF output changes to the frequency value of the table row containing the cursor and `1.000 000 000 00` is displayed in the `AMPLITUDE` area of the display.

2. Observe and record the measured value from the power meter.
3. Subtract the measured value from 0 dBm.
4. Move the table cursor over the correction value in row 1.
5. Press **Edit Item** > enter the difference value from step 3 > **dB**.

   The signal generator adjusts the RF output amplitude based on the correction value entered.

6. Repeat steps 2 through 5 until the power meter reads 0 dBm.
7. Use the down arrow key to place the cursor over the frequency value for the next row. The RF output changes to the frequency value of the table row containing the cursor, as shown in the `AMPLITUDE` area of the display.
8. Repeat steps 2 through 7 for every entry in the User Flatness table.

#### Save the User Flatness Correction Data to the Memory Catalog

This process allows you to save the user flatness correction data as in the signal generator's memory catalog. With several user flatness correction files saved to the memory catalog, any file can be recalled, loaded into the correction array, and applied to the RF output to satisfy specific RF output flatness requirements.

1. Press **Load / Store**.
2. Press **Store to File**.
3. Enter the file name `FLATCAL1` using the alphanumeric softkeys, numeric keypad, or the knob.
4. Press **Enter**.

The user flatness correction array file FLATCAL1 is now stored in the memory catalog as a `UFLT` file.

### Applying a User Flatness Correction Array

Press **Return** > **Return** > **Flatness Off On** to On.

This applies the user flatness correction array to the RF output. The `UF` indicator is activated in the `AMPLITUDE` section of the signal generator's display and the frequency correction data contained in the correction array is applied to the RF output amplitude.

#### Recalling and Applying a User Flatness Correction Array

Before performing the steps in this section, complete "Creating a User Flatness Correction Array" on page 52.

1. Press **Preset**.
2. Press **Amplitude** > **More (1 of 2)** > **User Flatness** > **Configure Cal Array** > **More (1 of 2)** > **Preset List** > **Confirm Preset**.
3. Press **More (2 of 2)** > **Load / Store**.

4. Ensure that the file FLATCAL1 is highlighted.
5. Press **Load From Selected File** > **Confirm Load From File**.

   This populates the user flatness correction array with the data contained in the file FLATCAL1. The user flatness correction array title displays User Flatness: FLATCAL1.
6. Press **Return** > **Flatness Off On** to On.

   This applies the user flatness correction data contained in FLATCAL1.

#### Returning the Signal Generator to GPIB Listener Mode

During the user flatness correction process, the power meter is slaved to the signal generator via GPIB, and no other controllers are allowed on the GPIB interface. The signal generator operates in GPIB talker mode, as a device controller for the power meter. In this operating mode, it cannot receive SCPI commands via GPIB.

If the signal generator is to be interfaced to a remote controller after performing the user flatness correction, its GPIB controller mode must be changed from GPIB talker to GPIB listener.

If an RF carrier has been previously configured, you must save the present instrument state before returning the signal generator to GPIB listener mode.

1. Save your instrument state to the instrument state register.

   For instructions, see "Saving an Instrument State" on page 34.
2. Press **Amplitude > More (1 of 2) > User Flatness > GPIB Listener Mode**.

   This presets the signal generator and returns it to GPIB listener mode. The signal generator can now receive remote commands executed by a remote controller connected to the GPIB interface.
3. Recall your instrument state from the instrument state register.

   For instructions, see "Saving an Instrument State" on page 34.

## Adjusting Reference Oscillator Bandwidth

The reference oscillator bandwidth (sometimes referred to as loop bandwidth) is adjustable in fixed steps for either an internal or external 10 MHz frequency reference. The reference oscillator bandwidth can be set to 25, 55, 125, 300, or 650 Hz.

At frequency offsets below approximately 1 kHz, the stability and phase noise are determined by the internal or external frequency reference. At frequency offsets above 1 kHz, stability and phase noise are determined by the synthesizer hardware.

To optimize the overall phase noise performance of the signal generator for your particular application, make this adjustment depending on your confidence in the stability and phase noise of the external or internal reference versus the synthesizer hardware for various frequency offsets from the carrier.

## To Select the Reference Oscillator Bandwidth

**When using the internal timebase reference:**

1. Press **Utility** > **Instrument Adjustments** > **Reference Oscillator Adjustment** > **Internal Ref Bandwidth**.
2. Select the desired bandwidth.

**When using an external timebase reference:**

1. Press **Utility** > **Instrument Adjustments** > **Reference Oscillator Adjustment** > **External Ref Bandwidth**.
2. Select the desired bandwidth.

## To Restore Factory Default Settings:

Internal Timebase: 125 Hz
External Timebase: 25 Hz

Press **Utility** > **Instrument Adjustments** > **Reference Oscillator Adjustment** > **Restore Factory Defaults**.

# 4 Analog Modulation

In the following sections, this chapter describes the standard continuous waveform, analog modulation capability, and the optional narrow pulse modulation in the Agilent E8663B Analog Signal Generator.


- "Analog Modulation Waveforms" on page 59
- "Configuring AM" on page 60
- "Configuring FM" on page 60
- "Configuring ΦM" on page 61
- "Configuring Pulse Modulation" on page 62
- "Configuring the LF Output" on page 63


## Analog Modulation Waveforms

Available standard internal waveforms include:

| | |
|---|---|
| Sine | sine wave with adjustable amplitude and frequency |
| Dual-Sine | dual-sine waves with individually adjustable frequencies and a percent-of-peak-amplitude setting for the second tone (available from function generator only) |
| Swept-Sine | swept-sine wave with adjustable start and stop frequencies, sweep rate, and sweep trigger settings (available from function generator only) |
| Triangle | triangle wave with adjustable amplitude and frequency |
| Ramp | ramp with adjustable amplitude and frequency |
| Square | square wave with adjustable amplitude and frequency |
| Noise | noise with adjustable amplitude generated as a peak-to-peak value (RMS value is approximately 80% of the displayed value) |

The signal generator can modulate the RF carrier with amplitude, frequency, phase, or standard pulse modulation.

