FONIX® FP35

Quick Reference Guide

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Contents

Introduction

Welcome to the FP35 quick reference guide. This manual explains all the major features of the FP35 analyzer, but is not a comprehensive guide to all of its functions. If you require further explanation or details, see the FP35 Operator's Manual.

1.1 Front Panel Layout

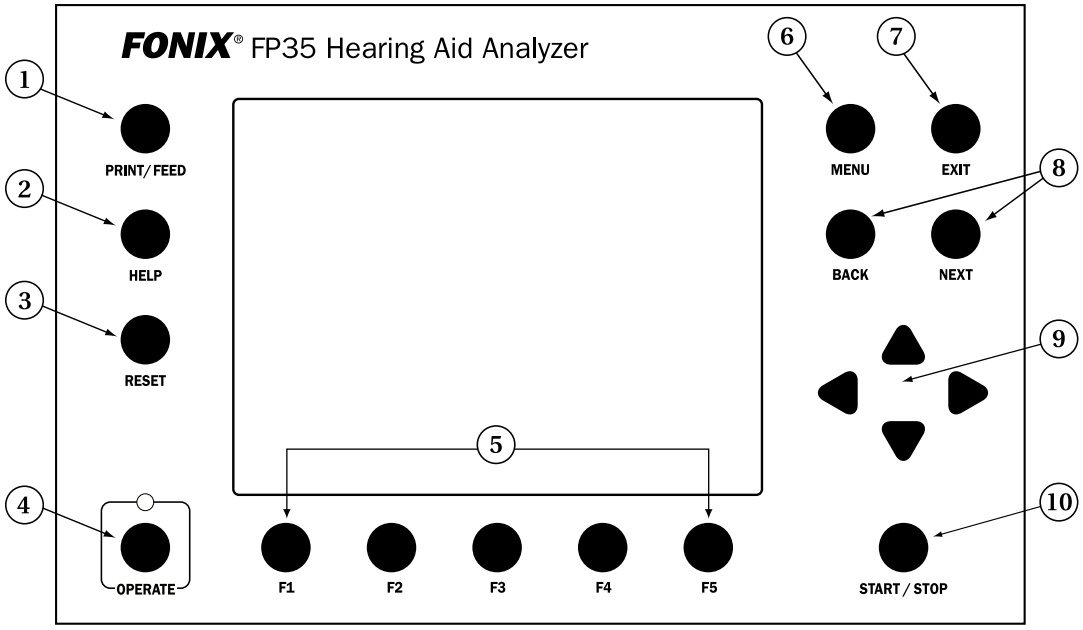


Figure 1.1—Front panel

The following is a short explanation of the basic functions of the keys on the FP35 front panel.

1. Print: Prints the current screen.
2. Help: Open the help window for the displayed screen.
3. Reset: Resets the analyzer, deleting measurements and returning many settings to their default selections.
4. Operate: Powers the analyzer on and off.
5. Function keys: F1—F5: Perform various functions, depending upon the displayed screen.

6. Menu: Opens the local menu or the default settings menu.
7. Exit: Exits from a screen.
8. Back & Next: Moves to the next measurement screen or through the menu system.
9. Arrow keys (up, down, right, left): Changes amplitude and frequency selections when in a measurement screen, and menu selections when in a local menu.
10. Start/Stop: Starts and stops a measurement.

1.2 Key Operation

This section describes the basic operation of the keys most often used on the FP35 analyzer. These keys are used to navigate through the different screens and pull up useful information and settings.

1.2.1 Navigating through the FP-35 screens

Most of the navigation through the FP35's screens are done with the function keys, the [NEXT] and [BACK] keys, and the [EXIT] key.

From the Opening screen, the function keys will take you to different measurement screens. For instance, [F3] will take you to one of the Coupler Multicurve screens, and [F2] will take you to one of the real-ear screens. The function of each key is displayed on the screen above the key.

The [NEXT] and [BACK] keys are used to take you to related screens. For instance, if you are in the Audiogram Entry screen, pressing [NEXT] will take you to the Real-ear SPL screen. [NEXT] and [BACK] are also used for navigating through the different menu levels.

The [EXIT] key is used to exit from the current screen. Pressing [EXIT] will never delete any measurements.

The [RESET] key can be used to return to the Opening screen. However, pressing [RESET] will delete measurements and reset settings that you may have changed. Unless this is your intent, it is recommended to use the [EXIT] key instead of [RESET].

1.2.2 Getting help

Pressing the [HELP] button will open a help window for the currently displayed screen. For instance, if you are in the Coupler Multicurve screen, pressing [HELP] will pop up a window containing a short explanation of all the commands available in the Coupler Multicurve screen. See Figure 1.2.2.

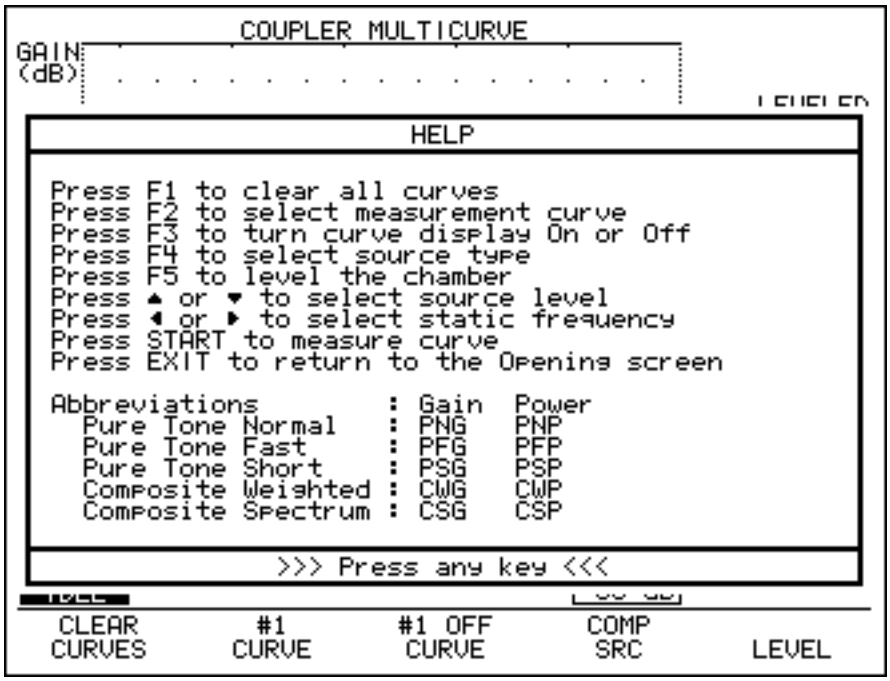


Figure 1.2.2—Help Screen

1.2.3 Using the local menus

Pressing the [MENU] button when in a measurement screen will open the local menu containing selection that pertain to the current screen. For instance, pressing [MENU] while in the ANSI 96 screen will open a local menu containing ANSI 96 selections. See Figure 1.2.3.

Advanced features and fine-tuning selections are often “hidden” away in an advanced menu reachable using the [NEXT] and [BACK] keys. Look at the title bar of the local menu to see if the [NEXT] and [BACK] keys are active in the displayed local menu.

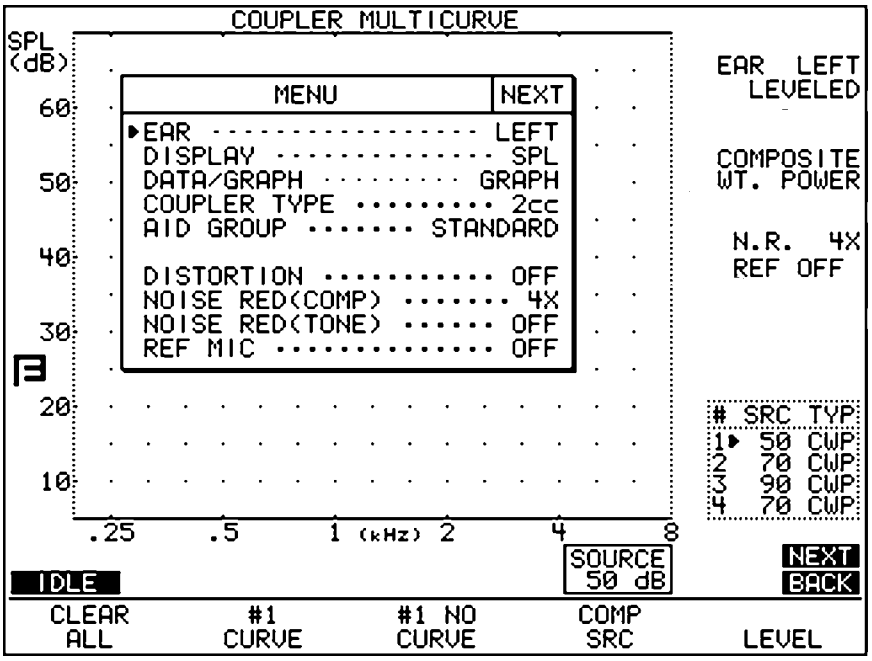


Figure 1.2.3—Local Menu

1.3 Default Settings

It's possible to change the default selections of many of the FP35 analyzer's settings. For instance, you might want to select Digital Speech as your default real-ear source type, or have the default source levels of CRV 1-4 be 50, 65, 80, and 90 dB SPL.

Three different sets of default settings can be saved into the FP35 analyzer's permanent memory. This allows you to have different default settings for different clinicians in your office or for different types of hearing aid technology.

To save a setting configuration:

1. Press [MENU] from the Opening screen. This opens the Default Settings menu. See Figure 1.3.
2. Use [F2], if desired, to select the desired SETTINGS number you want to save your settings to. Choose between SETTINGS 1, SETTINGS 2, and SETTINGS 3.
3. Use the arrow keys to make any changes to the displayed selections. The up/down arrows move between selections. The right/left arrows change the selection. Use the [START/STOP] key to jump ahead to the next group of selections.
4. Press [NEXT] to enter the next Default Settings menu, and repeat the process of setting up everything just the way you like it.

5. Press [NEXT] to enter the final Default Settings menu. Use the arrow keys to set up your selections.
6. Press [F5] to store all three menus into the SETTINGS number displayed above [F2].

To switch to a different saved setting configuration:

- Use [F1] from the Opening screen to switch between SETTINGS 1, 2, & 3.

  —or—

- Press [MENU] from the Opening screen to open the Default Settings menu. Use [F2] to switch between SETTINGS 1, 2, and 3. Press [EXIT] to return to the Opening screen.

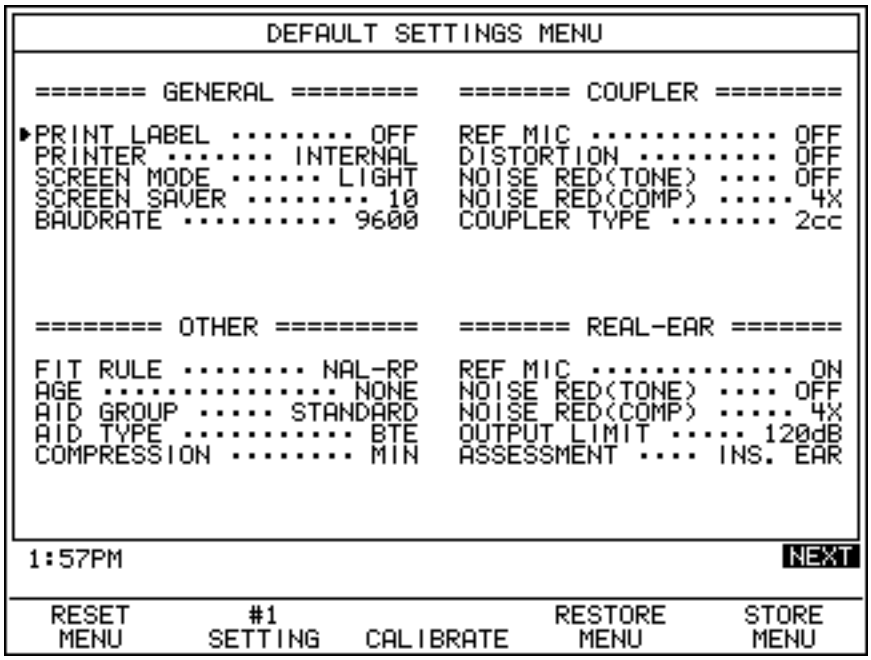


Figure 1.3—Default Settings Menu

1.4 User Level Mode

The FP35 analyzer has two user levels: EASY and ADVANCED. In Easy Mode, the measurement screens contain a little less information, but have a cleaner look. The local menus also contain fewer settings so that the user can focus on only the most important ones that are used in day to day testing activities. All of the operations in this Quick Reference Manual assume the user is in EASY mode, which is the factory default user level.

To change the USER LEVEL:

1. Press [MENU] from the Opening screen to enter the Default Settings menu.
2. Press [NEXT] to go to the Advanced Default Settings menu.
3. Use the [▲ , ▼] keys to select USER LEVEL under General Settings.
4. Use the [▶] key to select the setting. Choose between EASY and ADVANCED.
5. Use [F5] to save the setting, if desired.

1.5 Printing

The FP35 analyzer comes equipped with an internal thermal printer so that the ability to print a hard copy of your results is always available. The thermal printer prints a clear, easy-to-read image of the display. You can also hook up an external printer to print your results on normal office paper. You can use any external printer that supports HP PCL (Hewlett Packard Printer Computer Language) version 3.0 and above.

The general operation of the FP35 printer is easy:

- Press [PRINT/FEED] to print any screen.
- Press [PRINT/FEED] again to stop printing in the middle of a print job. This will work even when the screen goes dark.
- Press and hold down the [PRINT/FEED] button to feed the paper.

If you are in the middle of a test, and you want to switch between using the internal and the external printer in the local screen, without changing the default printer:

1. Press [MENU] from any test screen.
2. Press [NEXT] to enter the Advanced Menu.
3. Select PRINTER with the [▼] key.
4. Select either INTERNAL or EXTERNAL with the [▶] key.
5. Press [EXIT] to return to the test screen.

Coupler Multicurve

In the Coupler Multicurve screen, you can view curves in dB SPL or dB Gain, and run them with pure-tone, Composite, and Digital Speech signals (the latter two are only available with the Composite Option.) Up to four curves can be measured and displayed at the same time.

From the Opening screen of the FP35, enter the Coupler Multicurve screen by pressing [F3].

2.1 Leveling

Leveling is the process by which the response of the sound chamber is measured and computer-corrected so that a “flat” sound field is achieved. In most cases, leveling is performed using only the measurement microphone. This type of leveling is accurate enough for most clinicial tests. See the Operator’s Manual for information on leveling using the reference microphone.

