

# **FONIX<sup>®</sup> 6500-CX**

## **QUICK REFERENCE GUIDE**



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# QUICK REFERENCE GUIDE TO TESTING HEARING AIDS WITH THE FONIX 6500-CX

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## INTRODUCTION

The Quick Reference Guide contains “cookbook”-style instructions for testing hearing aids with the FONIX 6500-CX. There are two main sections, “Test-Chamber Procedures” and “Quik-Probe Procedures.” The “Test-Chamber” section describes testing with and without certain available software options. The “Quik-Probe” section describes tests that require the Quik-Probe II Option.

The instructions are written for users who already have a basic knowledge of hearing-aid testing and of operating the FONIX 6500-CX. Detailed descriptions and illustrations are, for the most part, excluded. In addition to step-by-step procedures, “The Guide” offers guidelines for interpreting the results of each test. This is something you won’t find in the main Operator’s Manual. The main Operator’s Manual remains a resource for complete and detailed information about the functions of the FONIX 6500-CX.

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## 1. TEST CHAMBER PROCEDURES

The sections that follow contain brief, step-by-step instructions on how to run common tests using software Version 4.0 or higher. Earlier software does not contain certain features, but operation will often be similar. The instructions assume that you have:

- switched on the power to the 6500-CX and the monitor.
- checked test chamber level status (level if necessary).
- installed the appropriate battery simulator pill into the hearing aid and selected the corresponding voltage on the Battery Voltage Supply or Module. (A real battery may be used if battery drain information is not needed.)
- connected the hearing aid to the appropriate coupler.
- installed the M1550E measuring microphone into the coupler.
- placed the hearing-aid/coupler assembly in the test chamber so that the hearing aid microphone is at the reference spot.
- closed and secured the test chamber lid.

When the results you want are displayed on the video monitor, press [CRT] to print a hard copy.

### 1.1 Composite Tests

#### 1.1.1 Full-on Gain Curve for Speech-Like Input

1. Set the hearing aid gain (“volume”) control to its maximum position.
2. The 6500-CX should be in COMPOSITE, WEIGHTED GAIN mode. If in doubt, press [RESET].
3. Use the [^] and [v] buttons to set the RMS SOURCE amplitude to 50 dB SPL (for high-gain and AGC aids) or 60 dB SPL (for low-gain aids).
4. Use [NOISE REDUCTION] as necessary for a stable display.

#### Guidelines for interpreting results:

The curve should be free of extremely sharp, or jagged peaks and valleys. However, a non-jagged peak in the region of the ear canal resonance (near 3 kHz) is often desirable.

### 1.1.2 “User” Gain Curve for Speech-Like Input

If the user is present:

1. Ask the user, while wearing the hearing aid, to set the gain (“volume”) control to its normal setting.
2. Tape the gain control to the hearing-aid case to lock the position.
3. Position the hearing aid with the proper coupler at the reference point in the test area.
4. The 6500-CX should be in COMPOSITE, WEIGHTED GAIN mode. If in doubt, press [RESET].
5. Use the [^] and [v] buttons to set the RMS SOURCE amplitude to 60 or 70 dB SPL.
6. Use [NOISE REDUCTION] as necessary for a stable display.

If the user is not available:

1. Follow the steps for “FULL-ON GAIN” in 1.1.1 above.
2. Observe the “RMS OUT” level on the right of the screen.
3. Adjust the gain (“volume”) control on the hearing aid in the following way. For ITE and Canal aids, set the RMS OUT level so that it is 10 dB lower than the full-on reading. For BTE and Body aids, set the RMS OUT level so that it is 15 dB lower than the full-on reading.
4. Use the [^] and [v] buttons to change the RMS SOURCE amplitude to 60 or 70 dB SPL.

Guidelines for interpreting results:

The curve should be free of extremely sharp or jagged peaks and valleys. However, a non-jagged peak in the region of the ear canal resonance (near 3 kHz) is often desirable.

### 1.1.3 Output Power (SPL) for Speech-Like Input

1. Set the gain (“volume”) control to full-on or “user” gain, as desired.
2. The 6500-CX should be in COMPOSITE, WEIGHTED POWER mode. If in doubt, press [RESET], and then press the [WEIGHT] button once.
3. Use the [^] and [v] buttons to set the RMS SOURCE amplitude as desired. To simulate very loud speech, use 90 dB SPL.

Guidelines for interpreting results:

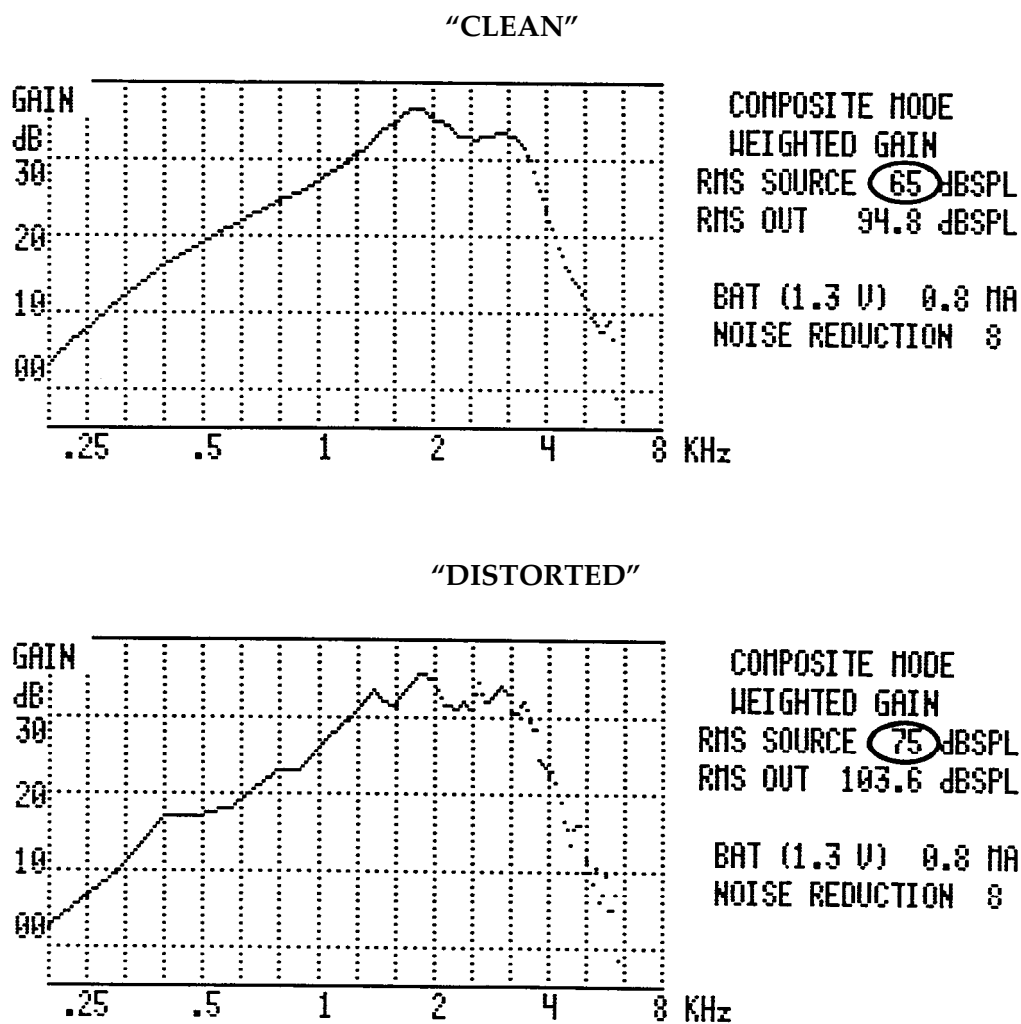
This curve indicates the maximum output the hearing aid is likely to produce for a very loud speech input. The response may exhibit a roll-off in the high frequencies, reflecting the spectral shape of the speech-like input signal. Expect the curve levels to be about 20 dB below the SSPL 90 curve levels; but the RMS OUT reading should be similar to the SSPL 90 high-frequency average.

**CAUTION:** When these results are measured in a 2cc coupler, expect that sound pressure levels in the real ear will often be 3-5 dB higher at frequencies lower than 1 kHz, and as much as 10 dB higher, or more, at higher frequencies.

The response of most peak-clipping (so-called “linear”) hearing aids will look jagged during this test, indicating severe overload distortion. However, a well designed instrument having output-limiting AGC should display a smooth response during this test.

**1.1.4 Intermodulation Distortion Test**

1. Set the gain (“volume”) control of the hearing aid for “user” gain (usually 10-15 dB below full-on; see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in COMPOSITE, WEIGHTED GAIN mode. If in doubt, press [RESET].
3. Use the [^] and [v] buttons to set the RMS SOURCE amplitude to 60 dB SPL.
4. Use [NOISE REDUCTION] as necessary for a stable display.
5. While watching the curve on the screen, push the [^] button repeatedly to observe the response as the source level increases from 60 to 90 dB SPL.
6. Note the level, if any, at which the response curve begins to look jagged. (See Figure 1.1.4-1)



**Figure 1.1.4 - 1 Intermodulation Distortion Test**

Guidelines for interpreting the results:

If the curve begins to look jagged at:

- 65 dB SPL: Most speech at average levels will sound distorted.
- 75 dB SPL: Some speech at average levels will sound distorted.
- 80 dB SPL: Most loud or close speech (including the user's own voice) will sound distorted.
- 90 dB SPL: Some loud or close speech (including the user's own voice) will sound distorted.

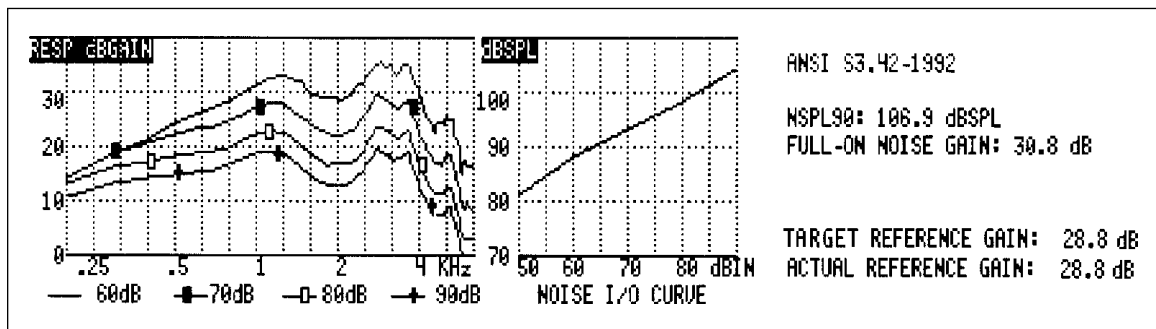


**NOTE:** Intermodulation distortion may be more objectionable than harmonic distortion, especially for persons with hearing loss. In general, peak-clipping (so-called “linear”) aids will show intermodulation distortion for high signal levels, whereas AGC aids will not.

### 1.1.5 The ANSI S3.42-1992 Option

This new standard has been developed to test non-linear hearing aids with a broad-band noise signal. Frye slightly modified its composite signal to meet standard requirements. (See section 7.1 of the operator’s manual for complete details.)

1. Set trimmer or programming controls on the hearing aid according to the manufacturer’s specifications. (As a rule, set non-linear / AGC for maximum compression; set all other controls for maximum output and widest response.)
2. Press [MENU] then [ANSI], select ANSI S3.42-1992 and press [MENU] again.
3. Using the [^, v] buttons, select the desired test choices.
4. Press [START] to run a test. If the tests stops for a reference test gain measurement, adjust the aid to the Target and press [CONTINUE] to finish the test.
5. Press [CRT] to print.