With Option UNW, the signal generator can modulate the RF carrier with narrow pulse modulation (20 ns minimum pulse width).

# Configuring AM

In this example, you will learn how to generate an amplitude-modulated RF carrier.

## To Set the Carrier Frequency

1. Press **Preset**.
2. Press **Frequency** > **1340** > **kHz**.

## To Set the RF Output Amplitude

Press **Amplitude** > **0** > **dBm**.

## To Set the AM Depth and Rate

1. Press the **AM** hardkey.
2. Press **AM Depth** > **90** > **%**.
3. Press **AM Rate** > **10** > **kHz**.

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 sine wave. Notice that sine is the default selection for the **AM Waveform** softkey, which can be viewed by pressing **(More 1 of 2)**.

## To Turn on Amplitude Modulation

Follow these remaining steps to output the amplitude-modulated signal.

1. Press the **AM Off On** softkey to On.
2. Press the front panel **RF On Off** key.

The AM and RF ON annunciators are now displayed. This indicates that you have enabled amplitude modulation and the signal is now being transmitted from the RF OUTPUT connector.

# Configuring FM

In this example, you will learn how to create a frequency-modulated RF carrier.

## To Set the RF Output Frequency

1. Press **Preset**.
2. Press **Frequency** > **1** > **GHz**.

## To Set the RF Output Amplitude

Press **Amplitude** > **0** > **dBm**.

### To Set the FM Deviation and Rate

1. Press the **FM/ΦM** hardkey.
2. Press **FM Dev** > **75** > **kHz**.
3. Press **FM Rate** > **10** > **kHz**.

The signal generator is now configured to output a 0 dBm, frequency-modulated carrier at 1 GHz with a 75 kHz deviation and a 10 kHz rate. The shape of the waveform is a sine wave. (Notice that sine is the default for the **FM Waveform** softkey. Press **More (1 of 2)** to see the softkey.)

### To Activate FM

1. Press **FM Off On** to On.
2. Press **RF On/Off**.

The FM and RF ON annunciators are now displayed. This indicates that you have enabled frequency modulation and the signal is now being transmitted from the RF OUTPUT connector.

#### DC Offset and External FM

Applying a DC offset to an external FM signal will shift the frequency of the FM signal above or below the carrier frequency, depending on the polarity of the DC level. The amount frequency shift is directly related to the amplitude of the DC level. A DC offset of +1.0 volt or greater will shift the external FM frequency by an amount equal to the maximum deviation setting. For example, if the signal generator CW frequency is 1 GHz and the maximum deviation setting is set to 100 kHz, an external DC-coupled signal with a +1.0 volt DC level used as the modulating source will center the FM signal at 1 GHz + 100 kHz. Keeping the same setup and settings and changing the DC level to +0.5 volts will center the FM signal at 1 GHz + 50 kHz.

## Configuring ΦM

In this example, you will learn how to create a phase-modulated RF carrier.

### To Set the RF Output Frequency

1. Press **Preset**.
2. Press **Frequency** > **3** > **GHz**.

### To Set the RF Output Amplitude

Press **Amplitude** > **0** > **dBm**.

### To Set the ΦM Deviation and Rate

1. Press the **FM/ΦM** hardkey.
2. Press the **FM ΦM** softkey.
3. Press **ΦM Dev** > **.25** > **pi rad**.
4. Press **ΦM Rate** > **10** > **kHz**.

The signal generator is now configured to output a 0 dBm, phase-modulated carrier at 3 GHz with a 0.25 p radian deviation and 10 kHz rate. The shape of the waveform is a sine wave. (Notice that sine is the default for the **ΦM Waveform** softkey. Press **More (1 of 2)** to see the softkey.)

### To Activate ΦM

1. Press **ΦM Off On**.
2. Press **RF On / Off**.

The ΦM and RF ON annunciators are now displayed. This indicates that you have enabled phase modulation and the signal is now being transmitted from the RF OUTPUT connector.

## Configuring Pulse Modulation

In this example, you will learn how to create a gated, pulse-modulated RF carrier with an external trigger.

### To Set the RF Output Frequency

1. Press **Preset**.
2. Press **Frequency** > **2** > **GHz**.

### To Set the RF Output Amplitude

Press **Amplitude** > **0** > **dBm**.

### To Set the Pulse Period, Width, and Triggering

1. Press **Pulse** > **Pulse Period** > **100** > **usec**.
2. Press **Pulse** > **Pulse Width** > **24** > **usec**.
3. Press **Pulse** > **Pulse Source** > **Int Gated**.
4. Connect a TTL signal to the Trigger In connector on the rear panel of the signal generator. To configure the trigger signal polarity, Press Utility > Instrument Adjustments > Signal Polarity Setup > Trigger In Polarity.

The signal generator is now configured to output a 0 dBm, pulse-modulated carrier at 2 GHz with a 100-microsecond pulse period and 24-microsecond pulse width. The pulse source is set to internal gated. (Notice that Internal Free Run is the default for the **Pulse Source** softkey.)

### To Activate Pulse Modulation

Follow these remaining steps to output the pulse-modulated signal.

1. Press **Pulse Off On** to On.
2. Press **RF On / Off**.

The Pulse and RF ON annunciators are now displayed. This indicates that you have enabled pulse modulation and the signal is now being transmitted from the RF OUTPUT connector. The TTL trigger signal state will control pulse modulation output.

## Configuring the LF Output

The signal generator has a low frequency (LF) output (described on page 8). The LF output's source can be switched between **Internal 1 Monitor**, **Internal 2 Monitor**, **Function Generator 1**, or **Function Generator 2**.

