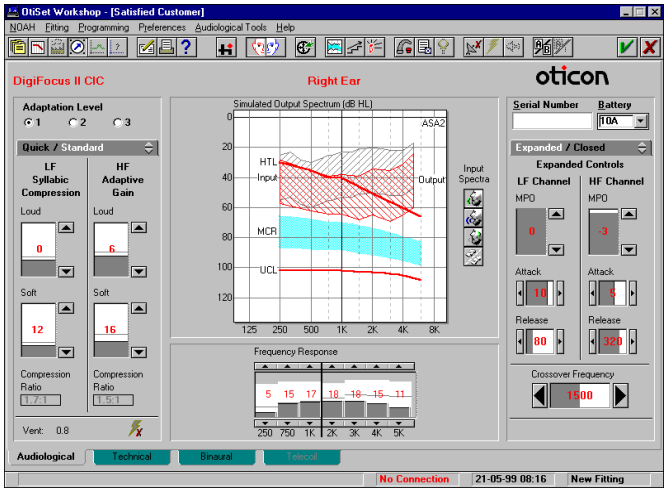
Oticon Fitting Software for NOAH

OtiSet User Manual

Version 4.1, February 2000



The OtiSet Workshop

OtiSet

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OtiSet

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OtiSet

OtiSet User Guide

Part 1

Fitting with OtiSet

Part 1 describes OtiSet and how selection of hearing instruments, fittings and follow-up adjustments take place.

Welcome to OtiSet, which:

- advises you in the selection of Oticon's hearing instruments
- proposes fitting control settings in accordance with the audiometric information, type of hearing instrument, and selected fitting rationale
- transmits settings to programmable instruments
- immediately illustrates the results of all adjustments and adds a visual dimension to the fitting process
- precisely identifies all elements governing hearing instrument performance
- provides a comprehensive range of audiological tools

This manual is divided into two parts:

Part 1: User instructions and audiological background

Part 2: Oticon hearing instruments

OtiSet ensures an optimum fitting based not only on hearing threshold values, but on feedback from clients as well. Based on client data and audiograms entered in NOAH, OtiSet proposes initial control settings and guides you towards a suitable fitting. Data from client evaluation and the selection of acoustic elements are incorporated to optimize the final setting.

During the entire fitting, you will use the graphic features of the OtiSet Workshop to find the control settings which best ensure speech audibility and listening comfort. The OtiSet Workshop illustrates the aided output spectra in a variety of environments, letting you instantly evaluate instrument performance.

OtiSet runs under Microsoft Windows, and readers are expected to have a general understanding of Windows concepts.

Installation of NOAH and OtiSet are discussed in the next section, and NOAH features are described in Chapter 2.

1 Installing NOAH and OtiSet

This section explains how to install NOAH and OtiSet.

Hardware and Software Requirements

OtiSet requires Microsoft Windows 3.1 or newer, and NOAH 1.20 or newer. The minimum configuration is a 486 PC, color VGA monitor, 8 Mbyte RAM and 15 Mbyte free disk space. A Pentium-based or more powerful PC is recommended.

Please ensure that TrueType fonts are enabled. Check the Fonts window, in the Windows Control Panel.

Installing NOAH

NOAH must be installed before OtiSet can be installed.

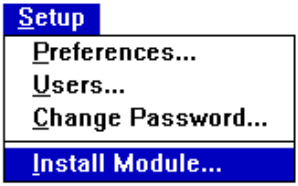
Insert the first NOAH disk in drive A. In Windows 95 or 98, select the Start button, then Run and write **a:setup**. Follow the guidelines in the setup program, and refer to the NOAH User's Guide if necessary.

Remove the NOAH disk before restarting the PC.

Installing OtiSet

Start NOAH and remain in the main window. To install OtiSet, you must have extended user rights in NOAH, which are initially set to **ABC** as the User ID and **123** as the Password.

In the menu bar, click on Setup. From the drop-down menu, select Install Module...



The window in Figure 1 appears.

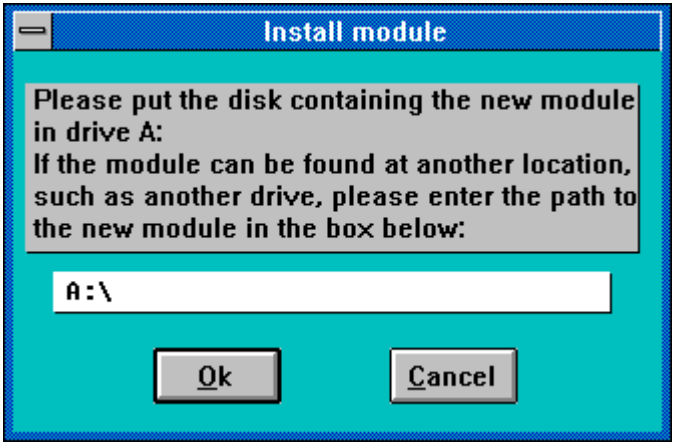


Fig. 1 Specify where the module is located, if necessary

OtiSet is distributed on a CD-ROM or on a set of floppy disks, depending on the version. To install:

- CD-ROM: follow the directions on the OtiSet booklet
- Disk: insert disk 1 in drive A: and click OK.

The installation program begins. NOAH checks to see if a module already resides on your hard disk with the same name as the module on the floppy. This will be the case, for example, when OtiSet is already installed. Therefore, an upgrade will cause the message in Figure 2 to appear.

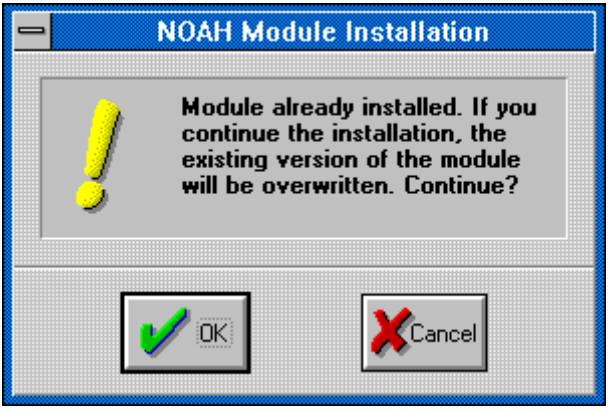


Fig. 2 Warning that the module is already installed

Click OK to continue the installation. Although a new version of OtiSet will be installed, no client information will be lost or changed.

Soon after, OtiSet will ask whether the Clear Speech files should be installed. Unless your computer is equipped with a sound card and loudspeaker, there is no point in installing these files. You will, however, be able to read the Clear Speech instructions regardless.

Before installation can proceed, you must enter the Installation Code supplied by your local Oticon dealer. The Code ensures that all the instruments available in your market are installed in OtiSet.

At the close of installation, OtiSet updates the software in your HI-PRO, if it is out-of-date. If OtiSet is unable to communicate with the HI-PRO, it displays a message stating that you can perform the update manually later, using the last disk in the OtiSet set or \hipro\wupdate.exe from the CD-ROM.

At this point, OtiSet offers to display a page describing new instruments and features in this version of OtiSet. Enter a checkmark if you are interested. The page can also be printed.

Finally, NOAH displays the following message. Click OK.

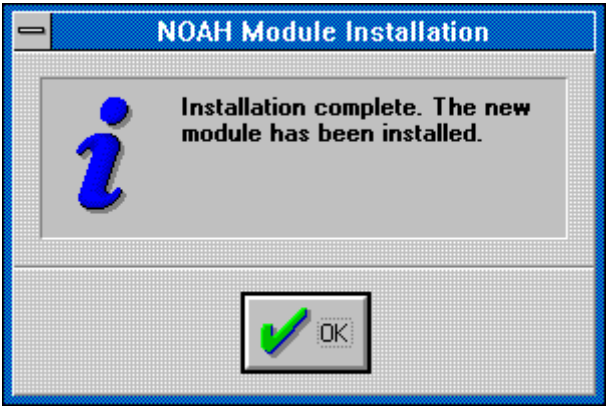


Fig. 3 OtiSet Installation is finished

The next time the NOAH Manufacturer Selection window is opened, the Oticon icon will be available.



In case of difficulties, please contact your dealer.

Mouse, Printer and Sound

Otiset requires a mouse. A printer, though not required, is necessary should you want to print fitting data or Journal entries.

OtiSet can use any Windows-compatible printer. The actual physical printer must, however, be known to Windows. The printer setup can be specified either in Windows, in NOAH, or in OtiSet.

OtiSet's Clear Speech program includes sound demonstrations. These can be heard if the PC has a sound card and a loudspeaker.

VGA Restrictions

When the monitor is in VGA mode, several buttons are not visible in the tool bar; however, the missing functions are available from the Fitting menu.

In the OtiSet Workshop, the name of the fitting rationale in use does not appear above the graph; it can be seen in the Select Oticon Hearing Instrument window.

2 Introducing NOAH

This section describes the goals governing the design of NOAH, and the services that NOAH and OtiSet provide for dispensers.

NOAH streamlines dispensing and administrative functions, and creates a common working environment for fitting systems.

NOAH is centered around a database which stores client records, audiometric data and fitting data. The program maintains records of previous sessions and a journal for each client, including information about office visits, testing, fitting and follow-up fittings. When OtiSet, Oticon's fitting program, is added to NOAH, it is integrated with the administrative and audiological data already stored.

OtiSet contains technical specifications and fitting information about Oticon's instruments. The dispenser uses NOAH and OtiSet to select, evaluate and fit hearing instruments.

In addition, dispensers can use NOAH and OtiSet to involve their clients in the fitting process. The unaided and aided hearing loss can be visually demonstrated, and changes to all hearing instrument parameters can be graphically demonstrated on the spot.

Who Uses NOAH?

NOAH is designed to be used by all employees in the dispensing clinic. The primary users will be audiologists and dispensers, but the administrative staff as well can take advantage of NOAH's client data management features.

Keeping all client information in one central place simplifies data management for both your administrative and audiological staff. Newly entered information is available to all authorized users, and it is easy to monitor the progress of the client at the various stages of the fitting process.

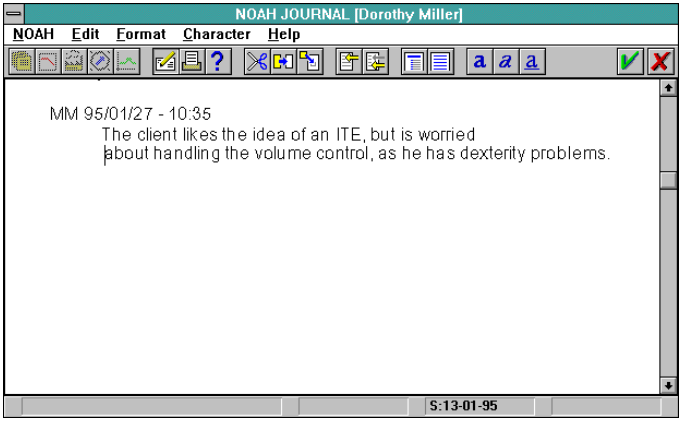


Fig. 4 The Journal: a good place to record both technical and informal notes about the client

A Standardized Interface

All NOAH-based fitting programs use a common, standard interface, which makes them easy to learn and use. You can freely move from program to program to compare the performance of instruments from different manufacturers.

Computer newcomers benefit from the fact that NOAH operates in the intelligent MS-DOS Windows environment. Once you have learned to use one NOAH Windows application - such as OtiSet - you have grasped the fundamentals of many.

A NOAH/OtiSet Session

A typical fitting session with NOAH and OtiSet usually consists of six or seven steps. These steps are represented on the NOAH tool bar by buttons, which appear sequentially, from left to right:



Client

1. All NOAH sessions begin by opening the Client Module. Information about a new client is entered from the keyboard into the NOAH client database. (To learn about NOAH functions, see NOAH online help or the NOAH User Guide.)

   A **new client** might be one who is new to your office, or a person who is already registered in your system, but wants to try a new hearing instrument.

   For **existing clients** - who have come in for an adjustment or service - you will skip the data entry steps and use the search function to retrieve information already stored in the NOAH database. After NOAH finds the client's records, you can move directly to Step 4.

2. Audiometric test data for the new client is entered in the NOAH Audiogram Module. Using the mouse, you can click in a selection of curves to create tone and speech audiograms. This data can be changed in the course of the initial session, and is likewise accessible at future fittings.



Audiogram

3. After the new client's personal and audiometric data has been entered, you are ready to open the Select Manufacturer window. A double-click on the Oticon icon starts OtiSet.



Manufacturer

.



OtiSet opens with the Select Oticon Hearing Instrument window. Here you can choose an

instrument and fitting rationale supported by OtiSet. The instruments can be presented by family, or by audiological criteria, whichever you find most convenient.

See Chapter 4 for directions in choosing an instrument best suited to compensate for the client's hearing loss.

4. In follow-up sessions, you will not need to enter more data into NOAH but can instead press the Fitting button to move directly to the OtiSet Workshop. This button is gray for new clients who have not yet been fitted, or for existing clients who are trying a new instrument.


Fitting

   At this point you can perform fine adjustments based on simulated output displays and client evaluation. The features and functions of the OtiSet Workshop are described in Chapter 5.

5. Once a fitting has been has been completed, it may be useful to enter comments in the NOAH Journal and to document fitting control settings and changes. The client's remarks may also be worth recording.


Journal

   The Journal is a simple word processor which offers a number of editing and printing features. You can set up NOAH to automatically add the name or initials of the person making the entry, as well as the date.

6. Finally, a printed report showing the audiometric curves, fitting information and administrative data can be produced for the clinic's paper files.


Print

At any time, context-sensitive help for both NOAH and OtiSet is available by pressing the Help button. All OtiSet features are also briefly explained on screen - in tool bar tips or in the status line of the OtiSet Workshop.


Help

NOAH Runs in the Background

While in OtiSet, you are able to access a number of NOAH features:

- Display the client module

Visible in view mode only; can be modified in NOAH

- Display the audiogram

  Visible in view mode only; can be modified in NOAH
- Write notes in the Journal and print the pages
- Print a fitting report
- Access NOAH online help

  Select Help On NOAH from the Help menu bar

3 Introducing OtiSet

This chapter introduces OtiSet and the concepts of the Oticon Fitting Philosophy. The steps involved in an initial fitting and a follow-up adjustment are briefly described.

OtiSet works hand-in-hand with NOAH. Personal data registered in the NOAH Client Module is available during the fitting and for printing in a fitting report. Information from the audiogram stored in NOAH is used to prescribe the initial settings for the Oticon hearing instruments. Subsequent adjustments of the controls are instantly applied to the graphic displays, allowing the settings to be visualized and used for client counseling.

By its application of a variety of fitting parameters and techniques, OtiSet embodies the Oticon Fitting Philosophy.

The Oticon Fitting Philosophy

OtiSet is a decision support system which is based on the Oticon Fitting Philosophy. OtiSet supplies the tools for calculation and visualization of the effects of given settings for hearing instruments, and realizes them in a variety of views.

In the **Technical View**, OtiSet offers familiar, traditional fitting procedures. In addition, OtiSet introduces a unique **Audiological View**, which is especially useful when fitting non-linear instruments such as microFocus, but can be used to verify linear fittings as well.

The Audiological View takes audiogram data, and consistently displays all relevant information about unaided and

aided instrument performance in an audiogram graph calibrated in dB HL.

A third view, the **Binaural View**, extends the Audiological View by showing control settings and audiological data for both ears simultaneously. A fourth view, **Telecoil View**, illustrates how an instrument performs when switched to telecoil, compared to the usual microphone mode.

Evaluating Hearing Perception

An important parameter in audiological care is the residual hearing area between HTL and UCL, also called the **Auditory Dynamic Range** (ADR). Surrounding sounds, i.e. music, traffic noise, speech, are perceived by normal-hearing persons in their full range. But because the ADR of a hearing-impaired person is narrower, these sounds must be transformed by the selected hearing instrument to fall within the ADR.

Speech audibility is another key parameter to be considered when fitting a hearing instrument. In Figure 5, an unaided input speech spectrum is shown together with an aided output speech spectrum processed by the chosen instrument. Since the aided spectrum is displayed with reference to the ADR, it is possible, at a glance, to see how much they overlap and thereby judge the improvement in speech audibility.



Advice

Oticon fittings also benefit from special Fitting Advice, which is available for several Oticon instruments. When adjustments to fitting controls are unsuitable, the Advice window pops up to guide you in the right direction.



Guide

The client's evaluation of the perceived sound can be put to good use in the **Fine Tuning Guide**. Enter the comments, and the Guide suggests - and in certain cases applies - new settings.

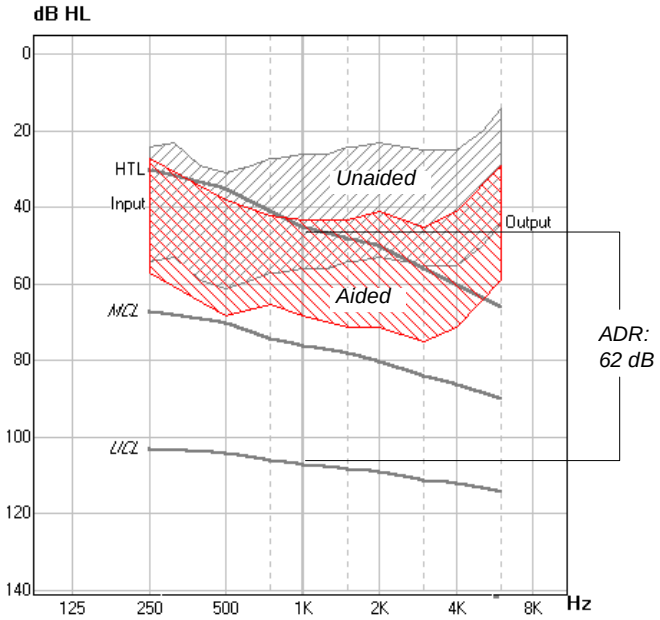


Fig. 5 Audiogram for an aided Normal Speech spectrum

OtiSet Includes Human Link Tools

Oticon's commitment to total client care is expressed by incorporation of two special audiological tools which offer services beyond traditional clinical treatment:

- COSI: the Client Oriented Scale of Improvement questionnaire lets the client identify specific needs and goals, to help you in your counselling.
- Clear Speech: a suite of instructions and exercises designed to improve oral communication between hearing-impaired persons and their families.