## 1.2 Puretone Tests

### 1.2.1 The ANSI S3.22-1987 Option

(Note: A special ANSI standard leveling procedure is given in Section 7.1.1 of the Operator’s Manual.)

### To view or alter the measurement settings before running the ANSI Option:

1. Set the trimmer or programming controls on the hearing aid according to the manufacturer's specifications. [As a rule, set the AGC threshold (when applicable) for maximum compression; set all other controls for maximum output and widest response.]
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU], then [ANSI], select ANSI S3.42-1987 and then press [MENU] again.
4. Use the [^, v] and [<, >] buttons to make selections, using the following guidelines:

#### **For linear (peak-clipping) instruments:**

- Select "AID TYPE: LINEAR."
- Select the "FULL ON GAIN" level specified by the hearing aid manufacturer. If specifications are not available, use 50 dB for instruments that have high gain and relatively low output (such as many high-gain ITEs). Otherwise, use 60 dB.

#### **For AGC instruments:**

- Select "AID TYPE: AGC WITH EIN," when you want equivalent input noise to be part of the test sequence. Otherwise, select "AGC WITHOUT EIN." For instruments having very long or adaptive recovery times, select the appropriate "ADAPTIVE AGC" setting.

#### **For instruments with telecoils:**

- Select "TELECOIL: ENABLED" only when you want to include the telecoil measurement in the sequence. Otherwise, leave "TELECOIL: DISABLED" to avoid slowing down the procedure.

#### **For "special purpose" instruments, e.g., "high-tone" or "low tone":**

- For "AVERAGE FREQUENCIES," select the "SPA" (special purpose average) frequencies closest to those specified by the manufacturer. When SPA frequencies are not specified by the manufacturer, use the HFA (high frequency average) frequencies. (This selection requires ANSI '87 hardware.)

#### **DELAY MENU:**

- Do not change defaults without referring to section 7.1.3 of the operator's manual.

5. Set the hearing aid gain (“volume”) control to its maximum position.
6. Press [START] to start the ANSI sequence.
7. If the program stops before the sequence is complete, follow the instructions at the bottom of the screen.
8. The words “TEST COMPLETE” will appear at the bottom left of the screen when the test sequence is over.
9. Press [START] to run another test, or press [CONTINUE] to exit the ANSI Option.

Simplified procedure, when you don’t have to check or change the menu settings:

1. Set the trimmer or programming controls on the hearing aid according to the manufacturer’s specifications. [If specifications are not available, set the AGC threshold (if applicable) for maximum compression; set all other controls for maximum output and widest response.]
2. Set the hearing aid gain (“volume”) control to its maximum position.
3. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
4. Press the [ANSI] button to start the ANSI sequence.
5. If the program stops before the sequence is complete, follow the instructions at the bottom of the screen.
6. The words “TEST COMPLETE” will appear at the bottom left of the screen when the test sequence is over.
7. Press [START] to run another test, or press [CONTINUE] to exit the ANSI Option.

Guidelines for interpreting the results:

Compare the results to the hearing-aid manufacturer’s specifications. If the results do not match, either the hearing-aid settings were not the same as those used by the manufacturer (check specifications), the measurement settings were not the same as those used by the manufacturer (check specifications), or the hearing aid needs service.

**1.2.2 The IEC Option (Amended 1995)**

(Note: The IEC leveling procedure is the same as the ANSI leveling procedure, and is described in Section 7.1.1 of the Operator’s Manual.)

### To view or alter the measurement settings before running the IEC Option:

1. Set the trimmer or programming controls on the hearing aid according to the manufacturer's specifications. (If specifications are not available, set all controls for maximum output and widest response. For AGC aids, this is usually accomplished by setting for minimum compression.)
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU], and then [IEC].
4. Use the [^,∨] and[<, >] buttons to select the settings according to the hearing aid manufacturer's specifications.
5. Set the hearing aid gain ("volume") control to its maximum position.
6. Press [START] to start the IEC sequence.
7. The 6500 will always pause after the measurement of the OSPL 90 curve. It will always be necessary to turn the gain of the aid down by at least 7 dB. Follow the instructions at the bottom of the screen.
8. The words "TESTS COMPLETE" will appear at the bottom left of the screen when the test sequence is over.
9. Press [START] to run another test, or press [CONTINUE] to exit the IEC Option.

### Simplified procedure, when you don't have to check or change the menu settings:

1. Set the trimmer or programming controls on the hearing aid according to the manufacturer's specifications. (If specifications are not available, set all controls for maximum output and widest response. For AGC aids, this is usually accomplished by setting for minimum compression.)
2. Set the hearing aid gain ("volume") control to its maximum position.
3. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
4. Press the [IEC] button to start the IEC sequence.
5. The test will stop before the sequence is complete. Follow the instructions at the bottom of the screen.
6. The words "TESTS COMPLETE" will appear at the bottom left of the screen when the test sequence is over.
7. Press [START] to run another test, or press [CONTINUE] to exit the IEC Option.

Guidelines for interpreting the results:

Compare the results to the hearing-aid manufacturer's specifications. If the results do not match, either the hearing-aid settings were not the same as those used by the manufacturer (check specifications), the measurement settings were not the same as those used by the manufacturer (check specifications), or the hearing aid needs service.

**1.2.3 Saturation Output Curve (SSPL 90/OSPL 90)**

1. The 6500-CX should be in the PURETONE mode. If in doubt, press [RESET] and then [SINE/COMPOSITE].
2. Set the gain ("volume") control on the hearing aid to its maximum position.
3. If necessary, use the [^ and v] buttons to set the SOURCE amplitude to 90 dB SPL.
4. Press [START] to start a frequency sweep.

**NOTE:** If your 6500-CX has the Gain Option, be sure the display is in the OUTPUT SPL mode. If in doubt, press the [GAIN] button repeatedly, until the label at the upper left of the graph is correct.

Guidelines for interpreting results:

This curve indicates the maximum levels the hearing aid can produce at any frequency. But CAUTION: When these results are measured in a 2cc coupler, expect that levels in the real ear will often be 3-5 dB higher for frequencies lower than 1 kHz, and as much as 10 dB higher, or more, for higher frequencies.

**1.2.4 Frequency Response Curves (with or without Harmonic Distortion Test)  
— Full-on Gain Curves, etc.**

1. The 6500-CX should be in the PURETONE mode. If in doubt, press [RESET] and then [SINE/COMPOSITE].
2. Set the gain ("volume") control on the hearing aid to the desired position. (For example, to measure a full-on gain curve, use the maximum setting of the gain control.)
3. Use the [^ and v] buttons to set the SOURCE amplitude as desired. (For example, to measure a full-on gain curve, use 50 dB SPL with high-gain and AGC aids, or 60 dB SPL with low-gain aids.)
4. Select the type of harmonic distortion you want to measure (2nd, 3rd, Total, or none) by pressing the [HARMONIC DISTORTION] button

repeatedly. (Note: Harmonic distortion is not measured in frequency sweeps for source amplitudes of 90 dB SPL or higher. Frequency sweeps will be fastest when the harmonic distortion measurement is switched off.)

5. Press [START] to start a frequency sweep.

**Note:** If your 6500-CX has the Gain Option, results can be displayed in terms of either AID GAIN or AID OUTPUT. Press the [GAIN] button repeatedly, until you see the appropriate labels on the screen. This can be done either before or after a curve is generated.

### Guidelines for interpreting results:

The curve should be free of extremely sharp or jagged peaks and valleys. However, a non-jagged peak in the region of the ear canal resonance (near 3 kHz) is often desirable.

Harmonic distortion is displayed as a bar graph near the bottom of the main graph grid. The scale on the right side of the grid gives the percent distortion. The lower the harmonic distortion, the better.

## 1.3 Special Tests for AGC, ASP, and Multi-Channel Instruments

### 1.3.1 Families of Composite Curves (requires the Multi-curve Option)

1. Set the gain (“volume”) control of the hearing aid for “user” gain (see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in COMPOSITE, WEIGHTED GAIN mode. If in doubt, press [RESET].
3. Use the [^ and v] buttons to set the RMS SOURCE amplitude to 50 dB SPL.
4. Use [NOISE REDUCTION] as necessary for a stable display.
5. Press [FREEZE] and then [START] to store the first curve in Multi-curve.
6. Press the [^] button twice to raise the SOURCE amplitude 10 dB to 60 dB SPL.
7. Press [FREEZE] and then [START] to store the second curve in Multi-curve.
8. Press the [^] button twice to raise the SOURCE amplitude 10 dB to 70 dB SPL.
9. Press [FREEZE] and then [START] to store the third curve in Multi-curve.

10. Press the [^] button twice to raise the SOURCE amplitude 10 dB to 80 dB SPL. (**Do not** press [FREEZE] this time).
11. Press [MULTI] to get into Multi-curve.
12. Use the [^] or [v] button to highlight MULTIPLE CURVES. Then press [START].
13. Be sure that CRV 1, CRV 2, CRV 3, and CRV 4 are listed in the box in the lower half of the screen. If not, use the arrow buttons to select those curves for display.

Guidelines for interpreting results:

**AGC Compression:** With single-channel dynamic-range compression, the shape of all four curves should be the same. But every time you raise the source amplitude above the AGC kneepoint, the overall gain should go down by an amount somewhat less than the amount you raised source amplitude.

**AGC Output Limiting:** With single-channel output-limiting compression, the shape of all four curves should be the same. But every time you raise the source amplitude above the AGC kneepoint, the overall gain should go down by an amount nearly equal to the amount you raised source amplitude. (Compare to “Clipping, or Saturation Distortion” below.)

**Clipping, or Saturation Distortion:** For each increment in source amplitude, the overall level of the gain curve will go down, and the curve will appear more jagged.

**Adaptive Low-Frequency Filtering:** For each increment in source amplitude, the level of the low-frequency portion of the gain curve will go down, but the high-frequency portion will not change.

**Multi-channel action:** For each increment in source amplitude, the levels and shapes of the individual portions of the gain curves, portions corresponding to the channels of the hearing aid, may change independently.

### 1.3.2 Special Attack & Release Tests (“\*” Option required)

Two special attack & release tests are described below. These tests can give you information about the way a signal-processing device will operate under real-use conditions.

### 1.3.2.1 Enhanced Attack & Release Test

With this test, you select the type and frequency of the test signal. The results are given in both numerical and graphical forms.

To view and/or change the menu settings before running the test:

1. Set the gain (“volume”) control of the hearing aid for “user” gain (see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU], and then [\*].
4. With the cursor on “ENHANCED A&R”, use the [<, >] (FREQUENCY) buttons or the [SINE/COMPOSITE] button to set the signal as indicated below:

**Single-Channel AGC Instruments:** Use the COMPOSITE tone or any PURETONE frequency within the frequency range of the instrument. Hints: Use the frequency specified by the manufacturer, or use 2 kHz.

**Adaptive Low-Frequency Filter Instruments:** Use the frequency specified by the manufacturer, or, if a specification is not available, use either 300, 400, or 500 Hz.

**Multi-channel:** Use either the COMPOSITE tone, or a puretone frequency that corresponds to the center of the channel you are testing. Or use the frequency(ies) specified by the manufacturer.