Using **Internal 1 Monitor** or **Internal 2 Monitor** as the LF output source, the LF output provides a replica of the signal from the internal source that is being used to modulate the RF output. The specific modulation parameters for this signal are configured through the AM, FM, or FM menus.

Using **Function Generator 1** or **Function Generator 2** as the LF output source, the function generator section of the internal modulation source drives the LF output directly. Frequency and waveform are configured from the LF output menu, not through the AM, FM, or FM menus. You can select the waveform shape from the following choices:

| | |
|---|---|
| Sine | sine wave with adjustable amplitude and frequency |
| Dual-Sine | dual-sine waves with individually adjustable frequencies and a percent-of-peak-amplitude setting for the second tone (available from function generator 1 only) |
| Swept-Sine | a swept-sine wave with adjustable start and stop frequencies, sweep rate, and sweep trigger settings (available from function generator 1 only) |
| Triangle | triangle wave with adjustable amplitude and frequency |
| Ramp | ramp with adjustable amplitude and frequency |
| Square | square wave with adjustable amplitude and frequency |
| Noise | noise with adjustable amplitude generated as a peak-to-peak value (RMS value is approximately 80% of the displayed value) |
| DC | direct current with adjustable amplitude |

**NOTE** The **LF Out Off On** softkey controls the operating state of the LF output. However, when the LF output source selection is **Internal Monitor**, you have three ways of controlling the output. You can use the modulation source (AM, FM, or FM) on/off key, the LF output on/off key, or the **Mod On / Off** softkey.

The **RF On / Off** hardkey does not apply to the LF OUTPUT connector.

### To Configure the LF Output with an Internal Modulation Source

In this example, the internal FM modulation is the LF output source.

**NOTE** Internal modulation (**Internal Monitor**) is the default LF output source.

#### Configuring the Internal Modulation as the LF Output Source

1. Press **Preset**.
2. Press the **FM / ΦM** hardkey.
3. Press **FM Dev** > **75** > **kHz**.
4. Press **FM Rate** > **10** > **kHz**.

5. Press **FM Off On**.

You have set up the FM signal with a rate of 10 kHz and 75 kHz of deviation. The FM annunciator is activated indicating that you have enabled frequency modulation.

#### Configuring the Low Frequency Output

1. Press the **LF Out** hardkey.
2. Press **LF Out Amplitude** > **3** > **Vp**.
3. Press **LF Out Off On**.

You have configured the LF output signal for a 3 volt sine wave (default wave form) output which is frequency modulated using the **Internal 1 Monitor** source selection (default source).

### To Configure the LF Output with a Function Generator Source

In this example, the function generator is the LF output source.

#### Configuring the Function Generator as the LF Output Source

1. Press **Preset**.
2. Press the **LF Out** hardkey.
3. Press **LF Out Source** > **Function Generator 1**.

#### Configuring the Waveform

1. Press **LF Out Waveform** > **Swept-Sine**.
2. Press **LF Out Start Freq** > **100** > **Hz**.
3. Press **LF Out Stop Freq** > **1** > **kHz**.
4. Press **Return** > **Return**.

   This returns you to the top LF Output menu.

#### Configuring the Low Frequency Output

1. Press **LF Out Amplitude** > **3** > **Vp**.

   This sets the LF output amplitude to 3 Vp.
2. Press **LF Out Off On**.

The LF output is now transmitting a signal using Function Generator 1 that is providing a 3 Vp swept-sine waveform. The waveform is sweeping from 100 Hz to 1 kHz.

# 5 Troubleshooting

This chapter provides basic troubleshooting information for the Agilent E8663B analog signal generator. If you do not find a solution here, refer to the *E8663B Analog Signal Generator Service Guide*.

**NOTE** If the signal generator displays an error, always read the error message text by pressing **Utility** > **Error Info**.


- "RF Output Power Problems" on page 65
- "No Modulation at the RF Output" on page 69
- "Sweep Problems" on page 70
- "Data Storage Problems" on page 71
- "Cannot Turn Off Help Mode" on page 72
- "Signal Generator Locks Up" on page 72
- "Error Messages" on page 73
- "Contacting Agilent Sales and Service Offices" on page 75
- "Returning a Signal Generator to Agilent Technologies" on page 75


## RF Output Power Problems

Check the RF ON/OFF annunciator on the display. If it reads RF OFF, press **RF On/Off** to toggle the RF output on.

### No RF Output Power when Playing a Waveform File

Preset the signal generator, then replay the waveform file.

If a header file is not specified for a waveform, the signal generator uses a default header file with unspecified settings. If you play a waveform file that has unspecified signal generator settings (settings not saved to the file header, see page 82), the signal generator will use the header file settings from the previously played file. If the previous header file had a marker routed to RF blanking, the RF output power will be blanked. Preset the signal generator to return the RF blanking marker function to its default state—off). Refer to the *E8663B Analog Signal Generator Key Reference*, Marker section, for more information.

**NOTE** If the default marker file is used, ensure that the **Pulse/RF Blank** softkey is set to **None**. Markers may have been set to **Pulse/RF Blank** by a previous file header.

## RF Output Power too Low

1. Look for an OFFS or REF indicator in the AMPLITUDE area of the display.

   OFFS 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 the following keys:

   **Amplitude** > **More (1 of 2)** > **Ampl Offset** > **0** > **dB**.

   REF tells you that the amplitude reference mode is activated. When this mode is on, the displayed amplitude value is *not* the output power level. 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, follow these steps:

   a. Press **Amplitude** > **More (1 of 2)**.

   b. Press **Ampl Ref Off On** until Off is highlighted.

   You can then reset the output power to the desired level.

2. If you are using the signal generator with an external mixer, see "Signal Loss While Working with a Mixer" on page 66.

3. If you are using the signal generator with a spectrum analyzer, see "Signal Loss While Working with a Spectrum Analyzer" on page 68.

