# Noise Figure Analyzers
# NFA Series

## Quick Reference Guide


**Manufacturing Part Number: N8972-90003**

**June 2000**

# Safety Notices

This product and related documentation must be reviewed for familiarization with safety markings and instructions before use.

This instrument has been designed and tested in accordance with IEC Publication 61010-1+A1+A2:1991 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

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**WARNING**

***Warning* denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

**CAUTION**

*Caution* denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

**NOTE**

*Note* calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.



This symbol is used to mark the on position of the power line switch.

This symbol is used to mark the standby position of the power line switch.

This symbol indicates that the input power required is AC.

**WARNING**

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

**WARNING**

**If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

**WARNING**

**No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

**WARNING** **For continued protection against fire hazard, replace line fuses only with the same type and ratings (115V range; type F 5A 125V; 239V range F 5A 250V). The use of other fuses or materials is prohibited.**

**CAUTION** To prevent electrical shock, disconnect the instrument from the mains (line) before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Environmental requirements: This product is designed for indoor use only and to meet the following environmental conditions:

- Operating temperature: 0° C to +55° C
- Operating humidity: <95% relative
- Altitude: up to 4500 m

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Documentation is updated periodically. For the latest information about Agilent NFA Noise Figure Analyzers, including firmware upgrades and application information, please visit the following Internet URL:

http://www.agilent.com/find/nf/

# Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive, from 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB(A).

- Sound Pressure Lp < 70 dB(A).
- At Operator Position.
- Normal Operation.
- According to ISO 7779:1988/EN 27779:1991 (Type Test).

**Herstellerbescheinigung**

Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärminformationsverordnung vom 18 Januar 1991.

- Schalldruckpegel Lp < 70 dB(A).
- Am Arbeitsplatz.
- Normaler Betrieb.
- Nach ISO 7779:1988/EN 27779:1991 (Typprüfung).

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# 1 Getting Started

This chapter introduces you to basic features of the Noise Figure Analyzer, including front panel and rear panel descriptions, and an overview of the display annotation.

## What You will Find in this Chapter

This chapter covers the following:

- Overview of the Front-Panel
- Overview of the Rear-Panel
- Display Annotation
- Overview of the Front Panel Keys
- Performing Common File Operations
- Working with Tables

# Overview of the Front-Panel

**Figure 1-1 Front panel parts overview**

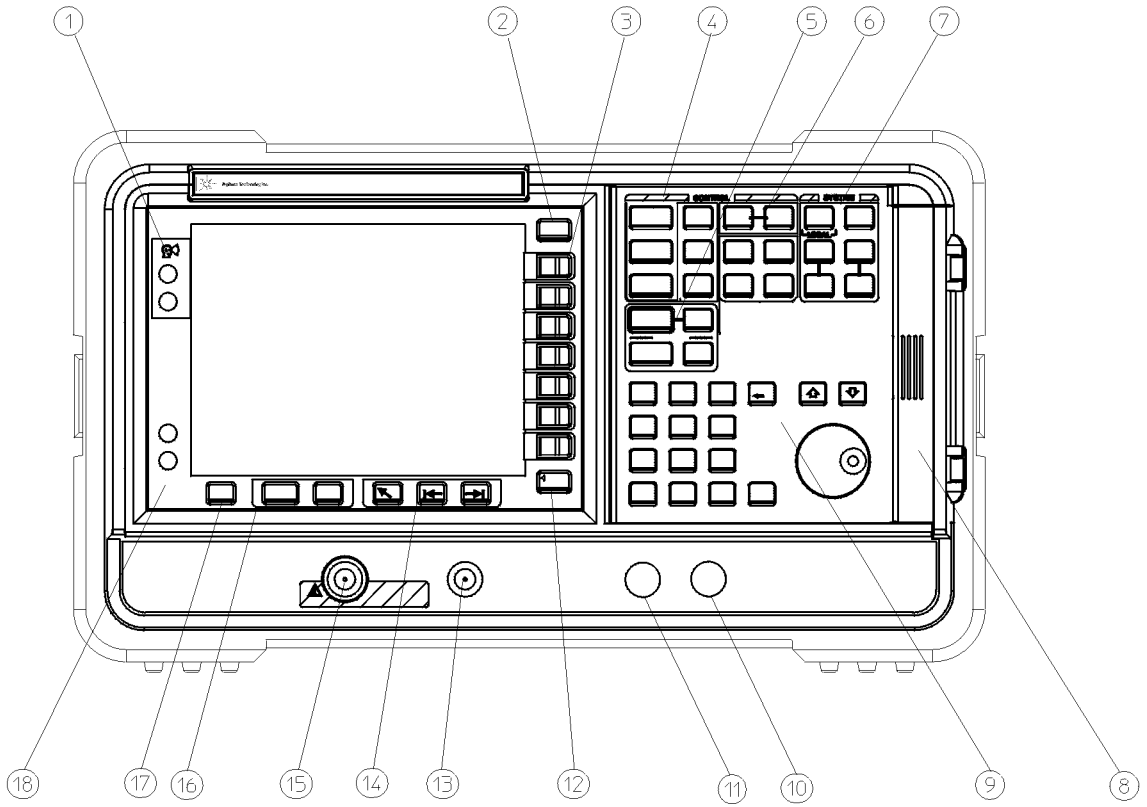



**Table 1-1 Front panel item descriptions**

| Item | Description |
|---|---|
| 1 | Viewing Angle keys allow you to adjust the display. |
| 2 | The **Esc** (escape) key cancels any entry in progress. |
| 3 | Menu keys are the unlabeled keys next to the screen. The menu key labels are shown on the display next to these unlabeled keys. |

**Table 1-1 Front panel item descriptions**

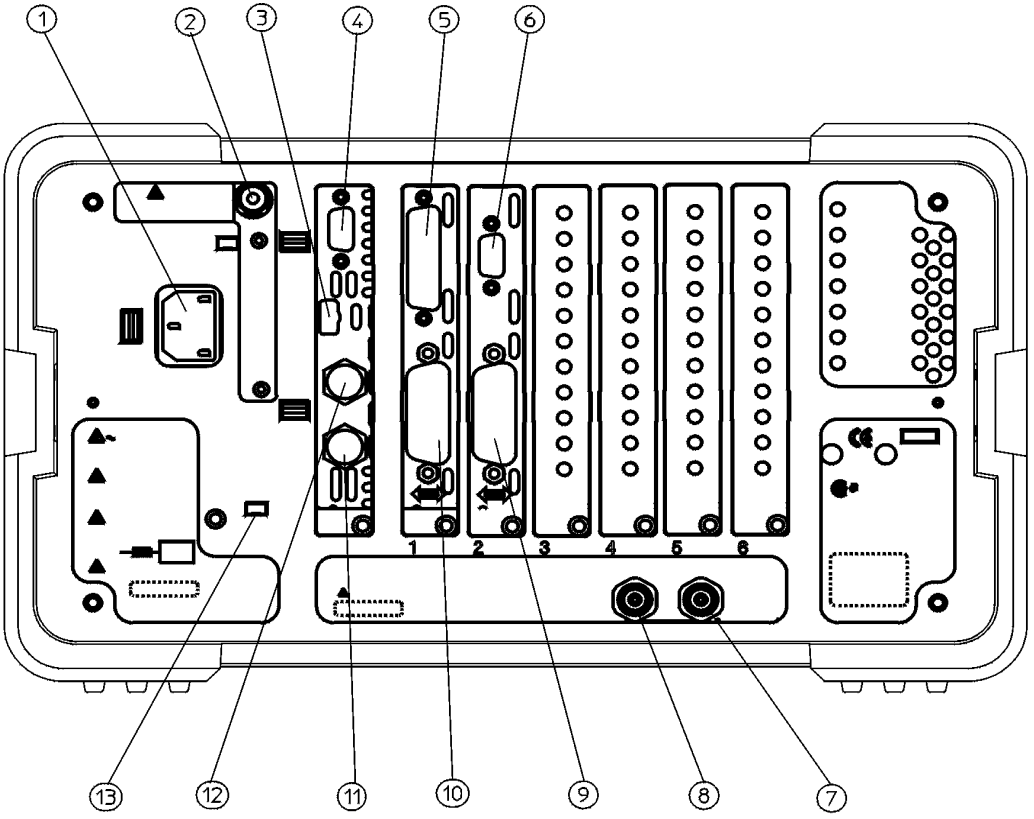
| Item | Description |
|---|---|
| 4 | The **MEASUREMENT** functions allow you to configure the measurement mode and set the NFA parameters needed for making measurements.<br><br>The **Frequency/Points** and **Averaging/Bandwidth** keys activate the primary set up function keys and access menus of related functions.<br><br>The **Calibrate** key removes any second stage noise contribution from the measurement. The **ENR** key accesses the ENR menu, from this menu, you can enter the ENR data.<br><br>The **Meas Mode** and **Mode Setup** keys are used to configure the NFA to measure mixers and frequencies greater than the basic frequency of the NFA using a Local Oscillator. |
| 5 | The **DISPLAY** functions allow you to configure the display results. |
| 6 | The **CONTROL** functions control the NFA's setup of **Loss Compensation** and **Limit Line**. The **Corr** key sets correction and input calibration ranges. The **Sweep** mode is controlled in this group, as is full screen display. The **Full Screen** functions in all display formats. |
| 7 | **SYSTEM** functions affect the state of the Noise Figure Analyzer. Various setup and alignment routines are accessed with the System key.<br><br>The green **Preset** key resets the Noise Figure Analyzer to a known state.<br><br>The **File** key menu allows you to save and load traces, ENR tables, limit-line tables, and frequency lists to or from the NFA memory or the floppy disk drive. The **Save Trace** key executes the **Save** function defined under **File**.<br><br>The **Print Setup** menu keys allow you to configure hardcopy output. The **Print** key sends hardcopy data to the printer. |
| 8 | The Media Door on the right side of the front panel accesses the 3.5 inch disk drive. |

**Table 1-1 Front panel item descriptions**

| Item | Description |
|---|---|
| 9 | The Data Entry Keys, which include the Up/Down arrow keys, RPG (rotatable knob), and numeric keys, allow you to enter or change the numeric value of an active function.<br>The RPG allows continuous change of functions such as, center frequency, averages, and marker position.<br>The Up/Down arrow keys allow discrete increases or decreases of the active function value. |
| 10 | The ⇐ **Prev** key accesses the previously selected menu. |
| 11 | Not currently supported. |
| 12 | **PROBE POWER** provides power for other accessories. |
| 13 | **NOISE SOURCE DRIVE OUTPUT +28V PULSED** this connector provides a 28 Vdc level to switch the noise source on. The noise source is off when no voltage is applied. |
| 14 | **Tab Keys** are used to move between table input fields, and to move within the fields of the dialog box accessed by the **File** menu keys. |
| 15 | **INPUT 50Ω** This is the signal input connector for the Noise Figure Analyzer. |
| 16 | The  *Next Window* key selects which graph or result parameter is active.<br>Pressing  *Zoom* key while in graph mode allows you to switch between the dual-graph and single-graph to display the active graph. |
| 17 | Press the **Help** key and then any front panel or menu key to get a short description of the key function and the associated remote command. |
| 18 | The **I**(On) key turns the Noise Figure Analyzer (NFA) on, while the **O** (Standby) key switches the NFA to standby. |

# Overview of the Rear-Panel

**Figure 1-2** **Rear panel parts overview**




Rp_mosq1

**Table 1-2** **Rear panel item descriptions**

| Item | Description |
|---|---|
| 1 | **Power input** is the input for the AC line-power source. |
| 2 | **Line Fuse**. The fuse is removed by twisting counterclockwise 1/4 turn. Replace only with a fuse of the same rating. See the label on the rear panel. |