Overview of Procedures

A brief review of the steps required in the fitting of an Oticon hearing instrument appears below.

ACTION	DETAILS
Enter audiometric data in NOAH Audiogram Module	Chapter 1
Define Specific Needs in COSI questionnaire	page 24
Select an Oticon hearing instrument	Chapter 4
Use the Adaptation Manager to ease the acclimatization period (for certain instruments)	page 29
Study the proposed settings and instrument performance in the OtiSet Workshop	Chapter 5
Transmit the settings to programmable instruments via HI-the PRO	Chapter 6
Adjust the instrument in accordance with the proposed control settings	Chapter 5
Eliminate feedback with the Feedback Manager	page 42
Change the acoustic configuration and observe the effect	page 61
Measure MCR and use the results to adjust DigiFocus settings	page 41
Apply the client's evaluation using the Fine Tuning Guide	page 63
Save your work and return to NOAH	page 52
Train client's family in Clear Speech techniques	page 67
At any time during the fitting you may:	
Switch between the various views in the OtiSet Workshop	page 36
Change your preferred setup	Chapter 8
View client data and the audiogram	page 49
Write and read in the Journal	page 50
Request help	page 20

Table 1 Key fitting procedures in OtiSet

All OtiSet fittings begin with NOAH. The two ways of moving from NOAH to OtiSet are explained in the next two sections.

Moving from NOAH to OtiSet

Before an OtiSet fitting begins:

- the client is interviewed about his hearing problem and his personal data is recorded in the NOAH Client Module
- an audiogram is recorded and the data is entered in the NOAH Audiogram Module



Manufacturer

The next step is to click the Manufacturer button in the tool bar. The NOAH Manufacturer Selection window opens.



OK

To open OtiSet, either double-click the Oticon icon or click the icon once and then the OK button.

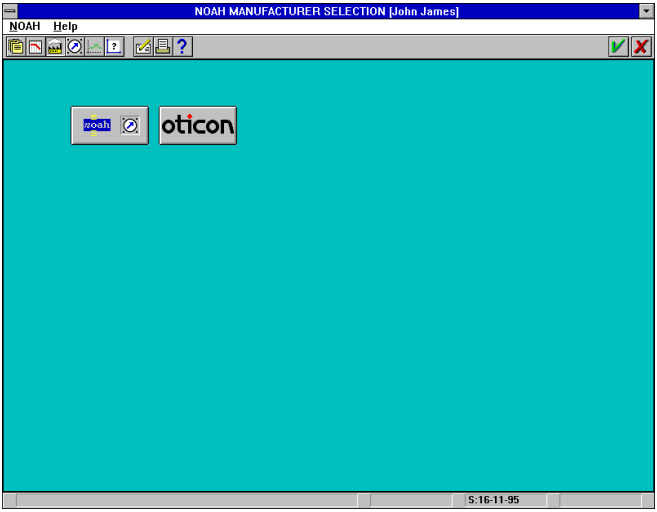


Fig. 6 The NOAH Manufacturer Selection window

Selecting Oticon automatically starts OtiSet.

If a manufacturer is not to be selected at this time, click Cancel and the screen reverts to the NOAH Client Module.


Cancel

Moving Directly to a Follow-up Fitting

If the client already has a hearing instrument registered with OtiSet, a shorter path is available. Observe that in the NOAH Client Module the last saved session in the session list is automatically highlighted, and the Fitting button in the tool bar is available. If you prefer to use an earlier session, highlight it and press the Fitting button.


Fitting

The OtiSet Workshop opens, bypassing the Manufacturer Selection window. The settings saved during the chosen session are displayed. The OtiSet Workshop, which is the main window in OtiSet, is described in Chapter 5.

Getting Help

OtiSet help is available from the menu bar, the tool bar, the various dialog boxes, and the status line:

- The menu bar: Click the Help menu title and a menu drops down, offering the following items:

  Contents: lists the topics for which help is available

  Search: allows a search for a specific topic

  Product Support: information about the OtiSet distributor

  New In OtiSet: describes new instruments and features in this version

  Quick Fitting Guides: suggest fitting flow and strategy for DigiFocus II, Ergo, Swift and Digilife.com

  Help On NOAH: starts the NOAH help system

  Oticon on the Web: opens the Oticon website

  Digilife.com on the Web: opens digilife.com website

About: provides product and version information about OtiSet


Help

- The Help button in the tool bar provides context-sensitive help: click on the button, and a help window opens, dealing with the situation at hand; pressing function key F1 gives the same result.
- A separate Help button is available in all dialog boxes. Press this button to obtain context-sensitive help for the current dialog.
- In the status bar at the bottom of the OtiSet Workshop, a text line explains the function of the tool bar button upon which the cursor is placed. Leave the cursor on the button for more than a second, and the same text line appears beside the button.
- Special help is available for non-linear fittings. As you choose instruments and make adjustments, the Fitting Advice window pops up to guide you when necessary. This feature is explained on page 65.

4 Selecting a Hearing Instrument

This chapter describes the Select Oticon Hearing Instrument window. It explains how to use the elements in the window, and how to choose the instrument and fitting rationale best suited to the individual client.

Double-click the Oticon icon in the NOAH Manufacturer Selection window and the Select Oticon Hearing Instrument window opens - see Figure 7. Here you will choose hearing instruments and fitting rationales.

The Select Oticon Hearing Instrument Window

The window is divided into three main sections:

- the top, where the names and pictures of the available instruments are displayed; the HTL (if entered in NOAH) and fitting range of the highlighted instrument appear on the right
- the middle, containing grouping tabs which govern the display of the instruments in the list
- the bottom, showing the chosen instruments and the corresponding fitting rationales.

When a client is newly entered in OtiSet, no instruments and no fitting rationales have been chosen; *None* appears in both Selected instrument text boxes in the bottom section, and the Rationale list boxes are empty.

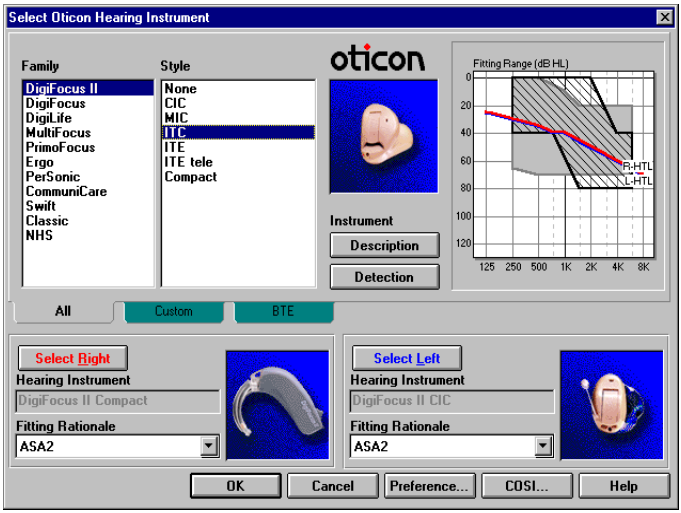


Fig. 7 The Select Oticon Hearing Instrument window

Defining Specific Needs with COSI

Before instruments are chosen, Oticon suggests that you use the COSI form to help the client define individual goals and expectations of hearing quality. Open COSI from Audiological Tools in the OtiSet Workshop menu bar.

COSI stands for *Client Oriented Scale of Improvement*. COSI is a simple and individualized assessment questionnaire that aims to promote client satisfaction and encourages direct client involvement. It seeks to identify a client's specific needs at the start of a rehabilitation program, and at the end of the program, determine how well the client feels those needs have been met.

The COSI form consists of two steps: Goal Establishment and Outcome Assessment.

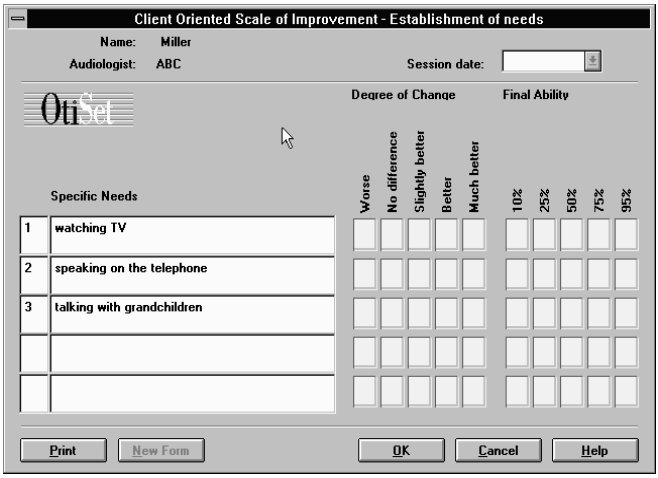


Fig. 8 COSI is ready for Specific Needs to be defined

Goal Establishment

After the hearing loss has been assessed, but before hearing instruments are chosen, you and the client identify needs and discuss expectations. This is an opportune time to counsel the client on any unrealistic expectations that may be present.

- Specific Needs: Ask the client to list up to five different listening environments in which communication is difficult. These needs should be very exact, e.g. "to be able to follow a conversation in a restaurant", not just in general terms such as "hear speech in noise".
- Rank: In the leftmost column, indicate the priority (if any) of the five situations. This will help you focus your efforts on the most important needs.

Click OK to return to the Select Oticon Hearing Instrument window.

Outcome Assessment

After the acclimatization period, once the client has gained sufficient experience with the instruments, it is time to determine how well the goals established at the first visit have been met.

- Degree of Change: Refers to how well the client now hears with the instruments. Draw the client's attention to the specific need and by discussion, establish whether a change has occurred since the previous session and if so, the extent of that change. Fill in the appropriate box on the form.
- Final Ability: Refers to how well the client hears in a specified situation - compared to a person with normal hearing - expressed by a percentage rating.

Compare Results from Session to Session

It is important to review the COSI form with the client, and to compare Final Ability with the goals originally set. COSI can also be used on an ongoing basis to strengthen the client's motivation towards continuously improving hearing ability, because once the goals set at the beginning of the program have been met, new goals can be chosen.

Another way to evaluate the client's progress is to select Session Date, and return to earlier sessions; here you can see which Specific Needs were important in the past and what advances have taken place.

The next time the client is fitted with a new instrument, select the New Form button. Together you can then modify the existing Specific Needs and enter new ones. OtiSet clears the entries in Degree of Change and Final Ability. But before clearing the form, you may want to select the Print button and give the client a printed COSI report for future reference.

Selecting a Hearing Instrument

The Select Oticon Hearing Instrument window displays the fitting range of an Oticon instrument together with the HTL. Use the mouse to click on the various instruments, and observe the changes in the graph. By comparing how the fitting range matches the HTL, you can determine performance and suitability. Press the "Description" button for technical details about the instrument.

You can also click the grouping tabs in the middle and experiment with other categories of instruments. The active tab is gray. The instruments can be grouped by audiological criteria or by style - see page 29 for details.

When you have found an appropriate instrument, select it as follows:

- Highlight its name and click the Select Right or Select Left button the name will appear in the corresponding Hearing Instrument text box, or
- Point the cursor at a name, hold down the left mouse button, and "drag" the name to an Hearing Instrument text box - left or right. Release the button.

Selecting a Rationale

The next step is to choose the fitting rationale OtiSet will use when calculating initial control settings. The name currently in the Rationale list box is the one OtiSet recommends for the chosen instrument. You can assign a different rationale to be the default; see menu item User Preferences, "Fitting Rationales".

To see other rationales, click on the Rationale text box and a drop-down list opens, showing the names of all available rationales. If there are scroll bars, click on them to display more rationales. If there are no scroll bars, or the scroll bar arrows are gray, the only rationales available are those which are displayed.

To choose a rationale, click on its name.

Descriptions of the various rationales appear on page 76.

Detection of Connected Instruments

Press the "Detection" button, and OtiSet reports which instruments are connected to the HI-PRO. Instruments from an existing client are compared with data stored in NOAH from the previous session; OtiSet informs you if there is a mismatch.

You can select the connected instruments and move on to the OtiSet Workshop, or press Cancel and return to the selection process.

Monaural or Binaural Fitting

OtiSet supports both monaural and binaural fittings. If the same instrument is to be fitted for both ears, be sure to select it for both ears.

If an audiogram exists for both ears but only one ear is to be fitted, let *None* remain for the other ear. Note that selecting *None* for an ear and saving that setting also has an effect on the last-saved fitting. Any instrument saved for that ear is removed from the NOAH database and does not appear in the NOAH session list.

If you select *None* for both ears and press OK, OtiSet issues a warning, cancels the fitting, and reverts to NOAH.

Suppressing Connection to a Programmable

If you choose a programmable instrument, OtiSet will automatically try to connect to it when you press OK to confirm the selection. This, however, might not be what you want at this point, especially if the client is wearing the instrument, and the settings have not been verified.

To avoid automatic connection, press the Preference button at the bottom of the window. The User Preferences window opens, and you can choose *Suppress connection to instrument* from "Communications". Subsequent adjustments will be displayed in the graph, but not sent to the instrument.

When you are ready to program the instrument, re-enable communications in User Preferences.

Displaying the Instruments: Grouping Criteria

The tabs in the middle of the window indicate how the instruments are grouped. There are two possibilities:

- by style: All, Custom or BTE
- by audiological criteria: Mild, Moderate, Severe, Profound, High-Frequency

To change from one criterion to another, click the Preference button, and choose "Instrument Selection".

Confirming the Selections

After selecting instruments and rationales, click OK. Either the OtiSet Workshop or the Adaptation Manager will open, depending upon which instruments have been selected.

If no instrument is to be chosen at this time, click Cancel to revert to NOAH.

Adaptation Manager

Choosing certain Oticon instruments causes the Adaptation Manager to open: for DigiFocus II, it is called Adaptation Level and is at the top of the control panel in the OtiSet Workshop. This tool offers a choice of adjustments to ease acclimatization.



Fig. 9 Adaptation Manager for DigiFocus II

Oticon recommends using a three-step process over the first several weeks of instrument use. Please select the option (Step) 1 for the initial fitting. At the first follow-up fitting, you may select the Adaptation Manager button from the Tool Bar and change the option to (Step) 2. In a later session, 3 or Final should be chosen.



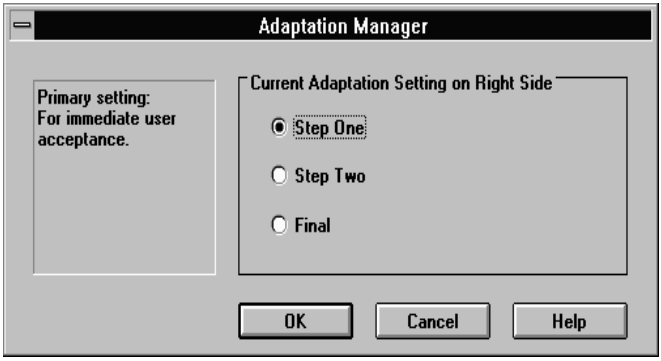


Fig. 10 The Adaptation Manager for certain older instruments

Some or all of the options may not be available, depending upon the nature of the hearing loss, and the settings in the instrument. Also, for some clients, options Step 2 and Final may be appropriate from the very beginning, depending upon their response to the initial settings.

Press OK and the OtiSet Workshop opens. For certain instruments, an icon resembling the Adaptation Manager button appears on the lower left. Run your cursor over the icon and a yellow tooltip pops up, stating the current Adaptation setting.

What does the Adaptation Manager offer your client? Clinical experience shows that new users often report that their devices are too strong, especially in the higher frequencies. This result is not completely unexpected, because to the sensorineurally impaired ear, the increased audibility of softer, especially higher frequency sounds may be unsettling during the first few weeks of use. This newly audible information is apparently disturbing not only to first-time users, but also to experienced users accustomed to devices with less HF gain.

The Adaptation Manager helps the newly-fitted client adapt to the new levels of sound. After several weeks of device use, these new levels of audibility should then become acceptable.

For DigiFocus, the Adaptation Manager will affect the settings of LF Gain, LF Compression Ratio, HF Soft Inputs, and HF Loud Inputs in addition to the LF and HF Attack times. For microFocus, the adjustments will affect all three trimmer settings.

Missing Audiogram

The OtiSet Workshop can appear in a variety of views. Audiological View is available when an audiogram has been entered for the ear for which an instrument has been selected. Binaural View is available when two audiograms have been entered and instruments have been selected for both ears.

If no audiogram has been entered, the fitting is based only on the technical data (simulated Insertion Gain and other measurements) available in Technical View.

After you select instruments and rationales, OtiSet will warn you that the Audiological View is not available. To recover from this, click Cancel to return to NOAH and enter an audiogram.

Selecting a Different Instrument

While working in the OtiSet Workshop, you might want to try a different instrument. Click the New button in the tool bar. OtiSet issues a message, reminding you that the current settings will be lost.



New

You can then choose to:

- Save current settings before trying a new instrument: press Cancel on the message box and then the OK button in the tool bar. You will revert to the NOAH Client Module. Click the Manufacturer button and the Select window opens.
- Not save before trying new instrument: press OK on the message box. The Select Oticon Hearing Instrument window opens.
- Continue with the current instrument: click Cancel on the message box.