5. Press [START] to run the test. The test takes several seconds and requires silence in the test area.
6. When the test is over, press [CURSOR], as needed, to change the horizontal scale of the graph.
7. Press [CONTINUE] to exit the “\*” Option.

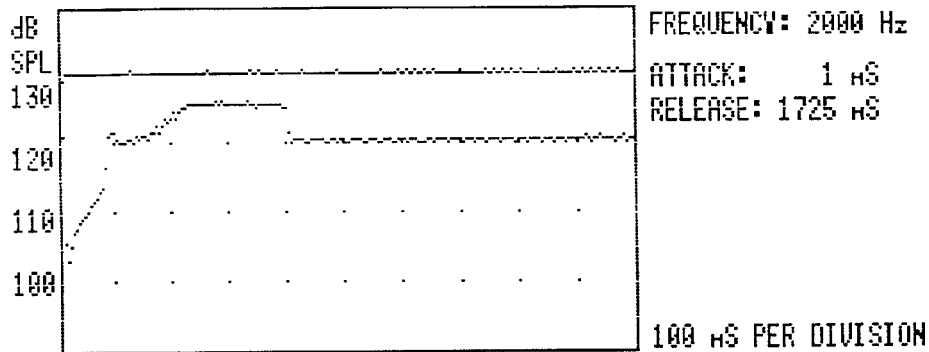
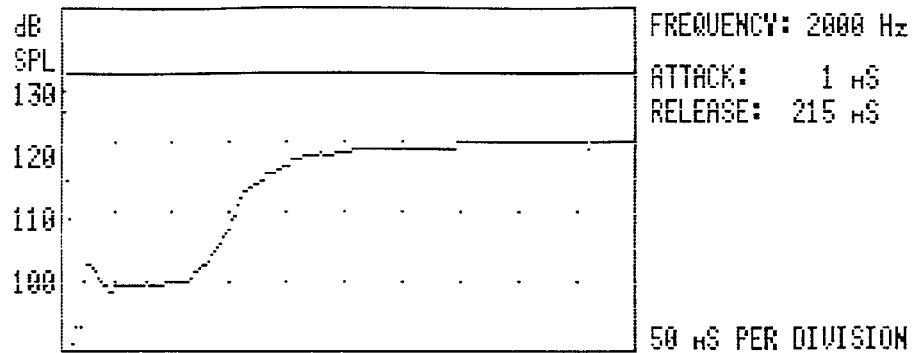
Simplified procedure, when you are re-using the previous settings:

1. Set the gain (“volume”) control of the hearing aid for “user” gain (see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].



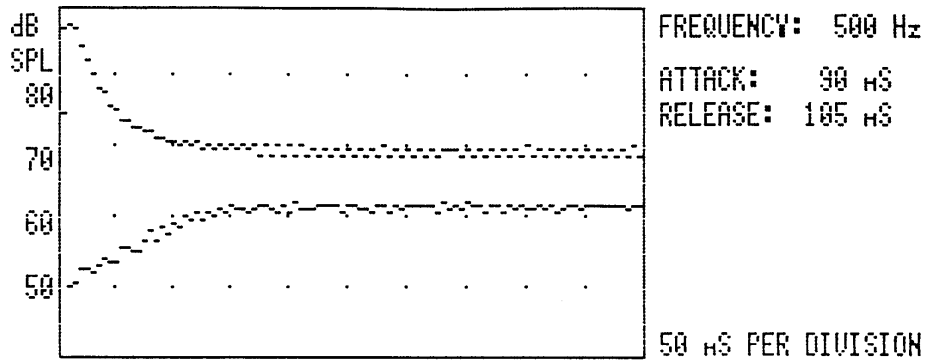
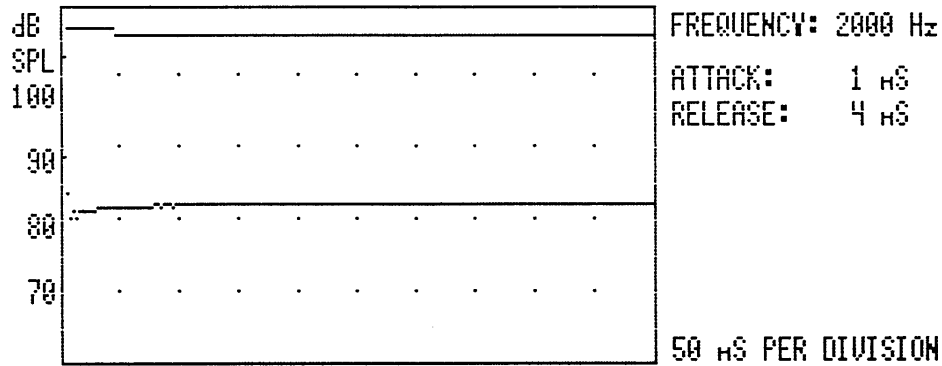
3. Press [\*] to run a test. The test takes several seconds and requires silence in the test area.
4. When the test is over, press [CURSOR], as needed, to change the horizontal scale of the graph.
5. Press [CONTINUE] to exit the "\*" Option.

Guidelines for interpreting results:



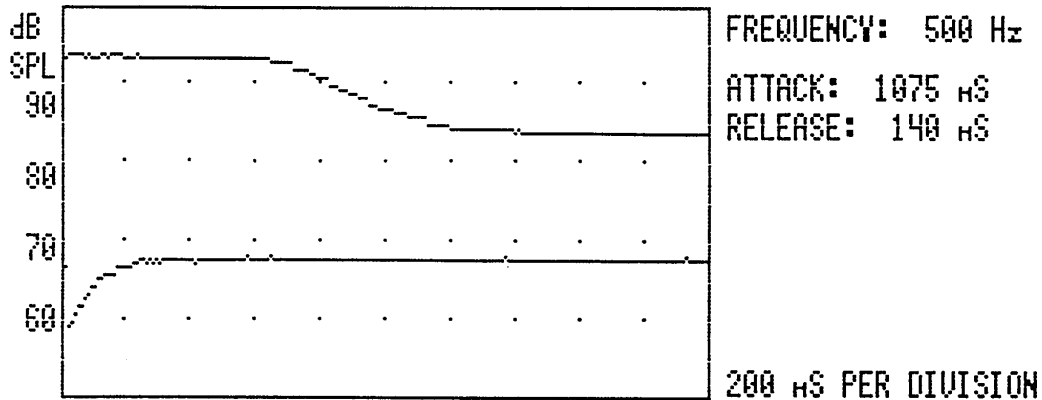
**OUTPUT-VERSUS-TIME GRAPH**

- »» Shows how AGC, ASP and other time-varying non-linear circuits perform during their attack and release phases.
- »» Above are two examples of defective release circuits.



### LOW-FREQUENCY ATTACK/RELEASE TIME

- »» Shows attack and release phases of an adaptive low-frequency (“ASP”) filter.
- »» Traditional ANSI (2000-Hz) test signal (upper graph) is too high to test this low-frequency circuit.
- »» Graph of output versus time shows smooth attack/release characteristics for a 500-Hz pure-tone signal (lower graph). But the relatively fast attack time (90 ms) means this circuit will probably react to speech, causing “pumping” or “breathing” sounds.



- »» Above, an adaptive low-frequency filter “waits” about 600 milliseconds before beginning to react (total attack time: 1075 ms). This circuit, therefore, should respond to ongoing background noise, but should not respond to speech.
- »» This circuit should exhibit far less “pumping” and “breathing” than similar circuits having shorter attack times (such as in the previous example).

### 1.3.2.2 Adaptive Attack & Release Test

This test gives you two release-time runs: one for a short stimulus and one for a long stimulus.

To view and/or change the settings before running the test:

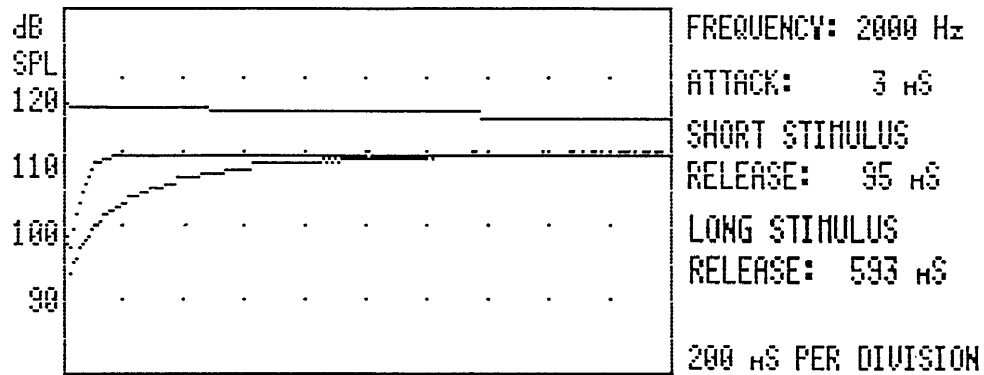
1. Set the gain (“volume”) control of the hearing aid for “user” gain (see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU], and then [\*].
4. Use the [∧, ∨] buttons to highlight “ADAPTIVE A&R.”
5. Use the [<, >] buttons to select the signal levels according to the manufacturer’s specifications (standard is 55 & 80).
6. Press [START] to run the test. The test takes several seconds and requires silence in the test area.

7. When the test is over, press [CURSOR], as needed, to change the horizontal scale of the graph.
8. Press [CONTINUE] to exit the "\*" Option.

Simplified procedure, when you are re-using the previous settings:

1. Set the gain ("volume") control of the hearing aid for "user" gain (see "USER" GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [\*] to run a test. The test takes several seconds and requires silence in the test area.
4. When the test is over, press [CURSOR], as needed, to change the horizontal scale of the graph.
5. Press [CONTINUE] to exit the "\*" Option.

Guidelines for interpreting results:



- »» Shows different release times for stimuli of different durations.
- »» Above is a test of a hearing aid that has an adaptive release time (e.g., Phonak, Telex, K-Amp). For a long stimulus (2 seconds), the release time is long (593 milliseconds); for a short stimulus (100 milliseconds), the release time is short (95 milliseconds).
- »» The purpose is that transient stimuli (such as dishes clanking) should not interrupt communication, whereas longer, but gapped stimuli (such as ongoing speech) should not cause raised levels of the background noise in the gaps.

### 1.3.3 Input/Output [I/O] and Input/Gain [I/G] Curves (I/O Option required)

Beginning with version 4.20, the delay mode choices have been expanded to include:

1. I/O Start Delay
2. I/O Measurement Delay

Please refer to section 7.1.3 of your operator's manual for complete details.

IMPORTANT NOTE: Changes in either delay will also cause the same change(s) in ANSI, CIC, JIS, and RS232

To view and/or change the menu settings before running the test:

1. Set the gain ("volume") control of the hearing aid for "user" gain (see "USER" GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU], and then [I/O].
4. Use the [∧, ∨] and [<, >] buttons to make selections with the following guidelines:

**Single-Channel AGC:** For FREQUENCY, use either the COMPOSITE tone or any puretone frequency within the frequency range of the instrument. For I/O MEAS DELAY, use 0.5 seconds or less.

**Adaptive Low-Frequency Filter Instruments:** Use the FREQUENCY specified by the manufacturer, or, if a specification is not available, use either 300, 400, or 500 Hz. For I/O MEAS DELAY, use twice the specified attack time, or twice the attack time measured in section 1.3.2, above.

**Multi-channel:** For FREQUENCY, use either the COMPOSITE tone or a puretone frequency that corresponds to the center of the channel you are testing; or use the frequency(ies) specified by the manufacturer.