## The Power Supply has Shut Down

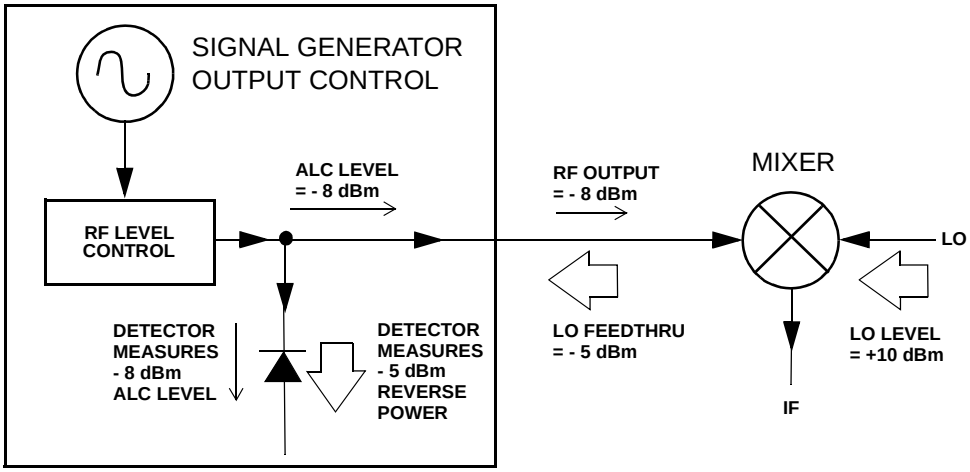
If the power supply is not working, it requires repair or replacement. There is no user-replaceable power supply fuse. Refer to the *E8663B Analog Signal Generator Service Guide* for instructions.

## Signal Loss While Working with a Mixer

If you experience signal loss at the signal generator's RF output during low-amplitude coupled operation with a mixer, you can solve the problem by adding attenuation and increasing the RF output amplitude of the signal generator.

Figure 5-1 shows a hypothetical configuration in which the signal generator provides a low amplitude signal to a mixer.

**Figure 5-1** **Effects of Reverse Power on ALC**

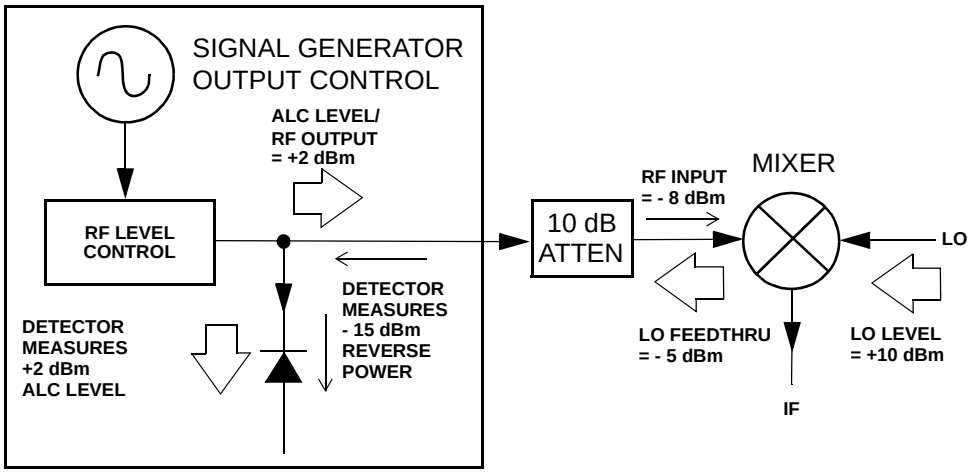



The internally leveled signal generator RF output (and ALC level) is -8 dBm. The mixer is driven with an LO of +10 dBm and has an LO-to-RF isolation of 15 dB. The resulting LO feedthrough of -5 dBm enters the signal generator's RF output connector and arrives at the internal detector.

Depending on frequency, it is possible for most of this LO feedthrough energy to enter the detector. Since the detector responds to its total input power regardless of frequency, this excess energy causes the ALC to reduce the RF output of the signal generator. In this example, the reverse power across the detector is actually greater than the ALC level, which may result in loss of signal at the RF output.

Figure 5-2 on page 68 shows a similar configuration with the addition of a 10 dB attenuator connected between the RF output of the signal generator and the input of the mixer. The signal generator's ALC level is increased to +2 dBm and transmitted through a 10 dB attenuator to achieve the required -8 dBm amplitude at the mixer input.

**Figure 5-2** **Reverse Power Solution**




Compared to the original configuration, the ALC level is 10 dB higher while the attenuator reduces the LO feedthrough (and the RF output of the signal generator) by 10 dB. Using the attenuated configuration, the detector is exposed to a +2 dBm desired signal versus the - 15 dBm undesired LO feedthrough. This 17 dB difference between desired and undesired energy results in a maximum 0.1 dB shift in the signal generator's RF output level.

## Signal Loss While Working with a Spectrum Analyzer

The effects of reverse power can cause problems with the signal generator's RF output when the signal generator is used with a spectrum analyzer that does not have preselection capability.

Some spectrum analyzers have as much as +5 dBm LO feedthrough at their RF input port at some frequencies. If the frequency difference between the LO feedthrough and the RF carrier is less than the ALC bandwidth, the LO's reverse power can cause amplitude modulation of the signal generator's RF output. The rate of the undesired AM equals the difference in frequency between the spectrum analyzer's LO feedthrough and the RF carrier of the signal generator.

Reverse power problems can be solved by using one of two unleveled operating modes: ALC off or power search.

### Setting ALC Off Mode

ALC off mode deactivates the automatic leveling circuitry prior to the signal generator's RF output. In this mode, a power meter is required to measure the output of the signal generator and assist in achieving the required output power at the point of detection.

Use the following steps to set the signal generator to the ALC off mode:

1. Preset the signal generator: press **Preset**.
2. Set the desired frequency: press **Frequency** and enter the desired frequency.
3. Set the desired amplitude: press **Amplitude** and enter the desired amplitude.