OK



Manufacturer

For further information about the Select Oticon Hearing Instrument window, please click the Help button.

5 Fitting the Hearing Instrument

This chapter explains how to fit a hearing instrument in OtiSet. The elements in the OtiSet Workshop are described, as well as the views in which data can be shown.

In the OtiSet Workshop you will evaluate proposed control settings and make adjustments. There are two ways to open the OtiSet Workshop:

- new fitting: click OK in the Select Oticon Hearing Instrument window, as described in Chapter 4, or
- follow-up fitting: click the Fitting button in the NOAH Client Module, after choosing an existing client.



Fitting

The Elements in the OtiSet Workshop

Figure 11 shows the OtiSet Workshop in Audiological View. The elements in the Workshop are described in the following pages.

The **menu bar** contains several menu titles:

- NOAH: see the NOAH User's Guide
- Fitting: provides a number of features used for instrument adjustment; all are explained in this chapter
- Programming: communication with programmable instruments; see Chapter 6
- Preferences: specify setup; see Chapter 8
- Audiological Tools: COSI, Clear Speech and the Adaptive Fitting Sequence
- Help: the Help items are described on page 20

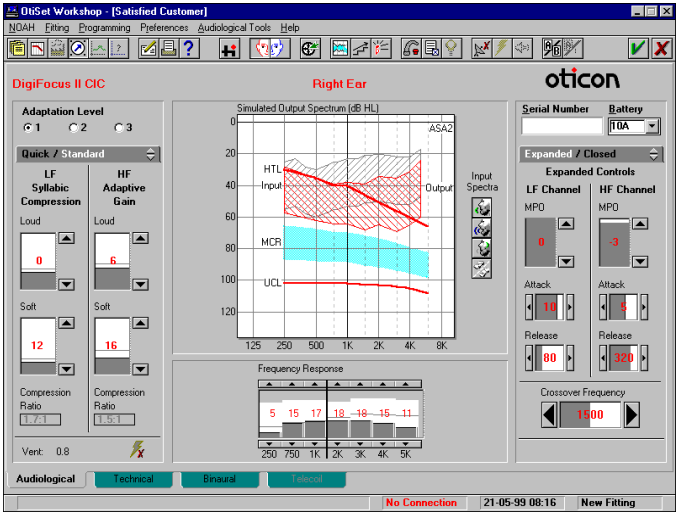


Fig. 11 The OtiSet Workshop: Audiological View of a DigiFocus fitting

The **fitting controls** duplicate the look of the controls on the hearing instrument, if any. The values are displayed in dB HL.

For MultiFocus instruments, the settings can be displayed in two ways: in dB HL, or as the number of clicks from the left-most position; see User Preferences, "Fitting Control Marking".

OtiSet calculates initial settings based on the selected fitting rationale, chosen hearing instrument, and HTL. Apply the settings to the instrument and let the client try them for some time.

To adjust the settings, move the fitting controls in various ways, using the left mouse button:

- Click the up or down arrows
- With the mouse, "slide" a control to the desired position

- Click in the vicinity of the controls

The changes are immediately reflected in the graph, in the spin boxes, and in the appearance of the fitting controls themselves.

The **graph** presents audiological information in a variety of views: Audiological, Technical, Binaural and Telecoil. Switch between views by clicking the appropriate **view tab** at the bottom of the Workshop. To distinguish measured values from estimated values, enable *Graph Points* in User Preferences, "Diagram Formats".

Above the graph is a line stating the measurement condition in use, and the chosen rationale (the latter might not appear, due to the computer's display limitations). To select other measurement conditions, or a different graph format, place your cursor anywhere in the graph and click the *right* mouse button. The User Preferences window opens, with a number of options relevant to the current view; see details in Chapter 8.

The heading above the graph specifies which ear is being fitted. Switch ears by clicking the appropriate button in the tool bar. The graph presents the audiological data calculated for that ear.

The **status line** at the bottom of the Workshop contains the date and time of the last session during which the settings were saved. When a programmable is being fitted, a green or red text line states the status of the connection.

On the lower left, up to three icons can appear. Run your mouse cursor over the icons, and yellow tooltips pop-up. Depending upon the instrument, the first contains the current Adaptation setting, the second states the results of Feedback Management, and the last reports whether the instrument has been programmed.

On the right is a list of input **sound spectra** used to evaluate instrument performance. Click on each by turn and

observe the changes in the input and output spectra. The input spectra are discussed in detail in Chapter 9.

Also on the right is a space to enter the **serial number** of the instrument and the **battery type**. OtiSet automatically proposes a battery type.

Audiological View

When the OtiSet Workshop is in Audiological View, as in Figure 11, audiometric and spectral data are presented in dB HL. The following curves are available, and where relevant, are blue or red, depending upon the ear:

- Input Spectrum: a striped gray band showing the unaided spectrum- Normal Speech, Own Voice, Loud Speech or Traffic Noise.
- Output Spectrum: a striped band showing the output spectrum of the aided Input Spectrum. The Output Spectrum illustrates how the instrument processes the unaided Input Spectrum and varies with each adjustment to the fitting controls.
- HTL: Hearing Threshold Level.
- MCR: a light blue band indicating the Most Comfortable Range. The MCR can be either measured based on MCL data manually entered, predicted from the HTL, or measured in situ.
- MCL: Most Comfortable loudness Level. MCL is calculated as the arithmetic average between HTL and UCL or derived from the MCR.
- UCL: UnComfortable loudness Level Estimated from HTL or derived from the MCR.

HTL, MCL, MCR and UCL are based on audiological data, and therefore remain constant, regardless of adjustments. The formulas from which these curves are derived appear in Chapter 9; here you will also find a detailed description of the Audiological View.

Display of all the curves can be suppressed in User Preferences; "Audiological View".

Binaural View

This view extends the Audiological view by showing the fitting controls and audiological data for both ears simultaneously. The input spectrum is not shown, but its name appears above the graph; it is the one last chosen in the Audiological View.

Choose User Preferences, "Binaural View", to enable and disable display of curves.

Technical View

Technical View displays simulated instrument performance with input levels at 50, 65 and 80 dB SPL. using any of the following formats:

- Simulated In-Situ Output (default)
- Simulated IEC 711 coupler
- Simulated ANSI 2cc coupler
- Simulated Insertion Gain
- Target Gain and Insertion Gain comparison



Ansi 2cc

Choose User Preferences, "Technical View", to switch between formats. Either select this option from the Preferences menu, or click the right mouse button in the graph.



Sim IG

The Technical View can also be used to confirm that an instrument performs as specified by Oticon. For measurement and demonstration purposes, OtiSet provides Technical Measurements - a verification and testing facility for certain programmable instruments. Choose this feature from the Fitting menu or Tool Bar, when the OtiSet Workshop is in Technical View.

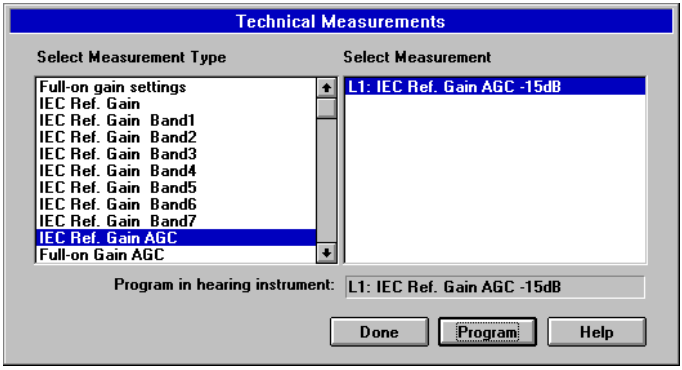


Fig. 12 The Technical Measurements window

Use the Technical Measurements window to apply a variety of standard settings to the instrument - for example, full-on gain. This allows a wide range of control and register parameters to be tested, without client involvement. Each setting is represented by a code which corresponds to IEC or ANSI standards.

Choose a setting and observe the behavior of the output spectrum in the OtiSet graph. If a hearing instrument is connected to the HI-PRO, press the Program button below and the setting will be sent to the instrument. At this point you may want to test the instrument in a measuring box and verify that the results achieved match those shown in OtiSet.

Press Done to close the Technical Measurements window. The hearing instrument reverts to the settings it had earlier.

Be aware that this feature is for testing only, and is not to be used with clients. Be sure to exit Technical Measurements before disconnecting the instrument, so that the original settings can be restored.

Technical View is discussed in detail on page 94. Special conditions which apply to DigiFocus appear on page 110.

Telecoil View

Telecoil View illustrates how an instrument performs when switched to telecoil, compared to the usual (microphone) mode. The control panel reflects the specific instrument, and allows the telecoil response to be customized to suit the client. This view is especially useful when fitting instruments with a programmable telecoil, and shows:

- Microphone: a static gray curve at 0 dB, which serves as a reference for the telecoil curve.
- Telecoil: a red or blue curve which shows the difference in gain between telecoil mode and microphone mode. Input to the telecoil is a magnetic signal at 10 mA/meter, and input to the microphone is a 50 dB pure tone (Own Voice).

  OtiSet assumes operation in the linear range.

Note that switching to Telecoil View is comparable to moving the physical M/T switch to T; even though the physical switch still points to M, input is through the telecoil.

The text on the Telecoil View tab is gray when the view is not available, either because the instrument does not have a telecoil, or is not yet supported by OtiSet.

The OtiSet Buttons

Many of the items in the menu bar are also available from the buttons in the **tool bar**. A button that has been selected appears pressed in; non-available ones are grayed. The tool bar buttons are shown below, followed by descriptions of their functions.

The two groups of tool bar buttons are:

- NOAH buttons:


Client


Audiogram


Manufacturer


Fitting


Insertion Gain


Journal


Print


Help


OK


Cancel

When the Client and Audiogram buttons are clicked in OtiSet, the Client and Audiogram Modules appear, in view mode. Changes to these modules can be made only in NOAH.

The NOAH buttons are described in the NOAH User's Guide or *Introducing NOAH,* earlier in this binder.

- OtiSet buttons:

Note that when the monitor is in VGA mode, not all the buttons are visible; some functions must be accessed from the Fitting menu.


New


Right


Left


Calculate


MCR


Adaptation


Feedback


Acoustics


Guide


Advice


Connect


Program


Mute


Freeze


Toggle

Most of the buttons are described in the following pages. The buttons Connect, Program and Mute are used when fitting Oticon's programmable hearing

instruments, and are described in Chapter 6.

Choosing a New Oticon Hearing Instrument


New

To continue the current fitting with the same audiogram but with a new instrument, click the New button in the tool bar.

OtiSet issues a message stating that the current settings will be lost. If you want to avoid this, click Cancel and proceed as explained on page 32.

Calculate Prescribed Settings


Calculate

Changes to the fitting controls can cause the simulated insertion gain to deviate from the target. You may thus want to use this option to return to the initial prescribed settings.

This feature is also useful if the hook or earmold have been changed, because they may influence the settings. For more information, see Chapter 7.

Entering or Measuring MCR


MCR

In the Audiological View, OtiSet can display a curve called the Most Comfortable Range to help you evaluate the performance of an instrument. The MCR represents that range of levels that the user would find comfortable or acceptable to listen to for long periods of time.

The MCR can be derived from data entered manually from the keyboard, estimated from the HTL, or measured in situ on certain instruments:. Audiological details, and directions for measuring MCR in situ, appear on page 83.

To enter MCL data manually, select the MCR button. The MCR window opens, displaying the estimated MCL values. Make your adjustments and press OK. To revert to the estimated values, remove the new data and select OK.

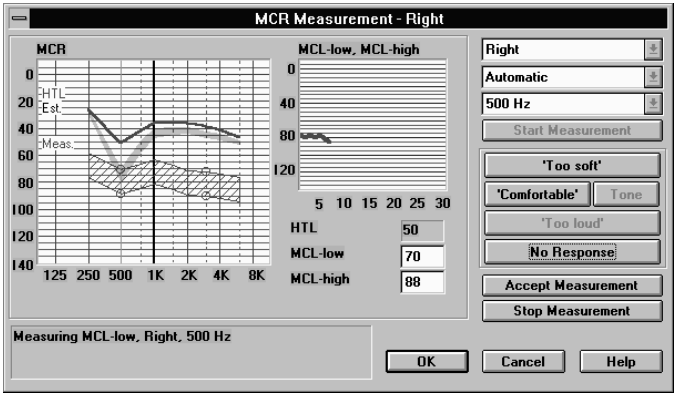


Fig. 13 OtiSet measuring MCR in situ on DigiFocus

Adaptation Manager



Adaptation

Please review page 29 to recall how the Adaptation Manager eases acclimatization for new users of Oticon's programmable instruments. This tool offers a three-step process aimed to take clients from an initial amplification setting designed for acceptance, to a setting designed for maximum speech understanding.

At follow-up fittings, use the Adaptation Manager to adjust the settings to reflect the client's growing comfort with the improved sound. Note that some or all of the options may not be available, depending upon the nature of the hearing loss, the instrument settings, and the Feedback limits imposed after the Feedback Manager has been invoked.

Feedback Manager



Feedback

A number of Oticon´s Hearing Instruments have a Feedback Manager, which makes it possible to eliminate any acoustical feedback. The cause of feedback varies; it can be due to prescribed settings which yield a very good high-frequency response, or high volume control levels.

The Feedback Manager lets you adjust the response and thereby eliminate feedback.

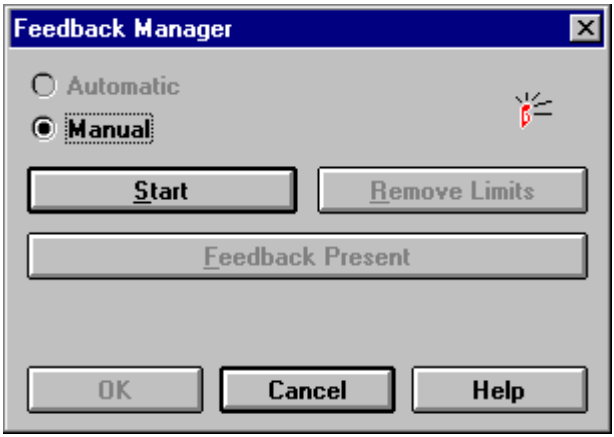


Fig. 14 The Feedback Manager runs the instrument through a test series and finds the feedback limits

To Activate the Feedback Manager

1. Make sure the instrument is connected; "Connected" should appear in the status bar.
2. Insert the instrument in the client's ear.
3. Choose the Feedback Manager from the Fitting menu or Toolbar; the OtiSet Workshop switches to Technical View.
4. Proceed to Manual or Automatic Operation below

Manual Operation

5. When the Feedback Manager opens, press Start.
6. OtiSet runs the instrument through a series of settings, which you can observe in the graph and control panel.

7. If the client reports feedback, click the Feedback Present button with the mouse, or press <Enter> on the keyboard; OtiSet will lower the settings.
8. Repeat the process until feedback is no longer reported; press OK to close the window.

For DigiFocus II Direct instruments, the Feedback Manager runs in both the Omni-directional and Directional programs, independent of link status and from which program the Feedback Manager is selected.

Automatic Operation

5. For DigiFocus, the Feedback Manager offers automatic operation. Select the Automatic button and press Start: OtiSet will automatically reduce the gain of one or more of the four HF filter bands if feedback is present. The instrument itself detects the whistling, so the process no longer requires manual intervention.

   Upon excessive background noise, however, the Feedback Manager cannot discern the signals satisfactorily. In such case, either reduce noise or use Manual operation.
6. Press OK to close the window.

The new settings are shown in the graph and control panel, and an icon appears below the controls. Note that it is not possible to adjust the controls above the new feedback limit. To remove the feedback limit, select the Remove Limits button in the Feedback Manager.

If desired, the process can be interrupted by pressing the Cancel button; the OtiSet Workshop reverts to the settings that existed before the Feedback Manager was invoked.

How Feedback Management Affects the Controls

In DigiFocus, feedback can usually be eliminated by reducing just one of the four HF bands by a few dB. This approach minimizes the need to reduce overall HF gain. The controls and the graph show the reductions as they take place, starting with the 2 kHz band.

Digilife.com takes the same approach as DigiFocus, but only the graph shows the reductions as they take place, starting at 2 kHz.

In PrimoFocus CIC, feedback can usually be eliminated by reducing HF Tone by a few dB. This approach minimizes the need to reduce overall gain. The controls and the graph show the reductions as they take place.

If the results of the feedback test indicate the highest achievable gain is significantly less than the prescribed settings, please check the size of the vent and/or the integrity of the earmold and remake as necessary.

In Ergo, feedback can be eliminated by reducing the level of high-frequency gain at higher volume levels. The value in the Feedback Manager window indicates the level on the volume control beyond which the high-frequency response will not increase when the volume control is turned up.

If the feedback test results in a very low number in the Feedback Manager window, please check the size of the vent and/or the integrity of the earmold and remake, if necessary.

During subsequent adjustments, you should repeat the feedback test if:

- the Fine Tuning Guide advises an increase in HF gain, overall gain or a widening of the vent

- the client reports feedback only during certain activities or positions; in such case, perform the test under the condition in question (such as while the client is chewing).

Acoustic Parameters


Acoustics

You may want to choose another acoustic configuration in order to optimize the fitting. To select a different hook, earmold or vent, open the Acoustic Parameters window as explained in Chapter 7.

For linear instruments, it may be useful to select Calculate Prescribed Settings to obtain new settings which take into account the changed acoustics. Note that OtiSet reverts to the original vent, because the calculation for the vent is based on the HTL and rationale. However, changes you have made to hook and earmold are retained.

Manually adjust the hearing instrument in accordance with the OtiSet fitting controls.