1. Enter the Coupler Multicurve screen by pressing [F3] in the Opening screen.
2. Open the sound chamber and place the coupler microphone at the center of the speaker cone in the sound chamber.
3. Place the coupler that you will be using inside the chamber next to the coupler microphone. This is necessary because of the small volume of the FP35 internal sound chamber, and measurement results, particularly in the high frequencies, could be affected by the space the coupler takes up inside the chamber. See Figure 2.1.
4. Close the sound chamber lid.
5. Make sure the environment is as quiet as possible.
6. Press [F5], followed by [START/STOP], to level the sound chamber.

Figure 2.1—Leveling setup

Leveling is not automatically saved into the analyzer's permanent memory. If you want to avoid releveling the chamber after you turn off the analyzer and turn it back on again, you will need to save the leveling.

1. Press [MENU] from the Opening screen to enter the Default Settings Menu.
2. Press [F3] to enter the Calibration Menu.
3. Use the [▲ , ▼] keys to move the cursor to the selection "Store Chamber Leveling in EEROM"
4. Press [START/STOP]. The FP35 will confirm that you want to store the leveling.
5. Press [START/STOP] again to proceed.
6. Press [EXIT] twice to return to the Opening Screen.

2.2 Frequency Response Measurements

The main purpose of the Coupler Multicurve screen is to perform frequency response measurements. This section contains a short description of the signal types available in this screen and a basic explanation of how to perform frequency response measurements.

2.2.1 Explaining the signals

By default, the FP35 analyzer comes with four types of pure-tone sweeps:

- NORMAL: single sweep containing 49 frequencies
- FAST: continuing sweeps containing 16 frequencies
- SHORT: single sweep containing 10 frequencies
- LONG: single sweep containing 64 frequencies

When the Composite/Digital Speech Option is ordered, the FP35 analyzer will also include these signals:

- COMP: broadband speech-weighted signal
- DIG SPCH: modulated, broadband, speech-weighted signal for testing digital hearing aids.

You can use any of these signal types when performing frequency response measurements in the Coupler Multicurve screen. If you have the Composite/Digital Speech Option, it is recommended to use DIG SPEECH for most measurements. If you do not have that option, use FAST if you want a real-time-like measurement or NORMAL for a detailed frequency response.

For a more detailed explanation of these signal types, see the FP35 Operator's Manual.

2.2.2 Performing a measurement

Measuring the frequency response of a hearing aid is very straight-forward in the Coupler Multicurve screen.

1. Enter the Coupler Multicurve screeen by pressing [F3] in the Opening screen.
2. Level the sound chamber, if necessary, as explained in Section 2.1.
3. Attach the hearing aid to the coupler (see the FP35 Operator's manual for details), and place the assembly in the sound chamber.
4. Close the sound chamber lid.
5. Select the source type you want to use by pressing [F4]. You can either press [F4] repeatedly until your desired source type appears on the screen above the [F4], or you can press and hold the [F4] key to bring up a pop-up menu containing all the selections. If you bring up a pop-up menu, use the [▲, ▼] keys to make your selection and the [START/STOP] key to close the menu.
6. Use the [▲, ▼] keys to select the designed source amplitude.
7. Press [START/STOP] to begin the measurement. If you are using the COMP, DIG SPCH, or FAST source type, press [START/STOP] again to stop the measurement when it has stabilized. See Figure 2.2.2.
8. Press [F2] to select CRV 2 and repeat steps 5-7 to perform a second frequency response measurement.

A total of four frequency response measurements can be made in the Coupler Multicurve screen in this fashion.

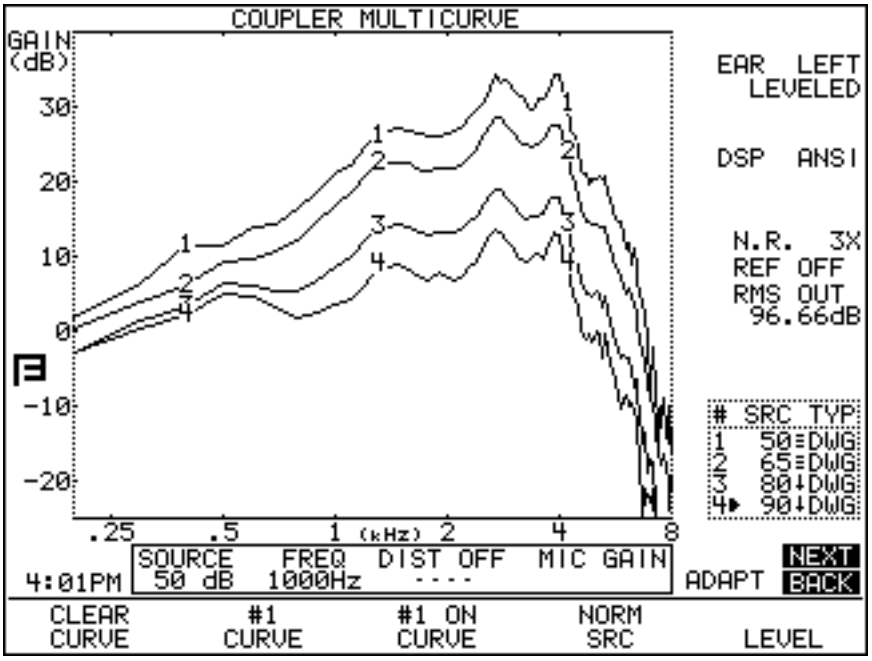


Figure 2.2.2—Frequency response measurement

2.2.3 Testing Digital Aids

The best way to get an accurate frequency response of a digital hearing aid is to use the Digital Speech signal. It's also useful to test the digital aid with the Composite signal. A comparison of these two curves will show you the amount of noise suppression in the digital circuit—some aids will show a lot of difference between a modulated and a steady state signal. Other aids will show no difference.

The Composite/Digital Speech Option is required for this test.

1. Follow the instructions in Section 2.2.2 to obtain a Digital Speech frequency response. In step 5, make sure to choose DIG SPCH.
2. Press [F2] to select CRV 2.
3. Use [F4] to select COMP.
4. Press [START/STOP] to start the Composite measurement. Leave the signal on for at least fifteen seconds, giving the aid plenty of time to adjust to the steady-state signal.
5. Press [START/STOP] again to stop the test.
6. Compare CRV 1, made with Digital Speech, to CRV 2, made with the Composite signal. If the aid has noise suppression, CRV 2 should show less amplification than CRV 1. See Figure 2.2.3

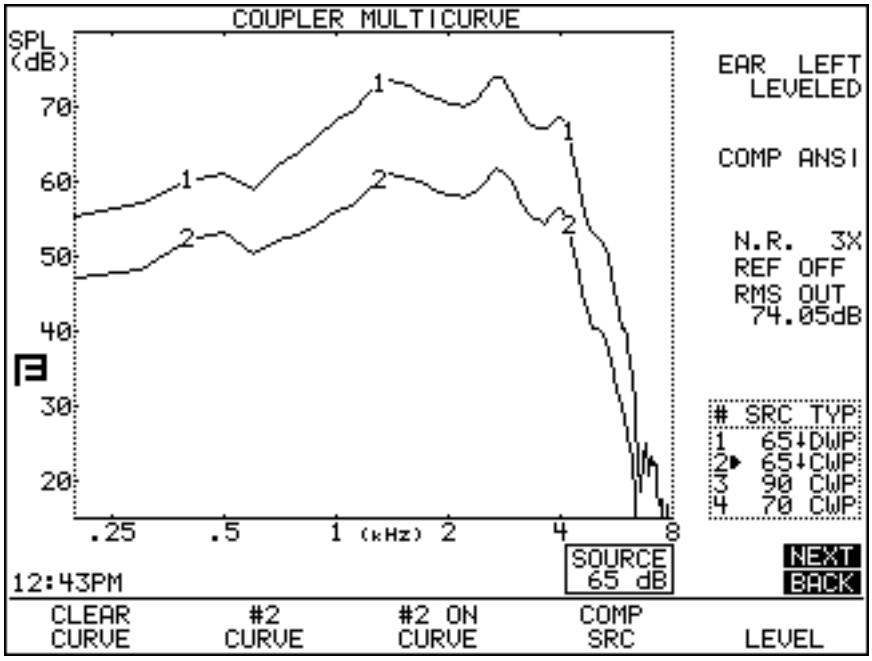


Figure 2.2.3—Digital speech curve comparison

2.2.4 Testing Harmonic Distortion

Harmonic distortion occurs when a hearing aid clips the peak of a pure-tone input signal, resulting in artifacts at harmonics (integer multiples) of that input signal. For example, if you present a 500 Hz tone to the hearing aid, distortion artifacts could occur at 1000 Hz and 1500 Hz.

Definitions:

- 2ND Harmonic: Energy of the second harmonic or twice the presented frequency
- 3RD Harmonic: Energy of the third harmonic or three times the presented frequency
- TOTAL: Combined 2ND and 3RD harmonic distortion

See the FP35 Operator's manual for more details. To perform a harmonic distortion measurement:

1. Enter the Coupler Multicurve curve screen by using [F3] from the Opening screen.
2. Set up the hearing aid in the usual way. Make sure to close the sound chamber lid.
3. Press [MENU] to open the Coupler Multicurve local menu.

4. Use the [▲, ▼] keys to select DISTORTION.
5. Use [◀, ▶] to select the type of harmonic distortion measurement you want to make. When in doubt, select TOTAL.
6. Press [EXIT] to close the local menu.
7. Use [F4] to select NORM.
8. Use the [▲, ▼] keys to select the source amplitude. When in doubt, choose 65 dB SPL.
9. Press [START/STOP] to run the pure-tone sweep. When the measurement has finished, it will automatically stop.
10. Look at the bars at the bottom of the graph. The scaling for these bars is on the right side of the graph. This is the amount of harmonic distortion measured with the pure-tone sweep. See Figure 2.2.4.

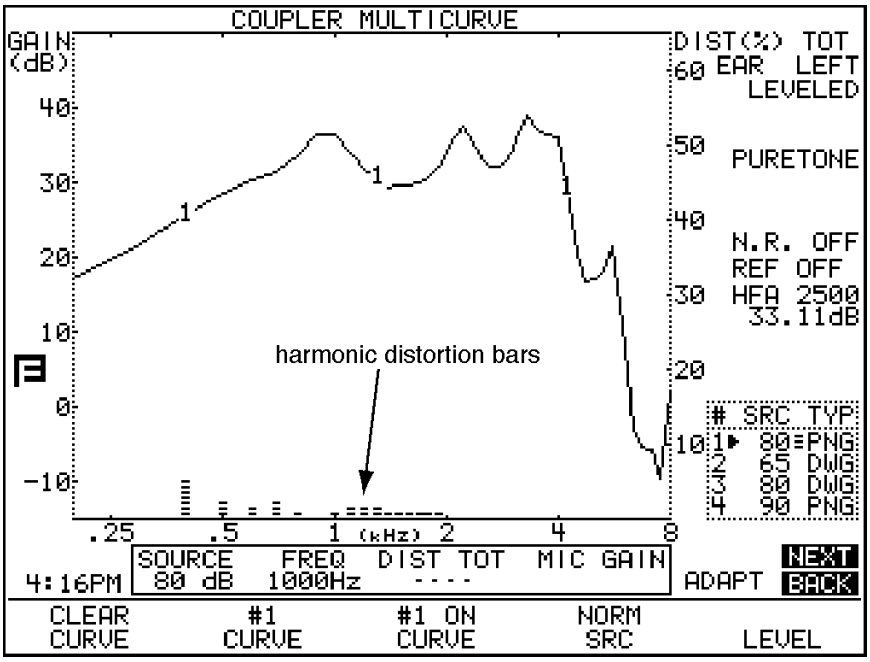


Figure 2.2.4—Harmonic distortion measurement

2.2.5 Testing Intermodulation Distortion

Intermodulation (IM) distortion occurs when more than one frequency is present in the source signal and those frequencies combine to create new frequencies not actually present in the source. IM distortion is visible as jagged peaks in the frequency response of the hearing aid when a Composite or Digital Speech source type is used.

In the FP35 IM Distortion test, the analyzer presents two tones simultaneously. The frequency distance between these two tones is set by the user. Any amplitudes found at frequencies other than the original two tones is considered distortion. Just as when a harmonic distortion measurement is run, the analyzer sweeps the tones across the entire frequency range—the only difference is that two tones are used at a time instead of only one, as in a pure-tone sweep. See the FP35 Operator's Manual for more details.

To run the IM test:

1. Set up the analyzer for coupler testing as usual.
2. Enter the Coupler Multicurve screen by pressing [F3] from the Opening screen.
3. Press [MENU] to enter the local menu.
4. Use the [▲, ▼] keys to select DISTORTION.
5. Use [◀, ▶] to select the type of IM distortion sweep you want to make. Use TOTAL to get the most IM distortion data.
6. Press [NEXT] to go to the Advanced Coupler Multicurve screen.
7. Use the [▲, ▼] keys to select IM FREQ DIFF.
8. Use [◀, ▶] to select the difference between the two tones used in the measurement.
9. Press [EXIT] to close the local menu.
10. Press and hold down the [F4] key for half a second. This will bring up a pop-up menu containing all the available source types.
11. Use the [▲, ▼] keys to select DIST.
12. Press [START/STOP] to complete the selection and close the pop-up menu.
13. Press [START/STOP] again to perform the IM distortion sweep. The test will stop automatically when it is finished. See Figure 2.2.5.

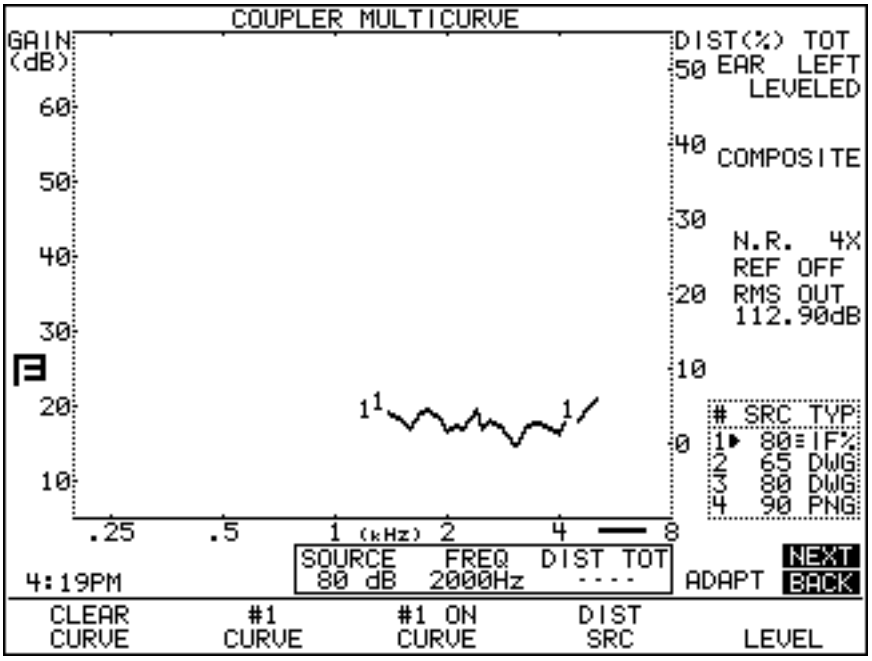


Figure 2.2.5—IM distortion measurement

Automated Test Sequences

3.1 The ANSI Sequence

The ANSI test sequence allows you to test hearing aids according to the ANSI S3.22 standard. You can use the ANSI test to control the quality of the hearing aids that you dispense. Compare the manufacturer's specifications with your own ANSI measurements of an aid. If they do not conform within expected tolerances, you can contact the manufacturer.