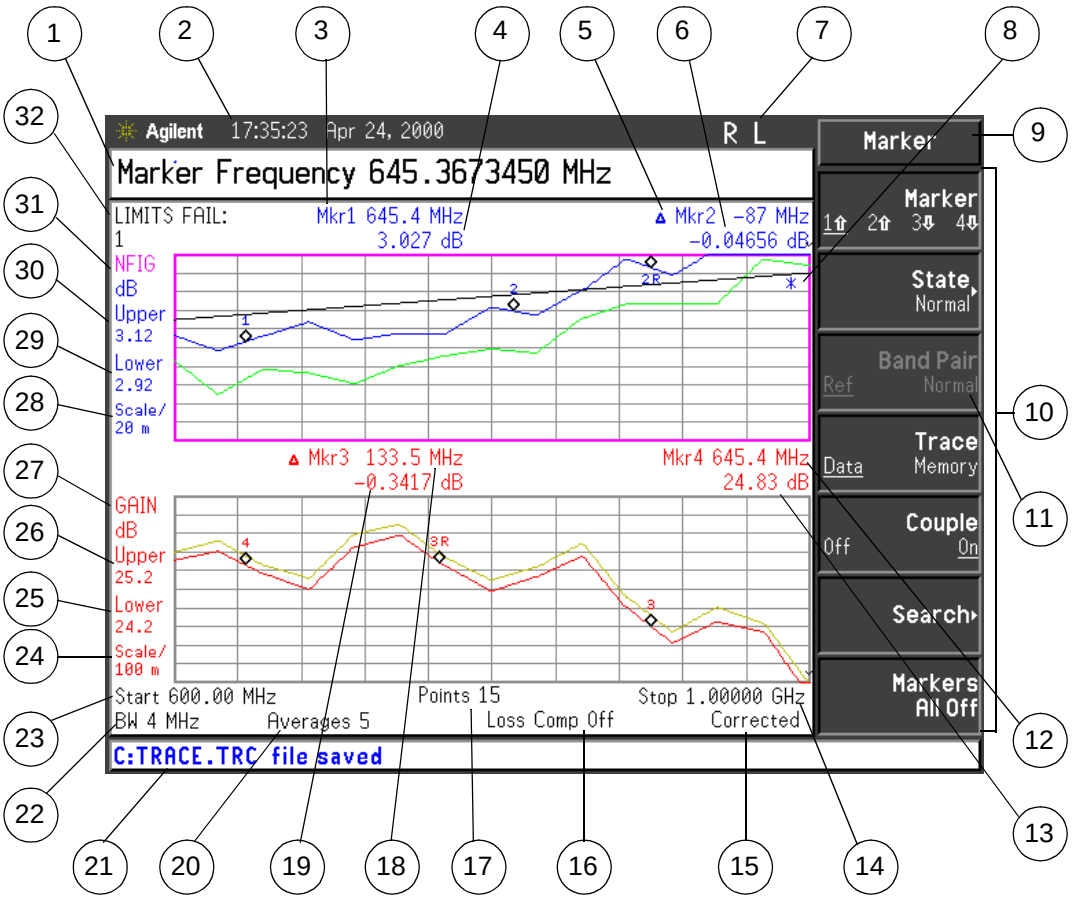
**Table 1-2 Rear panel item descriptions**

| Item | Description |
|---|---|
| 3 | Service Connector. The service connector is for service use only. |
| 4 | **VGA OUTPUT** drives an external VGA compatible monitor with a signal that has 31.5 kHz horizontal, 60 Hz vertical synchronizing rate, non-interlaced. |
| 5 | **PARALLEL** interface parallel port is for printing only. |
| 6 | **RS-232** interface supports remote instrument operation. |
| 7 | **10 MHz REF IN** accepts an external frequency source to provide the 10 MHz, –15 to +10 dBm frequency reference used by the Noise Figure Analyzer. |
| 8 | **10 MHz REF OUT** provides a 10 MHz, 0 dBm minimum, timebase reference signal. |
| 9 | **LO GPIB** port is for the control of an external LO by the NFA. |
| 10 | **MAIN GPIB** interface port supports remote instrument operation. |
| 11 | **AUX OUT (TTL)** it is not currently supported. |
| 12 | **AUX IN (TTL)** it is not currently supported. |
| 13 | Power On Selection selects an instrument power preference. |

# Display Annotation

The graph display annotation, shown in Figure 1-3, is referenced by numbers, which are listed with a description and a function key indicating which key activates the function related to the annotation.

**Figure 1-3 Display Annotation**




Each item is given a description and where applicable a function key associated with it.

**Table 1-3 Display annotation item descriptions**

| Item | Description |
|---|---|
| 1 | The active function area displays the label and value of the currently active key. |
| 2 | The time and date display, controlled by the **Time/Date** menu key, under the **System** key menus. |
| 3 | The marker 1 frequency, controlled by the **Marker(1⇑)** and **State** menu keys. |
| 4 | The marker 1 amplitude. |
| 5 | The marker 2 frequency, controlled by the **Marker(2⇑)** and **State** menu keys. |
| 6 | The marker 2 amplitude. |
| 7 | The GPIB annunciators RLTS. |
| 8 | The data invalid indicator appears when a measurement starts. It disappears after a complete sweep. |
| 9 | The key menu title, this is dependent on which key is selected. |
| 10 | The key menu. |
| 11 | A non-active menu key. |
| 12 | The marker 4 frequency, controlled by the **Marker(4⇓)** and **State** menu keys. |
| 13 | The marker 4 amplitude. |
| 14 | The frequency span or stop frequency, controlled by the **Freq Span** or **Stop Freq** key. |
| 15 | Displays whether the measurement is corrected or uncorrected, controlled by the calibration state and the **Corr** key. |
| 16 | Displays whether Loss Compensation is On or Off, controlled by the **Loss Comp** key. |
| 17 | The number of points, controlled by the **Points** menu key. |

**Table 1-3 Display annotation item descriptions**

| Item | Description |
|---|---|
| 18 | The marker 3 frequency, controlled by the **Marker(3⇓)**and **State** menu keys. |
| 19 | The marker 3 amplitude. |
| 20 | The number of averages, controlled by the **Averages** menu key. |
| 21 | The display status line, displays instrument status and error messages. |
| 22 | The bandwidth, controlled by the **Bandwidth** menu key. This is fixed at 4 MHz on the N8972A model. |
| 23 | The center frequency or start frequency, controlled by the **Center Freq** or **Start Freq** menu keys. |
| 24 | The lower trace scale, controlled by the **Scale/Div** menu key. (This is auto-coupled to 25 and 26.) |
| 25 | The lower trace lower limit, controlled by the **Lower Limit** menu key. (This is auto-coupled to 24 and 26.) |
| 26 | The lower trace upper limit, controlled by the **Upper Limit** menu key. (This is auto-coupled to 24 and 25.) |
| 27 | The lower trace result type, controlled by the **Result** menu key. |
| 28 | The upper trace scale, controlled by the **Scale/Div** menu key. (This is auto-coupled to 29 and 30.) |
| 29 | The upper trace lower limit, controlled by the **Lower Limit** menu key. (This is auto-coupled to 28 and 30.) |
| 30 | The upper trace upper limit, controlled by the **Upper Limit** menu key. (This is auto-coupled to 28 and 29.) |
| 31 | The upper trace result type, controlled by the **Result** key. |
| 32 | The limit line failure indicator. |

# Overview of the Front Panel Keys

## How the Front Panel Keys are Organized

The front panel keys are divided into four main groups:

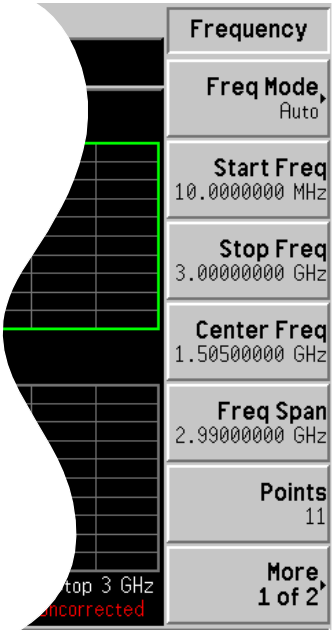
- **MEASURE** keys, which are used to configure the measurement parameters
- **CONTROL** keys, which are used to configure advanced measurement parameters
- **SYSTEM** keys, which perform system-level operations
- **DISPLAY** keys, which adjust the display characteristics of the measurement

## Navigating Through the Menu System

**Menu keys**

Pressing any of the grey front panel keys in the **MEASURE**, **DISPLAY**, **RESULT** or **SYSTEM** key groupings accesses menus of functions that are displayed along the right-hand side of the display. These keys are called **menu keys**. See Figure 1-4.

**Figure 1-4** **Menu Keys**




**Action keys**

Pressing any of the white keys (**Calibrate**, **Full Screen**, **Restart**, **Save Trace** and **Print**) invokes an action and these keys are called **action keys**.

**To activate a menu key function**

To activate a menu key function, press the key immediately to the right of the screen menu key. The menu keys that are displayed depend on which front panel key is pressed and which menu level or page is selected.

**Selecting a function within a menu key**

Some menu keys have functions contained within them, for example, **On** and **Off**. To turn the function on, press the menu key so that On is underlined. To turn the function off, press the menu key so that Off is underlined.

For a summary of all front panel keys and their related menu keys, see the User's Guide or the analyzer online help.

# Performing Common File Operations

This section covers:

- Formatting a diskette
- Saving a file
- Loading a file
- Renaming a file
- Coping a file
- Deleting a file

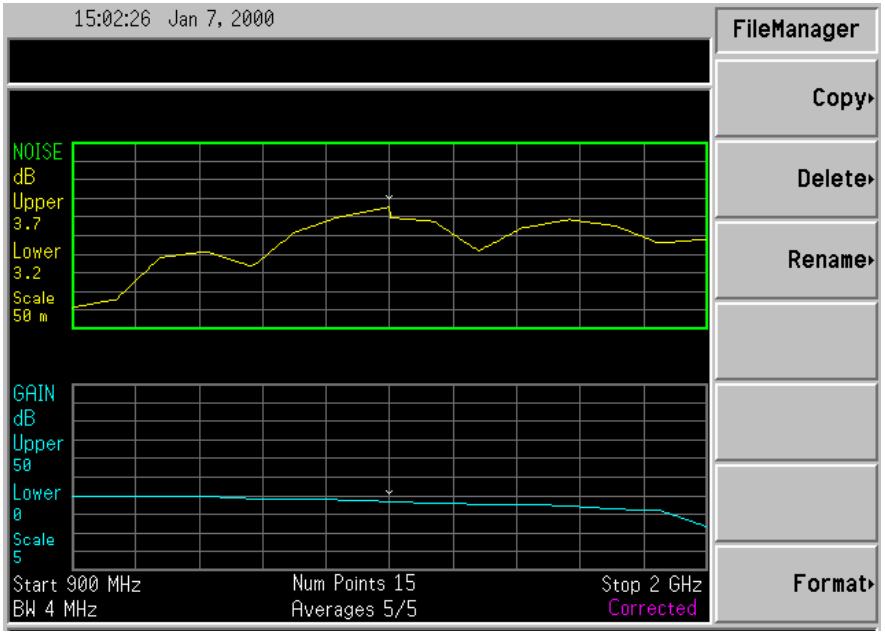
## Formatting a Diskette

The format is MS-DOS. It is not necessary to format your diskette with the Noise Figure Analyzer; pre-formatted disks can be used with the Noise Figure Analyzer.

**Step 1.** Place the diskette you wish to format into the diskette drive (A:\) of the Noise Figure Analyzer.

**Step 2.** Access the file manager menu by pressing **File** key, **File Manager**. See Figure 1-5.

**Figure 1-5** **File Manager Menu**




**Step 3.** Start the format process by pressing **Format**, then **Enter**.

**Step 4.** Press **Enter**, a second time to format the disk.

The format process takes approximately three minutes.

You are now ready to save files to the disk.

## Saving a File

You can save files (ENR tables, states, traces, limits, frequency lists, or screens) to a floppy disk (A:\), or the internal drive (C:\) of the Noise Figure Analyzer.

**Step 1.** To access the Save menu press **File**, **Save**.

**Step 2.** Select the type of file you want to save.

For example, if you have a limit line table data present and want to save it, press **Limits**.

**Step 3.** Select the limit tables file you wish to save (**1**, **2**, **3** or **4**).

For example, to save file 2, press **2**.

**Step 4.** Enter a filename using the Alpha Editor menu keys.

**Step 5.** Select the drive you wish to save to by pressing **Tab** →, to move to directory and file list, press **Select**.

**NOTE** If the correct drive is not listed in the Path: field, highlight ".." at the top of the directory list. This enables you to move up a directory. Press **Select**. To highlight the desired drive,[-A-] or [-C-]) use the arrow keys or the RPG, press **Select** when highlighted.

**Step 6.** Press **Enter**, to save the file to the drive.

## Loading a File

You can load files (ENR tables, states, limits or frequency lists) from a floppy disk (A:\), or the internal drive (C:\).

**NOTE** Not all the file types you save can be loaded back into the Noise Figure Analyzer. For example, screen files and trace files. The trace file is in a CSV (comma separated value) format, designed for use with a PC.

**Step 1.** To access the Load menu press **File**, **Load**.

**Step 2.** Select the type of file you want to load (ENR tables, states, limits or frequency lists).

**Step 3.** Select the drive where your file is located by pressing **Tab** →. Use the RPG to highlight [-C-] or [-A-], then press **Select**.

**Step 4.** Select the file you want to load into the Noise Figure Analyzer by changing the highlighted file with the up or down arrow keys to highlight the file name.

**Step 5.** Press **Enter** to load the specified file.

## Renaming a File

You can rename a file in the [-C-] or [-A-] drive as follows:

**Step 1.** Press **File**, **File Manager**, **Rename** to access the Rename menu items.

**Step 2.** Select the type of file you want to rename (ENR tables, states, traces, limits, frequency lists or screens).

For example, if you are renaming a ENR table file, press **ENR**.

**Step 3.** Select the drive where you file is located, by pressing the **Tab** → key, press **Select**. To change drive, use the arrow keys to highlight [-C-] or [-A-], then press **Select**.

**Step 4.** Select the file you want to rename by moving the cursor with the RPG or arrow keys to highlight the file name.

**Step 5.** Press **Tab** → to enter the Alpha Editor menu. File names are limited to eight (8) characters.

**Step 6.** Press **Enter** and your file is now renamed and visible within the directory displayed on your Noise Figure Analyzer.

## Copying a File

This allows you to copy a file to a different location on both the [-C-] and [-A-] drive.