4. Turn the RF off: set **RF On/Off** to On.
5. Turn the signal generator's automatic leveling control (ALC) off: press **Amplitude** > **ALC Off On** to Off.
6. Monitor the RF output amplitude as measured by the power meter.
7. Press **Amplitude** and adjust the signal generator's RF output amplitude until the desired power is measured by the power meter.

### Setting Power Search Mode

Power search mode executes a power search routine that temporarily activates the ALC, calibrates the power of the current RF output, and then disconnects the ALC circuitry. See the *E8663B Analog Signal Generator Key Reference* for more information on the Power Search function.

Use the following steps to set the signal generator to manual fixed power search mode:

1. Preset the signal generator: press **Preset**.
2. Set the desired frequency: press **Frequency** and enter the desired frequency.
3. Set the desired amplitude: press **Amplitude** and enter the desired amplitude.
4. Turn the signal generator's automatic leveling control (ALC) off: press **Amplitude** > **ALC Off On** to Off.
5. Turn the RF on: set **RF On/Off** to On.
6. Press **Do Power Search**.
   This executes the manual fixed power search routine, which is the default mode.

There are three power search modes: manual, automatic, and span.

When **Power Search** is set to Manual, pressing **Do Power Search** executes the power search calibration routine for the current RF frequency and amplitude. In this mode, if there is a change in RF frequency or amplitude, you will need to press **Do Power Search** again.

When **Power Search** is set to Auto, the calibration routine is executed whenever the frequency or amplitude of the RF output is changed.

When **Power Search** is set to Span, pressing **Do Power Search** executes the power search calibration routine over a selected range of frequencies at one time. The power search corrections are then stored and used whenever the signal generator is tuned within the selected range of frequencies.

## No Modulation at the RF Output

Check the MOD ON/OFF annunciator on the display. If it reads MOD OFF, press **Mod On/Off** to toggle the modulation on.

Although you can set up and enable various modulations, the RF carrier is modulated only when you have also set **Mod On/Off** to On.

# Sweep Problems

## Sweep Appears to be Stalled

The current status of the sweep is indicated as a shaded rectangle in the progress bar. You can observe the progress bar to determine if the sweep is progressing. If the sweep appears to have stalled, check the following:

- ❏ Have you turned on the sweep by pressing any of the following key sequences?

  **Sweep/List** > **Sweep** > **Freq**

  **Sweep/List** > **Sweep** > **Ampl**

  **Sweep/List** > **Sweep** > **Freq & Ampl**

- ❏ Is the sweep in continuous mode? If the sweep is in single mode, be sure that you have pressed the **Single Sweep** softkey at least once since completion of the prior sweep. Try setting the mode to continuous to determine if the missing single sweep is blocking the sweep.
- ❏ Is the signal generator receiving the appropriate sweep trigger? Try setting the **Sweep Trigger** softkey to Free Run to determine if a missing sweep trigger is blocking the sweep.
- ❏ Is the signal generator receiving the appropriate point trigger? Try setting the **Point Trigger** softkey to Free Run to determine if a missing point trigger is blocking the sweep.
- ❏ Is the dwell time appropriate? Try setting the dwell time to one second to determine if the dwell time was set to a value which was too slow or too fast for you to see.
- ❏ Do you have at least two points in your step sweep or list sweep?

## Cannot Turn Off Sweep Mode

Press **Sweep/List** > **Sweep** > **Off**.

In the sweep mode menu you can choose to set the sweep to various sweep types or to turn sweep off.

## Incorrect List Sweep Dwell Time

If the signal generator does not dwell for the correct period of time at each sweep list point, follow these steps:

1. Press **Sweep/List** > **Configure List Sweep**.

   This displays the sweep list values.

2. Check the sweep list dwell values for accuracy.
3. Edit the dwell values if they are incorrect.

---

**NOTE** The effective dwell time at the RF OUTPUT connector is the sum of the value set for the dwell plus processing time, switching time, and settling time. This additional time added to the dwell is generally a few milliseconds. The TTL/CMOS output available at the TRIG OUT connector, however, is asserted high only during the actual dwell time.

---

If the list dwell values are correct, continue to the next step.

4. Observe 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, follow these steps:

   a. Press **Configure Step Sweep**.

   b. Observe the value set for the **Step Dwell** softkey.

### List Sweep Information is Missing from a Recalled Register

List sweep information is not stored as part of the instrument state in an instrument state register. Only the current list sweep is available to the signal generator. List sweep data can be stored in the instrument catalog. For instructions, see "Storing Files to the Memory Catalog" on page 33.

## Data Storage Problems

### Registers With Previously Stored Instrument States are Empty

The save/recall registers are backed-up by a battery when line power to the signal generator is not connected. The battery may need to be replaced.

To verify that the battery has failed:

1. Turn off line power to the signal generator.
2. Unplug the signal generator from line power.
3. Plug in the signal generator.
4. Turn on the signal generator.
5. Observe the display for error messages.

   If either error message –311 or –700 is stored in the error message queue, the signal generator's battery has failed.

6. Refer to the *E8663B Analog Signal Generator Service Guide* for battery replacement instructions.

### Saved Instrument State, but Register is Empty or Contains Wrong State

If you select a register number greater than 99, the signal generator automatically selects register 99 to save the instrument state.

If the register number you intended to use is empty or contains the wrong instrument state, recall register 99:

Press **Recall** > **99** > **Enter**.

The lost instrument state may be saved there.

## Cannot Turn Off Help Mode

1. Press **Utility** > **Instrument Info / Help Mode**
2. Press **Help Mode Single Cont** until Single is highlighted.

The signal generator has two help modes; single and continuous.

When you press **Help** in single mode (the factory preset condition), help text is provided for the next key you press. Pressing another key will exit the help mode and activate the key's function.