Fine Tuning Guide


Guide

Additional fine adjustments can be made by use of the Fine Tuning Guide as explained in Chapter 7. The Guide proposes a number of solutions to enhance instrument performance. Click Apply after each suggestion and the changes are made to the fitting controls and displayed in the Output Spectrum.

Instruments being programmed are automatically adjusted. Other instruments must be manually tuned in accordance with the proposals.

Fitting Advice


Advice

OtiSet provides advice during the fitting, to guide you towards optimal control settings. When advice is available, the Advice button in the tool bar lights up. The Fitting Ad-

vice window itself pops up automatically or is opened on demand, as specified in User Preferences, "Fitting Advice".

Chapter 7 explains how OtiSet offers advice based on:

- Incomplete audiogram
- Choice of instrument
- Fitting control settings
- Proposed actions in the Fine Tuning Guide



Right

Switching between Right and Left

Click the appropriate button in the tool bar to switch between ears. "Right Settings" or "Left Settings" appears above the graph, and data for the selected ear is shown.



Left

The active button is pressed in. If a button is gray, no instrument has been selected for that ear.

Freeze and Toggle Settings



Freeze

OtiSet lets you compare different control settings without losing any along the way. Click the Freeze button to store the current settings temporarily - without saving them - they will be available should you wish to revert to them.



Toggle

Click the Toggle button, and the current settings are replaced by the frozen ones.

When the computer is in VGA Mode, these two buttons do not appear in the tool bar, but must be accessed from the Fitting menu.

Audible Status Indicator (Beep Controls)

Several advanced Oticon instruments automatically warn users about low batteries or changes in switch settings. Use this dialog - accessible from the Fitting menu - to modify or disable these warnings.



Fig. 15 Specify how and when the instrument shall send alerts

The frequency of the beeps is preset at 1000 kHz, but for DigiFocus II can be changed to 750 Hz or 500 Hz. The output level is preset at the client's MCL, but can be made louder or softer for DigiFocus II.

When the Battery Low option is enabled, the instrument emits 3 beeps at intervals of 64 ms.

When the M/T Switch Indicator is enabled, the instrument will beep at intervals of 127 ms when the switch is changed. Depending upon the style and the setting (not all settings are available in all models) the instrument will emit:

ITE and BTE (exceptions described below):

1 beep	Switch to:	M	M	M	M
2 beeps	Switch to:		T	MT	MT
3 beeps	Switch to:				T

DigiFocus II Compact Power:

1 beep	Switch to:	M
2 beeps	Switch to:	T
3 beeps	Switch to:	MT

DigiFocus II Direct:

1 beep	Switch to:	M/DM	M/DM	M/DM
2 beeps	Switch to:	T	MT	MT
3 beeps	Switch to:			T

M: Omni-directional microphone
DM: Directional microphone

The DigiFocus II Direct also beeps when the microphones are switched:

1 beep	Switch from:	Directional	to: Omni-directional
2 beeps	Switch from:	Omni-directional	to: Directional

Revert to Saved Settings

Any time during a fitting, you can choose this feature from the Fitting menu and restore the settings saved at the end of the last session. This option is gray during an initial fitting before the settings are saved.

Using the NOAH Features


Client

To view the client's personal data or audiogram, click the appropriate button in the tool bar

The NOAH Client and Audiogram Modules are displayed on top of the OtiSet Workshop. Click the OK button on the respective window to close it. Both windows are shown in view mode, and cannot be edited. To make changes in the Audiogram, please leave OtiSet and return to NOAH.

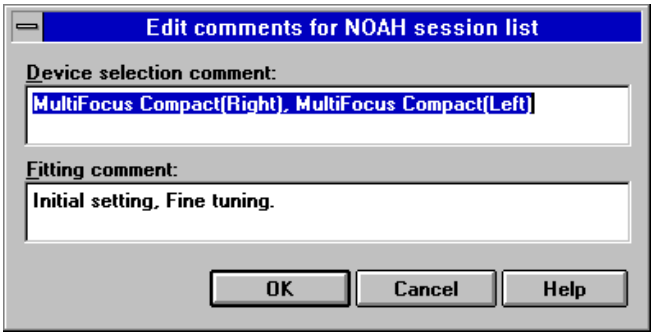


Fig. 16 You may change the text that will appear in the NOAH Session List

There are two ways to make changes in the Client Module:


Audiogram

- to edit personal data, close OtiSet and return to NOAH
- to edit the information in the NOAH Sessions list, click Edit Session Comments in the Fitting menu. Note that the "Device selection comment" can be changed only for new fittings.


Journal

Click the Journal button to access the NOAH Journal. You may enter new information, and read and print Journal pages.

Read about these features in the NOAH User's Guide.

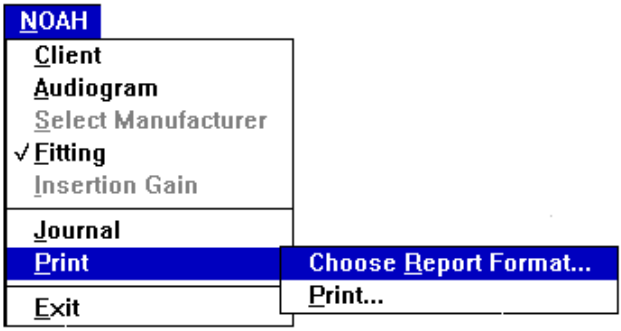
Printing a Fitting Report


Print

To print a report of the ongoing fitting, click on NOAH in the menu line, Print, and Choose Report Format.

The Choose Report Format dialog box opens. Choose between the basic or extended formats. The extended format includes the notes entered in the Edit Report Comments window from the Fitting menu.

Click the "Use this format..." button and the chosen format will be used automatically every time you print.



To quickly print a report of the ongoing fitting, click the Print button in the tool bar.

To print a NOAH fitting report, leave OtiSet and press NOAH in the menu line, and then Print.

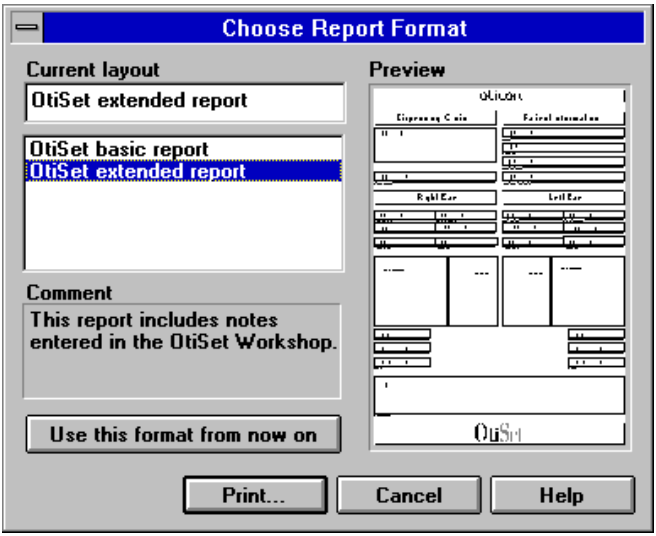


Fig. 17 Two report formats are available

Leaving OtiSet



OK

There are two ways to close OtiSet and revert to NOAH:

- Click the OK button. Current control settings, the serial number and user preferences are saved.
- Click the Cancel button. OtiSet reminds you to save your work if changes have been made:



Cancel

There are two ways to close OtiSet and NOAH:

- From the menu bar, select NOAH, and then Exit.
- Double click the control-menu button in the upper left corner

OtiSet reminds you to save current settings if changes have been made. Remember to enter the serial number of the hearing instrument in the OtiSet Workshop before exiting.

6 Programming with OtiSet

This chapter explains how to program Oticon hearing instruments using the OtiSet programming belt.

When you select a programmable instrument, OtiSet automatically selects HI-PRO as the programming interface. This can be changed to the OtiSet belt in User Preferences, as explained on page 72.

The OtiSet belt - which features cordless programming - is available for certain instruments. Adjustments made in the OtiSet Workshop are sent by an infrared transmitter to the OtiSet belt, which in turn relays them to the instruments.

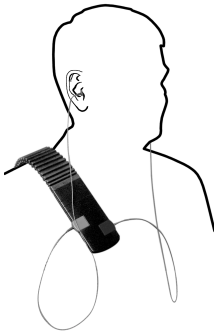


Fig. 18 The OtiSet belt; ready for transmission in a cordless fitting

When using the belt to adjust hearing instruments, the client must be near the transmitter, in line-of-sight view so that the infrared rays between transmitter and belt can pass unobstructed. Between adjustments however, he can freely

move about and try the instruments in different situations without removing them or the belt.

Setting up the Equipment

Installation instructions for the OtiSet belt appear in the *OtiSet Programming Belt Installation Guide*. For information about installing and using HI-PRO, see the HI-PRO documentation.

If you are using the OtiSet belt, be sure you are familiar with OtiSet procedures in general, and follow the directions in the next section.

Prepare the Client

Precise information about how to fit the particular instrument appears in the product information sheet. In general, proceed as follows:

1. Seat the client within 2.5 meters (8 feet) of the transmitter. Make sure there are no obstructions between the transmitter and the belt
2. Choose an existing client, or enter new client and audiogram in NOAH and start OtiSet.
3. In the Select Oticon Hearing Instrument screen, choose a programmable instrument.

   Consider the possibility of suppressing connection to the hearing instrument. This might be useful if the settings of the instrument have not been verified, and you want to experiment with the OtiSet graph first.

   To suppress, click the Preference button at the bottom of the screen and from "Communications", select *Suppress communication with instrument*. Remember to re-enable connection when you are ready to program the instrument.

4. Leave the PC and connect the instrument to the OtiSet belt. A plug can be used for either ear - the red side fits the right socket in the belt, and the blue the left socket.

   Plugging in the instrument automatically powers on the belt.

5. Drape the belt on the client's shoulder, with about half in front and half in back. The side with the Oticon label lies against the chest. Make sure the client faces the side of the transmitter with the Oticon logo.


Mute

6. In the tool bar, activate the mute function, to protect the client from unexpected sharp sounds.
7. Insert the instrument in the client's ear.

Return to the PC

Click OK in the Select window and move on to the OtiSet Workshop. Unless User Preferences have been changed, OtiSet will automatically try to connect with the chosen instrument, and sends several messages to that effect.


Connect

When the Workshop opens, a green "Connected" message will blink in the status line. The Connect button in the tool bar will contain a green checkmark.

Depending upon the nature of the fitting, the Workshop will show one of the following:

- prescribed settings for a new instrument
- last-saved settings of an instrument that has already been programmed
- a message asking which settings to use when the settings of the instrument do not match those saved.

Program the Hearing Instrument

Adjust the instrument using the features of the OtiSet Workshop, as explained in Chapter 5.

1. Observe whether the Connect button in the tool bar shows a green checkmark; this means communication is established. If a red cross appears instead, click the Connect button; the cross should be replaced by the checkmark. If this does not happen, consult the Troubleshooting Guide at the end of this chapter.



Connect

2. In the tool bar, deactivate the mute function.
3. Move the fitting controls, try the different input sound spectra, observe performance in the Audiological, Binaural and Technical Views. OtiSet automatically sends all changes to the belt and the instrument is adjusted accordingly.
4. When the settings seem satisfactory, let the client rise and move about, trying instrument performance in different situations. Remind him to hold the belt in place.
5. Save the settings in the instrument by clicking the Program Hearing Instrument button. Note that you can save the right and left sides separately. When you are finished, click the OK button and the settings will be saved in both the instrument and OtiSet.



Program

6. Disconnect the belt and plug from the hearing instrument to conserve batteries.

Some Important Guidelines

Programming with the OtiSet belt is as simple as switching TV channels with a remote control, but there are a few simple rules to observe:

- When cordless fitting is taking place, only one OtiSet programming belt should be in operation in a room, at any time. To ensure this, please check that hearing instruments are connected only to the belt that you intend to use.

  If several belts are to be used in the same room, wired transmission must be used for all belts. Furthermore, to avoid interference from infrared communications, you must disconnect all transmitters from their PC

interfaces.

Failure to comply with these guidelines can result in incorrectly programmed instruments.

- If the plugs and belt are not correctly connected, or the wrong plug has been chosen, OtiSet issues a message. To recover from this, reassemble the components correctly and click OK on the message box.
- Do not disconnect the instruments from the belt during a fitting. Changes which have not been saved will be lost. If this occurs, OtiSet will issue an error message.

  To recover, reassemble the equipment and click the Connect button. The green checkmark should appear and the fitting can continue.
- Never switch to a different instrument during a connection; disconnect the instrument first.
- If OtiSet is unable to transmit because the client is too far away or the belt is obstructed, a message appears. Move the client closer or remove the obstruction, and click Retry.
- The OtiSet belt conserves batteries; it switches itself off as soon as you disconnect instruments and plugs. After 60 minutes without transmission, the belt likewise becomes inactive to save power.

  To restart, remove the plugs from the belt and leave them out for at least 10 seconds. Insert them again, wait another 10 seconds.

Troubleshooting Guide

While fitting programmables, OtiSet may send error messages if difficulties arise in transmission. These are generated when OtiSet is unable to establish communication upon initialization, or upon failure during programming. Recovery procedures are stated in the message. Additional steps for problem solving in connection with cordless fitting are listed below:



Fig. 19 OtiSet warns that a programmable instrument has been chosen, but the belt is not operational

No communication upon initialization

Follow the directions on the message, and be sure that:

1. The belt is within 2.5 m and in clear line-of-sight of the transmitter.
2. The instruments are correctly connected. Make sure that for a monaural fitting, the instrument is connected to the correct side. If there is any doubt, disconnect the instruments, plugs and belt, wait 10 seconds, reconnect and wait another 10 seconds.
3. The PC interface is connected directly to the PC and powered on.
4. User Preferences, "Communications" is set to automatic detection or the OtiSet belt.

If all these conditions are met but problems remain, then:

1. Disconnect the instruments, plugs and belt, reboot the PC and restart NOAH and OtiSet.
2. Finally, use the belt cable to connect the belt to the PC interface and try to transmit. The belt cable is stored in the carrying case.

Communications fail during a session

Follow the directions on the error message, and be sure that the belt is within 2.5 m and in clear line-of-sight of the transmitter. If the error persists, reboot the PC.

No sound from the instrument

Check that:

1. The mute function is not selected.
2. Batteries are fully charged, for those instruments which require batteries during programming.
3. If the instrument has an MT switch, it is set to M.

If you still need help..

Phone your OtiSet support representative, after clicking the Info button on the error message to obtain full information.

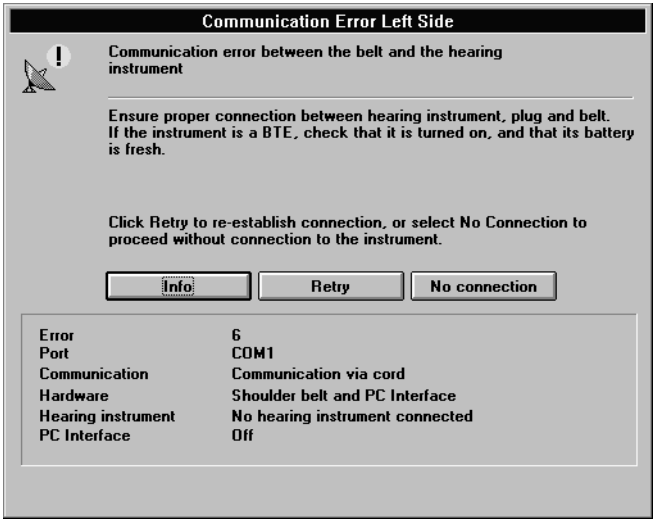


Fig. 20 The information in the Info panel will help your support representative solve the problem

7 Tuning and Training

This chapter describes additional OtiSet features which can optimize the performance of the hearing instrument, and improve the life quality of the client

OtiSet offers a number of special features to help fine tune instrument settings to achieve optimum performance:

- the Acoustic Parameters window: see below
- the Fine Tuning Guide: see page 63
- pop-up Fitting Advice: see page 65
- the Clear Speech program: see page 67

Hearing enhancement continues long after the fitting and concerns the family of the client as well. Oticon's commitment to total hearing care is expressed by the Clear Speech program, described at the end of this chapter.

Acoustic Parameters

The acoustic configuration of the hearing instrument influences its performance. With OtiSet, it is possible to view the impact on the output after changing one or more of the acoustic elements.


Acoustics

Click the Acoustics button in the tool bar or Acoustic Parameters from the Fitting menu. The Acoustic Parameters dialog box opens, with suggested defaults:

- Hook: the one most suitable for the instrument
- Earmold (sound bore): the one most suitable for the instrument

- Vent: reflects a compromise to minimize occlusion (requires large vent) and feedback (requires small vent). For a thorough discussion of vents, see page 96.

Although the defaults represent factory standards, changing them may optimize acoustical output. For example, to smoothen frequency response around 1 kHz by using a hook with greater damping resistance, click on *Hook*.

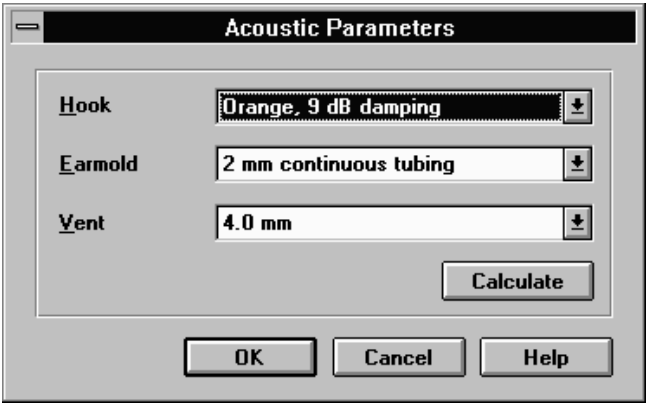


Fig. 21 The Acoustic Parameters dialog box

In the drop-down list, highlight the desired hook and the output spectrum in the OtiSet Workshop displays the effect of the changes. The Acoustic Parameters box remains, so that you can try other changes and immediately see the effect on the output.