**Step 1.** To access the Copy menu press **File**, **File Manager**, **Copy**.

**Step 2.** Put a formatted floppy in the A: drive.

**Step 3.** Select the type of file you want to rename (ENR tables, states, traces, limits, frequency lists or screens.

For example, if you are copying a State file, press **State**.

**Step 4.** Select the drive where your file is located, by pressing **Tab** → to highlight the From:Path: field. Select the drive, using the RPG or arrow keys to highlight [-C-] or [-A-], then press **Select**.

**Step 5.** Select the file you wish to copy by highlighting the filename using the front-panel knob or arrow keys.

**Step 6.** Press **Tab** → to move to the To:Path: field and select the drive where you want to copy the file using the RPG or arrow keys then press **Select**.

**NOTE** If the correct drive is not listed in the Path: field, highlight ".." at the top of the directory list. This enables you to move up a directory. Press **Select**, to highlight the desired drive, ([-A-] or [-C-]) then press **Select** again.

**Step 7.** Copy the file by pressing **Enter**.

## Deleting a File

This allows you to delete a file from the [-C-] or [-A-] drive.

**Step 1.** To access the Delete menu press **File Setup**, **File Manager**, **Delete**.

**Step 2.** Select the type of file you want to delete (ENR tables, states, traces, limits, frequency lists or screens).

**Step 3.** Select the drive where the file you wish to delete is located, by pressing **Tab** → then press using the RPG or arrow keys to highlight [-C-] or [-A-], then press **Select**.

**NOTE** If the correct drive is not listed in the Path: field, highlight ".." at the top of the directory list. This enables you to move up a directory. Press **Select**, to highlight the desired drive, ([-A-] or [-C-]) then press **Select** again.

**Step 4.** Select the file you want to delete by moving the cursor with the RPG or arrow keys to highlight the file name.

**Step 5.** Press **Enter** and your file is now deleted and is no longer visible in the directory displayed on your NFA.

## Working with Tables

The Frequency List, ENR Table and Limit Line Editor use table forms. The following is an overview of how to use the common features in these tables.

**Table 1-4 Using Tables**

| To... | Use the... |
|---|---|
| Move the highlight bar within the table | **Tab** keys |
| Bring the highlight bar to the top of the table | **Home** key |
| Clear the table of all entries | **Clear Table** menu key |
| Delete a single row entry | **Delete Row** menu key |
| Add a new entry | **Add** menu key |
| Move the highlight bar up one row | **Row Up** menu key |
| Move the highlight bar down one row | **Row Down** menu key |
| Move the table up a page block | **Page Up** menu key |
| Move the table down a page block | **Page Down** menu key |
| Enter a value | Numerical key pad |
| Terminate a value | The unit values presented by the menu keys [a] |
| Connect Limit Line points | The arrow keys or the RPG |

a. A limit line value is a limit less value where it depends on the result scale used. To terminate use the scale linear termination menu keys.

# 2 Making Basic Measurements

This chapter describes how to make basic noise figure measurements using your Noise Figure Analyzer and also covers the most common measurement related tasks.

## What You will Find in this Chapter

This chapter covers:

- Entering ENR Data
- Setting the Measurement Frequencies
- Setting the Bandwidth and Averaging
- Calibrating the Analyzer
- Displaying the Measurement Results
- Example of How to Make a Basic Amplifier Measurement

# Entering ENR Data

You can enter ENR data for the noise source you are using as a table for measurements at several frequencies, or as a single spot value for measurements at a single frequency.

## Selecting a Common ENR Table

To use the same ENR table for calibration and measurement, press the **Common Table** menu key set the **Common Table(On)**, see Figure 2-1.

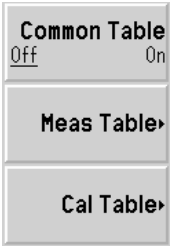
This is the default setting. In this mode the **Cal Table** is not accessible.

**Figure 2-1 Menu Keys showing Common ENR Table Enabled**


To use different ENR tables for calibration and measurement, press the **Common Table** menu key set the **Common Table(Off)**, see Figure 2-2.

In this mode, the **Cal Table** menu key is accessible. This is the ENR table of the noise source used to calibrate the Noise Figure Analyzer. The **Meas Table** is used to make the measurements.

**Figure 2-2 Menu Keys showing Common ENR Table Disabled**



## Entering ENR Table Data

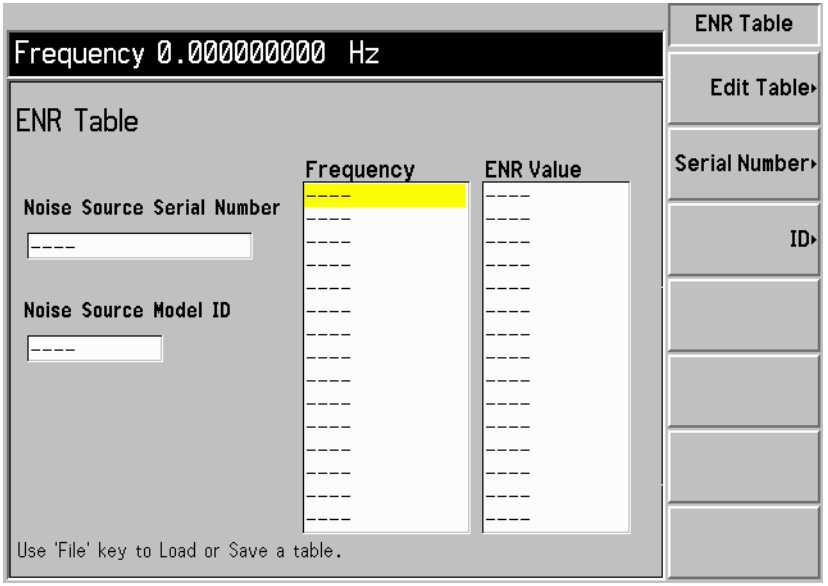
You can enter ENR data in the form of an ENR table in four ways:

- manually by inputting the required frequencies and corresponding ENR values
- loading the ENR data from a diskette, on which the data has been previously stored
- loading the ENR data from the internal memory, where the data has been previously stored
- loading of the ENR data using the GPIB Programmer, see the *Programmer's Guide* for more details

### To enter ENR table data manually

**Step 1.** Press the **ENR** key, and the **ENR Table** menu key.

**Figure 2-3 An Empty ENR Table**




**Step 2. Optional Step**

Press the **Serial Number** menu key and enter the noise source serial number using the numeric keys and the Alpha Editor.

**Step 3. Optional Step**

Press the **ID** menu key and enter the noise source model number using the numeric keys and the Alpha Editor.

**Step 4.** Press the **Edit Table** menu key to enter the noise source ENR values.

**Step 5.** Enter the first frequency using the numeric keys in the table using the unit termination menu keys.

**Step 6.** Press the **Tab —>** key to move the highlight to the ENR Value column and enter the corresponding ENR value of the ENR list.

When terminating the ENR value you can use either **dB**, **K**, **C**, or **F** menu keys. However, the result which appears in the table is in dB.

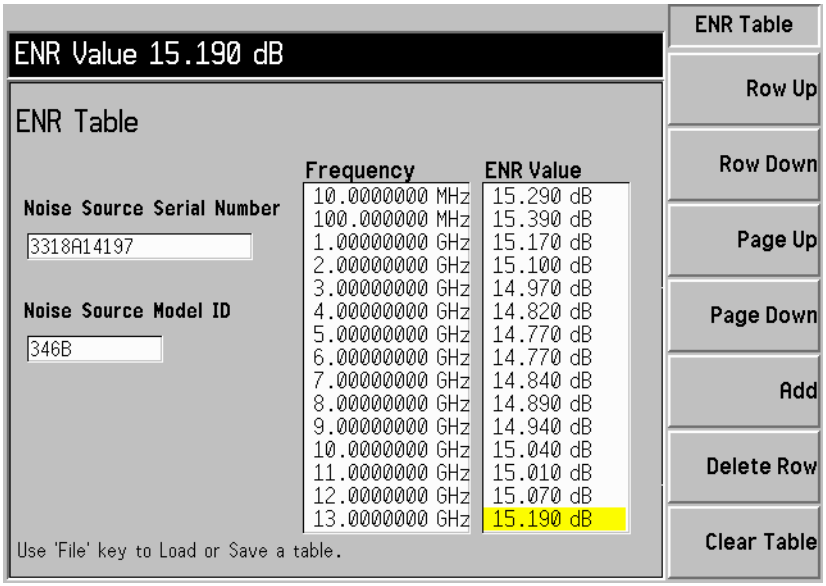
**Step 7.** Press the **Tab —>** key to move the highlight to the Frequency column and enter the next frequency value on the ENR list.

**Step 8.** Repeat steps 5 to 7 and until all the frequency and ENR values you need are entered.

**Step 9.** After completing the ENR table entries, press the **Prev** key or **ENR** key to return to the ENR menu.

**Step 10.** Once you have completed entering the ENR data, save the ENR table using the **File** key.

**Figure 2-4** **A Typical ENR Table after data entry**




**NOTE** If you do not save the ENR table, it is lost the next time you power down or preset the instrument, as the data is temporarily stored in volatile memory. This is overcome if you use **Power On(Last)** or **Preset(User)** which contains an ENR table.

**To load ENR data from memory**

**Step 1.** If the ENR file is on diskette, insert the diskette into the floppy drive of the Noise Figure Analyzer.

**Step 2.** Press the **File** key to access the File Manager.

**Step 3.** Press the **Load** menu key to access the file system.

**Step 4.** Press the **ENR** menu key.

**Step 5.** Press either the **Meas Table** or **Cal Table** menu key.

A list of available files on the [-A-] or [-C-] drive is displayed. Use the arrow keys to access the appropriate file.

**Step 6.** Press the **Enter** key.

## Saving an ENR Table

You can save an ENR table to the Noise Figure Analyzer's internal memory or to floppy disk as follows:

**Step 1.** Press the **File** key.

**Step 2.** Press the **Save** menu key.

**Step 3.** Press the **ENR** menu key.

**Step 4.** Press either the **Meas Table** or **Cal Table** menu key.

The **Alpha Editor** now appears, allowing you to create a name for the file.

**Step 5.** Input the name of the ENR table.

**Step 6.** Select using the arrow keys whether you want to save the files to the [-A-] or [-C-] drive.

**Step 7.** Press **Enter** to terminate.

## Entering a Spot ENR Value

To enter a Spot ENR value:

**Step 1.** Press the **ENR** key, then the **Spot ENR** menu key.

**Step 2.** Enter an ENR value using the numeric keys and terminate it using the unit termination menu keys. The default value is 15.20 dB.

**NOTE** If the frequency you want to measure is not a listed ENR value, then you need to interpolate the ENR list to an appropriate value.

**NOTE** To enable spot ENR mode to operate, press the **ENR** key, and select the **ENR Mode(Spot)** menu key.

## Changing the Default $T_{cold}$ value

When working in different temperature conditions you can change the $T_{cold}$ value to accommodate the condition.

To change the $T_{cold}$ value:

**Step 1.** Press the **ENR** key.

**Step 2.** Press the **Tcold** menu key changing it from the default **Tcold(Off)** to **Tcold(On)**.

**Step 3.** Press the **User Tcold** menu key

Enter a $T_{cold}$ value using the numeric keys and terminate it using the unit termination menu keys. The default $T_{cold}$ value is 296.5K.

The unit termination menu keys are in **K** (Kelvin), **C** (Celsius) or **F** (Fahrenheit).

# Setting the Measurement Frequencies

Three frequency modes are available:

- **Sweep** — the measurement frequencies are obtained from the start and stop (or equivalent center and span) frequencies and the number of measurement points.
- **List** — the measurement frequencies are obtained from the frequency list entries.
- **Fixed** — where the measurement frequency is taken at single fixed frequency.

## Selecting Sweep Frequency Mode

**NOTE** You can press **Full Span** at anytime to return the frequency range to the default full range setting. If you do this after a calibration and the calibration has been made over a narrower frequency range, it invalidates the calibration.

**Step 1.** Press the **Frequency/Points** key.

**Step 2.** Press the **Freq Mode** menu key and set the frequency mode to **Freq Mode(Sweep)**.

**Step 3.** Enter the frequency range by either entering the **Start Freq** and **Stop Freq** frequencies, or the **Center Freq** and the **Freq Span**.

**Step 4.** Press the **More 1 of 2**, **Points** menu keys.

**Step 5.** Enter the number of measurement points using the numeric keys to enter the number, press the **Enter** key to terminate.