DISPLAY: AMPLITUDE gives input/output curves;  
DISPLAY: GAIN gives input/gain curves.

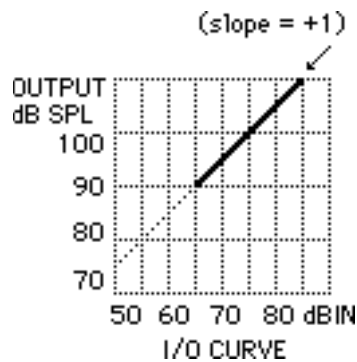
5. Press [START] to run a curve.
6. Press [CONTINUE] to exit the I/O Option.

Simplified procedure, when you are re-using the previous settings:

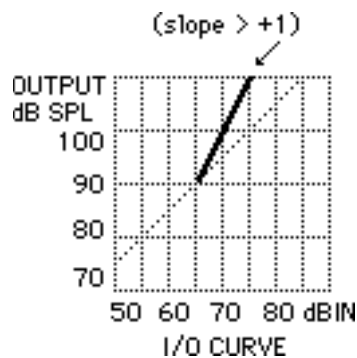
1. Set the gain (“volume”) control of the hearing aid for “user” gain (see “USER” GAIN in 1.1.2 above).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [I/O] to run a curve.
4. Press [CONTINUE] to exit the I/O Option.

Guidelines for interpreting results:

**INPUT/OUTPUT CURVES:**

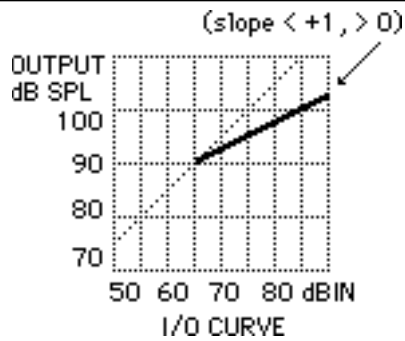


An I/O curve with a slope of “positive one” indicates linear amplification; as the input level increases, the output level increases by the same amount

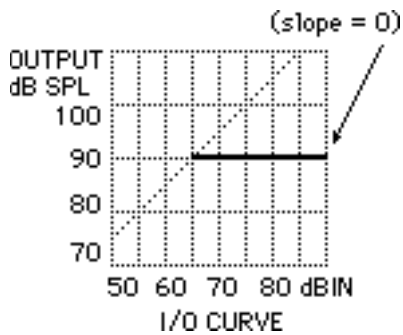


An I/O curve with a slope greater than “positive one” indicates either dynamic range expansion, or the addition of distortion components (both rarely seen, both rarely desirable).

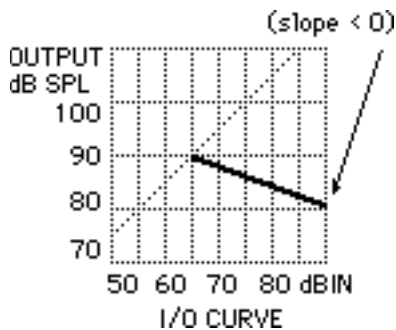
An I/O curve with a slope less than “positive one,” but greater than “zero” (horizontal),



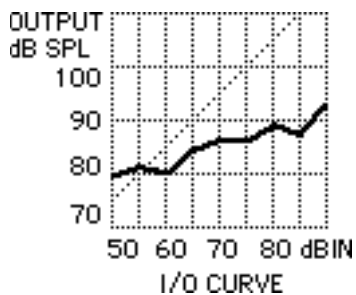
indicates moderate dynamic range reduction via compression or other means (often desirable with signal processing).



An I/O curve with a “zero” slope indicates output limiting, either from signal processing (often desirable) or from clipping/saturation (sometimes desirable, but rarely so).

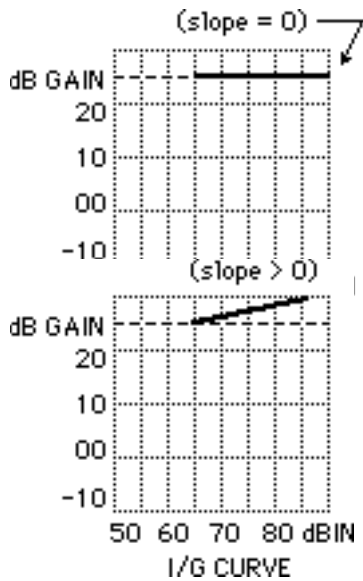


An I/O curve with a negative (downward) slope indicates extreme dynamic range reduction (sometimes desirable with ASP).



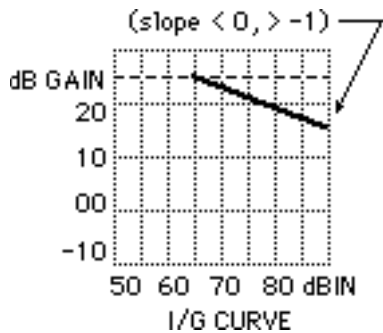
An I/O curve that rambles “randomly” (changes shape each time you measure) indicates noise. Try a higher or lower frequency.

**INPUT/GAIN CURVES:**

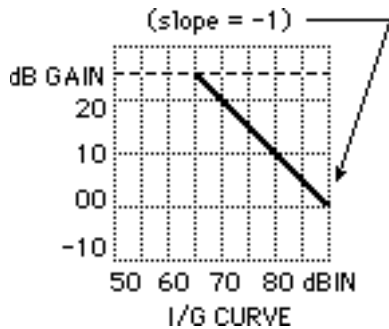


An I/G curve with a slope of “zero” indicates linear amplification; as the input level increases, gain remains constant.

An I/G curve with a positive slope (greater than “zero”) indicates either dynamic range expansion, or the addition of distortion components (both rarely seen, both rarely desirable).

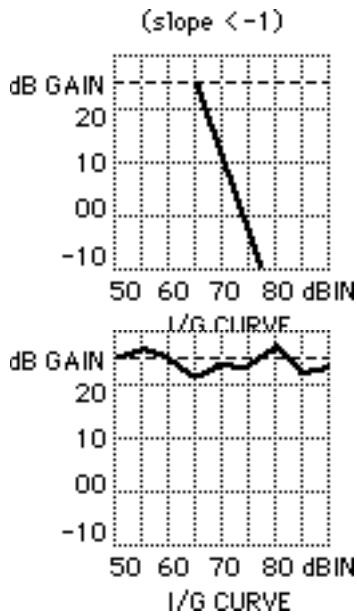


An I/G curve with a shallow negative slope (less than “zero” but not as steep as “negative one” — 45° downward to the right) indicates mild dynamic range reduction (often desirable with signal processing).



An I/G curve with a slope of “negative one” indicates output limiting, either from signal processing (often desirable) or from clipping/saturation (sometimes desirable, but rarely so).





steeper than “negative one” indicates extreme dynamic range reduction (sometimes desirable with ASP).

An I/G curve that rambles “randomly” (changes shape each time you measure) indicates noise. Try a higher or lower frequency.

## 1.4 Battery Tests

### 1.4.1 Current Drain

Whenever you have installed the appropriate battery simulator pill in the hearing aid and have made the appropriate selection on the Battery Voltage Supply (or Module), current drain readings are given on the screen for all normal measuring conditions, COMPOSITE, or PURE-TONE. Current drain is also given in the ANSI, Averaging, Coil, IEC, In-situ, and RBX Options). Check the hearing-aid manufacturer’s specifications for the correct battery type and voltage to select.

### 1.4.2 Estimated Battery Life (requires the RBX Option)

1. Be sure the appropriate battery simulator pill is installed in the hearing aid and the appropriate button is pressed on the Battery Voltage Supply or Module (check manufacturer’s specifications for battery type and voltage).
2. The 6500-CX should be in a normal measuring mode (either COMPOSITE or PURETONE, but not in any option). If in doubt, press [RESET].
3. Press [MENU] and then [RBX] to get into the RBX menu.
4. Press [START] to run RBX, and observe the ESTIMATED BATTERY LIFE on the screen.

5. Use the [^, v] and [<, >] buttons to vary the amplitude and frequency of the test signal, or press [COMPOSITE] to use a speech-weighted composite test signal.
6. Press [CONTINUE] to exit RBX.
7. For subsequent runs of RBX from a normal measurement mode, simply press [RBX].

## 2. QUIK-PROBE II PROCEDURES

The following sections contain brief, step-by-step instructions for running common probe procedures. Refer to Section 8 in the Operator's Manual for details. All button strokes refer to the buttons on the remote module, unless otherwise indicated. (Note: Operating the footswitch can, at your option, replace pressing the [START/STOP] button.)

### 2.1 Target Insertion Gain Curves

(Creating a target insertion gain curve can be done either before or after probe measurements.)

#### A. Enter the client's audiogram:

1. If not already done, press [START/STOP] to get to the Quik-Probe II Option.
2. Press [MENU] to call the main probe menu.
3. With the highlight cursor on "CREATE TARGET," use the [<, >] buttons to select "INS. GAIN" and press [START/STOP]. This will call either the audiogram screen or the target insertion gain screen (depending on what was done last).
4. If the box at the upper left is "AUDIOGRAM HL," you are already at the audiogram screen; proceed to the next step. If the label at the upper left of the graph is "GAIN dB," this is the target insertion gain screen; press [DATA] to call the audiogram screen.
5. If necessary, press [CLEAR] to clear the previously entered audiogram.
6. While watching number tables at the bottom of the screen, use the [^, v] and [<, >] buttons to enter the client's audiogram. Entries will be reflected on the audiogram graph. Inter-octave frequencies will be interpolated by the program, unless you make entries at these frequencies.

B. Select a fitting rule:

There are six selectable, pre-programmed fitting rules which convert the entered audiogram into a target insertion gain. Use one of these formulas as a starting point upon which to base your hearing-aid fitting.

Press [MENU] to select a TARGET I.G. FORMULA and the test ear. Your selection is displayed in the box at the upper right of the screen.

C. View and modify the target curve:

1. From the audiogram screen, press [DATA] to view the target insertion gain screen.
2. While watching number tables at the bottom of the screen, use the [ $\wedge$ ,  $\vee$ ] and [ $<$ ,  $>$ ] buttons to modify the displayed target curve. Changes will be reflected on the graph on the screen.
3. Press [START/STOP] to continue and to return to the main Quik-Probe screen. The target insertion-gain curve will be displayed in bold in the upper graph.

## 2.2 Instructions for All Quik-Probe Measurements

1. Put a reference mark on a fresh probe tube, so the tube will extend at least 5 mm (1 mm for CIC) past the earmold tip once everything is in place.
2. Install the probe tube on the probe microphone body.
3. Place the ear hanger over the ear to be aided.
4. Clip the microphone cable to the client's clothing for strain relief.
5. Secure the reference microphone to the top platform of the wedge-style ear hanger, so the front surface is just above the apex (highest point) of the ear to be aided. (Exception: With a CROS aid, the reference microphone should be placed above the ear on the transmitter side.)
6. Place the loudspeaker
  - at ear level, or slightly higher,
  - at a 45° angle toward the ear with the reference microphone,
  - 12 inches from the client's head (at the temple).
7. Place the probe tube into the ear to be aided, using the reference mark to assure the correct position. (Tape the probe tube in position, if necessary.)