To return to the OtiSet Workshop without making changes, either click Cancel, or double click the control button in the title bar of the dialog box. Click Help to get information specific to Acoustic Parameters.

You can also use this window to calculate new acoustic parameters after having adjusted the fitting controls. Select the Calculate button, and the optimal settings will appear.

Calculate New Prescribed Settings


Calculate

After changing the acoustic parameters for linear instruments, it may be useful to have OtiSet prescribe new control settings which take these changes into account.

When you select **Calculate Prescribed Settings** from the toolbar, OtiSet uses the new values to recalculate the settings and displays them in the output spectrum and fitting controls.

In addition, OtiSet will revert to the vent initially prescribed, because vent selection is based solely on the HTL. However, changes made to earmold and hook are retained.

When fitting a non-linear instrument, there is no point in recalculation if only the acoustics have been changed. This is because OtiSet takes only the HTL and rationale into account when calculating settings. As a result, changes to the acoustic elements do not influence the prescribed control settings,

Fine Tuning Guide


Guide

Due to variations between estimated and measured individual UCL and MCL, the client's perception of sound level and sound quality should be carefully monitored. Some clients may tolerate higher control settings, thereby gaining speech intelligibility; others may require a lower setting due to diminished tolerance for high input levels.

A client's tolerance towards loud sounds may improve as he gets used to an instrument. Tolerance often changes over time, especially for new users, and it is extremely important to use the Fine Tuning Guide after the initial adjustment in order to find the optimal fitting.

The rigorous questions and expert suggestions offered by the Guide are drawn from experience gained from extensive field tests. The Guide helps obtain client responses and suggests corrective actions.

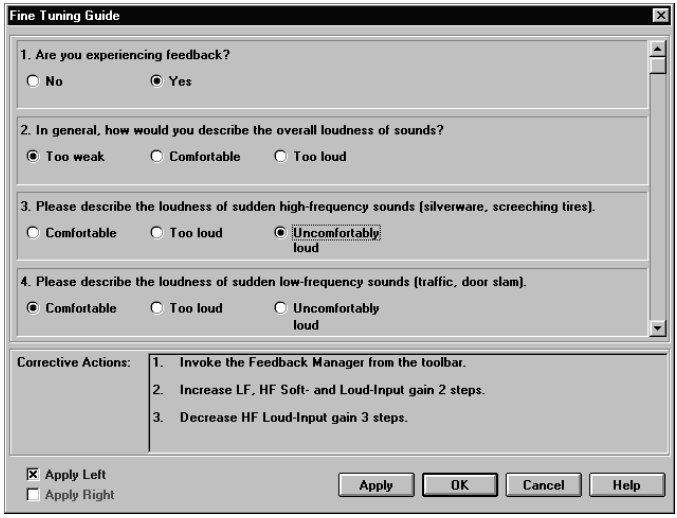


Fig. 22 The Fine Tuning Guide suggests corrective actions

Click the Guide button or choose Fine Tuning Guide from the Fitting menu. A window opens, revealing a series of questions and a lower panel. Use these questions during the fitting to elicit the client's response. Enter the response by clicking on the appropriate button and a suggested corrective procedure will appear in the bottom panel. Be sure to scroll down so that all the questions come into view.

Two types of Fine Tuning Guides are available, depending upon the instrument:

- Active guide: Select the Apply button, and OtiSet updates the fitting controls, output spectrum, and connected programmable instrument, if any. These proposed settings should be suitable for the initial fitting. Note that only one action can be applied at a time.
- Advisory guide: offers suggestions for adjustment, leaving you to implement them manually.

In Binaural View, the Fine Tuning Guide is available for:

- linear instruments: when two identical instruments have been chosen
- most non-linear instruments: when two instruments of the same family have been chosen

To apply the adjustments to only one instrument, click the appropriate *Apply Right* and *Apply Left* check box to disable it.

To interrupt the questioning and prevent any changes from taking place, click Cancel or double-click the control button in the title bar of the Fine Tuning Guide. For more information, click the Help button.

Fitting Advice



Advice

In Audiological View, OtiSet provides advice to guide you towards optimal settings. When advice is available, the Advice button in the tool bar lights. Click the button and the Fitting Advice window pops up.

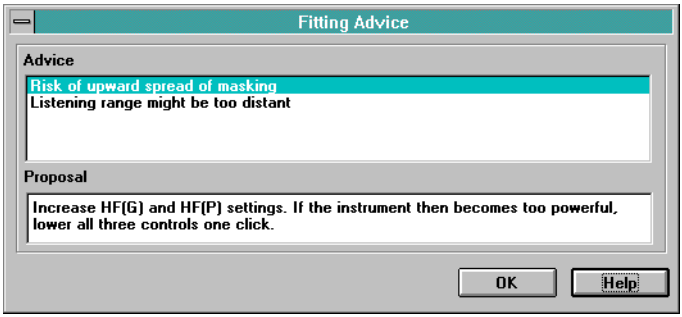


Fig. 23 Fitting advice for a MultiFocus

To have the Fitting Advice window to pop up automatically, choose this option in User Preferences, see page 72.

OtiSet offers fitting advice based on:

- Incomplete audiogram: if HTL data has been entered at 1 kHz, but is missing at 500 and/or 2000 Hz, OtiSet reports that these values will be estimated.
- **Choice of instrument**: the selected instruments may be too weak or too powerful to compensate for the specific hearing loss. OtiSet also notifies you if the Air-to-Bone Gap exceeds 10 dB at 1 kHz, or if the instrument is not suitable for reverse hearing losses (non-linear instruments).
- **Fitting control settings**: the controls have deviated so far from the prescribed settings that the instrument cannot meet the goals of the fitting rationale. OtiSet alerts you if the following changes have been made to the controls (non-linear instruments):
  1. LF increased so much that there is a risk of upward spread of masking.
  2. LF raised to more than 5 dB above HF(G); this setting is not suitable for the instrument.
  3. LF raised to more than 5 dB above the setting recommended by the rationale; the listening range may therefore be too distant.
  4. HF(G) raised to more than 5 dB above HF(P); this reduces the dynamic range and increases the likelihood of poor sound quality.
  5. HF(P) raised to more than 5 dB above the setting recommended by the rationale; the output limiting system will be triggered at too high a setting.
- **Fine Tuning Guide**: OtiSet warns you when unsuitable corrections have been chosen. This can occur when the remedy to a complaint suggests increasing or lowering a control beyond its physical boundaries (non-linear instruments).

OtiSet sometimes offers several pieces of advice at once; click on a single line and a proposal is suggested below.

For additional information, double-click on the line of advice or press the Help button.

To remove the Fitting Advice window:

- Correct the condition that activated the window, or
- Click the OK button on the Fitting Advice window
- Double-click the control button (upper left)

Note that the Advice button in the tool bar remains lit until the conditions that activated the advice are changed.

The Clear Speech Program

Oticon recognizes that hearing instruments are only one of many means to better understanding and enhanced life quality. Therefore, the services offered by OtiSet have been broadened to include the Clear Speech program, to help your client benefit from improved communication.

Choose Audiological Tools from the menu bar, and click on Clear Speech. The program opens with a script which will be useful when explaining Clear Speech to family members of your newly-fitted clients. The training module is designed to be demonstrated by you, followed by practice on the part of the family.

If your computer has a sound card and a loudspeaker, click on the icons on the exercise page for a demonstration of Clear Speech. At the end of the session, you can print the exercise for your clients to take home, for further practice.

8 User Preferences

This chapter explains how to choose between various views and settings for the OtiSet Workshop, and thereby customize the display.

The User Preferences menu lets you customize many OtiSet features, show the spectra in various ways, and to choose the communications media for Oticon programmable instruments. Settings are linked to the log-in name of the individual user, so two persons with OtiSet on a single PC can each have their preferred view and settings.

You can change preferences at any time during a fitting. The new settings are saved when OtiSet is closed. To return to the original factory settings, click Reset Preferences.

User Preferences

Click the Preferences menu, and choose User Preferences:

The OtiSet - User Preferences window opens, with "Audiological View" already selected, as shown in Figure 24.

Click Help for information about the various options.

You can also activate the User Preferences window by clicking the *right mouse button* on the OtiSet graph. In such case, only the options relevant to the current view are available.

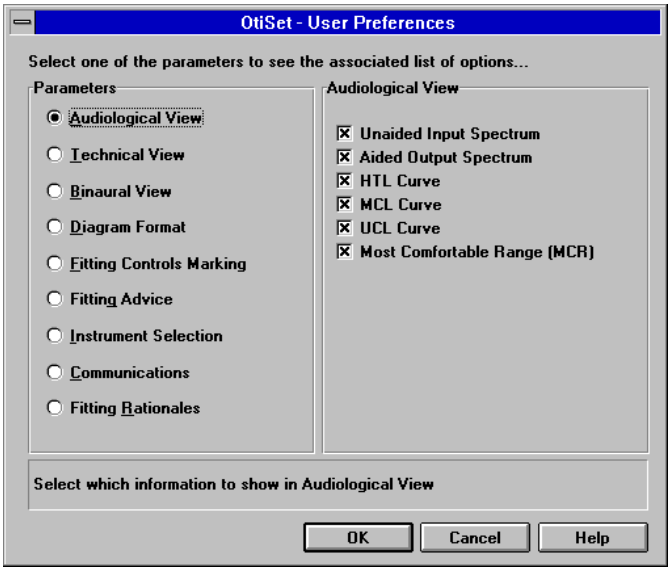


Fig. 24 The User Preferences window offers a wide variety of options

Audiological View

The Audiological View in the OtiSet Workshop automatically shows the following curves:

- Unaided Input Spectrum
- Aided Output Spectrum
- HTL
- MCL
- UCL
- Most Comfortable Range (MCR)

To suppress display of any of the curves, click the appropriate check boxes.

Technical View

Technical View offers several display options:

- Simulated In-Situ Output (default)
- IEC 711 coupler
- ANSI 2cc coupler
- Simulated Insertion Gain
  Based on KEMAR mannequin measurements in an anechoic chamber, and shown for three pure tone input levels: 50, 65 and 80 dB SPL.
- Target IG and Simulated IG
  Target Insertion Gain is based on the HTL and fitting rationale; the calculated settings attempt to match the Target Gain prescribed by the rationale. For non-linear instruments, OtiSet shows prescribed Insertion Gain as described on page 94.


Ansi 2cc


Sim IG

Binaural View

The Binaural View automatically shows the following curves:

- Aided Output Spectrum
- HTL
- MCL
- UCL

To suppress display of any of the curves, click the appropriate check boxes.

Diagram Format

Select the graph format for the OtiSet Workshop:

- ISO format: 20 dB = one octave (default)
- IEC format: 50 dB = one decade

The graph can be displayed in steps of 5, 10 or 20 dB. To distinguish between measured data and estimated data, enable Curve Points.

Fitting Control Markings

OtiSet shows the values in the fitting controls for all linear instruments in the same manner as they appear on the physical instrument. For MultiFocus, on the other hand, the values in the fitting controls can be displayed in two ways:

- dB HL (default)
- number of clicks from leftmost position

The values are displayed in the fitting control panel in the OtiSet Workshop.

Fitting Advice



Advice

OtiSet provides fitting advice to guide you towards optimal control settings. When advice is available, the Advice button in the tool bar lights. Click on the button, and the Fitting Advice window pops up, as shown on page 65.

To make the Fitting Advice window pop up automatically when advice is available, choose *Pop up immediately*.

Instrument Selection

In the Select Oticon Hearing Instrument window, the instruments can be grouped by style or by audiological criteria. The grouping tabs below the list of instruments indicate the chosen criterion - the gray tab is the active group.

Communications

Choose which media, if any, shall be used to communicate with a programmable instrument, such as microFocus.

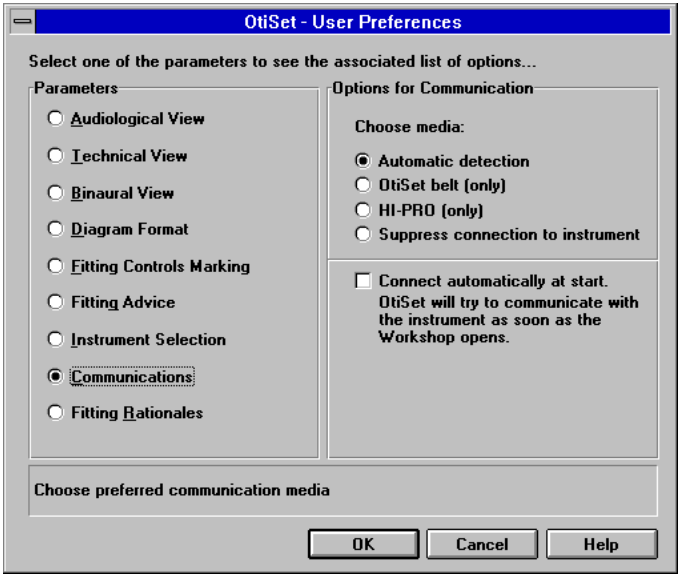


Fig. 25 The Communications options in User Preferences

The options are:

- *Automatic detection*: OtiSet first attempts to connect to the HI-PRO. If HI-PRO is not available, OtiSet attempts to connect to the belt. If neither is available, OtiSet issues an error message.
- *OtiSet Belt (only)*: OtiSet connects to the belt. Chapter 6 explains functionality.
- *HI-PRO (only)*: OtiSet connects to HI-PRO.
- *Suppress connection to instrument*: OtiSet will not initiate transmission when a programmable is chosen. Furthermore, clicking the Connect button will have no effect. Ongoing communication, however, will not be terminated.


Connect

The right, bottom panel offers a special feature. By default, if a programmable instrument has been chosen, OtiSet tries to connect to it as soon as the OtiSet Workshop opens. Subsequent adjustments will then automatically be sent to the instrument. This, however, might not be convenient if you want to experiment with the Workshop and examine the simulated settings first, before doing the programming.

To prevent OtiSet from seeking connection at start, click off the check box in the right bottom panel. During the fitting, you will be able to connect to the instrument at any time by clicking the Connect button in the tool bar.

Fitting Rationales

Select a default rationale for the linear instruments.

The chosen rationale will appear thereafter in the Fitting Rationale list boxes in the Select Oticon Hearing Instrument window. In that window, however, the other rationales will be available as well, should you wish not to choose the default.

9 Audiological Background

This chapter explains and documents the audiological approaches used by OtiSet.

Hearing instruments fittings may be illustrated using the Audiological View, Binaural View, Technical View and Telecoil View, or a combination of these. The Technical View will be more familiar to most hearing care professionals. However, the Audiological View may be particularly suitable for illustrating the effects of non-linear fittings.

Audiological Client Data

OtiSet uses the audiological data recorded in NOAH. In order to obtain the best fitting, an audiological examination covering the basic measurements - HTL (AC and BC) and UCL - should be carried out at as many frequencies as possible.

Nevertheless, OtiSet is able to carry out a fitting with little data. But as a minimum, the HTL for at least one frequency must be entered if a fitting based on the Audiological View is to be made.

Remaining HTL datapoints are interpolated between available datapoints.

BC HTL is used, if available at 1000 Hz. Otherwise, BC HTL is estimated as equal to AC HTL, i.e. ABG = 0 (Air-to-Bone Gap).

Be aware that if MCL (Most Comfortable Level) values have been entered in NOAH, OtiSet replaces them with new

MCL values calculated in accordance with the Oticon proprietary loudness model.

The OtiSet Fitting Rationales

OtiSet offers a number of prescriptive rationales which enable the frequency response and dynamic characteristics of the chosen hearing instrument to compensate for the given hearing loss. The rationales are formulas based upon hearing thresholds and estimates or actual values of MCL, MCR and UCL.

You select an appropriate rationale when choosing instruments in the Select Oticon Hearing Instrument window; see Chapter 4. The name of the chosen rationale appears above the graph in the OtiSet Workshop.

The rationales available in OtiSet apply to either non-linear or linear instruments. Their aims and characteristics are briefly described below:

Non-linear rationales used by DigiFocus

OtiSet uses Oticon's proprietary SKI rationale to prescribe optimal settings when fitting steeply-sloping hearing losses. SKI compensates for recruitment and controls upward spread of masking through the use of syllabic compression in the low-frequency range. At the same time, SKI applies linear gain and fast compressing limiting.

SKI attempts to give the user full access to the information in the speech signal, by using unique seven-band shaping to match the instrument's frequency response to the patient's audiometric profile. The crossover frequency between the LF and HF channels is also chosen on the basis of the audiometric profile.

The 2, 3 or 4 lowest frequency bands pass through the LF channel, which adjusts gain individually for each band. This channel incorporates syllabic compression, with gain and compression characteristics set to ensure audibility

and comfort for low-frequency signals, while protecting the higher frequencies from the effects of upward spread of masking.

The remaining frequency bands pass through the HF processor, where gain is individually adjusted for each band. This channel applies linear amplification over a wide range of input levels. For high input levels, a fast-acting compression limiter lessens user discomfort. This combination ensures audibility and comfort in noisy listening environments.

SKI provides an appropriate fitting for normal recruitment as well as over-recruitment.

The Adaptive Speech Alignment proprietary rationale compensates for recruitment and controls upward spread of masking through the use of syllabic compression in the low-frequency range. At the same time, ASA^2 adaptively adjusts gain for changes in input level in the high-frequency region, in an attempt to achieve high levels of both comfort and speech intelligibility.

The ASA^2 rationale attempts to give the user full access to the information in the speech signal. This access is accomplished in three ways.