## Selecting List Frequency Mode

You can create a frequency list in the following ways:

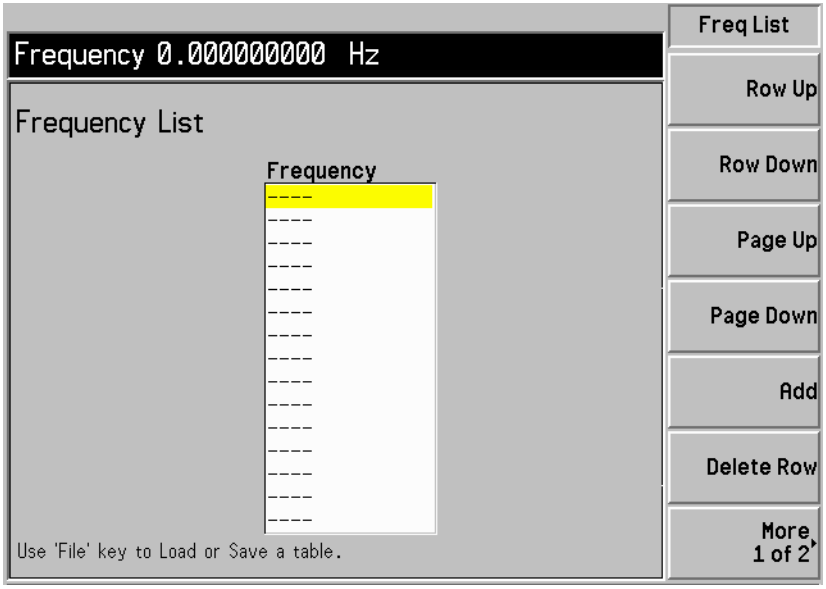
- Manually, by specifying each individual point
- From sweep points, by specifying the measurement frequency range and setting the Noise Figure Analyzer to generate equally spaced points within that range, using the **Fill** menu key.
- Loading a list from the internal memory or diskette, where the data has been previously stored.
- Loading a list using the GPIB Programmer, see the *Programmer's Guide* if you want to use this method.

### To Create a Frequency List Manually

**Step 1.** Press the **Frequency/Points** key and press the **More 1 of 2** menu key.

**Step 2.** Press the **Freq List** menu key.

**Figure 2-5** **An Empty Frequency List**




**Step 3.** Press the **More 1 of 2**, **Clear Table** menu keys.

**Step 4.** Enter the frequency value you want using the numeric keys. Terminate it using the unit menu keys which are presented to you.

**Step 5.** Press the **Tab —>** key or **Row Down** menu key.

Enter the next frequency value of the frequency list by using the numeric key pad and the unit termination keys.

**Step 6.** Repeat step 5 until your list is complete.

**Step 7.** Save the Frequency List to the Noise Figure Analyzer internal memory or to a diskette if required using the **File** key.

**NOTE**

You need to save the frequency list or it is lost if you power down the instrument, as the data is temporarily stored in volatile memory. This is overcome if you use **Power On(Last)** or **Preset(User)** which contains a Frequency List.

### Creating a Frequency List from Swept Points

When you have a series of swept frequency points and you want to create a frequency list from them, press the **More 1 of 2**, **Fill** menu keys. This clears the current frequency list and fills the list with the frequencies generated by the sweep frequency mode.

## Selecting Fixed Frequency Mode

The fixed frequency mode is used when you want to make a measurement at a single frequency.

To set a fixed frequency:

**Step 1.** Press the **Frequency/Points**, **Freq Mode** menu keys.

**Step 2.** Press the **Fixed** menu key to set the frequency mode to **Freq Mode(Fixed)**.

**Step 3.** Enter the frequency value using the numeric keys and the unit termination menu keys.

# Setting the Bandwidth and Averaging

## Selecting a Bandwidth Value

**Step 1.** Press the **Averaging/Bandwidth** key.

The current bandwidth is shown on the **Bandwidth** menu key.

**Step 2.** Press the **Bandwidth** menu key and select the bandwidth you want from the list of available options.

**NOTE** This feature is not applicable to N8972A. The bandwidth is fixed at 4MHz.

## Setting Averaging

Increased averaging reduces jitter and provides smoother display traces. However, the measurement speed is sacrificed.

**Enabling averaging**

Averaging can be enabled by setting the **Averaging(On)**. To disable averaging set **Averaging(Off)**

### Selecting the Number of Averages

**Step 1.** Press the **Averaging/Bandwidth** key, and then the **Averages** menu key.

**Step 2.** Enter the numeric value you want using the numeric key pad. Terminate it with the **Enter** key.

### Setting the Averaging Mode

Averaging Mode can be set to **Average Mode(Point)** or **Average Mode(Sweep)**.

**NOTE** The N8972A only functions in point average mode.

# Calibrating the Analyzer

Calibration is necessary to compensate for the noise contribution of the Noise Figure Analyzer and any associated cabling etc. in the measurement path.

To perform calibration you need to enter the ENR values and set up the frequency range, number of measurement points, bandwidth and the averaging used for the measurement. For more details on calibration, such as when to perform calibration and when calibration is invalidated etc. see the User's Guide.

## To perform a calibration

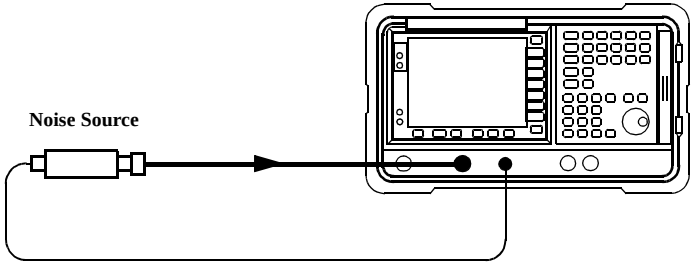
**Step 1.** Input the ENR values of the noise source into the Noise Figure Analyzer, or verify that the correct ENR table is loaded.

See "Entering ENR Data" on page 23 for more details.

**Step 2.** Configure the measurement parameters (frequency range, number of points, bandwidth and averages) you want to use for the measurement.

**Step 3.** Connect the noise source output directly to the Noise Figure Analyzer input.

**Figure 2-6 Noise Figure Analyzer Calibration**




**NOTE** You need an adapter on the Noise Figure Analyzer input unless the noise source is an Agilent 346B Option 001 (Type N male) output connector.

**Step 4.** If required select an input attenuator range by pressing the **Corr** key and the **Input Cal** menu key to set the minimum and maximum input attenuation.

See "Selecting the Input Attenuation Range" on page 35 for mode details on input attenuation.

**Step 5.** Press the **Calibrate** key twice to initiate the calibration.

## Selecting the Input Attenuation Range

When measuring a high-gain device you need to increase the input attenuation. If you do not know the gain of the DUT, you can perform calibration using the default range, note what error codes are presented and then calibrate again using the greater attenuation values. If the Noise Figure Analyzer continues to display error codes, there is a need to add external attenuator pads and correct for this using the Loss Compensation. This is explained in "Setting Loss Compensation" on page 55.

If an error message occurs while calibrating, you need to recalibrate. For a complete list of error codes see the User's Guide.

To select the input attenuation:

**Step 1.** Press the **Corr** (Corrected) key.

**Step 2.** Press the **Input Cal** menu key and select the attenuation range you want

**Step 3.** Set the attenuator range using the **Min Atten** and **Max Atten** menu keys, and select the attenuation values you want from the list.

# Displaying the Measurement Results

The following display format features are available:

- Graph, Table or Meter mode display
- Single or dual-graph display allowing any two available result types to be displayed simultaneously
- Zoom to display only one result graph on the display
- Combine option to display two result types on the same graph
- Markers for searching the trace
- Display a live trace, a memory trace or both
- Save the current trace data to memory
- Switch the graticule on or off
- Switch display annotation on or off

## Selecting the Display Format

You can display the measurement results in either:

- Graph format
- Table format
- Meter format.

To set the display format:

**Step 1.** Press the **Format** key.

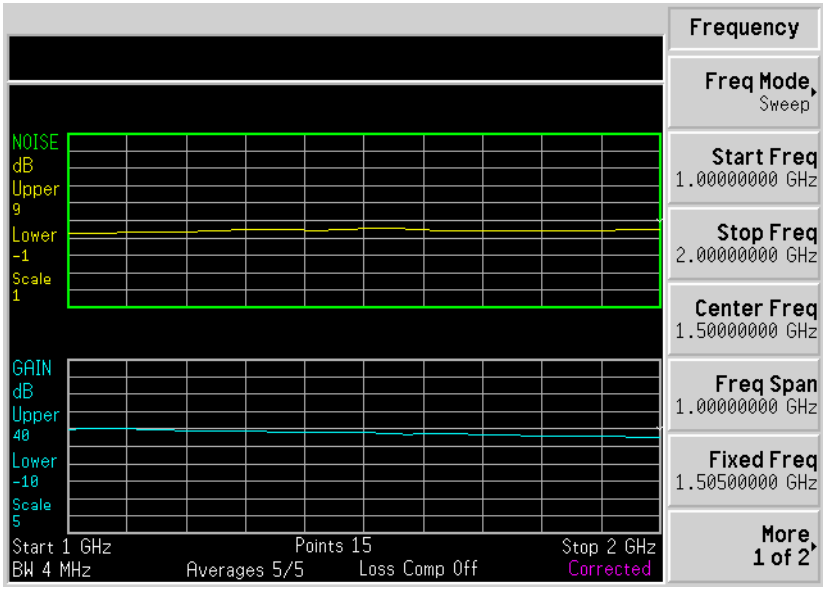
**Step 2.** Press the **Format** menu key and select the **Graph**, **Table** or **Meter** menu key to select the display mode you want.

### Navigating Around the Display

**Active Graph**

The active graph is highlighted by a green border. Noise Figure is the active graph by default.

**Figure 2-7** **Dual-graph display**




**Changing the Active Graph**

To change the active graph, press the  key below the display. This key allows you to set the upper or lower graph as the active graph.

**NOTE**

When in table or meter format the  key changes the active parameter.

**Viewing the Full Screen**

You can fill the entire display and remove the menu keys and certain annotation from the display. Press the **Full Screen** key to view the full screen. Pressing the **Full Screen** key again returns it to a previous display.

**NOTE**

The Full Screen key also functions in table or meter format.

## Setting which Result Types are Displayed

**To specify which measurement results are displayed**

**Step 1.** Press the **Format** key, then the **Format** menu key

**Step 2.** Select the Format by pressing the appropriate menu key.

**Step 3.** Select which result is active, using the  key.

**Step 4.** Press the **Result** key and select the result type that you want to display.

**Step 5.** Press the  key to make the other measurement parameter active.

**Step 6.** Press the **Result** key and select the result type you want to display.

**NOTE**

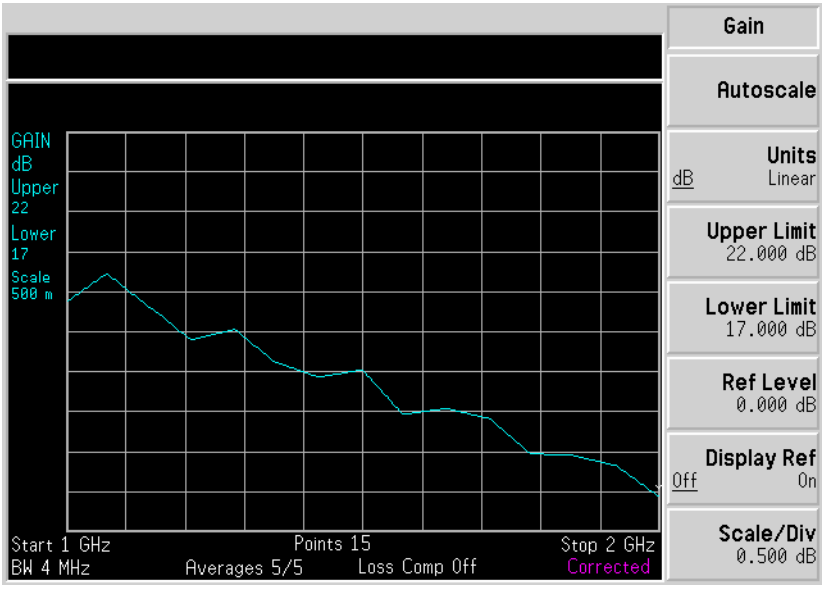
When you press the **Scale** key, the active result for the selected parameter is shown.

## Graphical features

### Viewing a single graph

While in graph format mode, you can press the  key located below the display and the active graph fills the display as a single graph.

**Figure 2-8** **Displaying a single graph**




### Combining the two graphs on the same graph

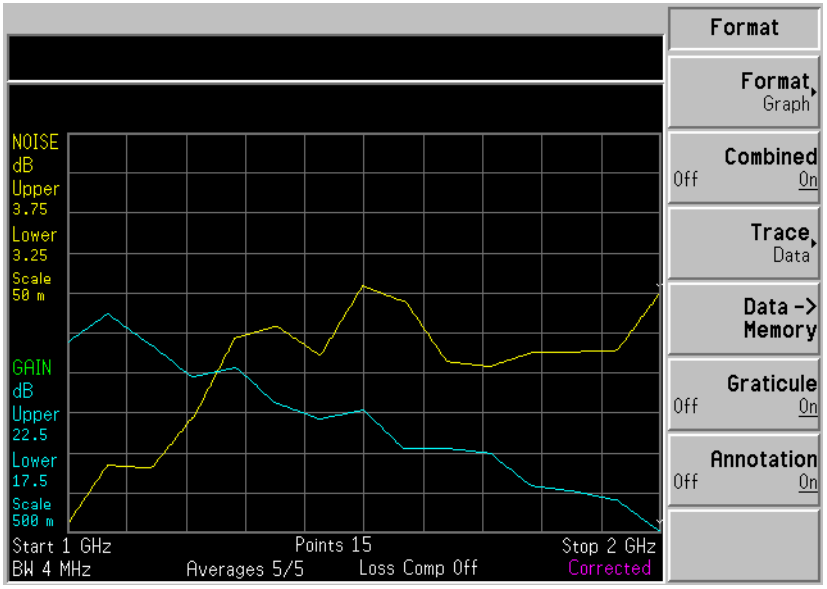
The default setting is **Combined(Off)** and the graphs are not combined.