There are two versions of the ANSI S3.22 standard on the FP35 analyzer: ANSI 96 and ANSI 03. As of the printing of this manual, ANSI 96 is the current standard to which the FDA requires hearing aid manufacturers to label their hearing aids. ANSI 03 will eventually replace this standard, but the date of the switchover is not yet known.

The [F4] or [F5] key in the Opening screen is normally used for entering the ANSI 96 screen. Press whichever key is labeled as "ANSI 96."

To switch between ANSI 96 and ANSI 03, first enter the ANSI test screen by using either [F4] or [F5] from the Opening screen: select the function key labeled either ANSI 96 or ANSI 03. From the ANSI screen, push [MENU] to open the local menu. Use [▲, ▼] to select ANSI TEST and [◀, ▶] to switch between S3.22-1996 and S3.22-2003. **After switching between the standards, you must press [MENU] twice to update the local menu if you want to make any further menu changes.**

3.1.1 Setting up for ANSI testing

The hearing aid controls must be set to conform with ANSI requirements for the test results to be valid.

1. Set the controls on the aid (except for the compression controls) to give the greatest possible output and gain.
2. Set the aid for the widest frequency response range.
3. For ANSI 96, set AGC aids to achieve the greatest possible compression or as otherwise specified by the manufacturer. For ANSI 03, set the compression controls to have minimum effect or as specified by the manufacturer.
4. If you are testing a digital hearing aid, put it in "test" mode if possible.
5. Set the gain control to full-on.
6. Set the aid up in the sound chamber as usual.

Setting up a Linear Aid

For ANSI 96, use [F1] to select LINEAR 50 or LINEAR 60. Your selection should be based upon manufacturer specifications. If the specifications are unavailable, use:

- 50 dB for aids with high gain and relatively low output.
- 60 dB all other aids.

In ANSI 03, the full-on gain measurement is always taken at 50 dB SPL, so this selection is not avialable.

Setting up an AGC Aid

Use [F1] to select AGC or ADAPTIVE AGC.

When you run the ANSI sequence on an AGC aid, you may run up to five different input/output curves. The frequencies that you can choose from are 250, 500, 1000, 2000, and 4000 Hz. Choosing AGC or ADAPTIVE AGC with [F1] will result in additional selections appearing above [F2] and [F3] that let you control the input/output settings.

Push [F2] to toggle through the frequencies. Use [F3] to turn the input/output curve for the current frequency on or off.

Press [NEXT] to see the ANSI I/O Screen. If you haven't yet run an ANSI test, the I/O curve selection box will show which curves you have selected to test.

3.1.2 Running an ANSI Test

1. Press [START/STOP] to begin the test.
2. Usually the FP35 will pause during the measurement process in order to let you adjust the gain of the hearing aid to the reference test position.
   a. Lift the sound chamber lid and adjust the gain control of the aid until the MEASURED gain matches TARGET gain.
   b. Close the sound chamber lid when finished.
   c. The MEASURED gain should be within 1 dB of the TARGET gain.
3. Push [START/STOP] to continue the test. If you are measuring to ANSI 03 and have set the aid type to AGC or ADAPTIVE, the analyzer will pause again after several measurements have been taken. Adjust the AGC controls of the aid to have maximum effect (or as specified by the manufacturer) and press [START/STOP] again to complete the test sequence. The analyzer will not pause if the ANSI TEST is set to S3.22-1996 or if AGC SWITCHING is OFF in the local menu. (See Section 4.1.5)
4. Press [NEXT] to view the ANSI 96 I/O Screen for AGC aids.
5. Press [PRINT] for a hard copy of the results.

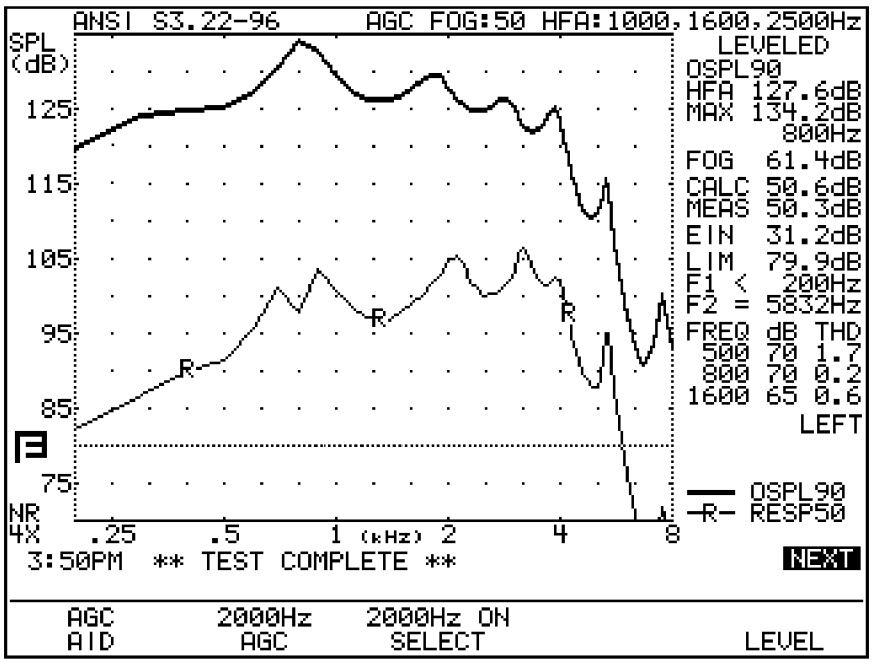


Figure 3.1.2A—ANSI test completed

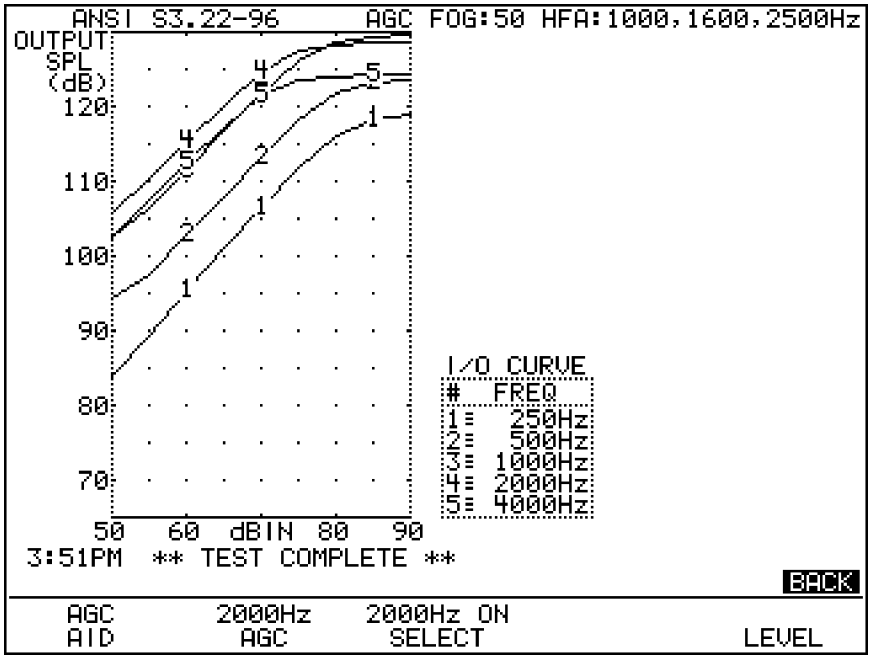


Figure 3.1.2B—ANSI 96 test, I/O Screen

3.1.3 Testing Digital Hearing Aids

The ANSI S3.22-1996 "labeling" standard for hearing aids was not designed with digital hearing aids in mind. In fact, most of the testing methods employed by ANSI 96 have been around since the 1970s. However, since ANSI is a standard, in order to conform to that standard, it must use only the testing techniques outlined in the standard. For this reason, **the FP35 has no provisions for incorporating composite or digital speech into the ANSI 96 standard.**

In order to test digital hearing aids with "noise reduction" or "speech enhancement" features to the ANSI 96 standard, put the aid in "test" mode via its programming software and do the steps outlined in Section 3.1.2.

In order to get an accurate picture of the aid's actual performance when it goes home with your client, put the aid in the mode you will use for that client, and perform response curve measurements in the coupler and in the real-ear via the procedures described in Chapter 2 and Chapter 4 using the digital speech (DIG SPCH) signal source.

3.2 IEC Testing

The IEC 118-7 standard was designed by the International Electrotechnical Commission to assess hearing aids. The performance part of that standard can be included as an automated sequence on your FP35.

The [F4] or [F5] key in the Opening screen is normally used for entering the IEC screen. Press whichever key is labeled as "IEC."

3.2.1 Setting Up the Hearing Aid for Testing

1. Set the controls on the aid (except for compression controls) to give the maximum output and gain.
2. Set the aid for the widest frequency response range.
3. Set AGC aids for maximum compression.
4. Make sure that the gain control of the aid is full on.
5. Set the aid up in the sound chamber as usual.
6. Press [F1] to select aid type.
7. Press [F2] to select between a full-on gain measurement at 50 dB or at 60 dB.
8. Press [F3] to select a reference frequency of 1600 Hz or 2500 Hz. Select 2500 Hz for high frequency emphasis aids.
9. Press [F4] to choose whether to test an I/O curve during the test sequence.

3.2.2 Running an IEC Test

1. Level the sound chamber, if needed.
2. Push the [START/STOP] button.
3. The FP35 will pause during the measurement process in order to let you adjust the gain of the hearing aid to the reference test position.
   a. Lift the sound chamber lid and adjust the gain control of the aid until the MEASURED gain matches TARGET gain.
   b. Close the sound chamber lid when finished.
   c. The MEASURED gain should be within 1 dB of the TARGET gain.
4. Push [START/STOP] to complete the test.
5. Press [NEXT] to view the I/O Screen.
6. Press [PRINT] for a hard copy of the results.

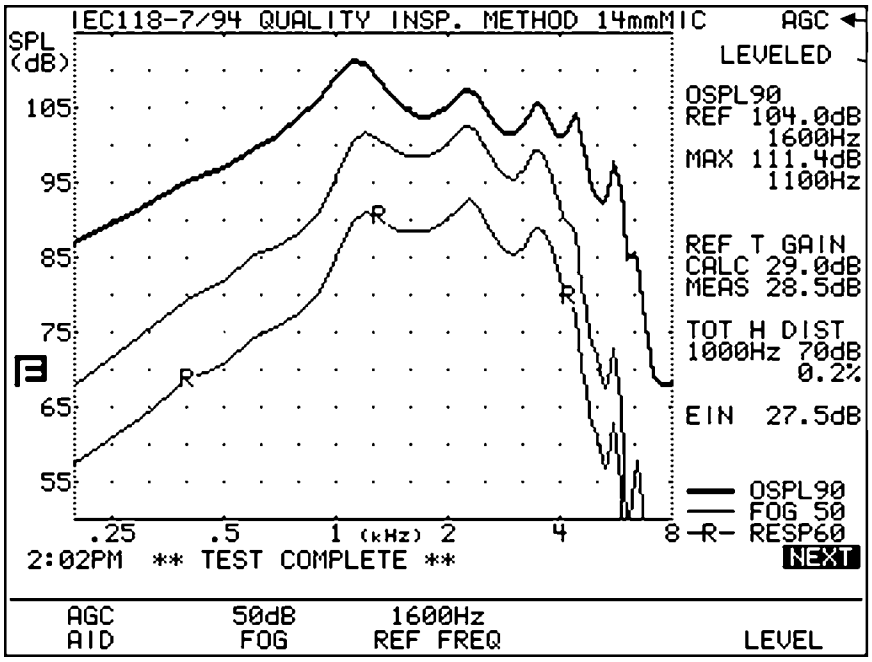


Figure 3.2.2A—IEC test completed

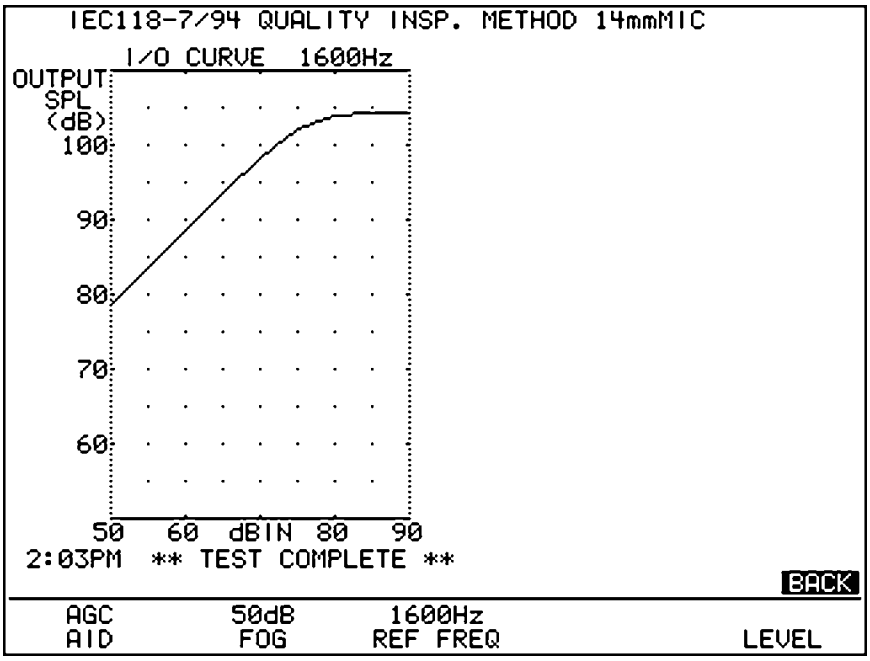


Figure 3.2.2B—IEC test results, I/O Screen

Real-Ear Measurements

4.1 Introduction

When the Real-Ear Option is ordered with your FP35 analyzer, you can test the hearing aid inside the patient's ear using the probe microphone. When performed correctly, this is the most accurate measurement available of the hearing aid's performance because it is performed using the patient's own ear canal resonance.

In the real-ear measurement screens, you can input an audiogram, generate a target, and take insertion gain and SPL measurements.

4.1.1 Real-Ear Screens

There are four different real-ear screens on the FP35 analyzer. One of these screens is for creating a real-ear target: the Audiogram Entry Screen. The other three screens are for performing real-ear measurements: the Unaided & Aided, Insertion Gain, and SPL Screen—the insertion-gain technique for fitting hearing aids has been separated into two separate screens to make it easy to distinguish between gain curves and insertion gain curves.