8. If not already done, press [START/STOP] to get to the Quik-Probe II Option.
9. Use the OPERATION PARAMETERS menu to choose the appropriate level for “OUTPUT LIMITING.” This limits the maximum **sound pressure level in the client’s ear canal. The default level is 120 dB SPL RMS.** (See Section 8.7.3 of the Operator’s Manual for details.)
10. Instruct the client to remain still and in the same position during all measurements.

### 2.3 Automatic Insertion Gain Tests

1. Follow the instructions in Section 2.2, above.
2. Be sure the words “AUTOMATIC TEST” appear at the lower right of the screen. If not,
  - Press [MENU] to call the PROBE OPTION menu;
  - Use the [^, v] and [<, >] buttons to change the “MODE” to “COMP/AUTO;”
  - Press [MENU] again to get back to the main Quik-Probe screen.
3. With the loudspeaker, reference microphone, and probe microphone in position, press [LEVEL] and then wait for the leveling sequence to finish.
4. With the probe microphone in the ear, but without the hearing aid, press [START/STOP] (or the footswitch) to start the “unaided” measurement.
5. When the curve on the screen has stabilized, press [START/STOP] once again, to stop the measurement.
6. The “Unaided Response” (REUR) is now stored.
7. While holding the probe tube in place, insert the hearing aid into the client’s ear.
8. Check the reference mark to see that the probe tube is in the correct position. If necessary, remove the hearing aid and re-insert it.
9. Adjust, or have the client adjust the gain (“volume”) control on the hearing aid to its setting of normal use.
10. Press [START/STOP] to resume the measurement.
11. When the curve on the screen has stabilized, press [START/STOP] once again, to complete the “aided” (REAR) measurement.
12. Aided and unaided responses are shown on the lower graph; insertion gain (REIG) and the I.G. Target are on the upper graph.

13. You can now repeat the “aided” measurement by pressing [START/STOP], or start all over by pressing [CLEAR].

## 2.4 Manual Probe Tests

1. Be sure the words “MANUAL PROBE” appear at the lower right of the screen. If not, press [MENU] to call the main probe menu, and use the [∧, ∨] and [<, >] buttons to change the “MODE” to “COMP/MAN.” Press [MENU] again to get back to the main Quik-Probe screen.
2. With the loudspeaker, reference microphone, and probe microphone in position, press [LEVEL] and then wait for the leveling sequence to finish.

### Unaided Response (REUR)

1. With the probe microphone in the ear, but without the hearing aid, press [START/STOP] (or the footswitch) to start the measurement.
2. When the curve on the screen has stabilized, press [START/STOP] once again, to stop the measurement.
3. Press [UNAIDED RESPONSE] to save this curve to the unaided response (REUR) buffer. The label “UN-AIDED” will appear to the right of the lower graph.

### Aided Response (REAR)

1. While holding the probe tube in place in the ear canal, carefully insert the hearing aid into the client’s ear.
2. Check the reference mark to see that the probe tube is in the correct position. If necessary, remove the hearing aid and re-insert it.
3. Adjust, or have the client adjust the gain (“volume”) control on the hearing aid to its setting of normal use.
4. Press [START/STOP] (or the footswitch) to start the measurement.
5. When the curve on the screen has stabilized, press [START/STOP] once again to stop the measurement.
6. Press [AIDED RESPONSE] to save the curve to the aided response (REAR) buffer. The label “AIDED” will appear to the right of the lower graph.
7. Repeating Steps 1-5 will not affect the saved Aided Response, until [AIDED RESPONSE] is pressed again. Repeat with different hearing aids and/or different settings, if desired.

### Insertion Gain Response — Guidelines for Interpreting Results

1. Whenever an Unaided Response and an Aided Response have been measured and labeled on the screen, the Insertion Gain Response is displayed on the upper graph. The Insertion Gain Response is the difference between the Aided and Unaided Responses.
2. The Insertion Gain Response should be smooth and free of sharp peaks or deep valleys. If you are using a target insertion gain curve, the goal is to match the measured Insertion Gain Response to the target curve within a few dB.
3. In manual mode, you can repeat the Aided Response measurement (e.g., with a different aid or setting) without affecting the previously displayed Insertion Gain curve. Both the old and new curves will be displayed on the screen. However, once you save the new Aided Response measurement by pressing [AIDED RESPONSE], the previous Aided and Insertion Gain Responses will disappear and be replaced by the new ones.

## **2.5 Testing for the Occlusion Effect**

Two methods are presented for documenting the occlusion effect: one that uses the client's own voice and one that uses an audiometric bone vibrator.

### Method using the client's own voice

1. In the Quik-Probe II menu, set  
MODE to COMP/MAN  
GAIN(G)/SPL to G/REF ON  
NOISE REDUCTION to 8X or 16X
2. In the Operation Parameters Menu, set  
SIGNAL LEVEL to OFF  
SMOOTHING to LOG
3. Mark a probe tube and place it in the unoccluded ear canal in the usual way; place the reference microphone in the usual position.
4. Press [START/STOP] to turn on the measurement.
5. Instruct the client to sustain a consistent "eee" sound.
6. While the "eee" is sounding, press [START/STOP] again to freeze the measurement. The client can now stop vocalizing.
7. Press [UNAIDED RESPONSE] to save this measurement as the REUR.
8. Carefully place the hearing aid in the ear, but do not turn it on.

9. Repeat the “eee” measurement sequence (steps [4] through [6]).
10. Press [AIDED RESPONSE] to save this measurement as the REAR. The curve in the upper graph, labeled “INSERTION GAIN,” is the occlusion effect.

Method using an audiometric bone vibrator

1. In the Quik-Probe II menu, set  
MODE to COMP/MAN  
GAIN(G)/SPL to SPL  
NOISE REDUCTION to 4X or higher
2. In the Operation Parameters Menu, set  
SIGNAL LEVEL to OFF  
SMOOTHING to LOG
3. Mark a probe tube and place it in the unoccluded ear canal in the usual way; place the reference microphone in the usual position.
4. Place the bone vibrator from an audiometer on the mastoid of the test ear in the usual way.
5. Press [START/STOP] to turn on the measurement.
6. Using the audiometer, present a 250 Hz tone to the bone vibrator at 45 dB HL.
7. When the curve has stabilized on the screen, press [START/STOP] again to freeze the measurement. You should see only low-frequency energy reflected in the curve.
8. Press [UNAIDED RESPONSE] to save this measurement as the REUR.
9. Carefully place the hearing aid in the ear, but do not turn it on.
10. Repeat the bone-vibrator measurement sequence (steps [5] through [7]).
11. Press [AIDED RESPONSE] to save this measurement as the REAR. The curve in the upper graph, labeled “INSERTION GAIN,” is the occlusion effect.

Guidelines for interpreting results

The occlusion effect is an un-intended increase in the low frequencies of a person’s own voice, caused by inserting an earmold or shell into the ear. This phenomenon can be very disturbing to listeners having normal or near-normal low-frequency hearing. Typical comments are “My voice sounds like it’s in a barrel,” or “My voice sounds too hollow.” With a completely sealed earmold, the occlusion effect

can be as great as 20 to 30 dB. You can reduce the occlusion effect by increasing the vent size. But a 10-dB reduction of the low-frequency blooming may be all that you can accomplish before feedback sets in when the hearing aid is turned on. A deeply sealed bore can also reduce the occlusion effect.

**NOTE:** The measured occlusion effect will be greater for the bone-vibrator method than for the client's-voice ("eee") method. The "eee" method has greater validity, but the client may be unwilling or unable to sustain a vocal "eee" sound, as required. The bone-vibrator method has the advantage of using a calibrated signal.

## 2.6 SPL Test (Automatic Mode)

1. Enter probe menu by pressing [START/STOP] (or [PROBE] on the front panel).

*NOTE: From here on use only the remote module to enter and test.*

2. Use [ $\wedge$   $\vee$ , < >] buttons to highlight CREATE TARGET and select SPL TARGET. Then press [START/STOP].
3. Press [MENU] to select and change settings.
4. Use [ $\wedge$   $\vee$ , < >] buttons to enter HTL audiogram info.
5. If desired, press [SWEEP START] to enter UCL levels.
6. Press [START/STOP] to continue.
7. Mark probe tube (5mm / 1/4") (1 mm / 1/16" for CIC)
8. Place wedge ear hook on subject.
9. Place Ref. Mic on Velcro platform above ear, and probe tube in ear.
10. Position subject 12" from speaker at 45 degree angle.
11. Press [LEVEL].
12. Hold probe tube in place, put hearing aid in ear, set to user gain + output levels.
13. Press [START/STOP] to run CRV 1 (50 dB COMP), then CRV 2 (65 dB COMP) and finally CRV 3 (90 dB BURST)
14. The graph will display T (threshold), U (UCL), MCL Target (thick line **—**), and CRV 1, 2, and 3.
15. Press [PRINT] to print.



### 3. GETTING TO KNOW THE TARGET 2CC PROGRAMS — A HANDS-ON TUTORIAL

The following is a brief tutorial on operating the Target 2cc FOG and SSPL 90 programs that are part of the Quik-Probe™ II Option. The tutorial does not cover 100% of the functions and features available, but does at least introduce most of them. When in doubt about which button to press, look for the help messages on the screen. For complete instructions, use the Operator's Manual.

#### 3.1 Target 2cc FOG (Full-On Gain)

*First, do a fast example.*

You will see that the Target 2cc FOG program can be very simple and straightforward. After this example, we will examine the components of the program, piece by piece.

- If feasible, turn the 6500/6400 off and then on, and re-level the test chamber, to clear all the Multi-curve memory registers. Be sure, at least, that you are starting with a no curves on the probe screen, and that REF 6 in Multi-curve is cleared.
- Press [START/STOP] on the remote module to enter the probe mode.
- Go to the Quik-Probe II menu.
- With "CREATE TARGET" highlighted, use the [>] button to select "2cc FOG" and then press [START/STOP].
- Enter a sample audiogram (Fig. 1).