To combine the two graphs:

**Step 1.** Press the **Format** key and ensure **Format(Graph)** is selected.

**Step 2.** Press the **Combined(On)** menu key to combine the two currently displayed graphs on the same graph.

**Figure 2-9** **Typical display with two traces combined on the same graph**




### Displaying the Current Data Trace and the Recalled Memory Trace

When a trace finishes its first complete sweep the **Data -> Memory** menu key becomes enabled.

To save a trace to memory, press the **Data -> Memory** menu key. After pressing the **Data -> Memory** menu key, the **Trace** menu key becomes active.

To view the saved trace, press the **Trace** menu key, followed by the **Memory** menu key. The recalled trace is presented in the display.

To view both the saved trace and the current active trace, press the **Trace** menu key, followed by the **Data & Memory** menu key.

To view the current data trace only, press the **Trace** menu key, followed by the **Data** menu key. This is the default setting.

### Turning the Graticule On and Off

To turn the graticule on or off:

**Step 1.** Press the **Format** key.

**Step 2.** Press the Graticule menu key to set it to the Graticule(Off) or Graticule(On) as required.

### Turning the Display Annotation On or Off

To turn the annotation on or off:

**Step 1.** Press the **Format** key.

**Step 2.** Press the Annotation menu key to set it to Annotation(Off) or Annotation(On) as required.

## Setting the Scaling

You can set the result's scale parameters in the active graph. To set the scale, press the **Scale** key.

To change the active graph, press the **Result** key and select another measurement parameter's menu key. Press the **Scale** key to set the scale of the selected measurement parameter.

You can set the scale for the measurement parameter or press the **Autoscale** menu key. Pressing **Autoscale** selects the optimum values for Upper Limit, Lower Limit, and Scale/Div.

**NOTE** When **Autoscale** is pressed and limit lines are displayed, the limit line may no longer appear in the display.

### Setting the Reference Level

**NOTE** The reference level is only visible when the **Display Ref(On)** is enabled.

**Step 1.** Press the **Display Ref** menu key if you want the reference level displayed in the active graph. Set the **Display Ref(On)** which switches the reference level on. The default setting is **Display Ref(Off)**.

**Step 2.** Press the **Ref Level** menu key. Change the reference level value using the RPG or the numeric keys. Values that are entered using the numeric keys, are terminated using the **Enter** key.

## Working with Markers

**NOTE** The marker functions only apply when you are working in graph format.

The Noise Figure Analyzer features four independent markers. **Marker(1⇑)** and **Marker(2⇑)** are associated with the upper graph trace, and **Marker(3⇓)** and **Marker(4⇓)** are associated with the lower graph trace.

### Selecting Markers

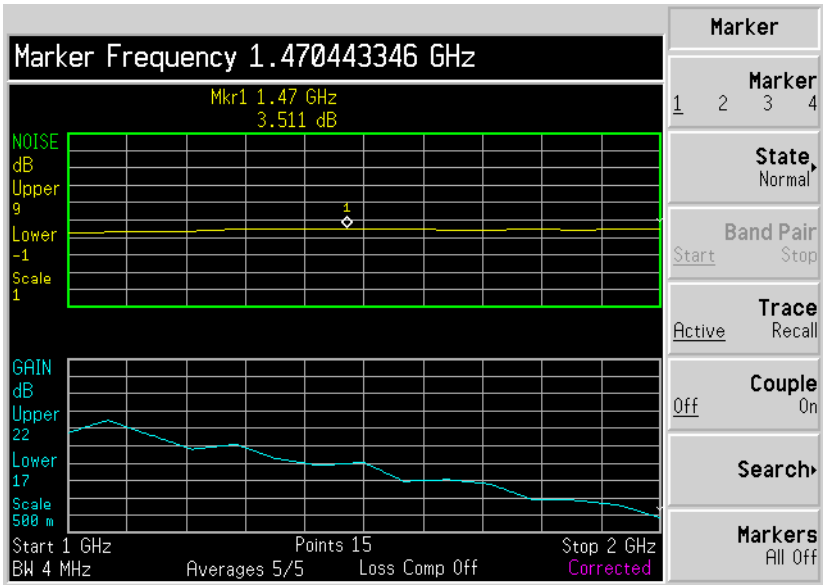
To select a marker:

**Step 1.** Press the **Marker** key.

**Step 2.** Press the Marker menu key to select the marker of interest.

**Step 3.** Press the **State** menu key and press the **Normal** menu key to highlight it.

**Figure 2-10 One Marker in Normal State**




Turn the RPG to place the marker at the point on the trace you want to measure or use the numeric keys to enter the frequency of interest.

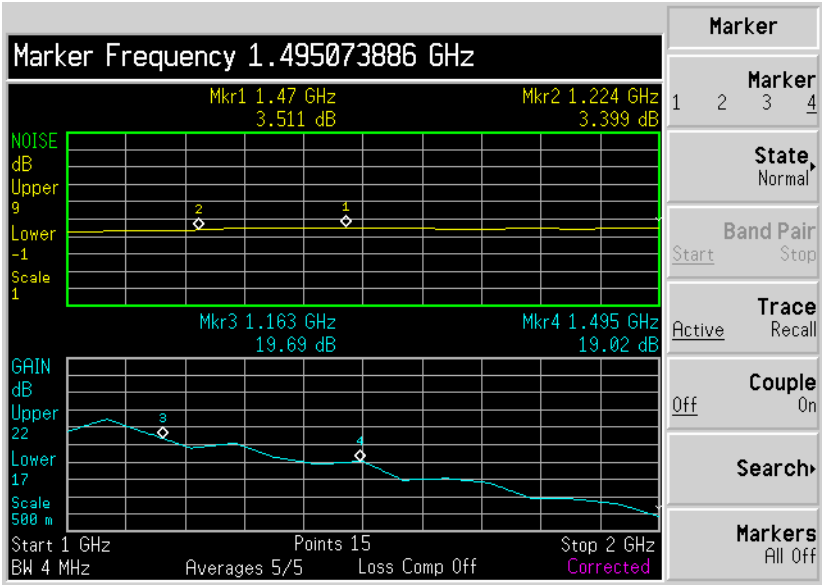
**To turn an active marker off**

To turn an active marker off press the **State** menu key and press the **Off** menu key to highlight it. This also removes the marker annotation from the display and uncouples any marker functions.

**To change the active marker**

The default active marker setting is **Marker(1⇑)**. To change the active marker, press the **Marker** menu key. This moves the active marker from **Marker(1⇑)** to **Marker(2⇑)**. Press it again and it moves the active marker from **Marker(2⇑)** to **Marker(3⇓)**. This process is repeated until it returns to the **Marker(1⇑)**. See Figure 2-11.

**Figure 2-11 Four Markers in Normal State**




**To Switch all the Markers Off**

To switch all the markers off press **Markers(All Off)**. This turns off all the markers and associated annotation.

### Changing the Marker States

**To use Delta Markers**

The **State(Delta)** menu key places a reference marker at the current position of the active marker. This enables you to measure the difference between the reference marker and an active marker position on the trace.

To activate a Delta marker:

**Step 1.** Press the **Marker** key.

**Step 2.** Press the **Marker** menu key to select the marker of interest.

**Step 3.** Press the **State** menu key and press the **Delta** menu key to highlight it. Use the RPG to move the Delta marker from the reference. The annotation displays the difference.

**To use Band Pair Markers**

The **State(Band Pair)** menu key places two markers allowing you to choose to move either the normal marker or the reference marker. The position of the reference marker remains fixed until **Band Pair(Normal)** menu key is pressed and the active marker becomes the fixed marker. This can be altered by pressing the **Band Pair(Ref)** menu key to enable the reference marker as the active marker. The active marker has its frequency and noise parameter values annotated in the display window relative to the reference marker.

To activate the Band Pair Markers:

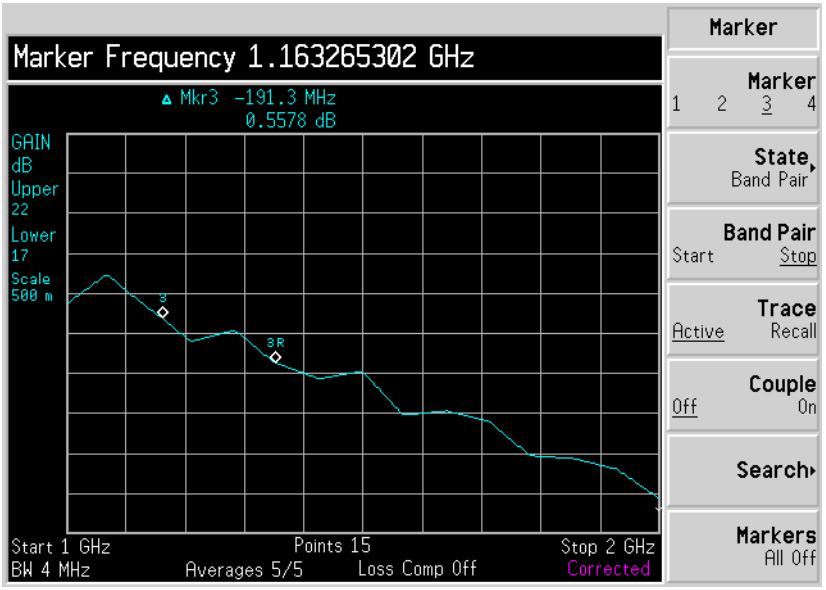
**Step 1.** Press the **Marker** key.

**Step 2.** Press the **Marker** menu key to select the marker of interest.

**Step 3.** Press the **State** menu key and press the **State(Band Pair)** menu key to highlight it.

**Step 4.** Use the RPG to move the active marker from the reference. The annotation displays the difference between the reference and the normal markers position.

**Figure 2-12** **Band Pair with Normal Marker Enabled**




### Marking Memory Traces

To place a marker on the recalled memory trace:

**Step 1.** Enable the **Trace(Memory)** menu key.

**Step 2.** Set the marker you want to use to **Normal**, **Delta**, or **Band Pair**

The marker is placed on the memory trace. If **Trace(Data&Memory)** is enabled, switching between **Trace(Data)** and **Trace(Memory)** switches the marker between the traces.

### Coupling Markers

To couple markers between the upper and lower graph traces:

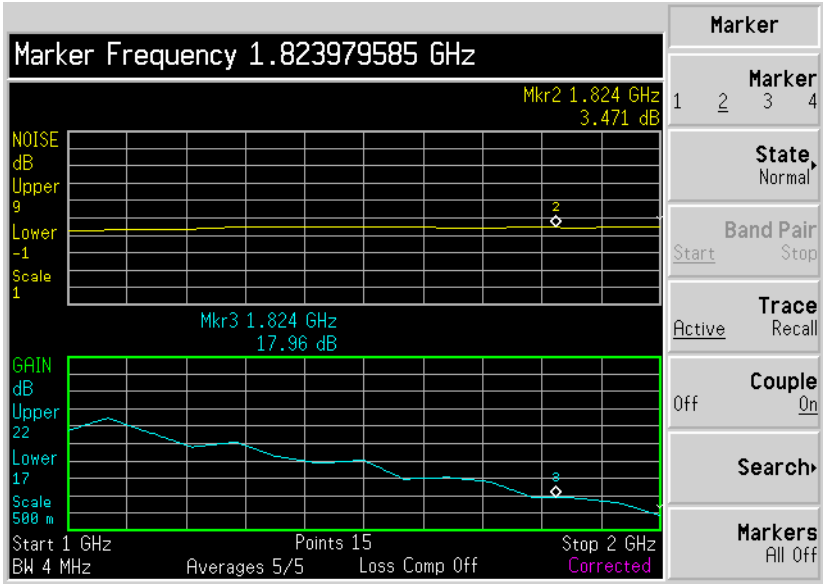
**Step 1.** Place a marker on both traces.

For details on setting markers, see "Selecting Markers" on page 43.

**Step 2.** Press the **Couple** menu key to set the **Couple(On)** each of the markers.

The markers have their frequency and noise parameter values annotated in the display window.

**Figure 2-13** **Coupled Markers**

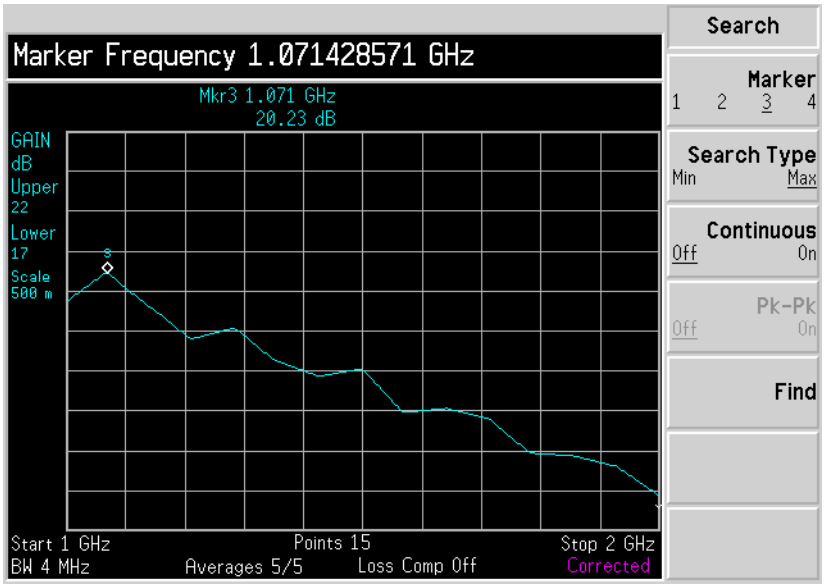



### Searching with Markers

**Searching for Min or Max point**

You need to have activated a marker state to Normal or Delta to perform a minimum or maximum search.