1. The seven-band shaping allows for precise matching of the instrument's frequency response to the patient's audiometric profile. The three lower frequency bands are sent to the low-frequency processor. This processor incorporates syllabic compression, with gain and compression characteristics set to ensure audibility and comfort for low-frequency signals, while protecting the higher frequencies from the effects of upward spread of masking.

   The four higher bands are sent to the high-frequency

processor. This processor applies Adaptive Gain to provide linear amplification for short-term changes in the input signal. At the same time, the gain to higher frequency signals is more gradually adjusted, based on their overall input level. This combination ensures audibility and comfort across a broad range of listening environments.

2. The low-frequency channel has two controls and a trimmer panel. The trimmer panel allows for adjustment to the relative gain in each of the three low-frequency bands. The low-frequency Gain control allows changes to the gain for lower frequency signals. The Compression ratio control allows for changes in the compression ratio for input signals above 50 dB SPL.
3. The high-frequency channel also has two controls and a trimmer panel. The trimmer panel allows for adjustment to the relative gain in each of the four high-frequency bands. The Gain control for the low-input levels adjusts the gain for higher frequency signals up to 50 dB SPL. The Gain control for the high-input levels adjusts the gain for higher frequency signals at 80 dB SPL.

Non-linear Rationales used by DigiLife

The WDRC+ rationale attempts to provide Wide Dynamic Range input Compression in two channels. This well proven approach uses two, fast acting syllabic compressors to maximize the amount of speech energy available to the listener in various listening environments, while at the same time maintaining comfort. The gain, crossover frequency and compression characteristics are set to be appropriate for the user's hearing loss and dynamic range.

You may want to adjust the gain for soft and loud inputs in both the low- and high frequency channels. The crossover frequency between the two channels is also adjustable. To

further protect against discomfort from high-level sounds, adjustable Active Output Limiters are available in both channels.

WDRC+ gives access to a broad range of signals that are amplified and compressed to best match the remaining dynamic range. Although soft speech sounds will be audible, louder sounds will not become uncomfortable.

The MultiFocus proprietary rationale compensates for recruitment in the low-frequency range and adjusts for good speech intelligibility and comfort in the high-frequencies.

Clients with a sensorineural hearing losses suffer from recruitment. This means that their Auditory Dynamic Range (ADR) is reduced but UCL is almost normal. As a result, weak sounds need high amplification while loud sounds need little or none.

The two-channel design of microFocus and MultiFocus compensates for recruitment using the following strategy:

1. The low-frequency channel (frequencies below 1.5 kHz) aims to restore normal loudness sensation between HTL and UCL. Our perceived loudness of sound is determined by low-frequency energy, present in most communication and sound.

   Accordingly, the low frequency channel uses full dynamic range compression, ensuring that weak sounds are audible, normal sounds are comfortable and loud sounds don't become overwhelming.

   The low-frequency control setting is calibrated in HTL and adjusts the gain compression ratio and output in one operation. It provides linear amplification for input signals up to 50 dB SPL, and gradually reduces amplification of signals above 50 dB SPL, ending in 0 dB (Unity Gain).

2. The high-frequency channel (frequencies above 1.5 kHz) must provide audibility, good sound quality and listening comfort. By using a linear rationale, speech intelligibility isn't compromised, yet excessively loud sounds are suppressed by an AGC-limiter.

   The high frequency channel has two controls - calibrated in HTL - which adjust the Maximum Power Output (MPO) and Gain.

   MPO is set close to the client's estimated pure tone MCL, thereby avoiding discomfort at high input levels and in noise. Gain is set to a level that prevents distortion by the MPO limiter during vocalization. Output and Gain are thus adjusted to an optimal compromise between audibility (speech intelligibility), listening comfort and sound quality.

Linear Rationales

POGO II defines insertion gain and MPO requirements for sensorineural losses. Note: the hearing loss should be less or equal to 80 dB HL at 250 Hz (if not, the SSM rationale is recommended, see below).

For losses below 65 dB HL, POGO II prescribes a Real Ear Insertion Gain (REIG) as half the HL, but with a reduction at 500 Hz and below. As the aim is to restore normal MCL[1], the target REIG above 65 dB HL is:

$$32.5 \text{ dB} + \text{HL} - 65 \text{ dB}$$

Libby modifies POGO II by changing target REIG dependence on the HL; persons with mild to moderate losses may prefer target REIG equal to one-third of their HL rather than one-half.[2]

1. "Hearing Aid Selection for Severe-To-Profound Hearing Loss", Schwartz, Lyregaard, Lundh (1988), The Hearing Journal, Vol. 41, No. 2, pages 13-17.

Berger approximates the half-gain rule; operating gain is slightly greater than half the HL.[3]

NAL-RP provides more gain for mid-frequencies and less for high- and low-frequencies. NAL-RP includes speech spectrum data in the gain-frequency response curve. OtiSet uses NAL-RP (revised), which is extended with a gain prescription rule for severe and profound hearing losses.[4]

SSM (Speech Spectrum Method) appropriate for severe and profound hearing cases with an HL greater than 80 dB HL at 250 Hz.

Sufficient low-frequency amplification is considered an important prerequisite for lip-reading. The one-third octave band speech spectrum should be amplified by 7 dB above the HTL for these cases.[5]

VHF (Very High Frequency) Rule defines target REIG as 0.4 × HL. The aim is to restore normal MCL at high frequencies. [6]

Corell (Custom ITE), a proprietary Oticon rationale has long been used to predict gain and MPO for custom-made ITE instruments. Corell combines the 1/3-, 1/2- and 2/3-

2. "Strategies for Selecting and Verifying Hearing Aid Fitting", Valente, M. (1994), Thieme Medical Publishers, Inc., New York, pages 271-276
3. *Ibid*, pages 12-15
4. "Modified hearing aid selection procedure for severe/profound hearing losses." Byrne, Parkinson, and Newall (1991). In Studebaker, Bess, and Beck (Eds.) The Vanderbilt Hearing Aid Report II (pp. 295-300). Parkton, MD: York Press.
5. "Gain and feedback problems when fitting behind-the-ear hearing aids to profoundly hearing-impaired children", Dyrlund and Lundh (1990), Scandinavian Audiology, no. 19, pp. 89-95.
6. Oticon Research Report no. 33-8-2: "Very High Frequency Hearing Loss", Lundh, P. (1987).

gain rules in a single formula, and thus provides less gain for hearing losses up to 60 dB and more gain for losses exceeding 75 dB, compared to the POGO II rationale.

Corell takes conductive elements of mixed losses into account when calculating the required gain.

The Adaptive Fitting Method

Certain instruments, such as the PrimoFocus Pro2 and CIC, can be fit by means of the Adaptive Fitting Method

This unique method lets you conduct a personalized, interactive fitting. Connect the instrument and choose Start Adaptive Method from Audiological Tools. Note that if the same instrument has been chosen for both ears, then both must be connected.

The procedure varies, according to the instrument:

For PrimoFocus Pro2, which has two channels, OtiSet will:

- set the current listening situation for channel one (P1) to General Use, and calculate prescribed settings
- lower the Gain and Kneepoint controls to a minimum
- prompt you to speak to the client in a raised voice, and adjust the Gain so that although your speech is loud, it is still acceptable
- prompt you to speak to the client in a soft voice, and adjust the Kneepoint until your voice is loud enough to be clearly understood
- open the Program Customizer, from which you can assign different listening situations to the two channels (P1 and P2) if desired; OtiSet adjusts the controls to reflect the chosen situations

For PrimoFocus CIC, OtiSet will:

- calculate prescribed settings
- lower the Gain and Kneepoint controls to a minimum

- prompt you to speak to the client in a raised voice, and adjust the Gain so that although your speech is loud, it is still acceptable
- prompt you to speak to the client in a soft voice, and adjust the Kneepoint until your voice is loud enough to be clearly understood
- prompt you to ask the client to speak in a normal voice, and adjust the LF Tone until his own voice sounds natural

If you are performing a binaural fitting, OtiSet will immediately guide you through the same steps for the other ear as well.

The Audiological View

Due to the complex effects of non-linear hearing instruments, it can be helpful to use the Audiological View during a fitting. In this view, instrument performance is shown in audiogram format for a variety of input spectra. The Audiological View can also be used to illustrate the effects of fitting linear instruments.

The use of such an audiogram-based format - whether reflected monaurally in the Audiological View or in the Binaural View - demonstrates where amplified sound falls in relation to the auditory characteristics of the client. Both views show the client's Auditory Dynamic Range (ADR), with HTL and UCL as the two boundaries. In addition, the hearing care professional can choose to also view the client's MCR and MCL.

MCR: Most Comfortable Range

The MCR represents that range of levels that the user would find comfortable or acceptable to listen to for long periods of time. OtiSet evaluates and displays the MCR using a combination of input data and proprietary formulas.

MCR can be measured directly, predicted from MCL values entered in the MCR window, or derived with the following formulas:



MCR

$$MCL\text{-}low = 59.98 + 0.0836 \times HTL + 0.004062 \times (HTL)^2$$

$$MCL\text{-}high = 84.65 - 0.0824 \times HTL + 0.004292 \times (HTL)^2$$

If the hearing loss is mixed or conductive, the air-to-bone gap is taken into account.

Note that OtiSet can store entered MCL values only if NOAH 2.0 or newer is installed.

Measuring MCL with an Audiometer

When collecting MCL values with a standard audiometer, Oticon recommends the following procedure:

1. Use an adaptive testing technique with intervals at 5 dB. Measure MCL-low and MCL-high separately at 500 and 3000 Hz, using pure tones. Measure MCL-low first at 500 Hz, with a starting level of:

   MCL-low start = HTL + 20 (if HTL <= 35 dB)

   MCL-low start = HTL + 5 (if HTL > 35 dB)

2. Inform the patient about the purpose of the test (to find comfortable levels for long-term listening through the hearing instrument). Ask him to respond after each tone presentation with a single descriptor: "too soft" or "comfortable". If the response is "too soft", increase the level by 5 dB. If the response is "comfortable", decrease the level by 5 dB.
3. Continue testing until there have been eight reversals of level (the response changing from "too soft" to "comfortable", or vice versa). After eight reversals, testing is complete for that frequency. The audiometer setting at which the client reversed should be averaged from the last six reversals.
4. Now measure MCL-high, with a starting level of:

MCL-high start = .4 (MCL-Low) + 75

Ask the client to respond after each tone, using a single descriptor: "too loud" or "comfortable". Use the same technique as above, with the exception that upon a response of "too loud", decrease the level by 5 dB, and upon a response of "comfortable", increase it by 5 dB.

5. Repeat steps 2-4 at 3000 Hz.

Measuring MCL with the MCR window

You can perform in situ measurements on the following DigiFocus instruments once they are connected: all ITEs, and BTEs with a serial number greater than 50,000.

Choose which ear to measure, and whether you want Automatic or Manual signal presentation. Instruct the client as follows: "You will hear a series of tones. Try to imagine how they would sound over a long period of time."

Automatic signal presentation:

1. Ask the client to respond with "Too soft" or "Comfortable" at the sound of the tone. Press Start Measurement; OtiSet sends a tone at 500 Hz to test for MCL-low.
2. Within 10 seconds of the tone, select the button that reflects the client's response; OtiSet automatically sends the next tone.
3. After eight reversals of level (the response changing from "Too soft" to "Comfortable", or vice versa), testing is complete for MCL-low at 500 Hz.
4. OtiSet is ready to send tones at 500 Hz to test MCL-high. Ask the client to respond with "Too loud" or "Comfortable". Press Start Measurement. After eight reversals, testing is complete for 500 Hz.
5. Press Start Measurement. OtiSet sends a tone at 3000 Hz. Repeat the procedure described in steps 1-4.
6. OtiSet displays the two MCL values. Select OK to close the MCR window.

Manual signal presentation:

1. Ask the client to choose either "Too soft" or "Comfortable" in response to each tone.
2. Press the Start Measurement button; a tone at 500 Hz is sent to the client.
3. Click the button that reflects the client's response.
4. Press the Tone button or the right mouse button for the next stimulus.
5. Continue testing until there have been eight reversals of level (the response changing from "Too soft" to "Comfortable", or vice versa). After eight reversals, testing is complete for that frequency and OtiSet displays the value for MCL-low.
6. Continue with MCL-high at 500 Hz, using the same procedure as above, with the exception that the client responds with "Too loud" or "Comfortable".
7. After eight reversals, OtiSet displays the value for MCL-high.
8. Repeat steps 2-7 for 3000 Hz.
9. Select OK to close the MCR window.

Note that for both modes, the Accept Measurement button becomes active after four reversals, allowing the test to be shortened to less than eight reversals. However, it is strongly recommended that all eight reversals be collected for each frequency and for level, to achieve the most accurate MCR.

To interrupt the measurements (and have a word with the client), select the Talk button. To resume, press Talk again. The Stop Measurement button also interrupts the measurements, but all the new MCL data collected up to that point will be lost.

Estimating MCL - Most Comfortable Level

MCL is a widely used indicator of user comfort, but is difficult to measure reliably. When MCR is available, OtiSet

represents MCL as the midpoint of the MCR. If MCR is not available, OtiSet estimates MCL for a pure tone at any given frequency to be the midpoint between MCL-low and MCL-high, using the formula:

$$MCL = (MCL\text{-}low + MCL\text{-}high) / 2$$

OtiSet replaces MCL values entered in NOAH with MCL values estimated in accordance with Oticon's proprietary loudness model.

Measuring and Estimating UCL: UnComfortable Level

Studies show that although UCL measurements are reproducible, their accuracy greatly depends upon the method used. It is therefore important to instruct the client carefully when measuring UCL. Oticon recommends the following procedure;

- Instruction to the client: "A pure tone of increasing level will be presented to you. When the tone is beginning to be uncomfortable, please press the button or raise your hand. Note: you are not asked to indicate the level of pain, but the beginning of discomfort."
- Procedure: Using pure tone, start at HTL, increasing the tone in five dB steps without interruptions until the client responds. Repeat the procedure until two out of three trials yield the same result.

When OtiSet displays UCL using measured UCL data, the curve is estimated in the same manner as for AC HTL. If no UCL data available, UCL is estimated as follows:

$$UCL_i = \sim 3.165 - 0.257 \times HTL_i +$$
$$+ 0.0139 \times MCL\text{-}low_i + 1.227 \times MCL\text{-}high_i$$

If the hearing loss is mixed or conductive, the air-to-bone gap is taken into account.

Using the Audiological View

During a fitting, the ADR remains unchanged, and naturally provides a reference when evaluating instrument performance.

In the audiogram in Figure 26, the ADR at 1 kHz is 62 dB, and the estimated MCL is 78 dB HL.

Fitting a hearing instrument is a dynamic process, because the instrument must function in a variety of different acoustic environments, such as speech from others at various levels, environmental background noise, and one's own voice.

OtiSet provides a variety of different input spectra so that the performance of the hearing instrument can be illustrated for such varied listening environments. These input options are useful in demonstrating how a non-linear device will optimally adjust its response depending on the nature of the listening task.

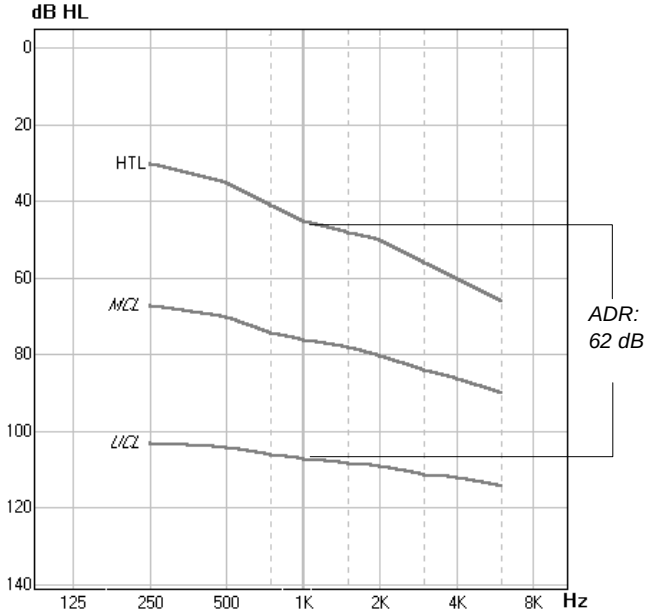


Fig. 26 An audiogram showing ADR and estimated MCL

The audiogram in Figure 27 adds the unaided Normal Speech spectrum as perceived by the client at 1 meter, thereby indicating how much of the speech is audible.

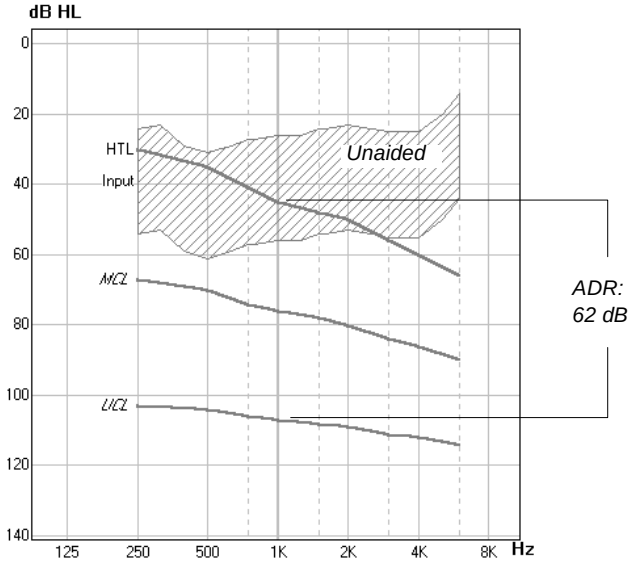


Fig. 27 ADR and the unaided Normal Speech spectrum

Audibility is affected when the surrounding environment changes, such as when:

- the speaker raises his voice
- the speaker approaches the client, making the speech louder

Audibility also changes when the client is fitted with a hearing instrument.