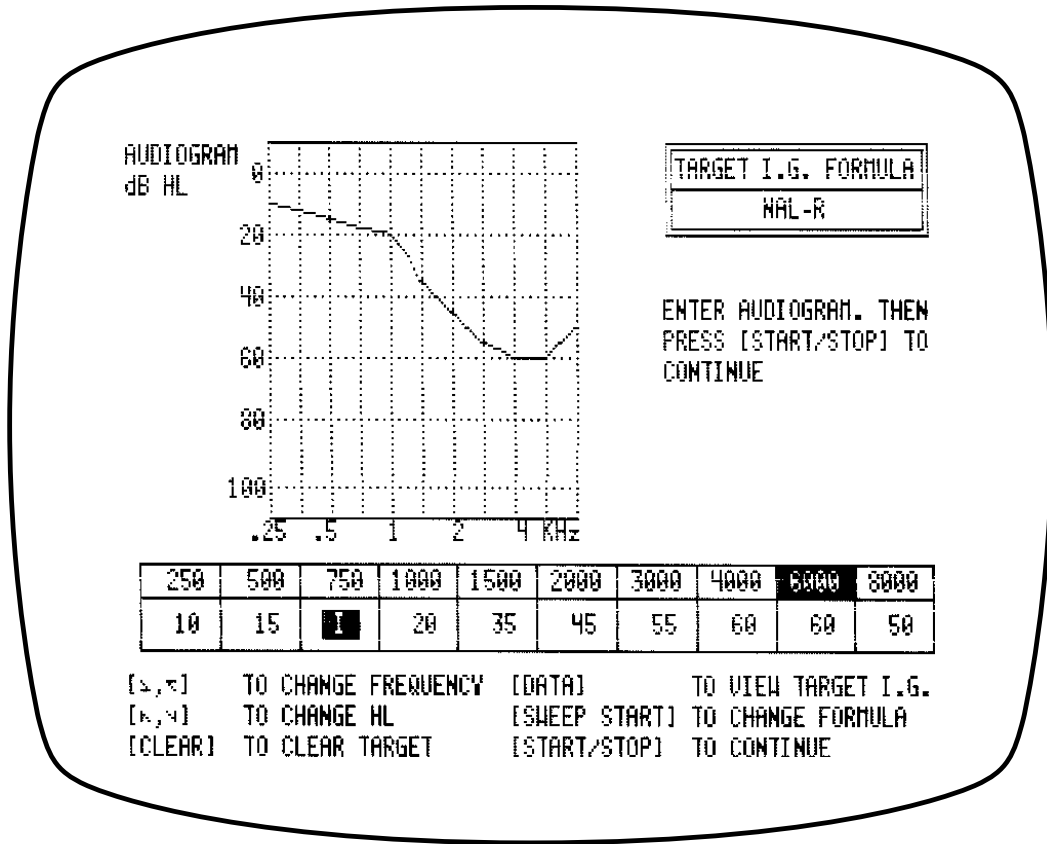
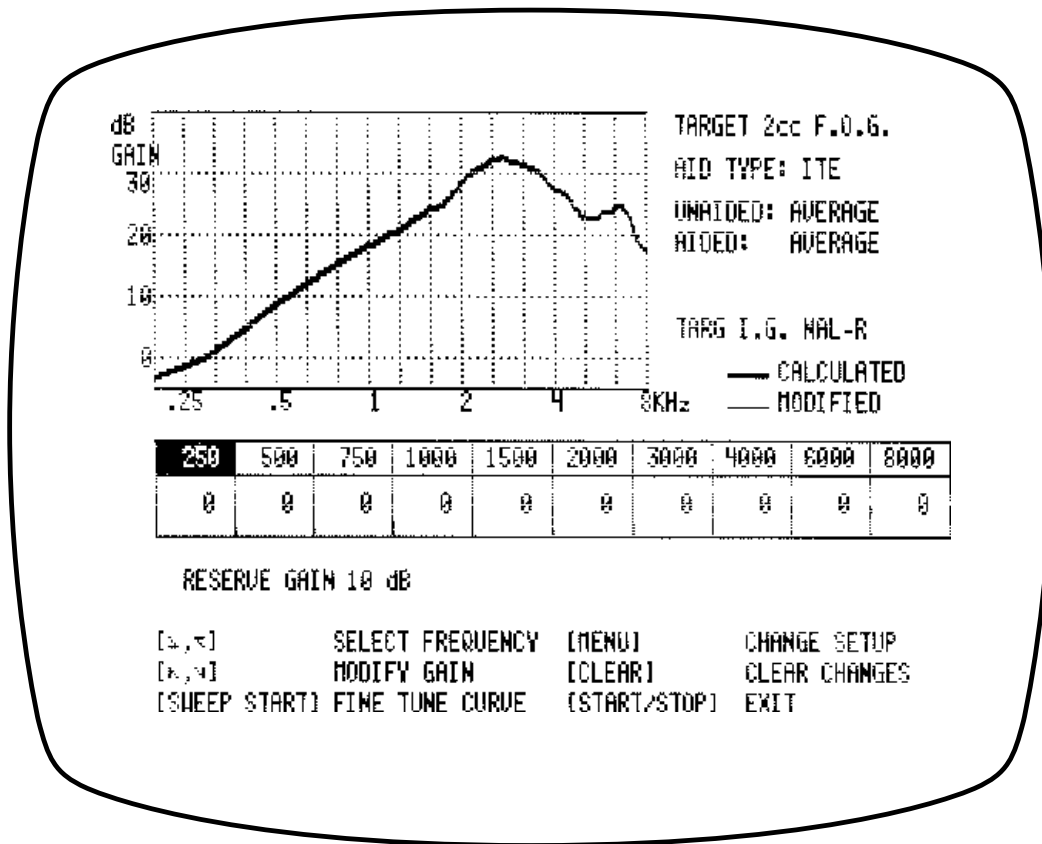


Figure 1: Example Audiogram

- Use the [MENU] button to select a TARGET I.G. formula (NAL-2 is the default). This is for calculating the target insertion gain corresponding to the entered audiogram.
- Press [START/STOP] to go to the Target 2cc FOG screen (Fig. 2). The program has converted the calculated insertion-gain values into a 2cc-coupler full-on gain target.



**Figure 2: Example Target 2cc FOG Screen**

The default conversion uses the average unaided and aided ear responses, and assumes an ITE hearing aid with 10 dB of desired reserve gain (extra gain over the target insertion gain when the volume control is full on).

Each of the default conditions can be altered via menu settings; these will be explained in the next part of the tutorial.

### 3.1.1 Examine Each Element

*The next section examines each of the elements of the insertion-gain-to-2cc conversion, one at a time, and how the user can manipulate those elements.*

(Note: For all the soundfield measurements used in the target 2cc FOG conversion, the position of the **opening of the reference microphone is directly over top of the ear**, and the position of the **loudspeaker is at a 45° angle** toward the test ear.)

*Initial, "ground zero" setup*

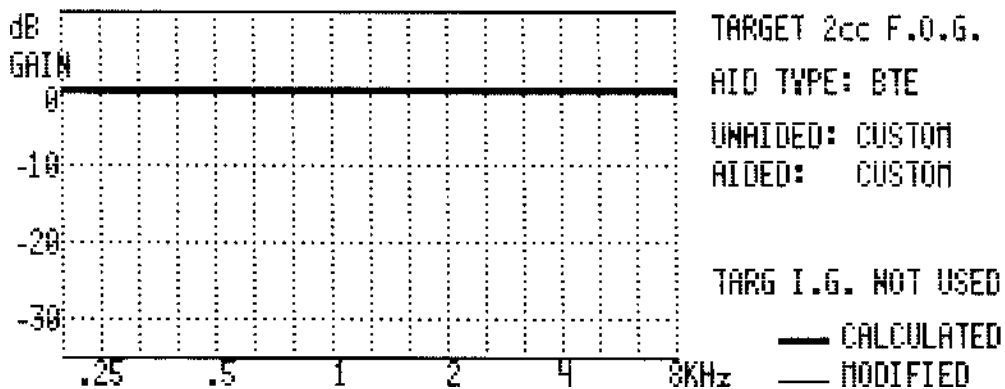
- From the Target 2cc FOG screen, press [START/STOP] to exit back to the main probe screen.
- Again run "CREATE TARGET 2cc FOG" from the Quik-Probe menu.
- Press [CLEAR] to clear the audiogram information.
- Press [START/STOP] to go to the Target 2cc FOG screen once again.
- Now press [MENU] to go to the Target 2cc FOG menu.
- Select the following settings.

Select

AID TYPE	BTE
UNAIDED EAR	CUSTOM (REUR)
AIDED EAR - 2CC	CUSTOM (REAR-REF 6)
RESERVE GAIN	0 dB

(Ignore "SCREEN PRINT" for now.)

- Press [MENU] to return to the Target 2cc FOG screen. You should see a thick line across the zero level of the graph (Fig. 3).



**Figure 3: "Ground Zero"**

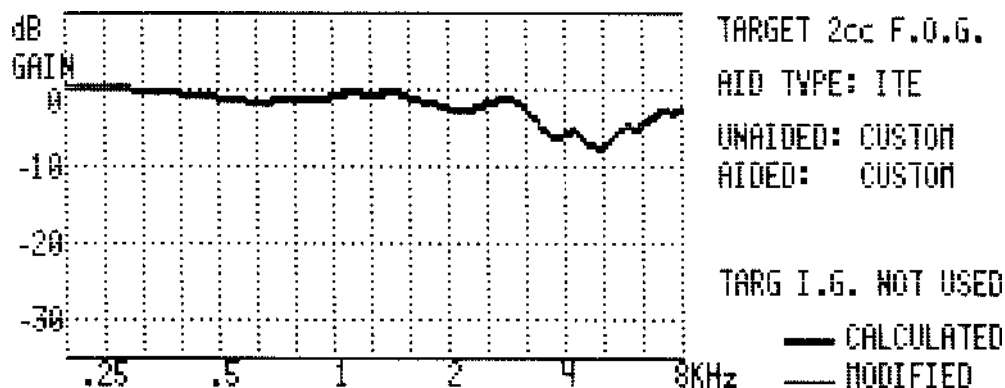
The following explains why we get all zeroes.

Recall that we are converting from a real-ear “insertion-gain” target to a “2cc-coupler” target. “AID TYPE,” “UNAIDED EAR,” “AIDED EAR - 2CC,” and “RESERVE GAIN,” comprise the four elements of the conversion.

1. The “AID TYPE” element corrects for different positions of the hearing-aid microphone. For a BTE, the hearing-aid mic is right next to the reference position both for insertion-gain and for 2cc-coupler measurements. Therefore, no AID TYPE corrections are used with BTEs.
- 2 & 3. As indicated in parentheses in the Target 2cc FOG menu box, selecting “CUSTOM” for “UNAIDED EAR” and “AIDED EAR - 2CC” makes use of pre-measured curves for customizing those elements of the conversion. (This is explained later.) Because we have cleared all the pertinent curves, only zeroes are present in those memory locations. Therefore, choosing “CUSTOM” currently serves effectively to replace the UNAIDED- and AIDED-EAR elements with zeroes.
4. With the “RESERVE GAIN” also set to zero, and with the Target Insertion Gain having also been cleared earlier, all the conversion elements add up to...zero.

*Now that we are starting at ground zero, we can enable each element of the 2cc FOG conversion independently.*

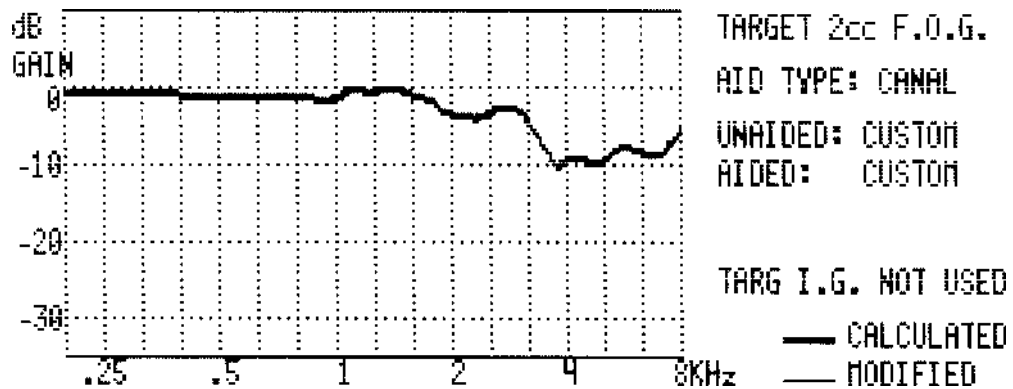
- Press [MENU] to go to the Target 2cc FOG menu.
- Set “AID TYPE” to “ITE.”
- Press [MENU] again to go back to the Target 2cc FOG screen (Fig. 4).



**Figure 4: Effect of “ITE” Aid Type**

We see a dip in the high frequencies, because placing an ITE microphone inside the pinna (which gathers high-frequency sound) will give some high-frequency gain in the “in-situ” response, that does not show up in the coupler response. In other words, in designing the target 2cc coupler prescription, we have to subtract out what will be gained later when the hearing aid is placed on the ear.