When you press **Help** in continuous mode, help text is provided for the next key you press and that key's function is also activated (except for **Preset**). You will stay in help mode until you press **Help** again or change to single mode.

## Signal Generator Locks Up

If the signal generator is locked up, check the following:

- Make sure that the signal generator is not in remote mode (in remote mode, the R annunciator appears on the display). To exit remote mode and unlock the front panel keypad, press **Local**.
- Make sure that the signal generator is not in local lockout condition. Local lockout prevents front panel operation. For more information on local lockout, refer to the *E8663B Analog Signal Generator Programming Guide*.
- Check for a progress bar on the signal generator display, which indicates that an operation is in progress.
- Press **Preset**.
- Cycle power on the signal generator.

### Fail-Safe Recovery Sequence

Use the fail-safe recovery sequence only if the previous suggestions do not resolve the problem.

**CAUTION** This process does reset the signal generator, but it also destroys the following types of data:

- all user files (instrument state and data files)
- DCFM/DCΦM calibration data
- persistent states

**NOTE** Do not attempt to perform any other front panel or remote operations during the fail-safe sequence.

To run the fail-safe sequence, follow these steps:

1. Hold down the **Preset** key while cycling power.
2. Continue to hold down the **Preset** key until the following message is displayed:

**WARNING** **You are entering the diagnostics menu which can cause unpredictable instrument behavior. Are you sure you want to continue?**

**CAUTION** Carefully read the entire message! It may list additional risks with this procedure.

3. Release the **Preset** key.
4. To continue with the sequence, press **Continue** (to abort with no lost files, press **Abort**).
5. When the sequence concludes, do the following:
   a. Cycle power.

      Cycling power restores all previously installed options. Because calibration files are restored from EEPROM, you should see several error messages.

   b. Perform the DCFM/DCΦM calibration.

      Refer to the **DCFM/DCΦM Cal** softkey description in the *E8663B Analog Signal Generator Key Reference*.

   c. Agilent Technologies is interested in the circumstances that made it necessary for you to initiate this procedure. Please contact us at the telephone number listed at *http://www.agilent.com/find/assist*. We would like to help you eliminate any repeat occurrences.

## Error Messages

If an error condition occurs in the signal generator, it is reported to both the front panel display error queue and the SCPI (remote interface) error queue. These two queues are viewed and managed separately; for information on the SCPI error queue, refer to the *E8663B Analog Signal Generator Programming Guide*.

**NOTE** When there is an unviewed message in the front panel error queue, the ERR annunciator appears on the signal generator's display.

| Characteristic | Front Panel Display Error Queue |
|---|---|
| Capacity (#errors) | 30 |
| Overflow Handling | Circular (rotating).<br>Drops oldest error as new error comes in. |
| Viewing Entries | Press: **Utility** > **Error Info** > **View Next** (or **Previous**) **Error Page** |
| Clearing the Queue | Press: **Utility** > **Error Info** > **Clear Error Queue(s)** |
| Unresolved Errors[a] | Re-reported after queue is cleared. |
| No Errors | When the queue is empty (every error in the queue has been read, or the queue is cleared), the following message appears in the queue:<br>`0 No Error Message(s) in Queue` |

a. Errors that must be resolved. For example, unlock.

## Error Message File

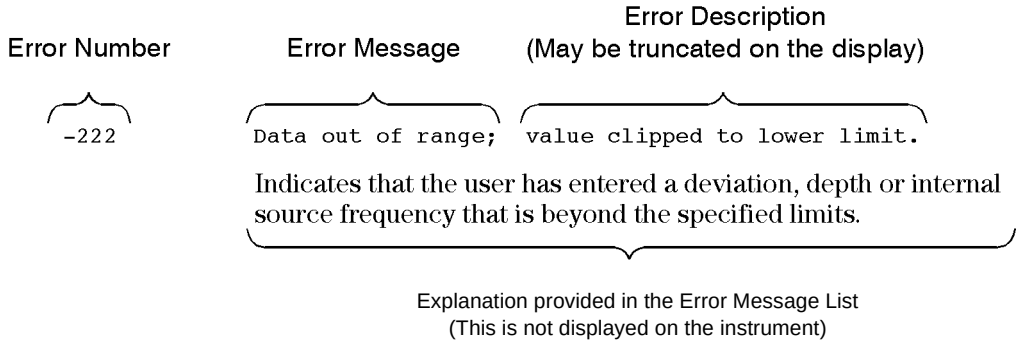
A complete list of error messages is provided in the file *errormessages.pdf*, on the CDROM supplied with your instrument.

In the error message list, an explanation is generally included with each error to further clarify its meaning. The error messages are listed numerically. In cases where there are multiple listings for the same error number, the messages are in alphabetical order.

## Error Message Format

When accessing error messages through the front panel display error queue, the error numbers, messages and descriptions are displayed on an enumerated ("1 of N") basis.

Error messages appear in the lower-left corner of the display as they occur.




## Error Message Types

Events do not generate more than one type of error. For example, an event that generates a query error will not generate a device-specific, execution, or command error.

**Query Errors (–499 to –400)** indicate that the instrument's output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, Chapter 6. Errors in this class set the query error bit (bit 2) 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. In this case:

- Either an attempt is being made to read data from the output queue when no output is either present or pending, or
- data in the output queue has been lost.

**Device Specific Errors (–399 to –300, 201 to 703, and 800 to 810)** indicate that a device operation did not properly complete, possibly due to an abnormal hardware or firmware condition. These codes are also used for self-test response errors. Errors in this class set the device-specific error bit (bit 3) in the event status register (IEEE 488.2, section 11.5.1).

The <error_message> string for a *positive* error is not defined by SCPI. A positive error indicates that the instrument detected an error within the GPIB system, within the instrument's firmware or hardware, during the transfer of block data, or during calibration.