Figure 28 shows the ADR and the Normal Speech spectrum with and without a hearing instrument. After processing by the instrument, more of the aided speech spectrum is above the HTL, and therefore audible.

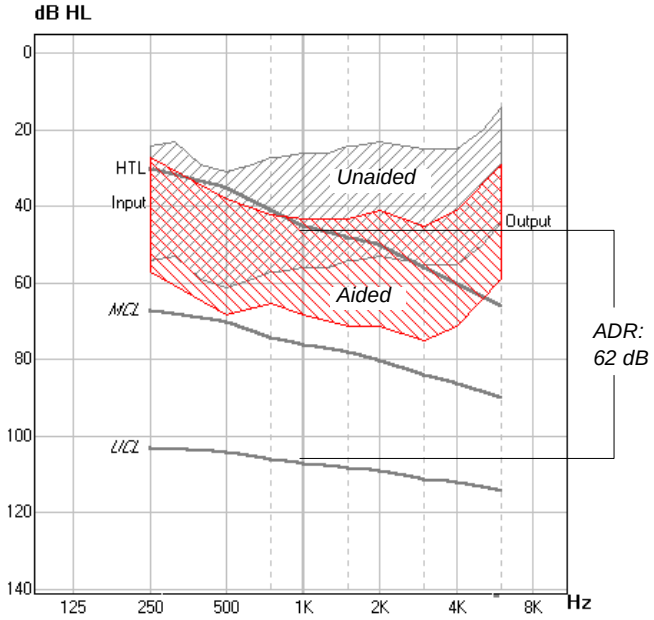


Fig. 28 The ADR, unaided and aided Normal Speech spectrum

The graph illustrates the instrument's ability to match the selected acoustic input spectrum. The transformation of the acoustic spectrum by the instrument is dependent on the circuit characteristics and the control settings.

Care should be exercised when comparing the output spectrum to the various audiometric measures:

- Audibility versus speech intelligibility
  The speech spectrum does not provide useful information to the listener until it is somewhat above threshold. The difference between the point where the speech is audible and the point where it begins to provide information to the listener varies across frequency, but is always more than 5 dB. Thus, speech spectral energy

above but near threshold probably does not provide useful information to the client.

- Pure tones versus wide band stimuli
  Also, suprathreshold measures such as MCL and UCL are made using frequency specific stimuli such as pure tones or narrow bands of noise. The spectra shown in OtiSet are wide-band stimuli. We do not have a complete understanding as to how wide-band stimuli relate to narrow-band suprathreshold measures such as UCL. Therefore comparisons of the output spectra to MCL and UCL should be made only in general terms.

  It would not be appropriate, for example, to attempt to carefully place the output spectrum of Normal Speech relative to the MCR. However, general principles can be applied when evaluating the effect of a fitting. For example, it is reasonable to expect to see loud input such as Loud Speech and Traffic Noise limited to below the UCL. In addition, compared to the unaided condition, the fitting of a hearing instrument should place considerably more of the Normal Speech spectrum above HTL.

The various input spectra available in OtiSet are:[7]

- Normal Speech: This spectrum represents the acoustic characteristics of speech presented from approximately one meter in quiet. The Normal Speech spectrum demonstrates a 30 dB dynamic range across frequency.
- Own Voice: This spectrum represents the levels of the hearing instrument user's own speech at the input to the device.

  Compared to the Normal Speech spectrum two major differences are present. First, the overall level is in-

7. All spectra are expressed as levels in dB HL. The derivation of these levels and the derivation of all the OtiSet input spectra are described on page 97.

creased. Secondly, the spectrum is dominated by low-frequency energy, due to the nature of the transmission path from the talker's mouth to the ear.

- Loud Speech: This spectrum represents the typical spectrum of the speech of a person attempting to speak loudly (increased vocal efforts) to be heard over the level of background noise.

  Compared to the Normal Speech spectrum, two major differences are present. First, the spectrum levels are increased by over 15 dB at some frequencies. Secondly, the spectrum demonstrates a shift towards greater mid- and high frequency energy.

- Traffic Noise: This spectrum represents a common environmental noise that hearing instrument users encounter.

  Compared to Normal and even Loud Speech, the spectrum levels of traffic noise are significantly higher. The spectrum has its peak level in the vicinity of 1 kHz.

Caution is advised when using the Audiological View to visualize the effects of a hearing instrument fitting. A temptation may exist to modify the settings on the hearing instrument in order to place all of the amplified Normal Speech spectrum within the ADR. However, the fitting rationales within OtiSet which are used to set the hearing instruments have all been extensively evaluated.

Both the non-linear and many of the linear rationales are designed to maximize speech understanding, while at the same time considering typical client preferences as to comfortable levels for amplified signals.

In addition, for many fittings, the higher frequency portion of the Normal Speech spectrum may fall below threshold. However, for listening to speech in quiet environments, it is not necessary to have the entire speech spectrum above threshold. Good understanding for connected speech can

be achieved even when only low- to mid-frequency information is audible.

Therefore significant changes in the prescribed settings based on an attempt to visually match a target may lead to unacceptable instrument performance. The Audiological View should not be used as a method to decide on device settings. Rather, it should be used as a method to visually illustrate the effect of a given device and circuit settings. Both the hearing care professional and the client may find this display instructive.

The Technical View

The Technical View offers the familiar approach, where an instrument's technical capabilities are expressed in either Simulated In-Situ Output, IEC 711, ANSI 2cc configurations, or Simulated Insertion Gain, at three different input levels. Select among options in the User Preferences window; see page 71.

For linear instruments, another option is available - Target IG and Simulated IG. OtiSet displays the target gain based on the audiogram and the chosen rationale (NAL-RP, Berger, POGO II, etc.). The initial control settings generate a simulated instrument response as close to the target gain as possible. OtiSet shows this curve as well, and its immediate dynamic response to adjustments to the fitting controls.

By visualizing the relationship between the target gain and the simulated insertion gain, the Technical View illustrates how well the instrument matches the desired target gain.

Major changes to the fitting controls can cause the simulated insertion gain to deviate from the target. You may want to restore the original settings by selecting Calculate Prescribed Settings from the toolbar.

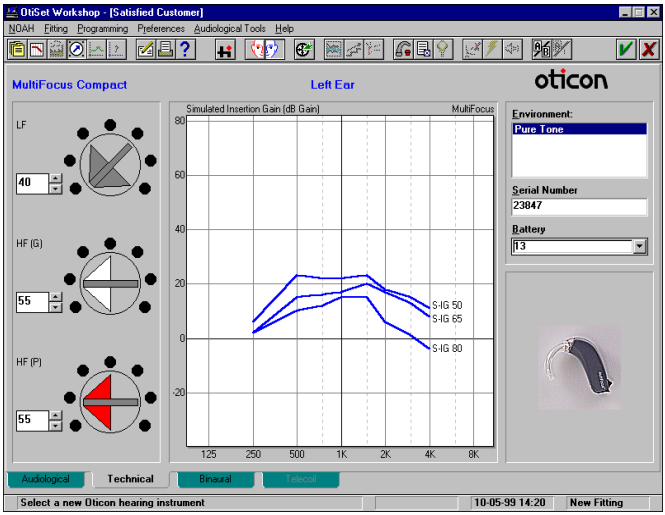


Fig. 29 Simulated Insertion Gain in the Technical View for input 50, 65 and 80 dB SPL.

The Technical View is very useful when fitting linear hearing instruments, but care must be taken when used in connection with non-linear instruments. The output from these instruments depends greatly on the characteristics of the chosen stimuli (level, spectral envelope, time properties) and comparing data with the shown pure tone data may be misleading.

For non-linear instruments, target gain cannot be calculated according to linear prescriptive fitting rules, such as POGO. Therefore OtiSet shows a prescribed insertion gain based on the applied non-linear rationale. In such case, the prescribed insertion gain equals the simulated insertion gain at 65 dB SPL input. Please note as well, that for these instruments, the simulated insertion gain varies with the input level.

The Telecoil View

The Telecoil View demonstrates how an instrument performs with telecoil enabled compared to microphone mode.

The instruments can receive either an acoustical signal (the MTO control is switched to M) or a magnetic signal (T). OtiSet lets you change the function of the MTO control so that T becomes MT, allowing the instrument to receive both the acoustical and the magnetic signals.

It is possible to use telecoil in the default setting - which is nearly identical to the M position, except for slight differences in the frequency response. If the magnetic field intensity is low due to a non-perfect telephone or induction loop, the volume can be boosted beyond the microphone level by 6 dB.

Selecting a Vent

Designing a proper vent is an integral part of a hearing instrument fitting. Vents influence occlusion, feedback and of course, frequency response. In the Acoustic Parameters window, OtiSet's initial vent proposal reflects a compromise between minimizing occlusion (requires large vent) and feedback (requires small vent). Proprietary Oticon rationales govern the choice of vent for the non-linear instruments.

There are many ways to implement a vent: D-Shape, Select-A-Vent, straight tubes, etc. The vents available in OtiSet are equivalent to a tube parallel to the sound canal, with an inner diameter and length, expressed in mm.

The OtiSet vents have inner diameters measuring 0, 0.8, 1.5, 2.3, 2.8 and 3.3 mm. Because only the inner diameter is given, the list below suggests nominal vent lengths for various instrument types:

- ITE (MF ITE, I22P*, I22PL*, Full Concha*) 20 mm

- ITE Half Concha* 16 mm
- ITE Canal* 12 mm
- ITE Mini Canal* 10 mm
- BTE instruments with standard earmold 16 mm
- BTE instruments with special earmold (430): see PerSonic 430 product information

*CommuniCare hearing instruments

When selecting the actual physical vent, use the equivalent of a straight tube with an inner diameter as specified by OtiSet, and with the nominal length as specified above. If the length of the actual physical vent differs from the nominal length, scale the inner diameter as follows:

$$\textit{Inner diameter} = \textit{OtiSet prescribed} \times \sqrt{\frac{\textit{nominal length}}{\textit{physical length}}}$$

If a tube with the suggested inner diameter is unavailable, choose one with a slightly smaller inner diameter.

When Select-A-Vent is used, choose a slightly larger tube and a Select-A-Vent plug with the proposed diameter.

The Input Spectra

All input spectra are expressed as levels in dB HL. The derivation of these spectra are described below.

Frequency (kHz)	0.25	0.5	1.0	2.0	3.0	4.0
1/3 octave dB SPL free field level [1]	53.0	55.0	48.0	42.0	39.5	39.0
–MAF binaural (dB SPL) [2]	11.2	6.0	4.2	1.0	–3.6	–3.9
–Monaural / binaural (dB) [3]	1.5	1.5	1.5	1.5	1.6	2.0
–1/3 octave (dB) critical ratio conversion [3]	-2.4	0	1.6	1.9	1.6	1.2
Audibility level of speech spectrum (dB HL)	42.7	47.5	40.7	37.6	39.9	39.7

Table 2 Long-term levels for Normal Speech, the spectra are expressed in dB SPL, converted to speech audibility level. The sum of the three middle rows is subtracted from the top row, and the result is shown in the bottom row.

[1] Cox & Moore 1988, Leq = 63 dB SPL

[2] ISO 226; MAF - Minimum Audible Field

[3] Pavlovic 1987

Conversion to the 30 dB range for speech intelligibility below the 99% fractiles for each band yields the spectra in Table 3:

Frequency (kHz), dB HL	0.25	0.5	1.0	2.0	3.0	4.0
High level (99% fractile)	54.7	59.5	52.7	49.6	51.9	51.7
Long-term levels	42.7	47.5	40.7	37.6	39.9	39.7
Low level	24.7	29.5	22.7	19.6	21.9	21.7

Table 3 Normal Speech spectra

The Loud Speech spectra in Table 4 are the same as the Normal Speech spectra in Table 3, corrected for vocal effort (male and female data from Pearsons et al, 1977).

Frequency (kHz), dB HL	0.25	0.5	1.0	2.0	3.0	4.0
High level (99% fractile)	63.0	71.0	71.2	68.5	68.2	67.1
Long-term levels	51.0	59.0	59.2	56.5	56.2	55.1
Low level	33.0	41.0	41.2	38.5	38.2	37.1

Table 4 Loud Speech spectra

The Own Voice spectra in Table 5 are recorded at the hearing instrument's microphone position, relative to the user's mouth, in a normal speech situation (data from Elberling & Nielsen, 1993):

Frequency (kHz), dB HL	0.25	0.5	1.0	2.0	3.0	4.0
High level (99% fractile)	67.1	71.5	64.3	54.4	53.2	49.8
Long-term levels	55.1	59.5	52.3	42.4	41.2	37.8
Low level	37.3	41.5	34.3	24.4	23.2	19.8

Table 5 Own Voice spectra

Table 6 shows a Traffic Noise spectrum expressed in dB SPL, converted to dB HL.

Frequency (kHz)	0.25	0.5	1.0	2.0	3.0	4.0
1/3 octave dB SPL free field level [1]	71.4	71.7	75.4	70.0	66.5	66.0
–MAF binaural (dB SPL) [2]	11.2	6.0	4.2	1.0	–3.6	–3.9
–Monaural / binaural (dB) [3]	1.5	1.5	1.5	1.5	1.6	2.0
–1/3 octave (dB) critical band conversion [3]	-2.4	0	1.6	1.9	1.6	1.2
Audibility level of traffic spectrum (dB HL)	61.1	64.2	68.1	65.6	66.9	66.7

Table 6 Long-term levels for Traffic Noise. The sum of the three middle rows is subtracted from the top row, and the result is shown in the bottom row.

[1] Oticon Research Report No. 41-8-3: "Spectral Characteristics of Traffic Noise", Jensen & Elberling (1994), Leq = 86.7 dB SPL

[2] ISO 226; MAF - Minimum Audible Field

[3] Pavlovic 1987

A 22.5 dB range below the 99% fractiles for each band yields the spectra shown in Table 7:

Frequency (kHz), dB HL	0.25	0.5	1.0	2.0	3.0	4.0
high level (99% fractile)	68.9	72.0	75.9	73.4	74.7	74.5
Long-term levels	61.1	64.2	68.1	65.6	66.9	66.7
Low level	46.4	49.5	53.4	50.9	52.2	52.0

Table 7 Traffic Noise spectra

Part 2

The Oticon Hearing Instruments

Part 2 provides information specific to the hearing instruments available with OtiSet

DigiFocus

Digilife.com

microFocus

PrimoFocus

MultiFocus

CommuniCare

PerSonic

Power

Classic

Ergo

Swift

DigiFocus

DigiFocus is a seven-band, two-channel 100% automatic hearing instrument which utilizes true digital signal processing (DSP). True DSP allows for precise, seven-band frequency shaping and a unique complex compression system with independent compression in two frequency channels. A programmable telecoil is mounted on several DigiFocus models. In addition to the standard fitting controls described below, expanded controls are available for advanced fine tuning.

Since acclimatization can be difficult for new users of instruments, OtiSet offers an Adaptation Manager with a three-step process. For DigiFocus II, this tool appears above the fitting controls. In older instruments it opens automatically or is available in the tool bar.

A Quick Fitting Guide - available from the Help menu - suggests fitting flow and strategy. You may want to print these pages and consult them as you move from step to step.

Name / Type	Max Fittable dB HL	Peak Gain 2cc / 711	Standard features (optional features)
CIC	ASA[2] 70 SKI 80	36 / 45 dB	MicroWaxbuster
Mini Canal (MIC)	ASA[2] 70 SKI 80	36 / 45 dB	MicroWaxbuster
Canal (ITC)	ASA[2] 70 SKI 80	40 / 50 dB	MicroWaxbuster
ITE	ASA[2] 75 SKI 85	46 / 55 dB	MicroWaxbuster (Telecoil)
ITE VC	ASA[2] 75	51 / 60 dB	Manual Override function, MicroWaxbuster (Telecoil)

Table 8 Specifications for DigiFocus II

Name / Type	Max Fittable dB HL	Peak Gain 2cc / 711	Standard features (optional features)
ITE Direct	ASA^2 75 SKI 85	46 / 55 dB	Directional / Omni-directional programs, MicroWaxbuster (Telecoil)
Compact (BTE)	ASA^2 80 SKI 95	58 / 66 dB	Telecoil (DAI connector)
Compact Direct (BTE)	ASA^2 80 SKI 95	58 / 66 dB	Directional / Omni-directional programs (DAI connector)
Compact Power (BTE)	ASA^2p 110	69 / 76 dB 70/ 78 dB	Telecoil, MT DAI connector Undamped hook

Table 8 Specifications for DigiFocus II

Programming Interface

DigiFocus II is fitted by means of the HI-PRO.

DigiFocus II Compact, Compact Direct and Compact Power use cable 2. DigiFocus II CIC, MIC, ITC and ITE use cable 3 with a FlexConnect adaptor, as explained below:

- Connect the large jack on cable 3 to the HI-PRO. Connect the small plug to the black connector on the FlexConnect, taking care to align the red dots.
- Insert a new battery in the instrument. While the battery door is open, insert the gold end of the FlexConnect into the space between the battery door and hinge. After insertion, make sure the dot is facing away from the door. The dot serves as "depth stop" for the FlexConnect. Close the door.

Older DigiFocus ITEs use cable 1, while BTEs use cable 2. Both older DigiFocus ITE and BTE Instruments can be fitted by means of either the HI-PRO or the OtiSet belt.