Audiogram Entry—Enter your audiograms, choose your fitting rule, perform RECD and REDD measurements, and generate a target in this screen._

Real-Ear SPL—View thresholds, UCLs, targets, and aided measurements in real-ear SPL on one screen. This gives you a complete picture of the client's hearing range and where the aided responses are falling in that range. You can perform Visible Speech measurements in this screen.

Real-Ear Unaided & Aided—Measure and display your client's unaided and aided measurements. You can run up to three separate aided curves and display them all on the same screen.

Insertion Gain—Measure and view your client's unaided and insertion gain measurements. Up to three insertion gain measurements can be displayed at one time.

4.1.2 Navigation

To enter the Real-Ear Mode, press [F2] from the Opening Screen of the FP35. This will one of the real-ear screens. To navigate through the four screens of the Real-Ear Mode, press the [NEXT] and [BACK] keys. Continuously pressing one of these keys will cycle you through the four choices, eventually bringing you back to screen where you started. See Figure 4.1.2.

To leave the Real-Ear Mode, press [EXIT] at any time.

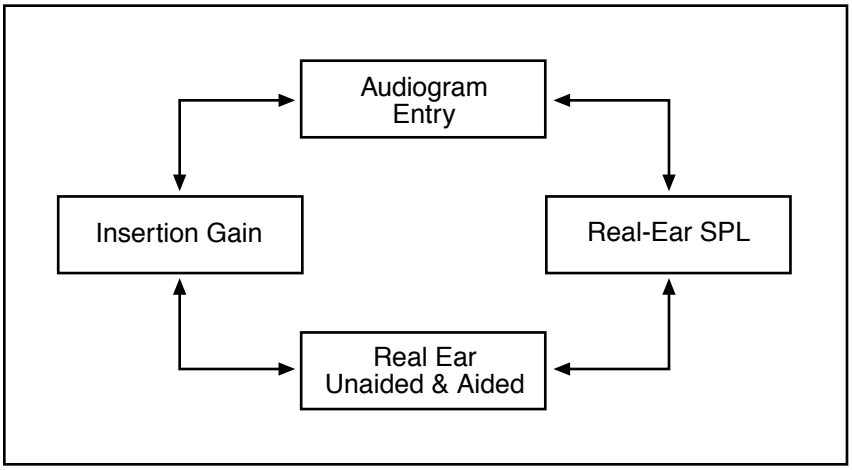


Figure 4.1.2—Real-ear navigation using next and back buttons

4.2 Real-Ear Setup

If you are using the FP35 as a portable unit, you can easily convert the internal sound chamber into a sound field speaker. If you are using the FP35 primarily in an office or clinical setting, you may wish to set up an external speaker for real-ear measurements.

4.2.1 General Setup

When testing, the loudspeaker should be about 12 inches (30 cm) from the surface of the client's head (near the temple) and pointing toward the ear to be tested. We recommend an azimuth angle of 45 degrees (halfway between the client's nose and ear). The height of the loudspeaker should be level with, or a little above the ear. See Figure 4.2.1.

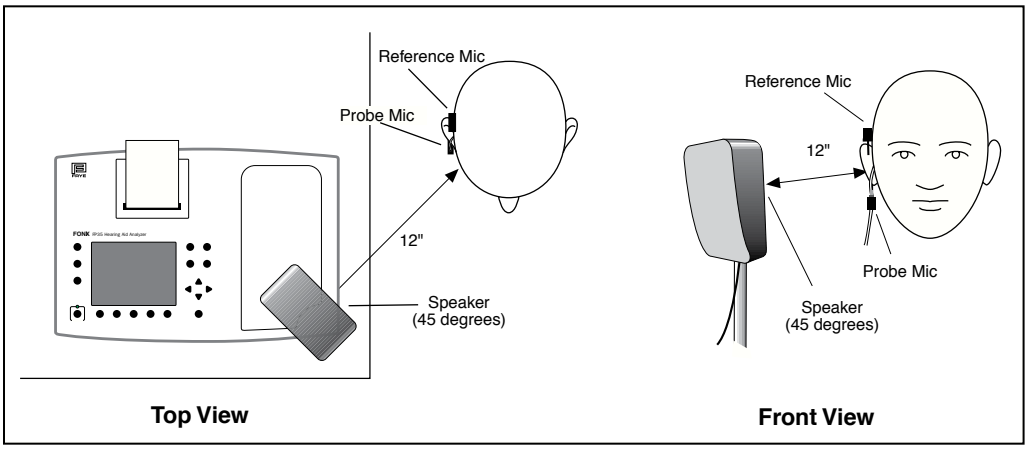


Figure 4.2.1—Real-ear measurement setup

Note: If you want to use a 90 dB signal during your measurements, the 12 inch distance is very important. If the client is too far away, a message box will open, alerting you to move the client closer. Don't forget to relevel for the client's new position.

4.2.2 Internal Speaker Setup

The technique for converting the FP35 analyzer's internal sound chamber into a sound field speaker to use for real-ear measurements is described in this section.

Removing the speaker from the FP35 compartment

- Open the sound chamber lid. Do this by pressing down on the metal latch at the front of the sound chamber lid.
- Lift the speaker out of the compartment.

Installing the speaker on the metal post

- Locate the metal post at the right side of the compartment. Remove the post and place the wide end in the hole at the bottom, right corner of the sound chamber.
- Place the speaker on the tapered end of the post. If the speaker does not reach your client's ear height, you may want to add an optional extension pole that raises the speaker by an additional 6.5 inches (16.51 cm).
- Position the FP35 at one edge of a table. The speaker can be rotated so that the correct angle for testing is easily achieved.

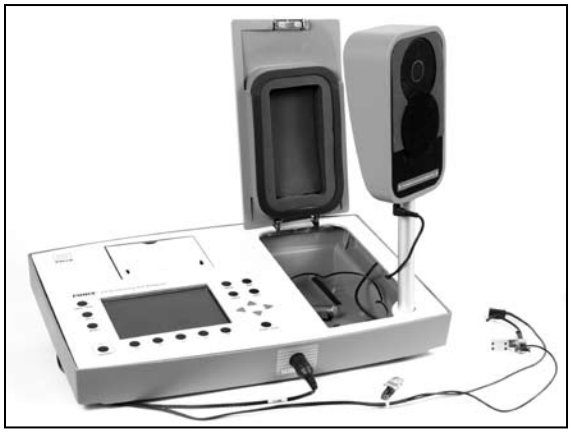


Figure 4.2.2—Internal sound field speaker setup

Replacing the speaker when the test is complete

- Remove the speaker from the post.
- Lift the post out of its hole and return it to the right side of the compartment. You must first slide one end of the post into the notch toward the front of the FP35 analyzer. The post will then fit easily onto the ledge.

- Make sure all cables in the compartment are put away so they will not interfere with replacing the speaker.
- Set the speaker back in the compartment. As you do this, guide the speaker wire so it stays to the side of the speaker, not underneath it.

4.2.3 External Speaker Setup

If desired, you can use an external speaker to perform your real-ear measurements. The external speaker can be mounted to a floor stand or to a swing arm. A swing arm is especially nice because you can move the speaker around the patient when you switch ears, rather than move your patient around the speaker.

Figure 4.2.3—External sound field speaker setup

To set up your FP35 software to use an external speaker:

1. Press [MENU] from the Opening screen to enter the Default Settings menu.
2. Press [NEXT] to enter the Advanced Default Settings menu.
3. Select SPEAKER under Real-Ear Settings with [▲ , ▼] keys.
4. Set EXTERNAL with [◀ , ▶]. All real-ear measurements will now be done with the external speaker.
5. Press [F5] to save the setting as the new default, if desired.
6. Press [EXIT] to return to the Opening screen.
7. Press [F2] to enter Real-Ear Mode again.

4.2.4 Placing the Probe Tube

To ensure the proper insertion depth of the probe tube into the ear canal, the following marking procedure is necessary. After some practice, the procedure is easy.

1. Place an unattached probe tube on a flat surface along with the client's earmold or shell as shown in Figure 4.2.4A so that the tube rests along the bottom of the canal part of the earmold, with the tube extending at least 5 mm past the canal opening.
2. Mark the probe tube with a marking pen where it meets the outside surface of the earmold.
3. Attach the probe tube to the integrated probe microphone and place the earhook of the microphone on the client's ear.
4. Insert the probe tube into the client's ear so that the mark is at the location where the bottom of the outer surface of the earmold would be. See Figure 4.2B.

Hints: To help keep the probe tube in place, position the tube so that it runs through the tragal notch, resting against the lower edge of the tragus (Figure 4.2.4B) If necessary, adjust the integrated microphone for better positioning. If desired, use surgical tape to hold the tube in position.

NOTE: Figures 4.2.4B and 4.2.4C contain pictures of the integrated probe microphone. The probe microphone setup with the older style M300 separate probe microphone set is shown in Figure 4.2.4D.

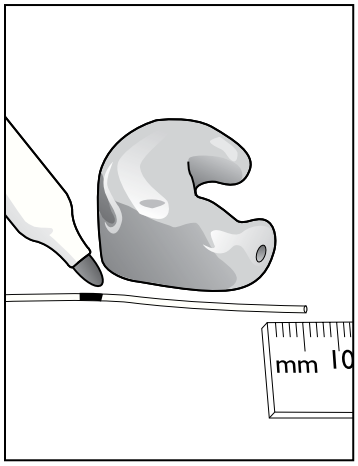


Figure 4.2.4A
Mark the probe tube.

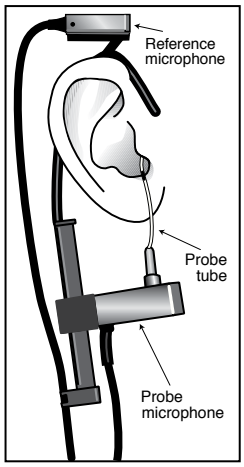


Figure 4.2.4B
Place the microphones.

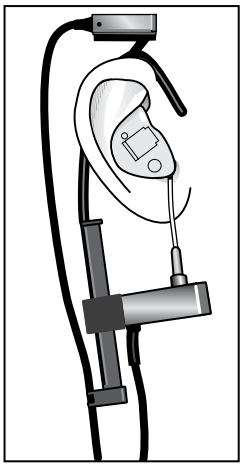


Figure 4.2.4C
Insert the hearing aid.

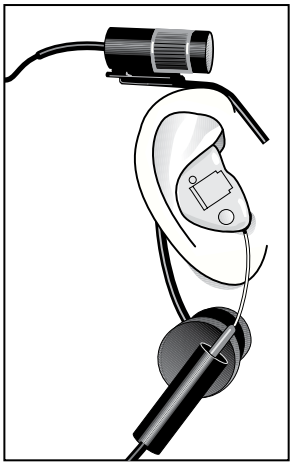


Figure 4.2.4D
Real-ear setup using M300 separate microphone set.

4.2.5 Placing the Sound Field Speaker

The placement of the sound field speaker can have a big influence on the accuracy and repeatability of your real-ear measurements. Research has shown that a consistent placement of 45 degrees azimuth to the client produces the most repeatable testing results. Some clinicians, however, prefer to use the more traditional 0 degrees azimuth to the client. See Figure 4.2.1 for a diagram of a client being tested at 45 degrees azimuth.

In both instances, we recommend a distance of 12–15 inches from the speaker to the client. A larger distance might make the FP35 analyzer unable to produce a 90 dB SPL signal to the client. A small distance might place the client in an unstable place in the field of the speaker.

To set the position of the speaker:

1. Press [MENU] in any real-ear measurement screen or in the Audiogram Entry screen.
2. Use [▲, ▼] to select SOUND FIELD.
3. Use [◀, ▶] to select 0° or 45°.
4. Press [EXIT] to return to the real-ear screen.

Notes:

- If you took your audiometric measurements with a sound field speaker, it is recommended that you use the same azimuth for the real-ear measurements as you used in the audiometric assessment.
- The speaker position is set when the sound field is leveled. If you want to change the speaker position after leveling, you must re-level the sound field speaker for the change to take effect.
- The leveling status will reflect the selected sound field speaker azimuth. By default, this is set to 45°.

4.2.6 Leveling the Sound Field Speaker

The leveling process measures the sound field at the client's ear, and accounts for inconsistencies in the testing environment. It is essential for obtaining accurate real-ear measurements. **You must re-level the sound field for every client and for every ear**.

The client must be in the same position for leveling and real-ear testing—you can use either a 0° azimuth or a 45° azimuth for leveling, as long as it is consistent with the speaker position used for the real-ear measurements.

Only the larger reference microphone is used during the leveling process. However, to speed things up and ensure the client is in the same position during leveling and during the measurement process, it is recommended that you insert the probe tube in the client's ear for the leveling process. See Section 4.2.4 for more details.

To level:

1. Place the integrated probe microphone on the client's ear. See Figure 4.2.4B.
2. Insert the probe tube into the client's ear, if desired. (The probe microphone is not used during the leveling process.)
3. Position the sound field speaker 12–15 inches from the client's head, at a 0° or 45° azimuth. (We recommend 45° azimuth in order to produce the most repeatable results.)
4. Select the azimuth used in the SOUND FIELD setting in the real-ear menu. See Section 4.2.5 for details.
5. Press [F5]—LEVEL in any of the real-ear measurement screens (not the audiogram entry screen).

6. Press [START/STOP]. The instrument will now attempt to level the sound field speaker.

These are the possible leveling status:

- LEVELED 0º or LEVELED 45º—The leveling process was correct within 2 dB. The azimuth used is indicated.
- UNLEVELED—The leveling process was incorrect at least 6 dB. You should check the speaker, client, and reference microphone position and try to level the instrument again. No azimuth is indicated for this status.
- 0º or 45º—A status showing only the azimuth indicates that the leveling process was correct somewhere between 2 dB and 6 dB. Just as with the UNLEVELED status, you should check the speaker, client, and reference microphone position and try to level the instrument again. However, if repeated attempts fail to reach a leveled status, you can consider this stage "good enough." Be aware that measurements when the instrument is in the in-between stage will not be as accurate as measurements taken when the sound field is leveled.

Note: The environment should be quiet during leveling. Noise can affect the leveling results, though the FP35 does use measurement methods to minimize the impact of external noise.

4.3 Audiogram Entry Screen—Creating A Target

Creating a target for one or both ears is actually something you can do before the client even enters the office. The first thing you have to do is enter the audiogram.