**Execution Errors (–299 to –200)** indicate that an error has been detected by the instrument's execution control block. Errors in this class set the execution error bit (bit 4) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either 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, or
- a valid program message could not be properly executed due to some device condition.

Execution errors are reported *after* rounding and expression evaluation operations are completed. Rounding a numeric data element, for example, is not reported as an execution error.

**Command Errors (–199 to –100)** indicate that the instrument's parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element that violates device listening formats or whose type is unacceptable to the device.), or
- an unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

## Contacting Agilent Sales and Service Offices

Assistance with test and measurement needs, and information on finding a local Agilent office are available on the Internet at:
*http://www.agilent.com/find/assist*

You can also purchase signal generator accessories or documentation items on the Internet at:
*http://www.agilent.com/find/e8663b*

If you do not have access to the Internet, contact your field engineer.

**NOTE** In any correspondence or telephone conversation, refer to the signal generator by its model number and full serial number. With this information, the Agilent representative can determine whether your unit is still within its warranty period.

## Returning a Signal Generator to Agilent Technologies

To return your signal generator to Agilent Technologies for servicing, follow these steps:

1. Gather as much information as possible regarding the signal generator's problem.
2. Call the phone number listed on the Internet (*http://www.agilent.com/find/assist*) that is specific to your geographic location. If you do not have access to the Internet, contact your field engineer.

   After sharing information regarding the signal generator and its condition, you will receive information regarding where to ship your signal generator for repair.
3. Ship the signal generator in the original factory packaging materials, if available, or use similar packaging to properly protect the signal generator.

### Symbols

ΦM, 12, 61

### Numerics

10 MHz connectors, 17, 18
1EM, option, 2
802.11b, 47

### A

AC power receptacle, 17, 18
active entry area (display), 11
adding & editing (instrument state), 35
adjustments, display, 9
Agilent web page
  additional information, 1
ALC
  annunciator, 12
  bandwidth selection, 47
  input connector, 8
  input connector (rear), 20
  limitations, amplitude, 49
  off mode, setting, 68
  with attenuator option, 48
AM, 12, 60
amplitude
  display area, 14
  hardkey, 6
  LF output, 64
  modulation. *See* AM
  reference & offset, 26
analog
  optional features
    optional features, 2
analog modulation, 4, 59–64
annunciators, 12
application notes
  obtaining, 1
ARMED annunciator, 12
arrow hardkeys, 9
ATTEN HOLD annunciator, 12
attenuator, external leveling, 48
automatic leveling control. *See* ALC
AUXILIARY INTERFACE connector, 17

### B

bandwidth
  ALC, selecting, 47
  reference oscillator, adjusting, 56
basic operation
  standard, 21
binary files, 32
bit files, 32
bursted signals, 47

### C

carrier signal, modulating, 31
CDMA, 47
certificate, license key, 41
comments, adding & editing (instrument state), 35
confidential data, 36
connectors
  front panel, 5
  rear panel, 15
continuous
  list sweep, 30
  step sweep, 28
continuous wave
  configuring, 24
  description, 4
contrast adjustments (display), 9
correction array (user flatness)
  configuration, 53
  load from step array, 54
  viewing, 54
  *See also* user flatness correction
couplers/splitters, using, 48
CW mode
  configuring, 24
  description, 4

### D

data
  fields, editing, 23
  files, 32
  input methods, 36
  removal, 38
  sensitive, 36, 38

# Index


data (*continued*)
  storage
    problems, 71
    security, 36
    *See also* instrument state register
    *See also* memory catalog
data sheets, 1
DC offset, 61
declassification, 36
Delete Item softkey, 23
Delete Row softkey, 23
description, adding & editing (instrument state), 35
detector
  diode response, 49
  using, 48
DHCP, 42
diode detector response, 49
display
  blanking, 40
  contrast decrease, 9
  contrast increase, 9
  descriptions, 11
  overview, 11
  secure, 40
DMOD files, 32
documentation, ix
documentation options, 3
downloading firmware, 3
dwell time, 27

**E**

Edit Item softkey, 23
Erase All, 38, 39, 40
erase and overwrite, 38
erase and sanitize, 38
erasing memory, 36, 38, 39, 40
ERR annunciator, 12, 73
error messages
  display, 14
  message format, 74
  overview, 73
  queue, 73
  types, 74
EXT
  annunciators, 12
EXT (*continued*)
  INPUT connectors, 7
  input connectors, 7
  input connectors (rear), 19
external
  detector, diode response, 49
external FM, 61

**F**

fail-safe recovery sequence, 72
failures. *See* troubleshooting
FAQ, 1
features, signal generator, 1
file store
files, 34
  catalogs, 32
  using, 33
  *See also* instrument state register
  *See also* memory catalog
FIR, 32
firmware
  options, 3
  upgrades
    obtaining, 3
    using GPIB, 3
    using LAN, 3
    using RS-232, 3
flatness correction. *See* user flatness correction
FM, 12, 60
FM/ΦM hardkey, 7
frequency
  display area, 12
  hardkey, 6
  modulation. *See* FM
  offset, 25
  ranges, 1
  reference, 25
  RF output, setting, 24
front panel
  description, 5–11
  disabling keys, 40

**G**

GATE/PULSE/TRIGGER
  input connector, 9
  input connector (rear), 20
gated, 62
Goto Row softkey, 23
GPIB, 17, 56
guides, ix

**H**

hardkeys, 5–10
Help hardkey, 7
help mode troubleshooting, 72
Hold hardkey, 9

**I**

Incr Set hardkey, 9
information
  additional, 1
  protecting sensitive, 36
Insert Item softkey, 23
Insert Row softkey, 23
installation guide, ix
installing firmware, 3
instrument state register
  comments, adding and editing, 35
  troubleshooting, 71
  using, 34
  *See also* memory catalog
int gated, 62
interface connectors
  AUXILIARY INTERFACE, 17
  GPIB, 17
  LAN, 18
  RS-232, 17
interface, remote, 56