**Figure 2-14 Typical Trace showing Maximum Point Found**




To search for the minimum point, select the **Search Type(Min)**:

**Step 1.** Press the **Search** menu key.

**Step 2.** Press the **Search Type** menu key to select the **Search Type(Min)**.

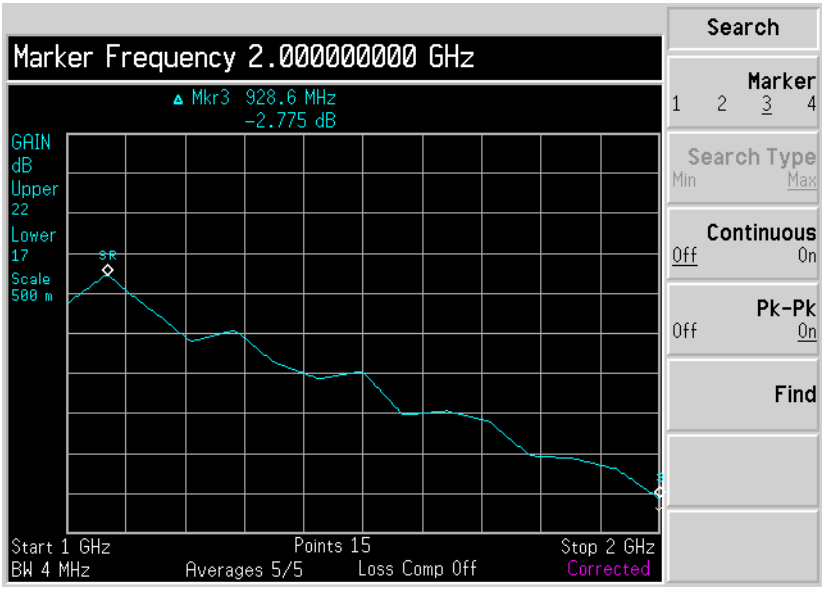
**Step 3.** Press the **Find** menu key.

If you want to continuously find the maximum point on the trace, select **Continuous(On)**.

**Searching for Peak to Peak points**

You need to have activated a marker state to Band Pair to perform a Peak to Peak search.

**Figure 2-15 Peak to Peak Found**




**Step 1.** Press the **Search** menu key.

**Step 2.** Press the **Search Type** menu key to select **Pk-Pk(On)**.

**Step 3.** Press the **Find** menu key.

If you want to continuously find the maximum and minimum points on the trace, select **Continuous(On)**.

# Indicating an Invalid Result

Several invalid result conditions may exist simultaneously. These conditions are ranked in order of severity and only the most severe condition present is displayed.

The ranking order is:

**Table 2-1 Ranking Order of Invalid Result Conditions**

| Ranking Order | Invalid Result Condition | Marker Indicator |
|---|---|---|
| 1 | Hot power ≤ cold power | "==" |
| 2 | Corrected calculation not possible | "xx" |
| 3 | Measurement result calculation invalid | "--" |

The ranked condition 2 only occurs if a corrected measurement is requested and either:

- The RF range used at this measurement point is not calibrated.
- The RF range is calibrated, but the calibration data is invalid at this point.

# 3 Advanced Features

This chapter describes how to use the Limit Lines and Loss Compensation features on your Noise Figure Analyzer.

## What You will Find in this Chapter

This chapter covers:

- Setting up Limit Lines and using them for pass/fail testing of the measurements.
- Setting Loss Compensation and using this to correct for losses in cabling, switches, or connectors caused by temperature variations etc.

## Setting up Limit Lines

The Noise Figure Analyzer features four independent Limit Lines. The **Limit Line(1⇑)** and **Limit Line(2⇑)** are applied to the upper graph, and **Limit Line(3⇓)** and **Limit Line(4⇓)** are associated with the lower graph.

**To change the Limit Line**

The default limit line setting is **Limit(1⇑)**. To change the active marker, press the **Limit Line** menu key. This moves the active marker from **Limit Line(1⇑)** to **Limit Line(2⇑)**, press it again and it moves the active marker from **Limit Line(2⇑)** to **Limit Line(3⇓)**. This process is repeated until it returns to the **Limit Line(1⇑)**.

**Setting the Type of Limit Line**

To set the limit line type, choose **Type(Upper)** if you want it to be above the trace or **Type(Lower)** if you want it to be below the trace. Each of the four limit line needs to be set up separately.

**Enabling Testing against a Limit Line**

To set the testing of the trace against the limit line, choose **Test(On)** if you want to result reported or **Test(Off)** if you do not want the result reported. Each of the four limit line needs to be set up separately.

**NOTE**

After a failure the resultant report remains displayed until you switch **Test(Off)** or change the limit line type.

**To Display a Limit Line**

To display the limit line, choose **Display(On)**. To not display the limit line, choose **Display(Off)**. Each of the four limit line needs to be set up separately.

**To Switch all the Limit Lines Off**

To switch all the Limit Lines off press **Limit Lines(All Off)**. This simultaneously switches off all Limit Lines regardless of what graph or trace they are associated with.

**NOTE**

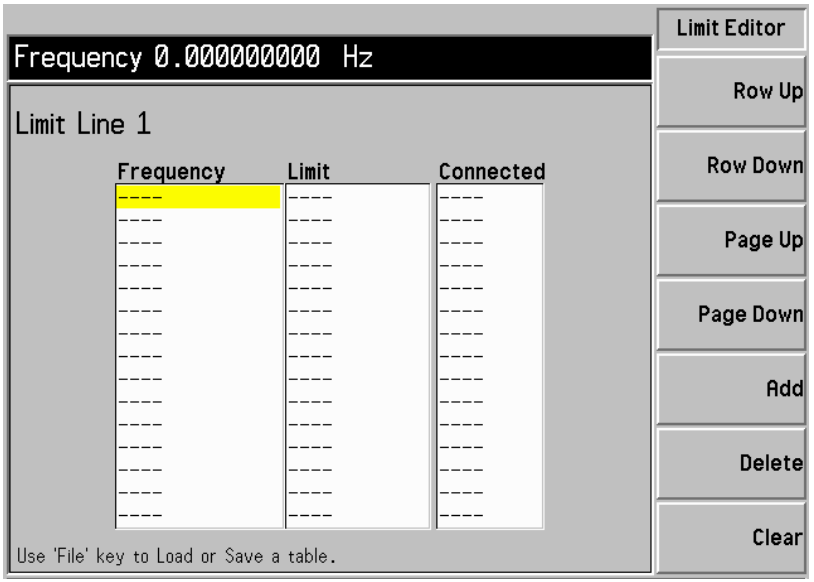
When a limit line is switched off the limit line data is not affected.

## Creating a Limit Line

**Step 1.** Press the **Limit Lines** key and select the limit line you want to create.

**Step 2.** Press the **Editor** menu key.

**Figure 3-1 Limit Line Table**




**Step 3.** Enter the first Frequency value. Press the **Tab** key.

**Step 4.** Enter the first Y-axis unit value. This value needs to calculated from the scale you are using to display the trace. Press the **Tab** key.

**Step 5.** Repeat this process until the limit line is defined.

**NOTE** Connected set to Yes connects the points to form a continous line. To disconnect any points, set Connected to **No** for the points(s) by pressing the arrow keys.

The limit line is now defined. Press the **Prev** key or **Limit Line** key to return to the limit line menu. To save a limit line table you save it as a limit line choosing which limit line number you want. See "Saving a File" on page 15.

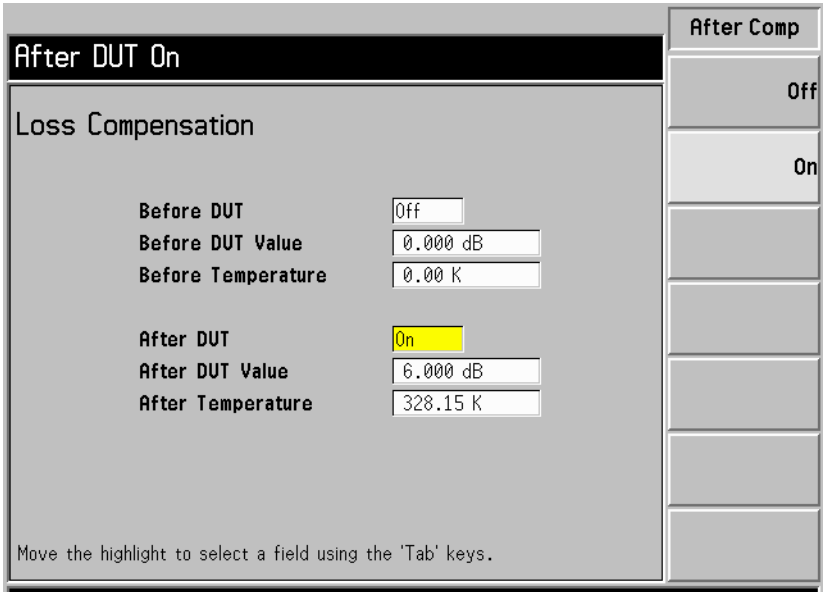
# Setting Loss Compensation

You can configure the Noise Figure Analyzer to compensate for losses due to cabling, connectors and temperature effects that occur in the measurement setup between the Noise Source and the DUT, and between the DUT and the Noise Figure Analyzer input.

## Configuring Loss Compensation

**Step 1.** Press the **Loss Comp** key to access the `Loss Compensation` form.

**Figure 3-2 Loss Compensation Form**




**Step 2.** When configuring loss compensation before the DUT, use the **Tab** key to navigate to the **Before DUT** field and set it to ON by selecting the **On** menu key to highlight it.

**Step 3.** Set the loss compensation value before the DUT, use the **Tab** key to navigate to the **Before DUT Value** field and input the required value for the loss occurring before the DUT.

**Step 4.** Set the temperature value before the DUT, use the **Tab** key to navigate to the **Before Temperature** field and input the required temperature loss value occurring before the DUT.

**Step 5.** When configuring loss compensation after the DUT, use the **Tab** key to navigate to the **After DUT** field and set it to ON by selecting the **On** menu key to highlight it).

**Step 6.** Set the loss compensation value after the DUT, use the **Tab** key to navigate to the **After DUT Value** field and input the required value for the loss occurring after the DUT.

**Step 7.** Set the temperature value after the DUT, use the **Tab** key to navigate to the **After Temperature** field and input the required temperature loss value occurring after the DUT.

# 4 Making Extended Frequency Measurements

This chapter describes how to make measurements outside the baseband frequency range of your Noise Figure Analyzer.

## What You will Find in this Chapter

This chapter covers:

- Overview of Configuring Extended Frequency Measurements
- An overview of the Measurement Modes

# Overview of Configuring Extended Frequency Measurements

Configuring extended frequency measurements involves four steps.

**Step 1.** Press the **System** key and configure the measurement system parameters as required using the **GPIB**, **LO GPIB** and **External LO** menu items.

**Table 4-1 System Parameters**

| Parameter | Description |
|---|---|
| NFA Address | This sets the NFA's GPIB address. Valid addresses are from 0 to 30. The default address is 8 |
| External LO Address | This sets the GPIB address of the External LO attached to the LO GPIB port. Valid addresses are from 0 to 30. The default address is 19 |
| LO GPIB Address | This sets the address through which other devices, attached to the LO GPIB, communicate with the NFA. Valid addresses are from 0 to 30. The default address is 8 |
| LO GPIB Control | The LO GPIB menu key accesses the `System LO GPIB Form`. This allows the NFA or another instrument to control the LO GPIB. Currently a not supported. |
| Command Set | This sets the External LO command language. The default setting is **Command Set(SCPI)** to operate a SCPI compliant LO. **Command Set(Custom)** is used when the External LO is not SCPI compliant and operated using the custom command strings. |

**Table 4-1 System Parameters**

| Parameter | Description |
|---|---|
| LO Commands | This accesses the `External LO Commands` Form. The form is used to enter the commands used to control a non-SCPI-compliant External LO. |
| Settling Time | This sets the settling time of the External LO. This is used as a settling period after the External LO frequency is changed. |
| Min and Max Frequency | This sets the minimum and maximum frequencies of the External LO. |

**Step 2.** Press the **Meas Mode** key to configure the measurement mode of the Noise Figure Analyzer.

For more details on the available measurement modes, see "Measurement Modes" on page 61.

**Step 3.** Press the **Mode Setup** key to configure the measurement mode parameters for the specific measurement mode you have selected.

**Step 4.** Configure the measurement (measurement frequency range, number of measurement points and averages etc.) using the **Frequency/Points** and **Averaging/Bandwidth** keys.