- Go back to the menu, set the AID TYPE to “CANAL,” and return to the Target 2cc FOG screen (Fig. 5).

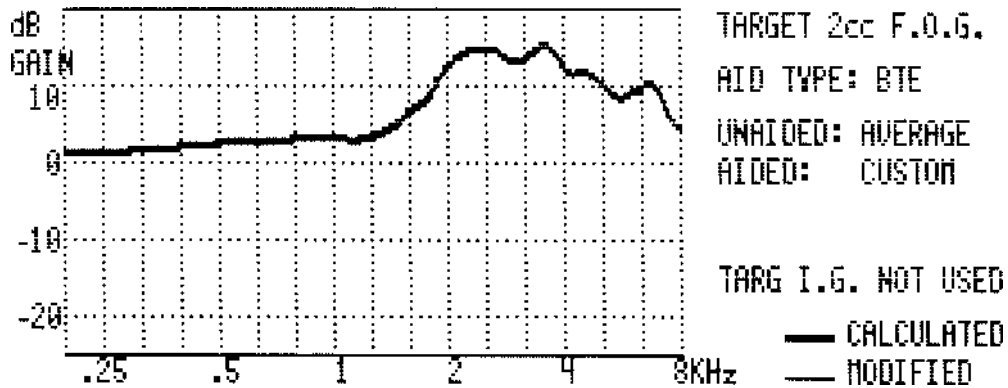


**Figure 5: Effect of “Canal” Aid Type**

Now even more high frequencies are subtracted because placing the hearing-aid mic near the canal opening will give even more in-situ high-frequency gain than is achieved with an ITE.

*Now we will examine the “UNAIDED-” and “AIDED-EAR” parts of the target conversion.*

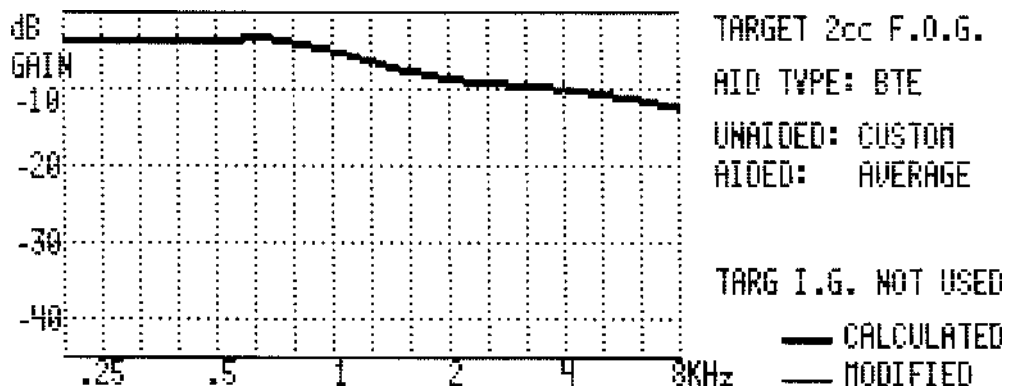
- Go back to the menu, set the AID TYPE once again to “BTE.” (You may want to return to the Target 2cc FOG screen momentarily, to be sure you are back at “ground zero.”)
- In the menu, set “UNAIDED EAR” to “AVERAGE,” and return to the Target 2cc FOG screen (Fig. 6).



**Figure 6: Real-Ear Unaided Response (REUR) of the KEMAR Manikin**

What you see is the real-ear unaided response (REUR) of the KEMAR manikin. The REUR is **added** to the target coupler response, because the natural unaided-ear amplifier (the REUR) will be lost when the hearing aid is placed on the ear. Thus we are putting it back by designing it into the hearing aid.

- In the menu, set “UNAIDED EAR” back to “CUSTOM.” As indicated by the note in parentheses, the CUSTOM setting means that if we want to use a custom REUR measurement instead of the KEMAR (or average) REUR, we must first make that measurement. Right now there is nothing stored in the Unaided Response (REUR) memory — only zeroes.
- Now set “AIDED EAR - 2CC” to “AVERAGE,” and return to the Target 2cc FOG screen (Fig. 7).



**Figure 7: KEMAR (average) Aided-Ear-versus-2cc Level Difference**

This curve was generated by measuring the probe response of an insert ear-phone in KEMAR's (occluded) ear, and then measuring the same insert ear-phone in a 2cc coupler. Because the physical volume of KEMAR's average ear occluded with a hearing aid is smaller than the volume of a 2cc coupler, there is more sound pressure level (SPL) in the occluded ear than in the coupler. Therefore, as with "aid type," we must subtract the "aided-ear-versus-2cc level difference" from the target 2cc prescription to compensate for the in-situ advantage. That's why the values are negative.

- Now set "AIDED EAR - 2CC" back to "CUSTOM." As indicated by the note in parentheses, the CUSTOM setting means that if we want to use custom aided-ear-versus-2cc measurements instead of the KEMAR (average) values, we must first make and save those measurements. The Aided Ear part of the measurement pair must be saved as the "Aided Response" (REAR), and the 2cc-coupler part must be stored in REFERENCE 6. Right now there is nothing (only zeroes) stored in the Aided Response (REAR) buffer and in REFERENCE 6.

### *Reserve Gain*

- To look at how we can manipulate the final element of the 2cc target conversion, set the "RESERVE GAIN" to any non-zero number between +50 and -50, and return to the Target 2cc FOG screen. Note that the displayed line (on your screen) is no longer across the zero level, as before, but is now at the level of the reserve gain you chose. Selecting a particular RESERVE GAIN will cause the hearing aid to give the listener that much extra insertion gain (over the target insertion gain) when the volume control is set to full-on. Or, in other words, when the volume control is set back from full-on by the amount of the selected RESERVE GAIN, the hearing aid should deliver the target insertion gain to the user.

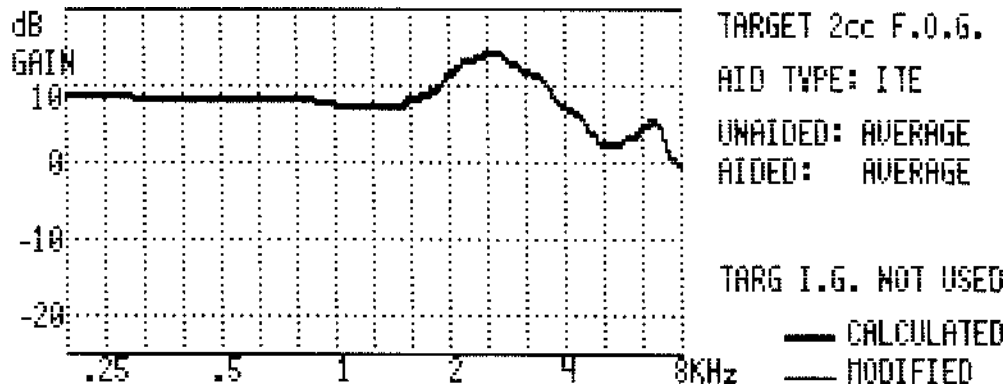
### *Put it all together.*

- Now set all the menu settings back to the default values:

AID TYPE	ITE
UNAIDED EAR	AVERAGE
AIDED EAR - 2CC	AVERAGE
RESERVE GAIN	10 dB

...and return to the Target 2cc FOG screen (Fig. 8).





**Figure 8: Average ITE Coupler Response for a Flat Insertion Gain (CORFIG) of 10 dB**

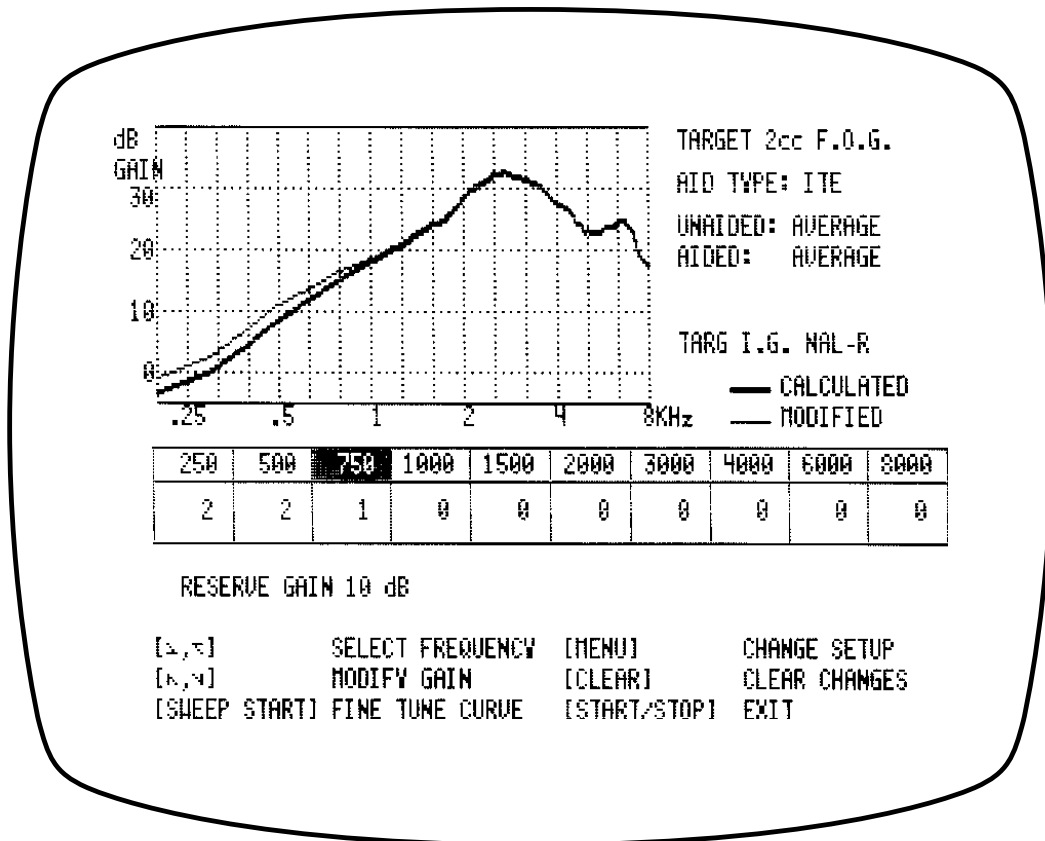
Keeping in mind that the target insertion gain is zero (we cleared it earlier), the curve you now see is the complete, average-ear, ITE Coupler Response for a Flat Insertion Gain (CORFIG); in this case, a flat 0-dB insertion gain plus a full-on reserve of 10 dB.

- If desired, change the “AID TYPE” to “CANAL” and then to “BTE” to view the CORFIG for each aid type. Reset “AID TYPE” to “ITE” before continuing.
- Press [START/STOP] to exit the Target 2cc program temporarily.
- Now go to the audiogram-entry screen once again (run “CREATE TARGET 2cc FOG” from the Quik-Probe II menu) and re-enter the audiogram data you entered in the first part of the tutorial (see Fig. 1).
- Press [DATA] to view the target insertion gain calculated for that audiogram and the selected formula.
- Now press [START/STOP] to go to the Target 2cc FOG screen. The target insertion gain values have been added onto the CORFIG curve, plus the reserve gain, to get the target 2cc FOG curve (see Fig. 2).

*Now we'll practice modifying the calculated target 2cc FOG curve.*

(Although the calculated target 2cc FOG curve is usually a good estimate of the required coupler response, the experienced practitioner may desire to modify the calculated curve before ordering the hearing aid, especially to account for venting effects.)