**K**

key, license, 41
keypad, numeric, 8
keys
  disabling, 40
  front panel, 5–10
knob, front panel, 6

**L**

L (listener mode) annunciator, 13
lan configuration, 42
LAN connector, 18
LEDs, 10
leveling
  ALC, 8, 68
  external, 48–51
  internal, 47
LF OUT connector, 19
LF output, 8, 63–64
license key, 41
line power LED, 10
list
  error messages, 74
  files, 32
  mode values table editor, 22
  sweep, 28, 70
listener mode annunciator, 13
Load/Store softkey, 23
Local hardkey, 9
low frequency output. *See* LF output

**M**

MDMOD files, 32
media storage, 36
memory
  base instrument, 36
  baseband generator, 36
  catalog, 32, 71
    *See also* instrument state register
  erasing, 36, 38
  hard disk, 36
  overwriting, 38
  persistence, 36
  physical location, 36
  sanitizing, 38
  secure mode, 39
  size, 36
  types, 36
  waveform, 36
  writing to, 36
MENUS hardkeys, 7
mixer, signal loss while using, 66

mod on/off, 8, 13
models, signal generator, 1
modes of operation, 4
modulation
  amplitude. *See* AM
  analog, 4, 59–64
  analog waveforms, 59
  annunciators, 12
  applying, 31
  file catalogs, 32
  frequency. *See* FM
  on/off hardkey, 8
  phase. *See* ΦM
  pulse, 4, 62
  *See also* digital modulation
MTONE files, 32

**N**

numeric keypad, 8
NVMKR files, 32
NVWFM files, 32

**O**

OFDM, 47
offset, 25, 26, 61
on/off switch, 10
operation
  basics, 21
  modes of operation, 4
options
  1EM, 2
  additional information, 3
  enabling, 41
  UNW, 2, 4, 59, 62
oscillator, reference, adjusting BW, 56
output power, troubleshooting, 66
output. *See* LF output *and* RF output
OVEN COLD annunciator, 13
overwriting memory, 38

**P**

Page Down softkey, 23
Page Up softkey, 23
performance, optimizing, 47–57
phase
  modulation. *See* ΦM
power
  meter, 52, 68
  output, troubleshooting, 66
  receptacle, AC, 17, 18
  search mode, 69
  supply troubleshooting, 66
  switch, 10
Preset hardkey, 10
private data, 36
problems. *See* troubleshooting
product information, 1
programming
  guide, ix
proprietary data, 36
protecting data, 36
pulse, 47
  annunciator, 13
  input, 9
  input (rear), 20
  modulation, 62
pulse modulation, 4
pulse source, 62
PULSE SYNC OUT, 19
PULSE VIDEO OUT, 20
PULSE/TRIG GATE INPUT, 20

**Q**

queue, error, 73

**R**

R (remote) annunciator, 13
rear panel description, 15
Recall hardkey, 6
recall states, 34
recovery sequence, fail-safe, 72
reference
  amplitude, setting, 26
  frequency, setting, 25
  oscillator bandwidth, adjusting, 56
references, ix
registers, 34, 35
remote operation, 7, 56

remote operation annunciator, 13
restricted data, 36
Return hardkey, 9
returning a signal generator, 75
RF blanking, 65
RF output
  annunciator, 13
  configuring, 24
  connector, 8
  connector (rear), 19
  leveling, external, 48–51
  On/Off hardkey, 8
  sweeping, 26
  troubleshooting, 65
  user flatness correction, 51–56
RS-232 connector, 17

## S

S (service request) annunciator, 13
sanitizing memory, 38
save and recall states, 34
save files
Save hardkey, 6
SCPI, 42
  reference, ix
SCPI commands, 7
secure display, 40
secure mode, 39
security functions, 36, 39
security level, 39
sensitive data, 36
Seq files, 32
sequences
  deleting, 35
  instrument state register, 34
service guide, ix
service request annunciator, 13
service, Agilent sales and service offices, 75
shape files, 32
signal generator
  features, 1
  firmware
    firmware, 3
  models, 1
  modes, 4
signal generator (*continued*)
  options
    options, 3
  overview, 1
signal loss, troubleshooting, 65
single step sweep, 27
softkeys, 6, 14, 23
software
  available, 1
  options, 3
SOURCE SETTLED OUTPUT connector, 19
spectrum analyzer, troubleshooting signal loss, 68
standby LED, 10
state files, 32
step array (user flatness), 52
  *See also* user flatness correction
step attenuator, external leveling, 48
step sweep, 27–28
storage, troubleshooting, 71
sweep
  annunciator, 13
  list, 28
  mode, 4
  output, 18
  RF output, 26
  step, 27
  trigger, 30
  troubleshooting, 70
sweep progress bar, 26
Sweep/List hardkey, 7
switch, power, 10
SYNC OUT connector, 8
SYNC OUT connector (rear), 19

## T

T (talker mode) annunciator, 13
table editor, using, 22–23
talker mode annunciator, 13
TCP/IP, 42
technical support, 1
text display area, 14
trigger
  hardkey, 6
  inputs
    GATE/PULSE/TRIGGER, 9

trigger (*continued*)
  inputs
    GATE/PULSE/TRIGGER (rear), 20
    TRIGGER IN, 19
  output, 19
  setting, 30
trigger in, 62
trigger polarity, 62
troubleshooting, 65–75

### U

UNLEVEL annunciator, 14
UNLOCK annunciator, 14
UNW, option, 2, 4, 59, 62
upgrading firmware, 3
user documentation, ix
user flatness, 32, 51–56
user-defined
  files, 32

### V

VIDEO OUT connector, 9
VIDEO OUT connector (rear), 20

### W

waveform memory, 36
waveforms
  analog modulation, 59
  file catalogs, 32
web server, 42
website
  web page, 1
WFM1 files, 32

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