4.3.1 Entering the Audiogram Screen

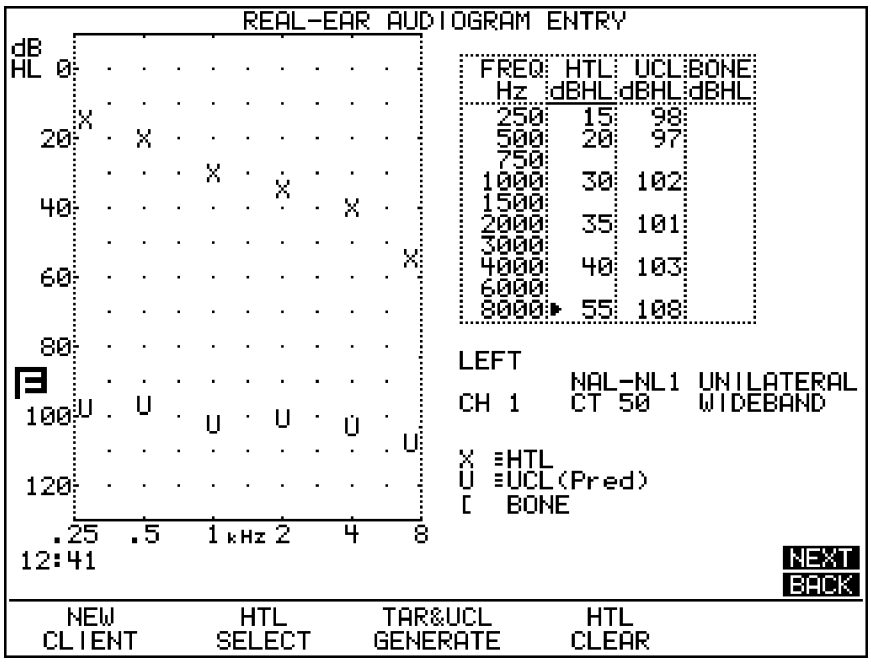


Figure 4.3.1—Audiogram Entry screen

- If necessary, press [F2] from the Opening Screen to enter the Real Ear Mode.
- The FP35 will automatically bring you to the real-ear screen you left the last time you did a real-ear measurement.
- If necessary, use the [NEXT] or [BACK] buttons to reach the Audiogram Entry Screen.

4.3.2 Entering Audiometric Information & Creating A Target

Use the following instructions to create a non-NAL-NL1 target. See Section 4.3.3 for NAL-NL1 instructions. The following step-by-step instructions assume that you are in the Audiogram Entry Screen.

1. Press [MENU] to enter the main local menu, and select the desired EAR, and ASSESSMENT.
2. Press [BACK] to enter the Target Menu, and select the desired FIT RULE and AGE.
3. Press [EXIT] to return to the Audiogram Entry Screen.
4. Use [F2] to select HTL. A small arrow cursor will appear in the HTL column of the data entry box.
5. Use the [▲ ,▼] keys to move the cursor through the frequencies. Use the [◀ , ▶] to enter the client's threshold levels in dB HL at each frequency.
6. If you have measured your client's uncomfortable levels:
   - Press [F2] to select UCL.
   - Use the [▲ ,▼] keys to move the cursor through the frequencies. Use [◀ , ▶] to enter the client's uncomfortable levels in dB HL at each frequency.
7. Press [F3] to generate a target using your selected fitting rule. If you did not enter any measured UCLs, predicted UCLs will also be generated.
8. Press [MENU] and change the selected EAR, if desired. Press [EXIT] to exit the audiogram menu. If you entered the thresholds for the other ear, those thresholds will automatically be copied to the current ear as a starting point. The UCL and target values will not be copied.
9. Repeat steps 4-7 for the new ear, if desired.

4.3.3 Creating an NAL-NL1 Target

The NAL-NL1 fitting rule is more adjustable and slightly more complicated than DSL and the traditional linear fitting rules. In addition to the client's air conduction thresholds, it takes into consideration the client's bone conduction thresholds, whether the fitting is binaural or monaural, the number of channels of the hearing aid, and the type of limiting the aid has. The steps to creating an NAL-NL1 target are very similar to creating a DSL or a linear target – NAL-NL1 just requires a few more menu selections.

To create an NAL-NL1 target:

1. Press [MENU] in the Audiogram Entry screen and use the arrow keys to select the following:
   - EAR: Current ear
   - ASSESSMENT: Type of transducer used in creating the audiogram
2. Press [BACK] to enter the Target menu. Use the arrow keys to select the following:
   - FIT RULE: NAL-NL1
   - AGE: Age of the client
   - COMPRESSION: The wideband compression threshold of the aid
   - CHANNELS: The number of channels of the aid
   - AID LIMITING: The type of limiting the hearing aid has
   - FIT TYPE: Unilateral or bilateral
3. Press [EXIT] to return to the Audiogram Entry screen.
4. Press [F2] until HTL is selected. A small arrow cursor will appear in the HTL column of the data entry box.
5. Use the [▲ ,▼] keys to move the cursor through the frequencies. Use the [◀ , ▶] to enter the client's threshold levels in dB HL at each frequency.
6. (Optional) Press [F2] to select UCL, and use the arrow keys to enter the client's UCL values in the same manner as you entered the HTL values.
7. (Optional) Press [F2] and select BONE in order to enter the client's bone conduction thresholds. Use the arrow keys to enter the bone values in the same manner as you entered the HTL values.
8. Press [F3] to generate the NAL-NL1 target. If you did not enter any measured UCL values, predicted UCLs will also be generated.
9. (Optional) If you selected a FIT TYPE of "bilateral" in Step 2, you need to enter audiometric data from both ears.
10. Press [MENU] to enter the menu.
11. Change the EAR by using the arrow keys.
12. Press [EXIT] to return to the Audiogram Entry screen. The threshold values for the first ear will be displayed on the screen as a starting point for the entry of the new audiogram.
13. Repeat Steps 4-8 to enter the audiogram for the new ear.

4.3.4 Measuring the Real-Ear to Coupler Difference

The real-ear to coupler difference (RECD) is the acoustical difference between the response of an insert earphone in the ear versus in a 2-cc coupler. It involves two measurements: a coupler measurement, and a real-ear measurement. Both measurements are performed with an insert earphone.

The coupler part of the RECD is performed when you "calibrate" the insert earphone used in the measurement. When this calibration is performed, the coupler measurement is saved into the FP35 analyzer's permanent memory. See Appendix C

of the Operator's Manual for instructions on performing the calibration of the insert earphone.

4.3.4.1 Analyzer Setup for RECD

This section describes how to set up the analyzer to perform the real-ear portion of the RECD.

1. Enter the Audiogram Entry Screen (See Section 4.3.1).
2. Press [MENU].
3. Select desired EAR, using [◀] if necessary.
4. Select ASSESSMENT with [▲ , ▼] keys.
5. Press [◀ , ▶] to select INS. EAR.
6. Press [EXIT] to return to Audiogram Entry Screen.
7. Press [F2] repeatedly until RECD (or REDD) is selected. You will see an additional column of average RECD information for the selected age appear on the screen.
8. Make sure that SHOW RECD is displayed above [F5]. If it isn't, press [F5] to toggle the display.
9. Look at the bottom right corner of the LCD screen. If you see the message "Earphone not calibrated," you will need to follow the instructions found in Appendix C of the Operator's Manual for calibrating the insert earphones. See Figure 4.3.4.1.
10. Press [F3] to select MEASURE RECD.
11. Plug the insert earphone into the "earphone" jack in the back of the FP35.

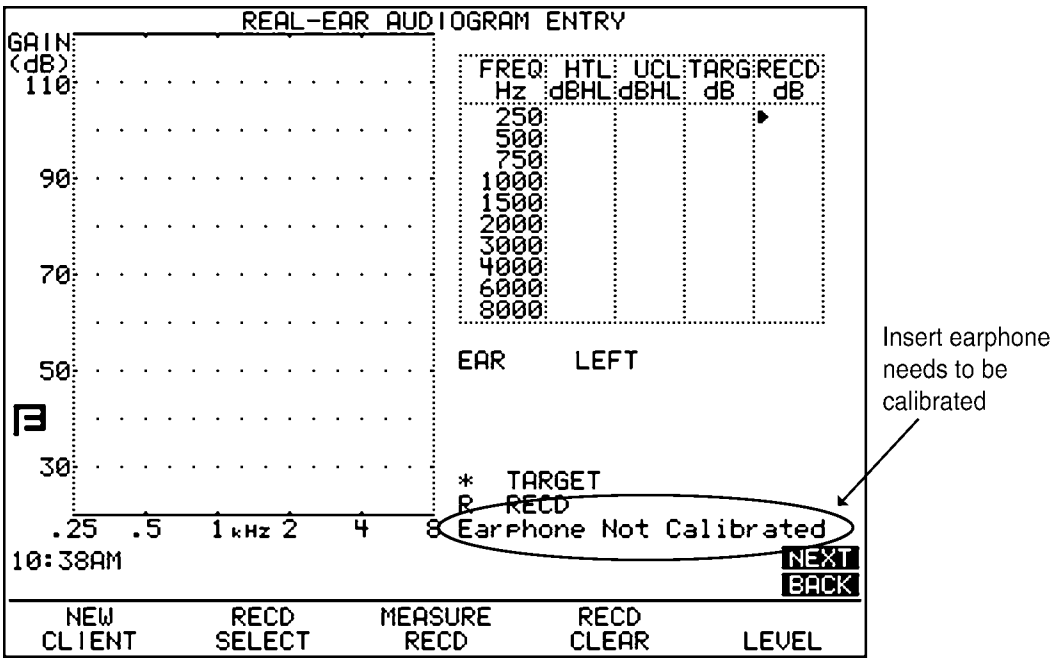


Figure 4.3.4.1— This screen indicates that the coupler part of the RECD needs to be taken.

4.3.4.2 Client Setup for RECD

This section describes how to set up the client for the real-ear portion of the RECD measurement.

1. Insert the probe microphone into your client's ear. See Figure 4.3.4.2A.
2. Insert custom earmold or foam eartip coupled to the insert earphone into your client's ear. See Figure 4.3.4.2B.

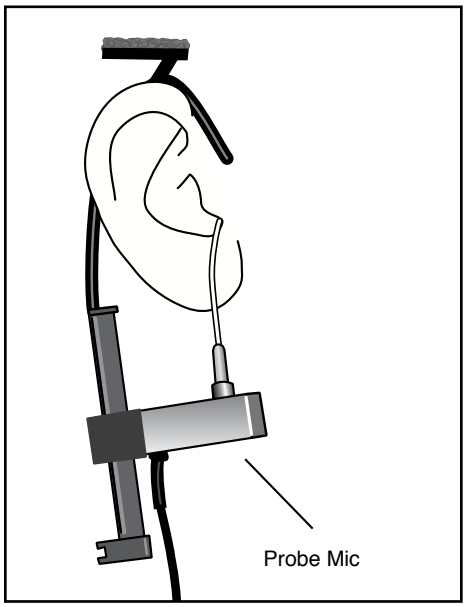


Figure 4.3.4.2A—Insert probe microphone

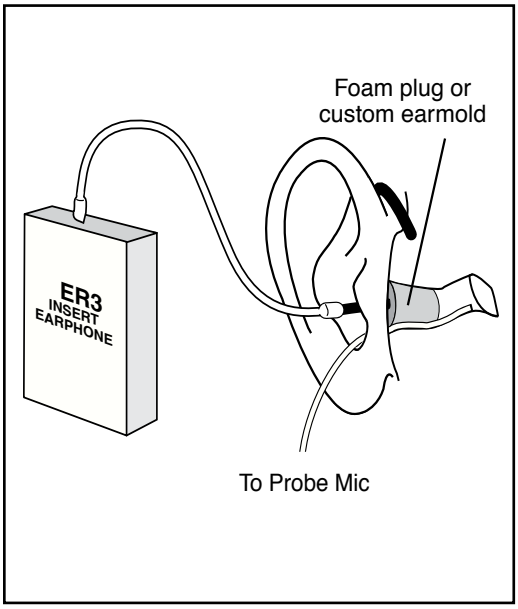


Figure 4.3.4.2B— Insert foam eartip connected to insert microphone

4.3.4.3 Taking the RECD Measurement

If you've performed the steps described in Sections 4.3.4.1 and 4.3.4.2, you just have to press [START/STOP] to take the RECD measurement. Results will be displayed in graphical format in dB GAIN as well as numerical format in the data table.

To erase the measured RECD, press [F4] and [START/STOP].

4.4 Insertion Gain Testing

An insertion gain test measures how much gain the hearing aid is providing over the client's unaided response. **This section assumes you have already generated a target curve (see Section 4.3.2 and 4.3.3) and are ready to test.**

The Unaided & Aided Response screen and the Insertion Gain Screen are two parts of the same insertion gain method of fitting hearing aids. The Unaided & Aided Response Screen lets you measure and view ***aided gain*** measurements of the hearing aid. See Figure 4.4A. The Insertion Gain screen displays the insertion gain target and lets you measure and view ***insertion gain*** measurements of the hearing aid. See Figure 4.4B. We divided insertion gain into two screens in order to clearly distinguish between the aided gain and insertion gain curves.

Insertion gain is the difference between the client's unaided response and his/her aided response. In other words, insertion gain is the actual gain that the aid is producing. ***Aided gain***, in contrast, is the gain the aid is producing ***plus*** the natural gain of the ear.