- Using the arrow keys and frequency boxes in the same way as with entering audiogram data, try modifying the target 2cc FOG curve. In the example immediately below (Fig. 9), 2 dB has been added at 250 and 500 Hz and 1 dB has been added at 750 Hz to account for an anticipated slit leak in the earmold.



**Figure 9: Modified Target 2cc FOG Curve**

- Finer tuning of the high frequencies is available by pressing the [SWEEP START] button. Press [SWEEP START] once to get frequency boxes between 2000 and 3800 Hz; press it once again to get frequency boxes between 4000 and 7600 Hz. In the example below, the second peak in the target response (at about 6500 Hz) has been eliminated (Fig. 10).

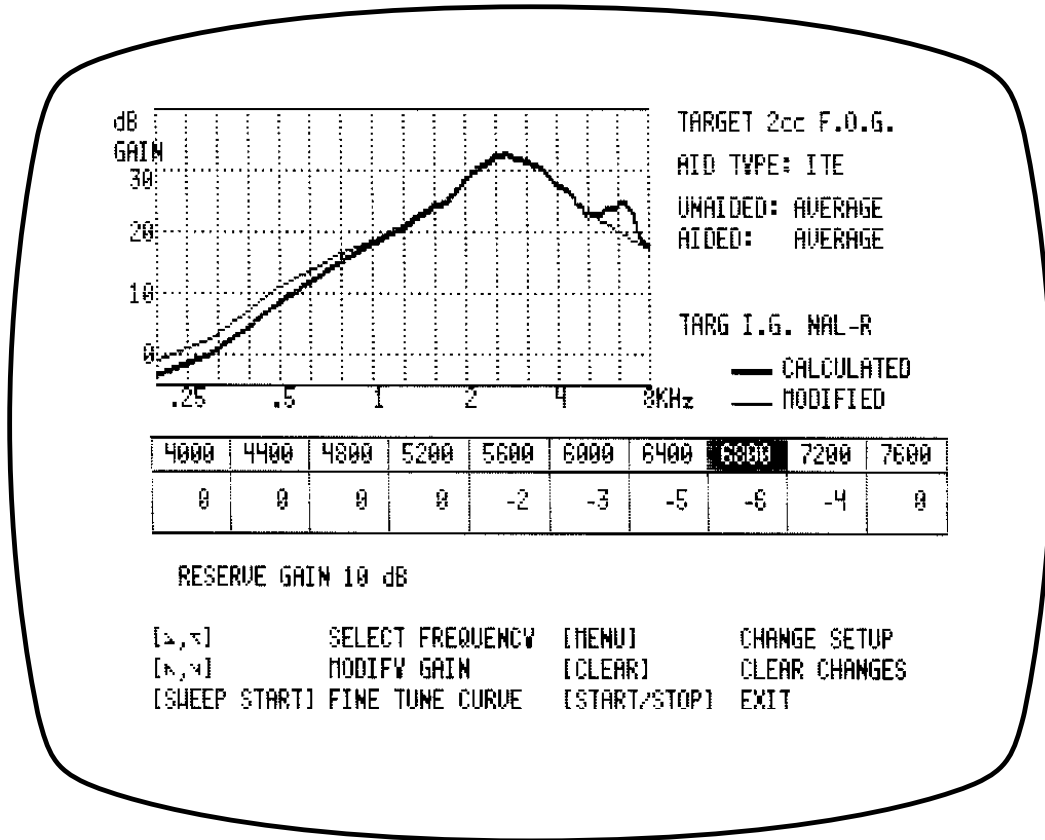


Figure 10: "Fine-Tuned" Target 2cc FOG Curve

*Printing the target 2cc FOG curve.*

- Press [PRINT] or [CRT] to get a printout of just the modified curve (Fig. 11).

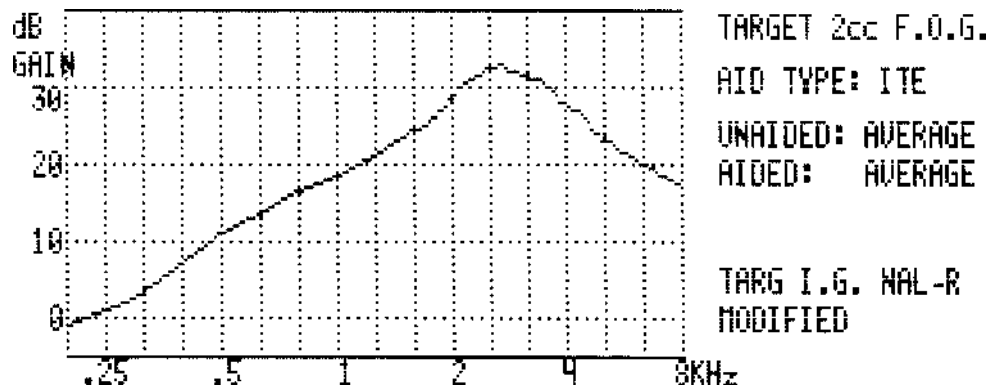


Figure 11: "Half-Screen" Printout of Final Target 2cc FOG Curve

- If you want to print both the calculated and modified curves, set “SCREEN PRINT” to “FULL” (in the Target 2cc FOG menu) before printing.

An important feature to remember is that when you exit the Target 2cc FOG program by pressing [START/STOP], the final curve is automatically stored into REFERENCE 8 in Multi-curve, so that you may later view that curve while also viewing actual test-box results for comparison.

### 3.1.2 Summary of steps for generating a Target 2cc FOG curve.

1. Decide whether you will be using “custom” or “average” data for the “UNAIDED EAR” and “AIDED EAR-2CC” parts of the conversion. If you will be using custom data, make the appropriate probe measurements and store them as indicated in the Target 2cc FOG menu.
2. Enter an audiogram and select an Insertion-Gain Formula.
3. Go to the Target 2cc FOG screen and check the list of settings displayed to the right of the graph. If necessary, use the Target 2cc FOG menu to change the settings.
4. Modify the curve as desired (using the arrow keys and [SWEEP START]).
5. Print.
6. Press [START/STOP], which exits the program and stores the results in REFERENCE 8 of Multi-curve.

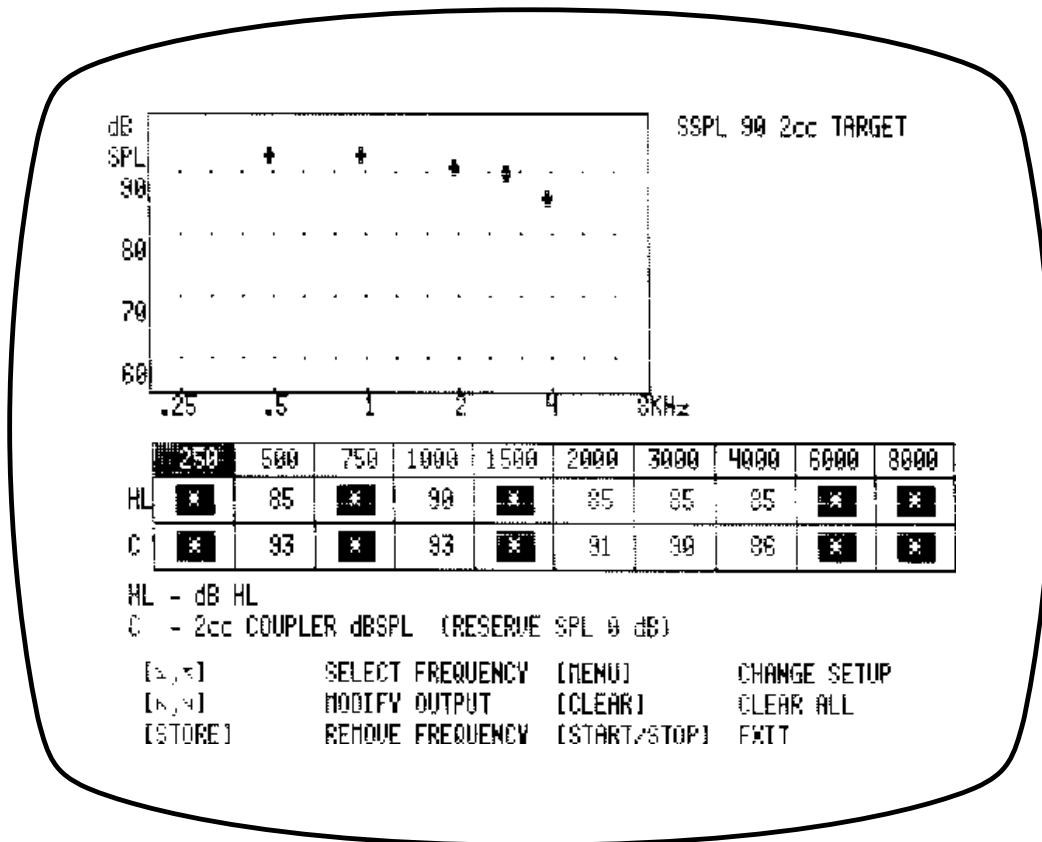
This concludes the Target 2cc FOG part of the tutorial.

## 3.2 Target 2cc SSPL 90

The Target 2cc SSPL 90 program is very simple to operate. But first you must test the patient or client for loudness discomfort levels (LDL/UCL) or highest comfortable levels (HCL), in dB HL, using audiometric earphones and narrow-band test signals (such as pure-tones or warble tones). You’ll get the best results if you use ER-3A insert earphones (or equivalent) with the eartips inserted in the ear canal as closely as possible to the depth of the final hearing aids.

*Once the comfort/discomfort tests have been done:*

- In the Quik-Probe II menu, change the “CREATE TARGET” selection to “2cc SSPL90,” and then run that selection to get to the Target 2cc SSPL 90 screen (Fig. 12).



**Figure 12: Example Target 2cc SSPL 90 Screen**

- Watching the “HL” boxes underneath the graph (upper boxes), use the arrow keys (in the same manner as entering an audiogram) to enter the comfort/discomfort test results. (Use the “up” arrow first.) Enter data only at the frequencies you have tested audiometrically. The numbers in the lower boxes (marked “C”) are the 2cc-coupler SPL values that correspond to the entered comfort/discomfort hearing levels. The coupler SPL levels are indicated by the positions of the symbols on the graph above.
- If you wish, you can modify the results at each frequency simply by changing the numbers in the boxes with the arrow keys. Or you can move all the graph symbols up or down at once by changing the RESERVE SPL via the Target 2cc SSPL 90 menu.
- In the Target SSPL 90 menu, you can also change the number of dB for each arrow-press from 5 to 1 dB, for better resolution.
- Print either the graph only or the entire screen, depending upon your choice in the Target 2cc SSPL 90 menu.

An important feature to remember is that when you exit the Target 2cc SSPL 90 program by pressing [START/STOP], the final curve is automatically stored into REFERENCE 7 in Multi-curve, so that you may later view that curve while also viewing actual test-box results for comparison.

### **3.2.1 Summary of steps for generating a Target 2cc SSPL 90 curve.**

1. Measure audiometric LDLs, UCLs, or HCLs.
2. Go to the Target 2cc SSPL 90 screen.
3. Enter the dB HL values in the (upper) frequency boxes.
4. Modify the entries as desired.
5. Print.
6. Press [START/STOP], which exits the program and stores the results in REFERENCE 7 of Multi-curve.

This concludes the tutorial.