For more details on configuring measurements, including calibration see Chapter 2 , "Making Basic Measurements," on page 21.

# Measurement Modes

**Available modes**

The Noise Figure Analyzer offers the following measurement modes through the **Meas Mode** key on the front panel:

- The DUT is an amplifier-type device with no frequency conversion. This is the basic measurement mode where the measurement frequency is within the NFA's frequency range.
- The DUT is an amplifier-type device with frequency downconversion occurring in the measurement test setup (system downconversion). The LO can be either fixed or variable in this case.
- The DUT is a frequency downconverter (that is, frequency downconversion occurs in the DUT itself and not in the measurement test setup). The LO can be fixed or variable.
- The DUT is a frequency upconverter (that is, frequency up conversion occurs in the DUT itself and not in the measurement test setup). The LO can be fixed or variable.

**NOTE**

The **Amplifier** measurement mode is for any DUT that does not perform frequency conversion and includes amplifiers, filters, attenuators and so forth.

Noise figure measurements involving mixers are necessary when:

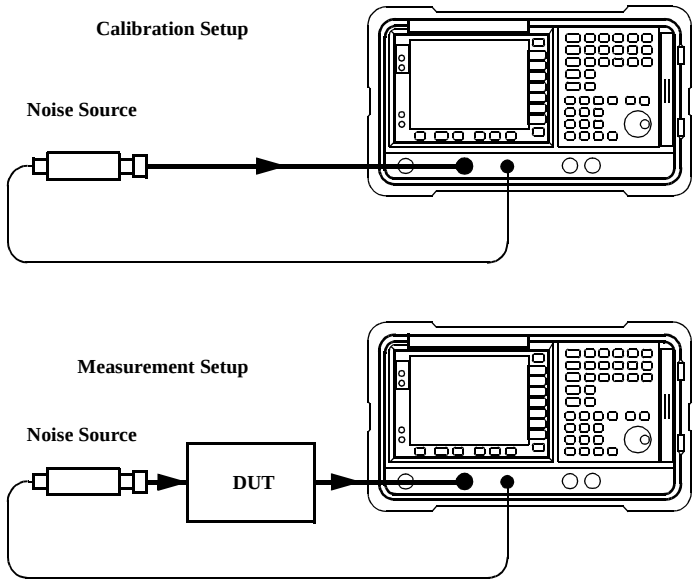
- The frequency conversion is part of the DUT. For example, the DUT is a mixer or a receiver.
- The frequency conversion is part of the measurement test set-up. The DUT is to be measured at a higher frequency than the NFA's frequency range covers, hence an external mixer and local oscillator are added to the measurement test set-up to convert this frequency to a frequency within the NFA's range.

The NFA can make a single frequency conversion, either in the DUT, or as an added **System Downconverter**, which configures the NFA as a frequency range extender. The NFA can also control an LO source remotely using the SCPI commands or the custom commands. Under this control the LO can be swept.

## Basic Measurement — No Frequency Conversion

The basic measurement setup is shown in Figure 4-1, allowing you to compare more complex setups with it.

**Figure 4-1 Basic Noise Figure Measurement — No Frequency Conversion**




When an uncorrected measurement is performed, the result is the measured Noise Figure of all of the components after the noise source. When the calibration setup is connected and the calibration performed, the NFA measures its own noise figure. When a corrected measurement is performed, the contribution of the calibration setup is removed from the uncorrected result, giving a corrected measurement of the DUT only.

For these measurements the NFA mode is set to

| | |
|---|---|
| **DUT** | **Amplifier** |
| **System Downconverter** | **Off** |

**NOTE** The input section of the NFA has a 3 GHz Low Pass Filter on both the Agilent N8972A and the N8973A.

## Frequency Down-converting DUT

In this mode, the DUT contains a frequency down-converting device, for example, a mixer or receiver.

There are two modes to choose from:

1. A variable frequency LO and fixed IF.

   Making this measurement, the NFA remains locked at one frequency and the LO sweeps.

2. A fixed frequency LO and variable IF.

   Making this measurement, the LO remains locked at one frequency and the NFA sweeps.

### Fixed IF Variable LO (N8970B Mode 1.3)

This is an overview of the key presses needed to setup the mode.

In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Downconv** |
| **System Downconverter** | No Access |
| **LO Mode** | **Variable** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **IF Frequency** | Enter a value |
| **Sideband** | **LSB**, **USB** or **DSB** |
| **LO Control** | **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

**NOTE** The External LO Power Level is displayed on the NFA as dBm.

### Variable IF Fixed LO (N8970B Mode 1.4)

These are an overview of the key presses needed to setup the mode.

In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Downconv** |
| **System Downconverter** | No Access |
| **LO Mode** | **Fixed** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **IF Frequency** | Enter a value |
| **Sideband** | **LSB**, **USB** or **DSB** |
| **LO Control** | **Off** or **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

**NOTE** The External LO Power Level is displayed on the NFA as dBm.

## Frequency Up-converting DUT

In this mode, the DUT contains a frequency up-converting device, for example, a transmitter measurement.

There are two modes to choose from:

1. A variable frequency LO and fixed IF.

   Making this measurement, the NFA remains locked at one frequency and the LO sweeps.

2. A fixed frequency LO and variable IF.

   Making this measurement, the LO remains locked at one frequency and the NFA sweeps.

### Fixed IF Variable LO (N8970B Mode 1.3 with SUM Sideband)

These are an overview of the key presses needed to setup using this mode. In this mode, the DSB measurement is not allowed.

In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Upconv** |
| **System Downconverter** | No Access |
| **LO Mode** | **Variable** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **IF Frequency** | Enter a value |
| **Sideband** | **LSB** or **USB** |
| **LO Control** | **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

### Variable IF Fixed LO (N8970B Mode 1.4 with SUM Sideband)

These are an overview of the key presses needed to setup using this mode. In this mode, the DSB measurement is not allowed.

In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Upconverter** |
| **System Downconverter** | No Access |
| **LO Mode** | **Fixed** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **IF Frequency** | Enter a value |
| **Sideband** | **LSB** or **USB** |
| **LO Control** | **Off** or **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

**NOTE** The External LO Power Level is displayed on the NFA as dBm.

## System Downconverter

The DUT is a non-frequency converting device, for example an amplifier or filter, and its frequency is higher than the NFA's measurement range (frequencies greater than 3.0 GHz). Frequency down-conversion is required within the measurement system, using a mixer, external to the DUT, to convert the signal of interest to the frequency range of the NFA.

There are two modes to choose from:

1. A variable frequency LO and fixed IF.

   Making this measurement, the NFA remains locked at one frequency and the LO sweeps.

2. A fixed frequency LO and variable IF.

   Making this measurement, the LO remains locked at one frequency and the NFA sweeps.

### Variable LO Fixed IF (N8970B Mode 1.1)

These are an overview of the key presses needed to setup using this mode. In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Amplifier** |
| **System Downconverter** | **On** |
| **LO Mode** | **Variable** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **IF Frequency** | Enter a value |
| **Sideband** | **LSB**, **USB** or **DSB** |
| **LO Control** | **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

### Fixed LO Variable IF (N8970B Mode 1.2)

These are an overview of the key presses needed to setup using this mode. In this mode, a DSB measurement is not allowed.

In the `Measurement Mode Form` set the following:

| | |
|---|---|
| **DUT** | **Amplifier** |
| **System Downconverter** | **On** |
| **LO Mode** | **Fixed** |

In the `Mode Setup Form` set the following:

| | |
|---|---|
| **LO Frequency** | Enter a value |
| **Sideband** | **LSB** or **USB** |
| **LO Control** | **Off** or **On** |
| **External LO Power Level** | Enter value and terminate using either **dBm** or **W** |

**NOTE** The External LO Power Level is displayed on the NFA as dBm.

# 5 Performing System Operations

This chapter describes how to perform the system-level tasks, such as configuring the Noise Figure Analyzer's GPIB address, defining the preset conditions and configuring an external LO.

# What You will Find in this Chapter

This chapter covers:

- Setting the GPIB Addresses
- Configuring the Serial Port
- Configuring the LO GPIB
- Configuring the Characteristics of an External LO
- Configuring the Internal Alignment
- Displaying Error, System and Hardware Information
- Presetting the Noise Figure Analyzer
- Defining the Power-On/Preset Conditions
- Restoring System Defaults
- Setting the Time and Date
- Configuring a Printer

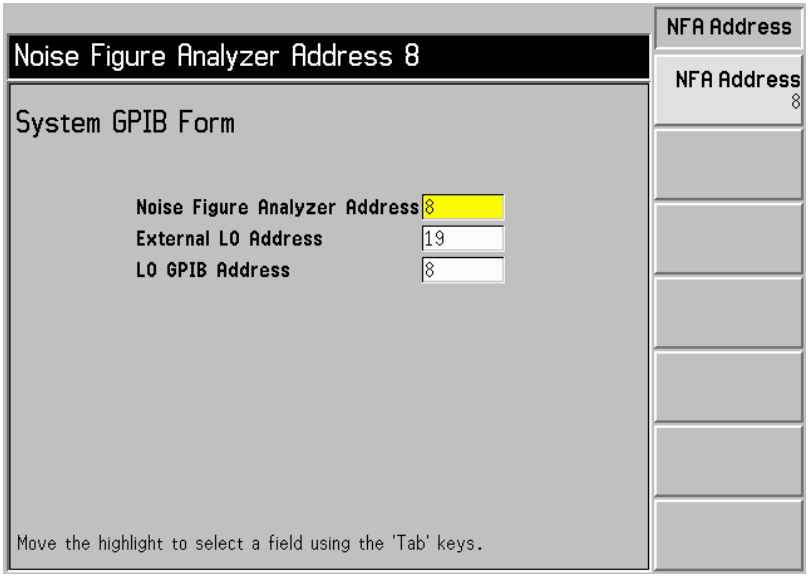
# Setting the GPIB Addresses

**NOTE** The LO GPIB does not support a Network Analyzer or plotters.

## To Set the GPIB Addresses

**Step 1.** Press the **System** key and press the **GPIB** menu keys.

**Figure 5-1 System GPIB Form**




**Step 2.** Using the **Tab** key to navigate through the form configure the GPIB parameters as required.

For a description of the GPIB parameters, see the analyzer online help or the User's Guide.

**NOTE** Ensure the **Remote Port** menu key is set **Remote Port(GPIB)**.

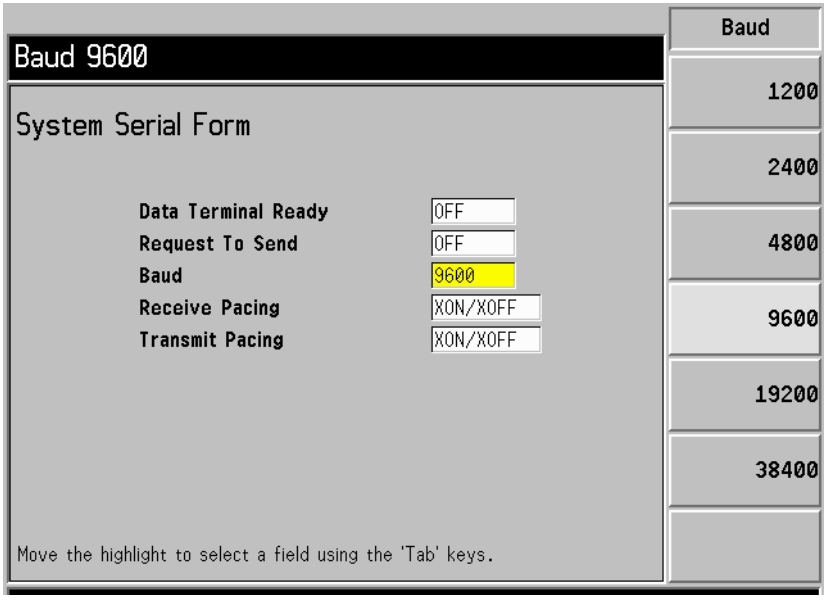
# Configuring the Serial Port

**Step 1.** Press the **System** key

**Step 2.** Press the **Serial** menu key.

The `System Serial Form` now appears. See Figure 5-2

**Figure 5-2 System Serial Form**




**Step 3.** Use the **Tab** keys to navigate through the form and the menu keys to configure the serial parameters as required.

For a description of the serial parameters, see the analyzer online help or the User's Guide.