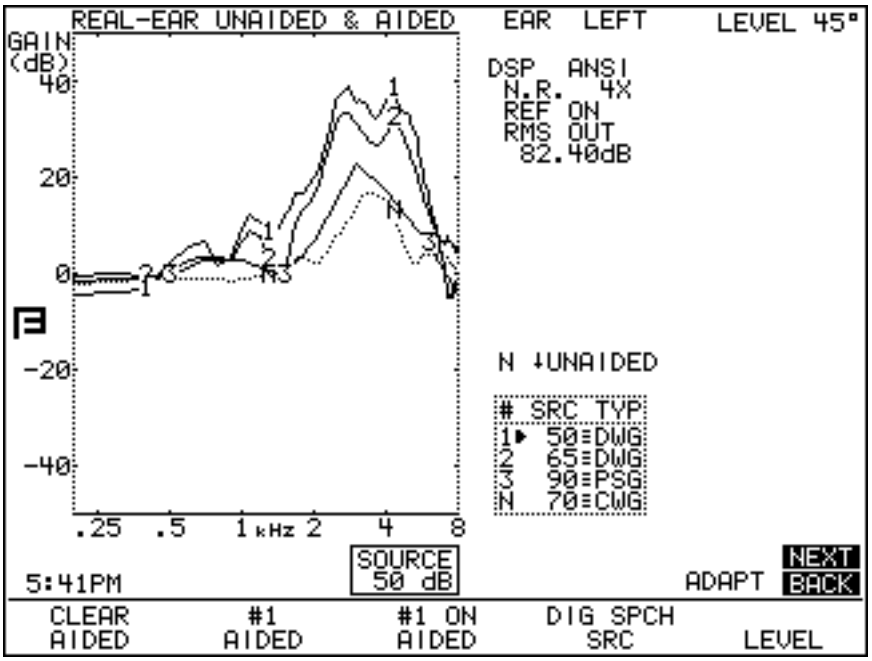


Figure 4.4A—Real Ear Aided & Unaided screen

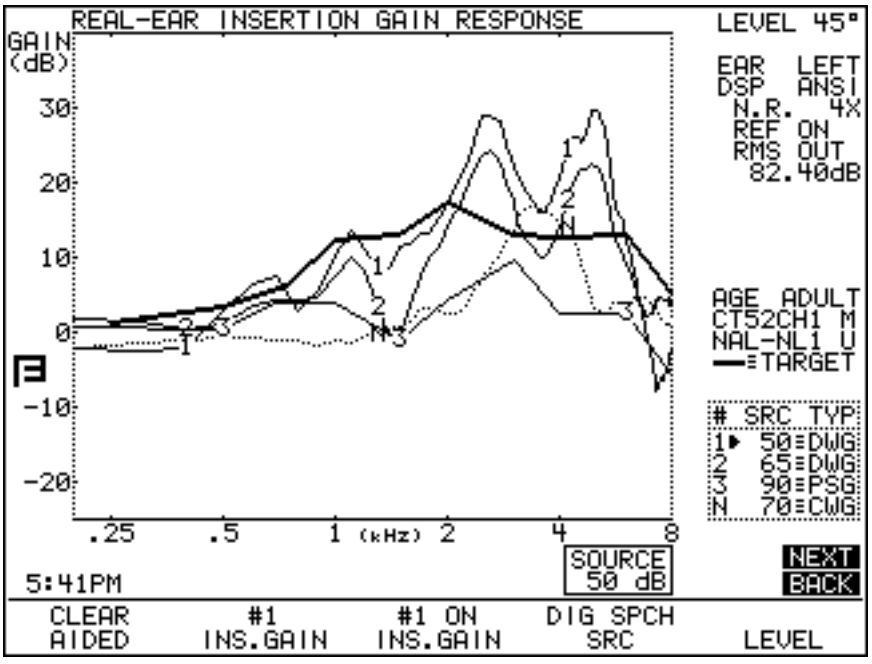


Figure 4.4B—Real-Ear Insertion Gain screen

4.4.1 Measuring the Unaided Response

The first step in taking an insertion gain measurement is to measure the unaided response. You can do this from either the Unaided & Aided Response Screen or the Insertion Gain Screen.

If you are using the average unaided response, skip to the next section.

1. Place the probe tube in your client's ear as described in Section 4.2.4. Level the sound field speaker. See Section 4.2.6.
2. Press [F4] to select the signal type. Use COMP if you have the Composite Option. If not, use NORM.
3. Press [F2] to select CUSTOM UNAIDED. If AVG UNAIDED appears, press [MENU] and use the arrow keys to change the UNAIDED selection to CUSTOM. Press [EXIT] to close the local menu.
4. Use the [▲ , ▼] keys to adjust the source amplitude to 65 or 70 dB SPL.
5. Have the client sit still in the same position they were in during leveling, and press [START/STOP] to begin measuring the unaided response. If you are using the composite signal, press [START/STOP] when the measurement stabilizes.
6. The real-ear unaided response (REUR) will be displayed on the graph as a dotted line marked with the letter N.

Note: To display the average unaided measurement, set UNAIDED to AVERAGE in the menu. Then select AVG UNAIDED with [F2] and turn ON its display with [F3].

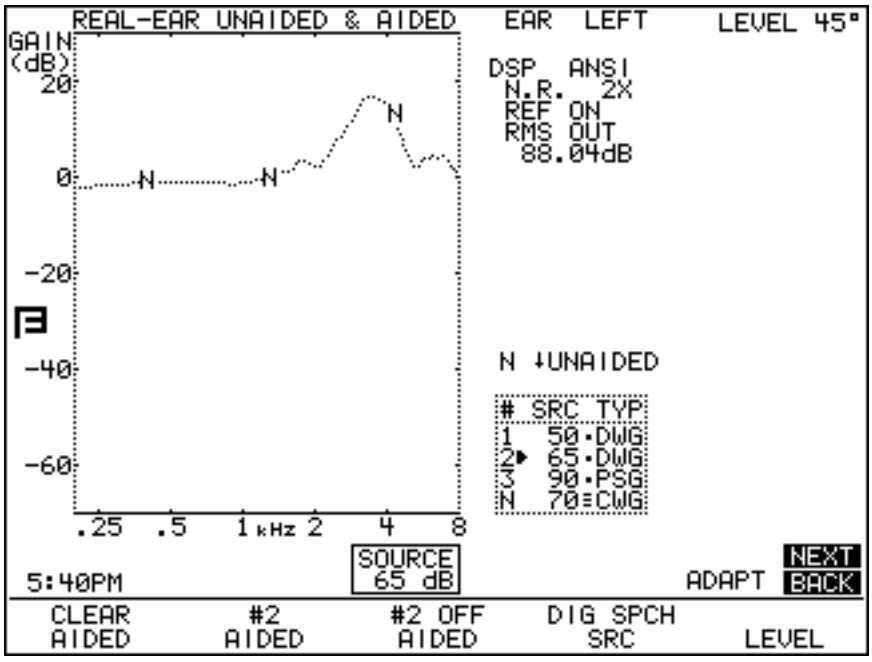


Figure 4.4.1—Unaided response

4.4.2 Measuring the Aided Response

The second step in an insertion gain measurement is the aided response.

If you would like to view the measurement as an ***insertion gain*** curve and compare it to an insertion gain target, take this measurement from the Insertion Gain Screen. If you would prefer to view the ***aided gain***, take this measurement from the Unaided & Aided Response Screen. Move between the two screens by using the [NEXT] and [BACK] keys while in Real-ear mode.

Whenever you take a measurement in one of these screens, it will automatically be converted and placed into the other screen.

To take an aided measurement:

1. Place the aid into the client's ear taking care not to drag the probe tube further into the ear canal. Once the aid is in the ear, the red mark on the probe tube should be at the same position it was for the unaided test. (See Figure 4.2.4C.)
2. Have the client set the aid's gain control to the normal use level.
3. Press [F4] to select the source type. DIG SPCH is recommended if you have the Composite/Digital Speech Option. Otherwise, use FAST.
4. Use the [▲ , ▼] buttons to adjust the source amplitude to the desired level, usually the same level used for the unaided measurement.
5. Instruct the client to resume the position they were in for leveling and testing. Tell them to sit very still while the signal is on.
6. Press [START/STOP] to introduce the signal. The aided response will appear on the graph as a thin line labeled with a curve number. See Figure 4.4.2.

   Note: If you are using the COMP, DIG SPCH, or FAST signal, you can change the source amplitude during testing to see how the aid responds to such changes.
7. Press [START/STOP] to end the measurement if you are using the COMP, DIG SPCH, or FAST signal.
8. If desired, press [F2] to select a another curve number and repeat steps 3-7.

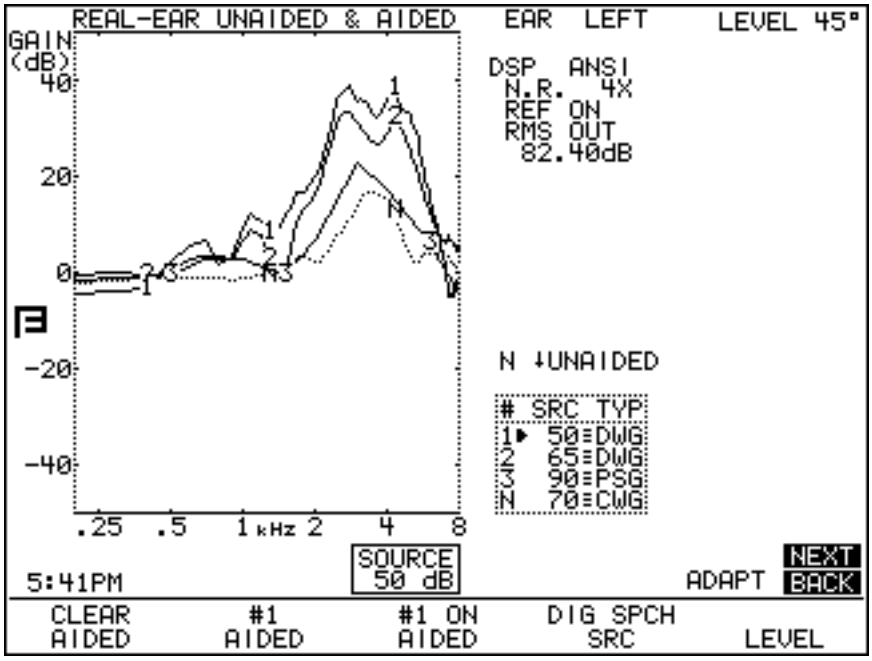


Figure 4.4.2 —Unaided and aided response

4.4.3 Testing Automatically

The FP35 analyzer has the capability of performing automatic real-ear aided measurements. This feature automatically tests the three aided measurements automatically without needing user intervention between measurements. Auto Test always measured AIDED 1, 2, and 3, in that order.

To enable auto test:

1. Press [MENU] in the real-ear measurement screen.
2. Use [∨, ∧] to select AUTO TEST and set it to ON.
3. Press [EXIT] to close the menu.
4. Press [START/STOP]. The analyzer will automatically test AIDED 1, AIDED 2, and AIDED 3.

The Auto Test feature can be defaulted to on. See Section 1.3 for details

4.4.4 Testing Directional Hearing Aids

The Insertion Gain screen is a good place to perform a directionality test for directional hearing aids. In an insertion gain measurement, the unaided curve is subtracted from the aided curve in order to arrive at the insertion gain curve. You can use this functionality in order to find out how much advantage the directional microphones of the hearing aid are providing.

To test directionality:

1. Place the probe tube in your client's ear as described in Section 4.2.4, and level the sound field speaker as described in Section 4.2.6. Although we usually recommend a 45° azimuth for real-ear measurements, for this measurement you should use a 0° azimuth, with the sound field speaker directly in front of the patient.
2. Place the hearing aid in your client's ear, making sure not to move the probe tube.
3. Enter the Unaided & Aided Response screen. Use the [NEXT] and [BACK] keys if necessary.
4. Press [MENU] to enter the real-ear menu. Make sure that CUSTOM is selected for UNAIDED. Use the arrow keys to make the selection, if necessary. Press [EXIT] to return to the real-ear measurement screen.
5. Press [F1] and [START/STOP] to clear all existing curves, if necessary.
6. Use [F2] to select AIDED #1.
7. Use [F4] to select the signal type. DIG SPCH is recommended if you have the Composite/Digital Speech Option. Otherwise, use FAST.
8. Use [▲ , ▼] to select a signal source of 65 dB SPL.
9. Press [START/STOP] to take the measurement. If you're using a FAST, COMP or DIG SPCH signal, press [START/STOP] again to stop the signal once the measurement has stabilized. This curve will be the "forward" measurement.
10. Turn your client around so that the back of his head is facing the speaker. See Figure 4.4.4A. Alternately, if you are using an external speaker on a swing arm, you can swing the speaker around the client.
11. Use [F2] to select CUSTOM UNAIDED. Although this is an aided measurement, the "unaided" measurement slot will give you a nice directional subtraction curve when the second measurement is completed.
12. Use [F4] to select the signal type used in the "forward" measurement.
13. Use [▲ , ▼] to select a signal source of 65 dB SPL.
14. Press [START/STOP] to take the measurement. If you're using a FAST, COMP or DIG SPCH signal, press [START/STOP] again to stop the signal once the measurement has stabilized. This curve is the "reverse" measurement. See Figure 4.4.4B.
15. Press [NEXT] to enter the Insertion Gain screen. The displayed measurement curve is the difference between the "forward" and the "reverse" measurements, or the amplification advantage provided by the directional microphones of the hearing aid. See Figure 4.4.4C.

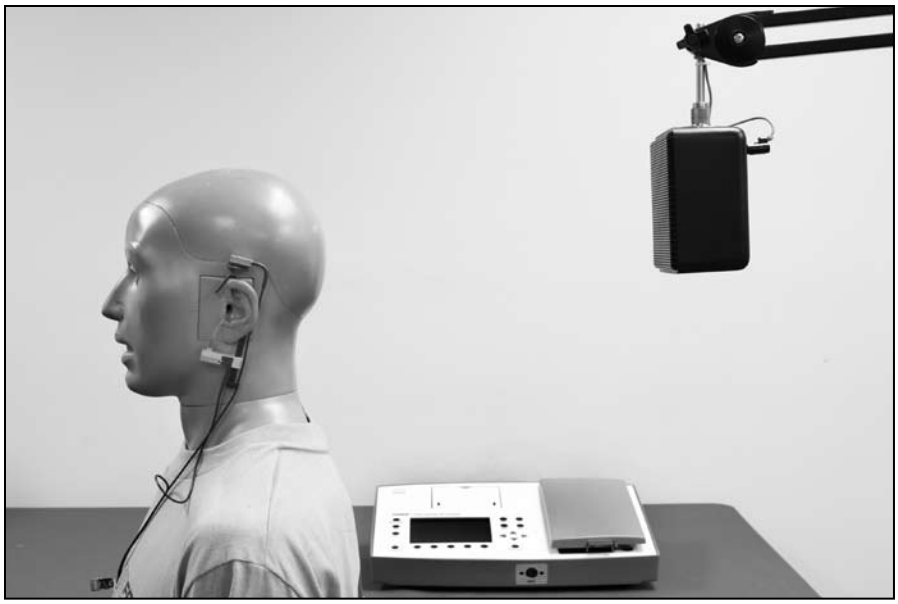


Figure 4.4.4A—"Reverse" directional aid setup

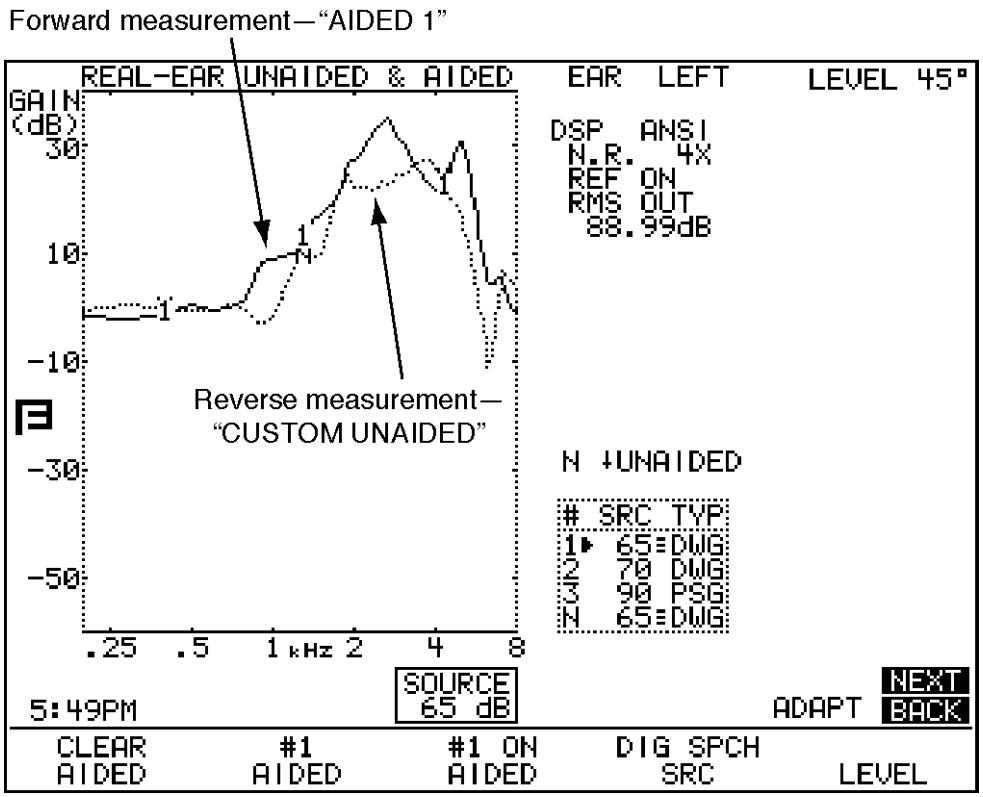


Figure 4.4.4B—"Forward" and "reverse" directional aid measurements in the real-ear unaided & unaided screen

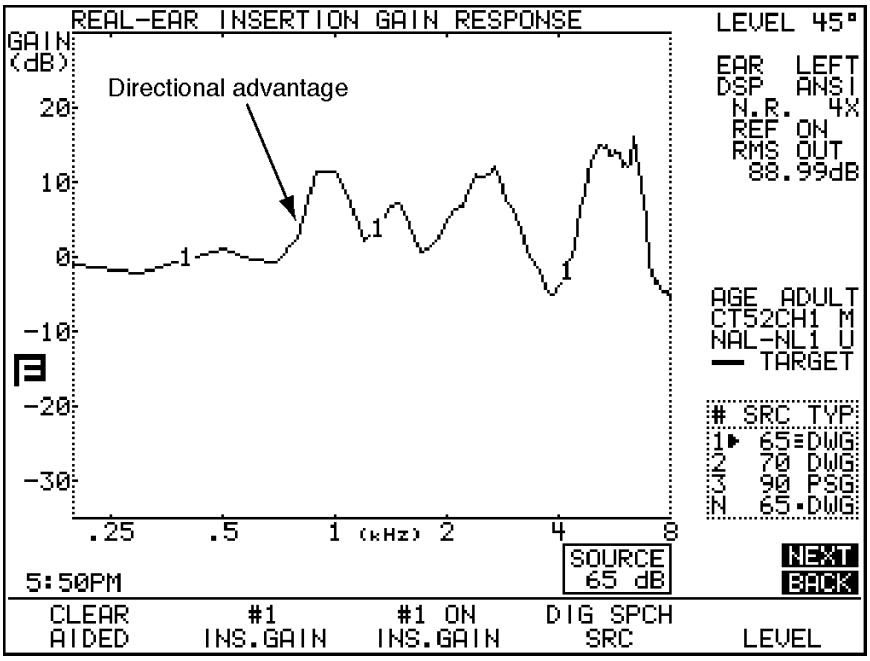


Figure 4.4.4C—Amount of amplification advantage provided by the directional microphones

4.5 Testing in the SPL Screen

The SPL screen permits the user to view all the major components of a client's hearing loss and hearing aid fitting on one screen in dB SPL. The hearing thresholds and uncomfortable loudness levels, which are generally measured in HL, are converted to SPL. The insertion gain target is also converted to SPL. You can measure and display the unaided response and three aided responses, in SPL, at three different source amplitude levels. Having all this information in a common format provides a convenient way to view the hearing loss and the amplification provided by the hearing aid without the confusion of different frames of reference.

The factory default amplitudes used in this program are generally 50, 65 and 90 dB. (When DSL is the selected fitting rule, these default levels will vary.) The user may choose other amplitude levels while conducting the tests. The idea is to make sure that:

- Soft sounds are audible (AIDED 1).
- Moderate sounds are comfortable (AIDED 2).
- Loud sounds do not exceed the user's uncomfortable loudness level (AIDED 3).

This technique is especially appropriate for non-linear hearing aids.

4.5.1 Viewing the SPL Display

The information on the SPL screen is similar to the information in the other real-ear measurement screens. However, in addition to the measurement curves and the SPL-converted target, the SPL Screen also displays SPL-converted thresholds and uncomfortable levels, allowing you to directly compare the measurement curves to the audiometric information.

X denotes left thresholds
O denotes right thresholds
* denotes the target
U denotes the uncomfortable levels.

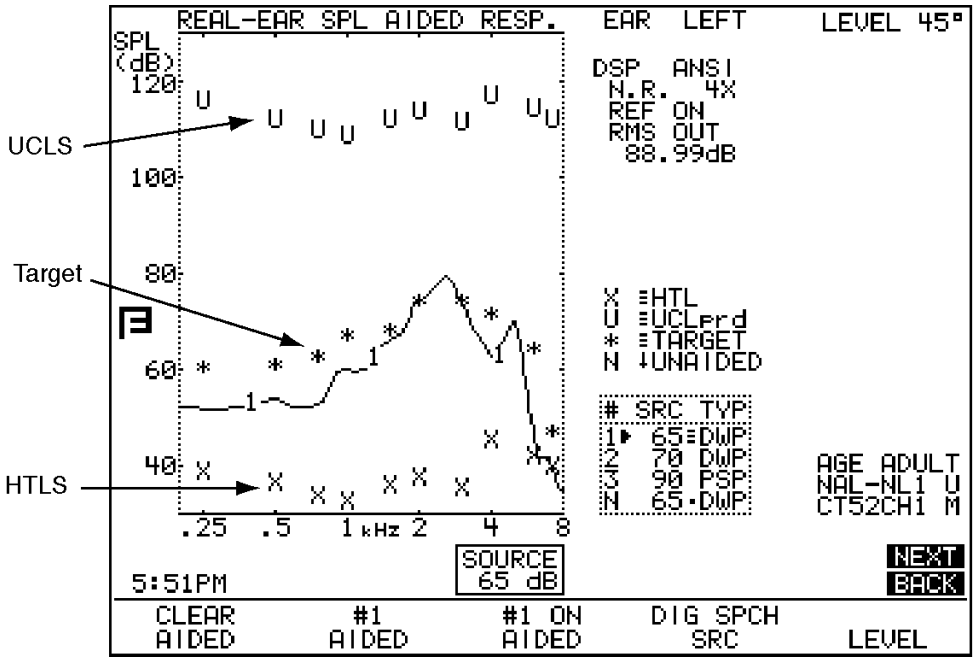


Figure 4.5.1—SPL display

4.5.2 Running an SPL Test

This section assumes you have already entered the client's audiometric data in the Audiogram Entry Screen, and that you have generated a target. See Section 4.3.3 and 4.3.4 for more details.

1. Place the probe tube into the client's ear following the instructions provided in Section 4.2.4.
2. Insert the aid into the client's ear, being careful not to drag the probe tube farther into the ear canal (See Figure 4.2.4C). Do not turn the aid on.
3. Instruct the client to remain still when the signal is on.
4. Press [F5] and [START/STOP] to level.
5. Have the client turn the aid on and set the gain control to the normal use level.
6. Use [F2] to select AIDED 1.
7. Use [F4] to select the source type for AIDED 1, and use the [▲ , ▼] buttons to set the source amplitude
8. Have the client resume the position they were in during leveling, and remind him to stay still while the signal is on.

9. Press [START/STOP] to test. If you are using the COMP, DIG SPCH, or FAST signal source, you will need to press [START/STOP] again to stop the signal.
10. Repeat steps 6 through 9 for AIDED 2 and AIDED 3. See Figure 4.5.2.

In general, AIDED 1 is tested at low levels (50 dB SPL) to make sure soft sounds are above the patient's threshold values. AIDED 2 is tested at medium levels (65-70 dB SPL) to make sure that the aid meets the target. AIDED 3 is tested at loud levels (90 dB SPL) to make sure that loud sounds are beneath the patient's UCLs.

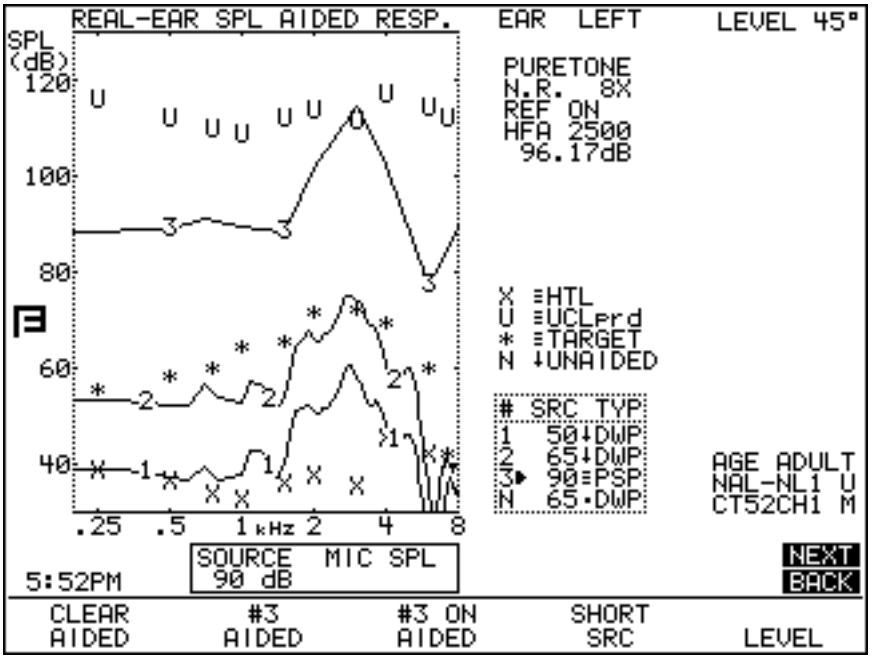


Figure 4.5.2—Real-Ear SPL screen with measurements

4.5.3 Testing Automatically

The FP35 analyzer has the capability of performing automatic real-ear aided measurements. This feature automatically tests the three aided measurements automatically without needing user intervention between measurements. Auto Test always measured AIDED 1, 2, and 3, in that order.

To enable auto test:

1. Press [MENU] in the real-ear measurement screen.
2. Use [∨, ∧] to select AUTO TEST and set it to ON.
3. Press [EXIT] to close the menu.
4. Press [START/STOP]. The analyzer will automatically test AIDED 1, AIDED 2, and AIDED 3.

The Auto Test feature can be defaulted to on. See Section 1.3 for details

4.6 Visible Speech Testing

In the Spectrum Analysis mode, available with the Composite/Digital Speech Option, you can use the external signal of your choice with your real-ear measurements, including sounds from a CD player, the patient's own voice, or the voice of a spouse or family member. Several different methods of using external signal in your real-ear measurements are described in this section.

When you use live speech in the real-ear SPL screen, you can compare the hearing aid's response to the actual speech to the patient's threshold and uncomfortable levels. This can be a great counseling tool for your patient.

4.6.1 Using Speech as a Test Signal

Visible Speech testing can be performed with a live voice signal or with a prerecorded stimulus from an external CD player or MP3 player. This is especially useful if you have the spouse or family member of the client in the testing room. You can use his/her voice as the test signal in order to educate both the client and the spouse how close they need to be to each other in order for the hearing aid to work effectively.

Visible Speech can be performed in any real-ear measurement screen, but this section will focus on measurements in the Real-ear SPL screen.

To set up for Visible Speech:

1. Follow the instructions in Section 4.2 to set up the client and hearing aid for real-ear measurements. The sound field speaker does not need to be leveled for live speech testing.
2. Insert the patient's hearing aid carefully and turn it on with the volume control at the normal user setting.
3. Follow the instructions in Section 4.3 to create a real-ear target, if desired.
4. Enter the Real-Ear SPL screen by using [NEXT] from the Audiogram Entry screen.
5. Make sure that AIDED #1 is shown above F2. If necessary, use [F2] to change the curve number. Visible Speech will not function when the UNAIDED curve is selected.
6. Use [F4] to select COMP.
7. Press [▼] repeatedly until the SOURCE is turned OFF. This is displayed in the source box on the display above the F3 key.
8. Press [MENU] to open the local menu.
9. Use [▲, ▼] to select VISIBLE SPEECH. The BARS selection will display a set of vertical bars indicating the maximum and minimum response to the test. The AVERAGE selection will display a second curve during the measurement, indicating the average response over the time of the test using a peak decay method.

10. Use [▲, ▼] to select NOISE RED (COMP) and [<, >] to select the amount of averaging you would like to do when the measurements are performed. Large noise reduction numbers will create a smoother curve that will update more gradually with more averaging. If the noise reduction is turned to a low number or OFF, the measurement curve will update more quickly with less averaging.
11. Press [EXIT] to close the local menu.

To use an external CD/MP3 player

If your FP35 has been manufactured after October 2008, you can connect an external CD player or MP3 player to the FP35 analyzer and play the signal through the FP35 speaker using the 3.5mm "line-in" jack on the back of the analyzer. If your analyzer does not have this jack, then it was probably manufactured previous to the addition of this feature. Existing analyzers can be upgraded. Contact your FONIX distributor for details.

When the FP35 is in spectrum analysis mode (as described in the "To set up for Visible Speech" section above) and an external player is connected using the line-in jack, then the FP35 will automatically play any input coming from the external player

To calibrate a pre-recorded signal

We recommend that you calibrate the external signal for best measurement results. Many CDs used by hearing health professionals contain a calibration track as the first track of the CD. This is generally a puretone signal at a particular input level.

1. Set up the patient for real-ear measurements as described in the "To set up for Visible Speech" section above.
2. Put the analyzer in spectrum analysis mode and play the calibration track on the CD through the FP35 speaker. Make sure to start a measurement by pressing the [START/STOP] key.
3. Adjust the volume control on the external player until the REF measurement (located to the right of the measurement graph, above the RMS OUT measurement) matches the desired level of the calibration tone. This level should be indicated on the instruction materials of the CD.

To start measuring:

1. Press [START/STOP] to start the measurement.
2. Start your input signal:
   a. If you are using a live voice, such as the patient's spouse, have the person speak to the patient from about 6 feet away (2 meters). It helps to have something for them to read.
   b. If you are using a pre-recorded signal, start the signal from the external player.
3. Examine the measurement graph. The screen will display the hearing aid's response to the live voice or pre-recorded signal and how it relates to the displayed speech banana. If you chose the BARS setting in step 9 of the Setup

section, you will also see a succession of bars on the screen, indicating the maximum peaks of the speech. If you chose the AVERAGE setting, you will see a second curve composed of small diamonds indicating the long term average response over the time of the test. See Figure 4.6.1.