**NOTE** Ensure the **Remote Port** menu key is set **Remote Port(Serial)**. This needs a power cycle to take effect.

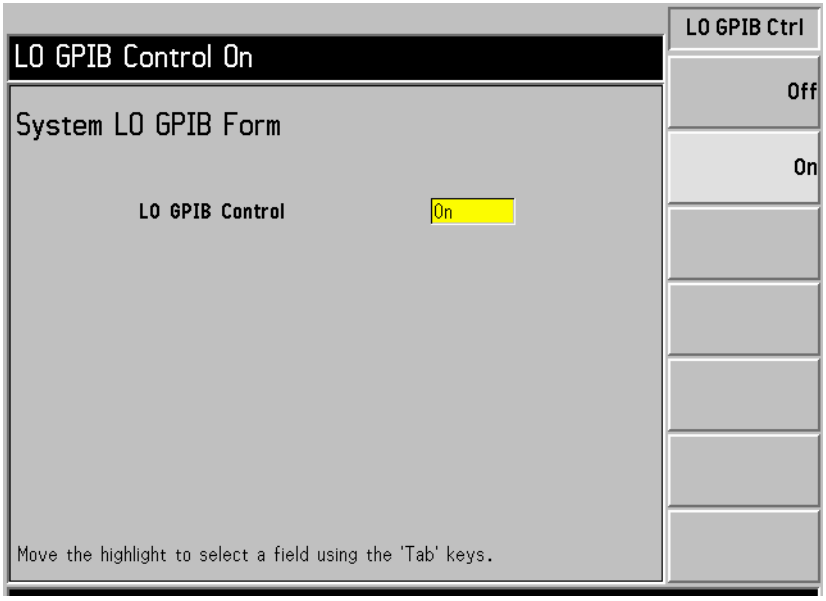
# Configuring the LO GPIB

**Step 1.** Press the **System** key

**Step 2.** Press the **LO GPIB** menu key.

You are presented with a `System LO GPIB Form`. See Figure 5-3

**Figure 5-3 System LO GPIB Form**




**Setting the LO GPIB Control**

This enables or disables the NFA as the LO GPIB controller.

When the LO GPIB Control is highlighted, the menu keys for this are presented to you. To disable the NFA as the LO GPIB controller, set the **LO GPIB(Off)**. When the NFA is disabled, another instrument on the GPIB can act as controller.

To enable the NFA as the LO GPIB controller, set the **LO GPIB(On)**.

# Configuring the Characteristics of an External LO

The NFA can control an external LO using its LO GPIB port.

## Custom Command Set

If the LO has a GBIB you are unlikely to use the custom command set. However, you can customize a command set to define the operation of a non-GPIB compatible LO.

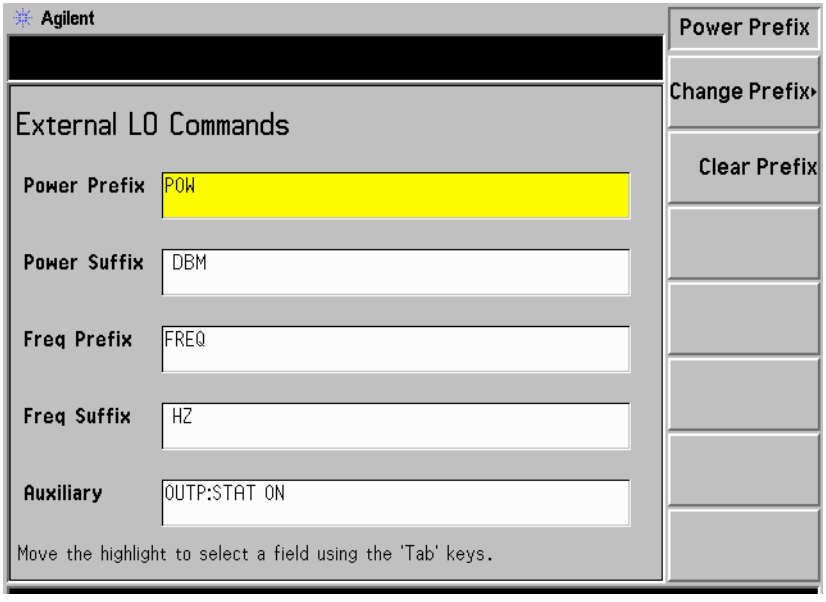
To access the menu to configure the command characteristics of an external LO:

**Step 1.** Press the **System** key.

**Step 2.** Select the **External LO** menu key.

**Step 3.** Select the **LO Commands** menu key.

**Figure 5-4 External LO Commands Form**

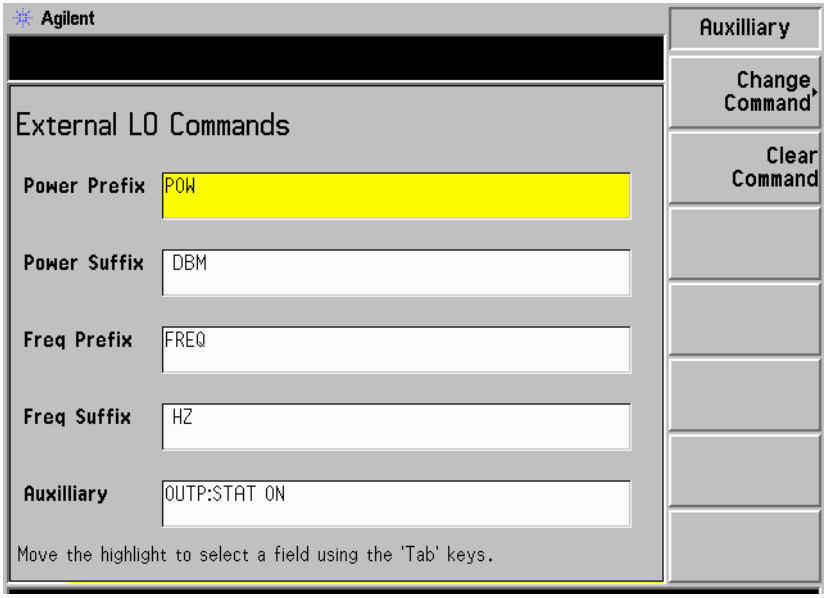


**NOTE** The default suffix commands have an intentional space inserted.

**Step 4.** Press the **Tab** key to move the highlight to the required position in the form.

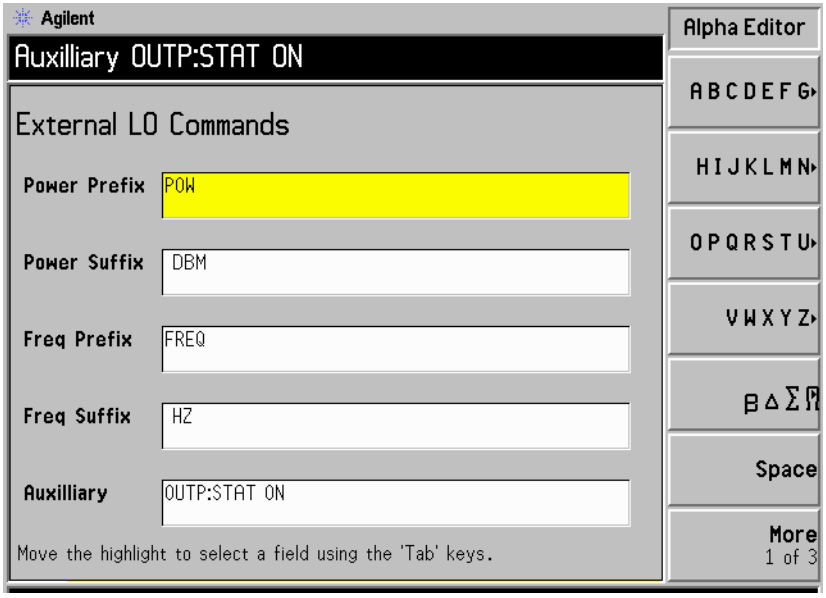
You can choose to enter the Prefix and Suffix of the power and frequency. Also you can enter an auxiliary command. This procedure explains this process using the auxiliary commands.

**Figure 5-5 External LO Auxiliary Menu Keys**




- Selecting the **Clear Command** menu key, clears the current command. See Figure 5-5 showing the Auxiliary menu keys.
- Selecting the **Change Command** menu key, you are presented with an Alpha Editor, allowing you to enter a command string using it and the numeric keys, see Figure 5-6. Press the **Prev** key to enter the command. The command string can have up to a maximum of Seventy-nine (79) characters.

**Figure 5-6 External LO Auxiliary Command Changes**




## Settling Time

The purpose of the settling time is to ensure that the NFA waits a sufficient amount of time after issuing a command to allow the LO's output to stabilize.

Pressing the **Settling Time** menu key allows you to set the settling time of NFA. Valid settling times are between 0 ms and 100 s. The default value is 100 ms.

## Minimum and Maximum Frequencies

The minimum and maximum frequencies, in most cases, represent the frequency capability of the LO. However, they do not affect the LO and are only used by the NFA to determine if the requested frequency parameter is acceptable. If an attempt to enter an out-of-range frequency is made, the NFA displays an invalid frequency entry error message.

Pressing the **Min Freq** menu key allows you to set the minimum frequency the NFA expects the External LO to have. The default value is 10 MHz.

Pressing the **Max Freq** menu key allows you to set the maximum frequency the NFA expects the External LO to have. The default value is 26.5 GHz.

# Configuring the Internal Alignment

Data from the internal alignment routine is necessary for accurate NFA operation and when enabled, the internal alignment routine runs continuously to ensure that the NFA is using current alignment data which improves the NFA's accuracy.

## Turning Alignment Off and On

**Step 1.** Press the **System** key.

**Step 2.** Press the **Alignment** menu key to access the Alignment menu.

**Step 3.** Press the **Alignment** menu key to turn alignment **Alignment(On)** or **Alignment(Off)** as required.

The default is alignment on.

## Changing Alignment Mode

**Step 1.** Press the **System** key.

**Step 2.** Press the **Alignment** menu key to access the Alignment menu.

**Step 3.** Press the **Alignment Mode** menu key to turn alignment mode **Alignment Mode(Point)** or **Alignment(Sweep)** as required.

The default is alignment mode is sweep.

# Displaying Error, System and Hardware Information

## Displaying the Error History

**Step 1.** Press the **System** key.

**Step 2.** Press **Show Errors** menu key to view the error queue.

To clear the error screen, press **Clear Error Queue**.

## Displaying System Information

**Step 1.** Press the **System** key.

**Step 2.** Press **Show System** menu key to view system information.

## Displaying Hardware Information

**Step 1.** Press the **System** key.

**Step 2.** Press **Show Hdwr** menu key to view hardware information.

# Presetting the Noise Figure Analyzer

To preset the analyzer using its factory defaults:

**Step 1.** Turn the NFA on by pressing the **On** key and wait for the power-up process to complete.

**Step 2.** Press **System**, **Power On/Preset**, **Preset (Factory)**.

**Step 3.** Press the green **Preset** key.

**NOTE** Turning on the analyzer performs an instrument preset. Turning on the analyzer also fetches alignment data; clears both the input and output buffers; turns off limit line testing; and sets the status byte to 0. The last state of the analyzer before it was turned off is recalled when **Power On(Last)** is pressed (under the **System** key).

# Defining the Power-On/Preset Conditions

You can set the NFA so that it returns to a user-defined state upon power-up and preset. The power-up and preset conditions can be different if required.

## Setting the Power On Conditions

**Step 1.** Press the **System** front panel key.

**Step 2.** Press the **Power On/Preset** menu key.

**Step 3.** Set **Power On** to **Power On(Last)** or **Power On(Preset)** as required.

'Last' means that the instrument, upon power-up returns to the state it was in when it was powered off.

'Preset' means the instrument returns to its defined preset state.

## Setting the Preset Conditions

You can set the NFA to return to its factory default state or a user defined state upon preset.

### To set the preset conditions to factory default

**Step 1.** Press the **System** front panel key.

**Step 2.** Press the **Power On/Preset** menu key.

**Step 3.** Enable the **Preset(Factory)** menu key.

### To set the preset conditions to user defined

**Step 1.** Configure the NFA to the desired state.

**Step 2.** Press the **System** front panel key.

**Step 3.** Press the **Power On/Preset** menu key.

**Step 4.** Enable the **Preset(User)** menu key.

**Step 5.** Press the **Save User Preset** menu key to save the current NFA state.

# Restoring System Defaults

**Step 1.** Press the **System** key

**Step 2.** Press the **More 1 of 3** menu key.

**Step 3.** Press the **Restore Sys Defaults** menu key.

# Setting the Time and Date

## To turn the time and date on and off

**Step 1.** Press the **System** key.

**Step 2.** Press the **Time/Date** menu key.

**Step 3.** Press the **Time/Date** menu key to turn alignment **Time/Date(On)** or **Time/Date(Off)** as required.

## To set the time and date

**Step 1.** Press the **System** key.

**Step 2.** Press the **Time/Date** menu key.

**Step 3.** Set the **Date Mode** to either US format (Month/Day/Year) or European format (Day/Month/Year).

**Step 4.** Set the time in hhmmss (hours, minutes seconds) format.

**Step 5.** Set the date in yyyymmdd (year, month, day) format.

# Configuring a Printer

**Printer connection**

To connect your printer turn off the printer and the NFA and connect the printer to the parallel I/O interface connector of the NFA using an IEEE 1284 compliant parallel printer cable.

If appropriate, configure your printer (see your printer documentation for more details on configuring your printer).

## To Configure a Printer

**Step 1.** Power on the NFA and the printer.

**Step 2.** Press the **Print Setup** key and then press the **Printer Type** menu key. Refer to the analyzer online help or User's Guide for a description of the options.

**Step 3.** Press **Printer Type** to access the **Printer Type** menu keys and press **Auto** to make the NFA attempt to identify the connected printer.

The printer should now be automatically recognised by the NFA. If the printer is not automatically recognised, then see the User's Guide for more details on printer setup.

## Testing Correct Printer Operation

When printer setup is complete test correct printer operation by pressing **Print Setup**, **Print (Screen)** and then pressing the **Print** key to print a test page.

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