4. Press [START/STOP] to stop the measurement. Show your patient and his spouse how the hearing aid amplified the speech.
5. Press [F2] to select AIDED 2, and repeat steps 5-6 in the section above. Press [START/STOP] to start a second measurement. If using a live voice signal, instruct your patient's spouse to stand 3 feet away (1 meter) and speaker again.
6. Press [START/STOP] to stop the measurement. When used with a live voice signal, this exercise can show how distance improved the gain of the frequency response.
7. Experiment in this manner with different distances. This will help demonstrate how close your patient and his spouse need to be to each other to maximum speech intelligibility.

Notes

The target displayed in the Real Ear SPL screen when in spectrum analysis mode assumes a 60 dB SPL input level.

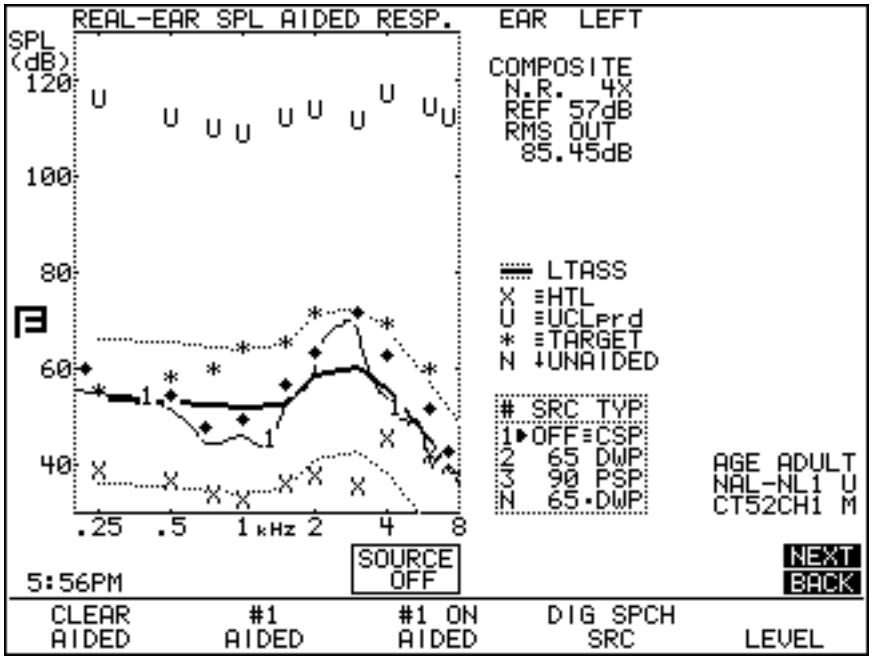


Figure 4.6.1—Visible Speech Testing

4.6.2 Measuring the occlusion effect

If you have the Composite/Digital Speech Option, you can use the Aided & Unaided screen in order to measure the "occlusion effect" of a hearing aid. By analyzing the spectrum of your patient's own voice, you can judge whether the occlusion effect

will make the hearing aid uncomfortable, and you can measure an improvement (lessening) of the occlusion effect after adjusting the vent opening.

To set up for measuring the occlusion effect:

1. Enter the Unaided & Aided screen. To do this, press [F2] from the Opening screen and use [NEXT] or [BACK] until the Unaided & Aided screen appears.
2. Follow the instructions in Section 4.2.4 to insert the probe tube into your patient's ear. There is no need to level the sound field speaker when measuring the occlusion effect.
3. Insert the patient's hearing aid, becing careful not to move the probe tube. The hearing aid can be turned on or off.
4. Use [F2] to select UNAIDED. If AVG UNAIDED shows up above F2, press [MENU] and use the arrow keys to change UNAIDED to CUSTOM. Press [EXIT] to close the menu.
5. Use [F4] to select COMP.
6. Press [▼] repeatedly until the SOURCE is turned OFF. This is displayed in the source box on the display above the F3 key.
7. Press [MENU] to open the local menu, and use the arrow keys to change NOISE RED (COMP) to 16X. This will increase the amount of averaging the analyzer does when the measurements are performed. Press [EXIT] to close the local menu.

To measure the occlusion effect:

1. Press [START/STOP] to start the measurement.
2. Instruct your client to sustain the vowel sound "eee."
3. Press [START/STOP] while the "eee" is still sounding and the curve has stabilized. The patient can now stop vocalizing.
4. Look at the gain in the low frequencies. If it seems high, you may consider adjusting the vent to a more open condition in order to prevent occlusion-effect discomfort.
5. Press [F2] to select AIDED 1. Make sure COMP is the selected source type above F4, and the SOURCE is OFF. Use [F4] and [▼] to make these selections, if necessary.
6. Press [START/STOP] to start a second measurement.
7. Ask your patient to sustain an "eee" sound again. Press [START/STOP] during the vocalization when the measurement has stabilized. (You can then tell your patient to stop.)
8. Compare AIDED 1 to the "UNAIDED" measurement to see how your vent adjustments have changed the response of the hearing aid.
9. Press [NEXT] to view the Insertion Gain screen. This will show you the actual difference that your adjustments made—the first measurement is subtracted from the second measurement.

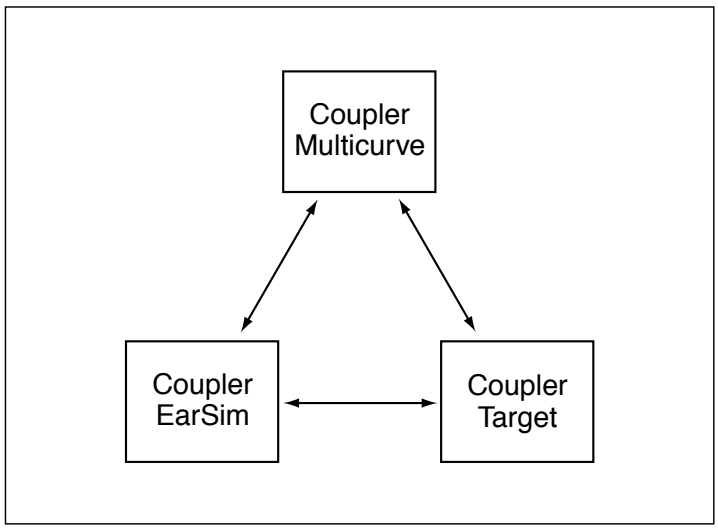
2-CC Targets

In the 2-cc target screens, you can measure hearing aids using a coupler in a sound chamber and compare them to a target. This type of testing is especially useful when fitting a patient who is unable to sit still for a real-ear measurement, such as an infant or a young child. There are two 2-cc target screens available: the Coupler Target screen, which converts real-ear targets into coupler targets, and the Coupler EarSim screen, which converts coupler measurements into simulated real-ear measurements. **The Real-ear Option is required to access these screens.**

In the Coupler Target screen, real-ear targets are converted into coupler targets so that you can compare them to coupler measurements. Targets and measurements can be displayed in either dB SPL or dB GAIN.

In the Coupler EarSim screen, the opposite approach is used, and actual real-ear targets are displayed. When coupler measurements are taken, the response curves are converted, using average or measured RECD transforms, into simulated real-ear measurements, which can then be directly compared to the displayed real-ear targets. Two displays are available: Insertion Gain and SPL. When the SPL display is selected, the patient's HTL and UCL values are also displayed on the screen. These HTL and UCL values are identical to the ones that would be displayed in the real-ear SPL screen.

The Coupler Multicurve (described in Chapter 2), Coupler Target, and Coupler EarSim screens are all connected to each other by the [NEXT] and [BACK] keys, similar to the way that the real-ear screens are connected to each other. Any measurements taken in one screen are automatically converted to the other screens, minimizing your measurement time.



5.1 Target Creation

In order to create a target for use in the Coupler Target or Coupler EarSim screen, you must enter the patient's threshold values in the Audiogram Entry screen, just as you would if you were creating a real-ear target.

To create a target in the Target Coupler screen:

1. Enter the Audiogram Entry screen by pressing [F2] from the Opening screen and using the [NEXT] and [BACK] keys if necessary.
2. Follow the instructions found in Section 4.3 to enter the patient's audiogram and to create a real-ear target.
3. Follow the instructions found in Section 4.3.4, if desired, to measure the patient's RECD.
4. Press [EXIT] to return to the Opening screen.
5. Press [F3] to enter one of the coupler multicurve screens. If the screen is labeled COUPLER MULTICURVE (the label is found on top of the large graph), press [NEXT] to enter the Target Coupler screen.
6. Press [MENU] and [BACK] to enter the Target menu. Set the AID TYPE, FIT RULE, and AGE in this menu using the arrow keys. If you are creating an NAL-NL1 coupler target, you will also have to set COMPRESSION, CHANNELS, AID LIMITING, FIT TYPE, TUBING, and VENT. See Section 4.3.3 for details.
7. Press [EXIT] to return to the measurement screen. You are now ready to perform the coupler measurements.

5.2 Coupler Target

Press [NEXT] from the Coupler Multicurve screen or [BACK] from the Coupler EarSim screen to enter the Coupler Target screen.

In the Coupler Target screen, the real-ear target is converted into a coupler target displayed in either dB GAIN or dB SPL. Coupler measurement can be performed and compared directly to the target. The only major difference between this screen and the basic Coupler Multicurve screen (described in Chapter 2), is the addiition of the coupler target. See Figure 5.2.

To get the most accurate real-ear to coupler target conversions, measure the patient's unaided response in one of the real-ear measurement screens (Section 4.4.1) and the RECD in the Audiogram Entry screen (Section 4.3.4). When these measurements are not taken, average values, corrected for the age of the patient, are substituted automatically.

See Section 2.2 for instructions on how to perform measurements in the Coupler Target screen—the operation of the Coupler Target screen is identical to the operation of the Coupler Multicurve screen.

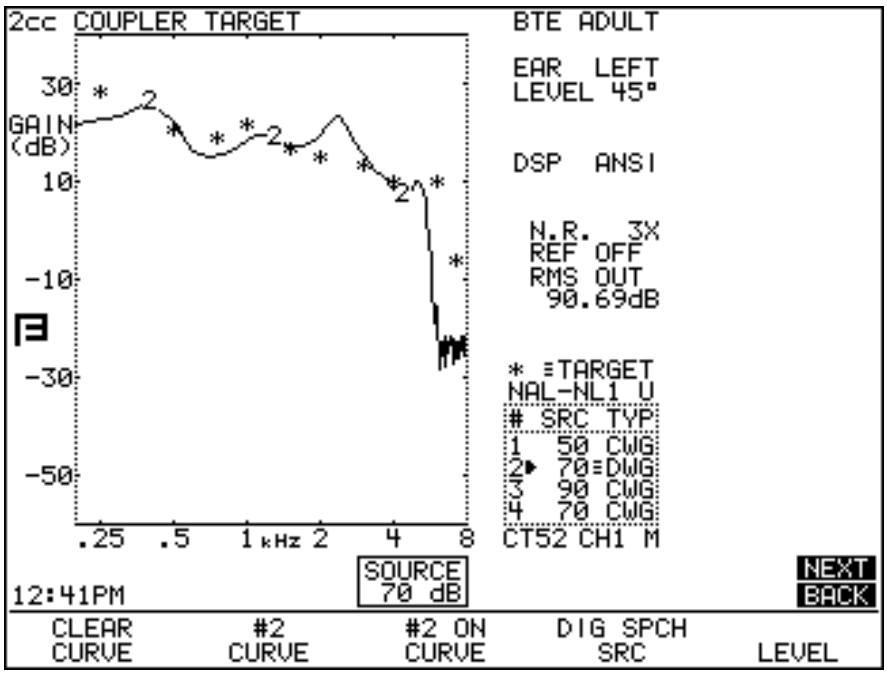


Figure 5.2—Coupler Target screen.

5.3 Coupler EarSim

Press [NEXT] from the Coupler Target screen or [BACK] from the Coupler Multicurve screen to enter the Coupler EarSim screen.

In the Coupler EarSim screen, the actual real-ear target prescribed for the patient is displayed in either dB IG (insertion gain) or dB SPL. When the Coupler EarSim display is set to dB SPL, the patient's threshold and uncomfortable values are also displayed. Any coupler measurement made in this screen is converted into simulated real-ear measurements that are directly comparable to the displayed real-ear target.

To get the most accurate real-ear to coupler target conversions, measure the patient's unaided response in one of the real-ear measurement screens (Section 4.4.1). The measured REUR will be used to convert the coupler measurements into simulated real-ear measurements. See Section 4.4.1 for instructions on performing the REUR measurement.

In the SPL display (Figure 5.3), the patient's audiometric data (HTL and UCL values) are converted from dB HL to dB SPL and displayed on the screen. To get the most accurage HL to SPL conversion (and the most accurage real-ear target), measure the patient's RECD in the Audiogram Entry screen. See Section 4.3.4 for details.

When the REUR and RECD are not measured, the FP35 substitutes average data to calculate the real-ear target and the coupler measurement conversions. These averages are sensitive to the selected age of the patient.

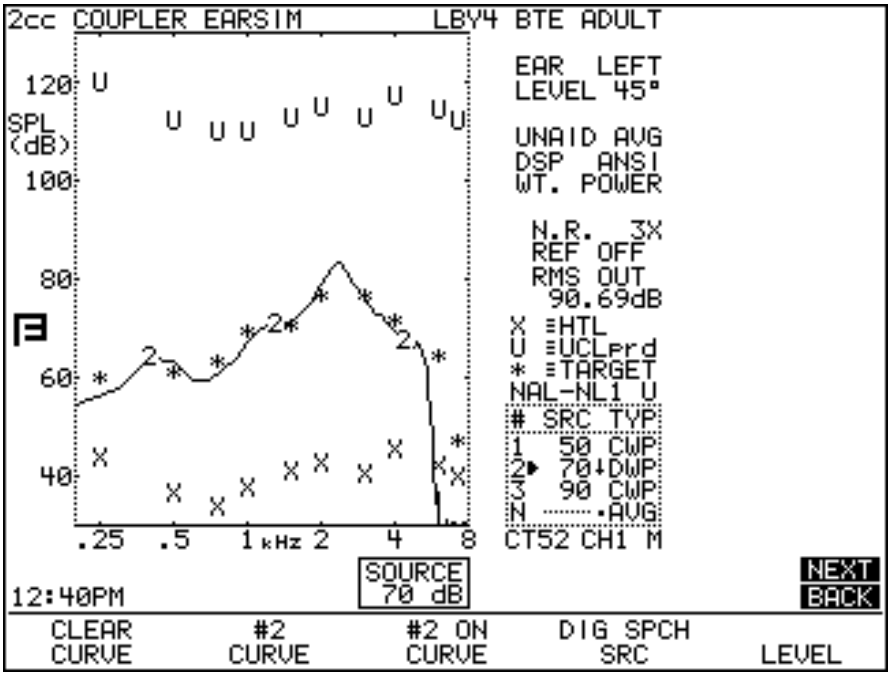


Figure 5.3—Coupler EarSim screen.

See Section 2.2 for instructions on how to perform measurements in the Coupler EarSim screen—the operation of the Coupler EarSim screen is identical to the operation of the Coupler Multicurve screen.

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