The DigiFocus Fitting Rationales

OtiSet uses Oticon's proprietary SKI and Adaptive Speech Alignment (ASA^2/ASA^2p) fitting rationales to calculate initial settings, based on the client's HTL, UCL and MCR. If UCL or MCR data are not specifically entered or measured in OtiSet, UCL and MCR will be predicted. However, for about 25% of clients, loudness recruitment deviates significantly from what one would expect with the given HTL. Therefore, a better initial fitting will result when you select the MCR button from the tool bar and measure MCL-high and -low in situ.


MCR

For older DigiFocus, it is worthwhile to open the MCR window and manually enter MCL values collected with an audiometer. OtiSet can then calculate the MCR and display the MCR curve, if enabled in User Preferences "Audiological View".

If you do not want measured UCL data to influence the prescribed settings for DigiFocus, delete the UCL data from NOAH.

DigiFocus and the OtiSet Workshop

Use the Audiological View of the OtiSet Workshop to evaluate the fitting with several acoustic input spectra:

- Normal Speech spectrum: helps ensure reasonably good audibility. In quiet situations, output should lie between HTL and MCL-low.
- Own Voice spectrum: helps ensure satisfactory sound quality of client's own voice when speaking in quiet environments. The output should lie well below UCL (at least 12 dB).
- Loud Speech spectrum: output should lie above HTL and not significantly exceed MCL-high.
- Traffic Noise spectrum: confirms that UCL is not exceeded even when the input is very powerful.

The speech spectra demonstrate how DigiFocus processes the low-frequency channel in a non-linear manner, and ensure both audibility in normal speech and comfort in loud speech and traffic noise.

Please note that in Technical View, the graph option *Target IG and Simulated IG* differs from those for the linear instruments, as explained on page 95.

Optimize Performance with the Standard Panel

OtiSet automatically recommends initial settings for DigiFocus based on the audiometric characteristics of the client. However, you can further adjust the response to meet client needs, using the fitting control panels. Depending upon which instrument and rationale were chosen, the Standard panel will contain some or all of the following controls:

The **microphone** fine tuning panel opens, by default, when you enter the OtiSet Workshop. The appearance of the panel depends upon whether the SKI or ASA^2/ASA^2*p* rationale has been chosen, but in both cases it is divided into four sections:

- LF Syllabic Compression controls the general processing in the LF channel. The Soft control adjusts overall gain for input signal levels up to the kneepoint level (50 dB SPL for most instruments), and the Loud control adjusts overall gain for input signals of 80 dB SPL. The LF compression ratio achieved is indicated in the small box at the bottom of this section.
- HF Adaptive Gain in ASA^2/ASA^2*p* or HF Linear Processing in SKI controls the general processing in the HF channel. For ASA^2/ASA^2*p*, a Soft control adjusts overall gain for input signal levels up to the kneepoint level (50 dB SPL for most instruments), and a Loud control adjusts gain for input signals of 80 dB SPL. The HF compression ratio achieved is indicated in the small box at

the bottom of the panel. For SKI, a Gain control adjusts the linear gain in the HF channel and an MPO control adjusts the maximum output signal level.

- Reserve gain (for instruments with manual override functionality) controls the available reserve gain in both the LF and HF channels. The reserve gain can be changed in steps of 5 dB and indicates how much the gain can be increased in the instrument by the means of the volume control. The volume control covers a dynamic range of 37.5 dB of which the reserve gain indicates the amount of gain available above the programmed setting.
- Frequency Response contains slide controls for each of the seven frequency bands. These adjust the shape of the frequency response. The thick vertical bar indicates the current position of the boundary between the LF and HF channels. The light grey bars above each frequency band indicate the maximum gain available.

When dragging a slider, you may find its movement impeded before it reaches the visible ends of the slider scale. This is because the setting of another slider is preventing further movement. The slider causing the limitation will flash with a colored arrow. Moving the limiting control in the direction of the arrow will enable further movement of the limited control.

Likewise, if the Soft control is adjusted beyond a certain point, its movement may be limited by one or more of the bands in the Frequency Response section. Arrows will then flash on these bands to indicate that adjustment in that direction will enable further change of the Soft control.

Note that thin grey horizontal lines indicate the prescribed setting. These lines remain stationary, serving as reference points as the controls are trimmed up or down.

Quick Panel for DigiFocus II

The Quick panel - with its simpler controls - enables speedier fittings. Toggle between the Quick and Standard panels by clicking the title bar. The Quick controls are:

- **Gain**: Use this control to adjust overall gain in steps of 2 dB; this changes the compression ratio slightly in order to protect against loud sounds. Increasing the gain also increases the compression ratio.
- **Loud**: for ASA^2/ASA^2*p*, use this control to adjust gain for loud input signals
  MPO: for SKI, use this control to adjust the maximum output signal level.
- **Tonal Balance**: Use this control to emphasize high or low frequencies, with the hinge point at the crossover frequency. As one channel is decreased, the other is equally increased in steps of 1 dB.

In Binaural View, the Left-Right Balance control allows for adjustment of the loudness balance between left and right instruments. Increasing one instrument by 1 dB relative to the current setting, decreases the other instrument by 1 dB.

Optimizing Telecoil Performance

For DigiFocus II

On the Telecoil panel, the following controls are available:

- Telecoil Boost: Use this control to apply a 6 dB boost to the telecoil, relative to the microphone sensitivity. The telecoil response is automatically adjusted according to the response of the microphone.
- Push button and switch configuration: Select between several configurations of the M-T-(0) switch. In a binaural fitting, each instrument must be set individually.

ITE instruments: The selection configures a user-operated push button on the instrument:

M/T switches between Microphone and Telecoil

M/MT switches between Microphone and Microphone combined with Telecoil

M/MT/T switches between Microphone, Microphone combined with Telecoil and Telecoil

BTE instruments: The selection configures a user-operated switch on the instrument:

M/T/0 switches between Microphone, Telecoil and instrument OFF

M/MT/0 switches between Microphone, Microphone combined with Telecoil and instrument OFF

The instrument automatically beeps when the user moves the controls. You can modify this feature in the Beep Controls dialog, in the Fitting menu.

For Older DigiFocus Instruments

The default setting of the telecoil controls makes the T position identical to the M position (except for slight differences in the frequency response) if the magnetic field intensity is appropriate. However, deviations from the ideal conditions may be compensated for by means of the telecoil controls.

- Volume: controls the overall response of the telecoil circuit, equivalent to turning up a volume control. Use this control to compensate for a non-perfect telephone or induction loop.
- Hum Control: allows further reduction in gain below 500 Hz. Use this control to counteract the hum induces by stray electromagnetic energy in the environment (fluorescent lights, etc.).
- Treble: controls the amount of gain above 1500 Hz. Use this control to adjust tonal balance according to client needs.

- Bass: controls the amount of gain below 1500 Hz. Use this control to adjust tonal balance according to client needs.

When fine tuning the telecoil, note that *all* four controls affect the levels of the seven bands. Because OtiSet is trying to optimize the shape of the response to conform with your wishes, some apparently contradictory changes may occur in the control settings. For example, there are situations in which a downward adjustment of the Bass control might lead to upward changes in the Hum control. Again, this situation is due to the fact that both controls affect the 250 Hz band, and that OtiSet is attempting to optimize the shape of the response.

Expanded Fitting Controls

Extra controls are available for special fine tuning. For DigiFocus II, the Expanded Control Panel is always available on the right, when the OtiSet Workshop is in Monaural View. Click the title bar to open or close the panel. When adjusting older DigiFocus, access the Expanded Controls from the Fitting menu.

The panel is activated separately for left and right sides and has several sections;

- **HF and LF MPO**: These controls limit the maximum output of the instrument. For ASA^2 (the HF and LF channels) and the SKI LF channel. Adjustment of loud sounds is mainly done by means of the Loud controls, but the MPO controls may be used in situations where adjustment of the Loud controls is not desirable. For example, when only sudden sounds are uncomfortable or if adjustment of the Loud controls leads to degradation of speech performance at medium and loud levels. Using MPO controls could be a solution for clients with a low UCL.

  For SKI, use the HF MPO to adjust output at loud levels. Increase the HF MPO if loud high-frequency

sound is too weak or if loud speech is unclear. Decrease HF MPO if loud high-frequency sounds or loud speech are uncomfortably loud.

- **Attack time**: The attack time is a measure of the speed with which the amplification is adjusted (reduced) after a rise in input signal level. Shortening the attack time may help if sudden sounds - like door slamming or cutlery rattling - are uncomfortably loud. A shorter attack time leads to a more comfortable sound quality. A longer attack time leads to clearer and more distinct speech.
- **Release time:** The release time is a measure of the speed with which the amplification is adjusted (increased) after a drop in input signal level. Changing the release time changes the function of the entire compression system. A longer release time slows down the compressor system, reducing any audible 'pumping'; this results in a more linear functionality, and the overall output is kept at a lower level. Longer release times are normally used to achieve overall comfort and tolerance. Shorter release times are used to increase the audibility of weaker portions of input signals with rapidly varying levels.
- **Combining attack and release times:** Individual clients may perceive the same attack and release times very differently. But as a general rule, one should always ensure that the attack time is at least two adjustment steps shorter than the release time in the same frequency channel. For very short attack times or very long release times the margin should be increased. The optimal relationship between attack/release times in different frequency channels depends on the aim of the fitting rationale.
- Crossover Frequency: Use the slider to change crossover frequency between the LF and HF channels.

- **Kneepoint**: (available only for DigiFocus II instruments with manual override functionality) The kneepoint is the level at which the compressor becomes active. Increasing the kneepoint decreases the gain for soft sounds and maintains the gain for moderate and loud sounds. There is therefore no change in compression ratio.

  Since increasing the kneepoint results in a decrease of soft gain, this may be helpful in feedback management. Increasing the kneepoint and the soft gain results in a more linear amplification, which may be helpful for immediate acceptance of the instrument for previous users of linear power instruments.

Special Controls for Direct Instruments

In DigiFocus II Direct instruments, two programs are available: Omni-directional and Directional. An icon below the controls of both the Quick and the Standard panels lets you switch between the two programs.

A link in the icon allows the fitting of the two programs to interact. If the link is selected, all adjustments made in the Omni-directional program will apply in the Directional program as well. If the link is deactivated, adjustments apply only in the Omni-directional program. Adjustments made in the Directional program apply only to the Directional program, regardless of link status.

The Directional program offers the following innovations:

- Quick panel contains two controls:

  Roll Off: Controls the degree of low-frequency roll off, thereby setting the gain in the three LF bands

  Gain: Adjusts the overall gain in steps of 1 dB.
- Standard panel is the same as for all DigiFocus instruments, plus the Roll Off control, explained above.
- The Expanded panel is the same for both programs.

Technical Measurements

The Technical Measurements feature in the Fitting menu lets you test DigiFocus at a wide variety of settings and different frequency levels, without client involvement.

Hearing instrument measurement standards (IEC, ANSI) generally assume instruments to be linear or include a broadband limiting system (Peak Clipper / Automatic Gain Control). Therefore, the standards do not specify suitable definitions for the measurement of complex hearing instruments, such as multi-channel compression aids. Furthermore, neither the IEC nor ANSI standards are very specific when it comes to trimmer reference settings. Generally they prescribe trimmers to be set at maximum, with the widest possible frequency response, and this has, as far as possible, been implemented in OtiSet's Technical Measurement feature.

DigiFocus is extremely flexible, but the settings normally used are very different from those described in the standards. Measuring OSPL90 with swept pure tones, and with DigiFocus configured as a two-channel compression system, leads to apparent irregularities. These are due to the measurement method, rather than to an inherent property of the instrument, and are caused by the interaction between the two channels (one channel is fully compressed, while the other is not compressed at all). This is evident when an ANSI S3.42 broadband noise signal is used instead. In this case both compressors are activated, corresponding to what would happen with real-life sounds.

Because measurements using broadband signals are generally not standardized, OtiSet uses swept pure tones for measurement purposes, also because this is what is available in most clinics. In order to avoid the irregularities which can arise in technical measurements, DigiFocus is configured as a single channel instrument.

Digilife.com

Digilife.com is a two-channel 100% automatic hearing instrument which utilizes true digital signal processing (DSP). True DSP allows for a unique complex compression system that - depending upon the needs of the client - can implement either the MF+ (MultiFocus) or the WDRC+ fitting rationale. A programmable telecoil is mounted on several Digilife.com models.

Since acclimatization can be difficult for new users of instruments, OtiSet offers an Adaptation Manager with a three-step process. For Digilife.com, this tool appears above the fitting controls. In older instruments it opens automatically or is available in the tool bar.

Digilife.com is fitted with HI-PRO.

A Quick Fitting Guide - available from the Help menu - suggests fitting flow and strategy. You may want to print these pages and consult them as you move from step to step.

Name / Type	Max Fittable	Peak Gain 2cc / 711	Standard features (Optional features)
Compact BTE	80 dB HL	58 / 66 dB	Telecoil cable 2 (DAI connector)
ITE Tele	75 dB HL	46 / 55 dB	Telecoil MicroWaxbuster cable 3 + FlexConnect
ITE	75 dB HL	46 / 55 dB	MicroWaxbuster cable 3 + FlexConnect
ITC	70 dB HL	40 / 50 dB	MicroWaxbuster cable 3 + FlexConnect
CIC / MIC	65 dB HL	36 / 45 dB	MicroWaxbuster cable 3 + FlexConnect

Table 9 Audiological specifications for Digilife.com

MultiFocus+ Rationale: OtiSet Controls

When the MF+ fitting rationale is chosen, OtiSet shows the following fitting and fine tuning controls:

- LF: Controls low frequency gain, compression, and output. Provides precise control over automatic loudness compensation. Useful in controlling overall perception of loudness and minimizing the effects of occlusion and upward spread of masking.
- HF (G): Controls high frequency gain. Provides precise control over the audibility of high-frequency speech energy. Useful in providing a clear sharp sound picture without discomfort.
- HF (P): Controls high-frequency power output. Provides precise control over the activation level of the output limiting compression. Useful in protecting against discomfort from loud inputs.

WDRC+ Rationale: OtiSet Controls

When the WDRC+ fitting rationale is chosen, OtiSet shows the following fitting and fine tuning controls:

- LF Loud: Control over louder, low frequency inputs. · Lock*: Links the LF Loud and Soft controls, leading to overall gain changes in the low frequency channel
- LF Soft: Control over softer, low frequency inputs
- LF MPO: Controls the activation level of the output limiter for the LF channel
- CR: The Compression Ratio is the change in input level divided by the change in output level; if for every 5 dB increase in input there is a 2.5 dB increase in output, then the system has a CR of 2
- HF Loud: Control over louder, high frequency inputs
- Lock*: Links the HF Loud and Soft controls, leading to overall gain changes in the high frequency channel

- HF Soft: Control over softer, high frequency inputs
- HF MPO: Controls the activation level of the output limiter for the HF channel
- CF: The Compression Frequency controls the separation frequency between the LF and HF channels

*Activation of both lock controls links all four gain controls. This allows adjustment of any one gain control to operate as an overall volume control.

Digilife.com and the OtiSet Workshop

The Audiological View lets you evaluate the fitting - using either rationale - in several acoustic input spectra. These demonstrate how Digilife.com independently processes the low-frequency and high-frequency channels, in order to achieve the proper balance of comfort and clarity for the individual client's needs.

Use Technical View to simulate technical performance, and to compare Target IG with Simulated IG. Note that the presentation of these curves differs from that for linear instruments. Follow the suggestions of the Fine Tuning Guide to achieve an optimal fitting.

For additional testing without client participation, for example, by means of an acoustical test box, choose Technical Measurements, from the Fitting menu or Tool Bar. This feature, which is available only in Technical View, allows the instrument to be tested with a variety of settings, and at a wide range of frequencies.

OtiSet automatically recommends initial settings based on the client's audiometric characteristics. However, you can further adjust the microphone response and the telecoil response, independently of one another.

Optimize Microphone and Telecoil Performance

In most hearing instruments, moving from microphone to telecoil usually causes a loss in transmission. OtiSet shows how DigiLife can automatically compensate for this typical loss, making volume control adjustment unnecessary when using the programmable telecoil. To add a boost to the telecoil response for either rationale, select Telecoil View, accessible from a tab below the graph. The volume control affects the overall response of the telecoil circuit relative to the microphone response.

Note that in all DigiLife controls, both in Microphone (Audiological) View and Telecoil View, thin gray horizontal lines indicate the prescribed setting. These lines remain stationary, serving as reference points as the controls are trimmed up or down.s

microFocus

microFocus is suitable for flat and sloping sensorineural hearing losses ranging from mild to moderate. microFocus is fitted using a proprietary Oticon rationale.

microFocus is a programmable, two-channel, truly non-linear and fully automatic canal instrument with an expanded frequency range. The sound processing inside microFocus is controlled by a microchip that constantly monitors the incoming signals and automatically adjusts the levels of amplification to adapt to the user's environment.

The result is a fully automatic instrument without user controls which ensures an optimal compromise between speech intelligibility and listening comfort.

Name/Type	Max Fittable	Peak Gain 2cc / (711)	Standard features (optional features)
microFocus canal	70 dB HL	30 / (40) dB	Patented wax protection system - WaxBuster, programming cable 1, (programmable telecoil)

Table 10 Specifications for microFocus

microFocus is fitted with Oticon's MultiFocus Fitting Rationale, as described on page 76.

microFocus and the OtiSet Workshop

Use the Audiological View of the OtiSet Workshop to evaluate the fitting with several acoustic input spectra:

- Normal Speech spectrum: helps ensure reasonably good audibility in the low-frequency channel, below 1.6 kHz. In quiet situations, output should lie between HTL and MCL.

- Own Voice spectrum: helps ensure satisfactory sound quality of client's own voice when speaking in quiet environments. The output should lie well below UCL (at least 12 dB).
- Loud Speech spectrum: output should lie above HTL and close to MCL.
- Traffic Noise spectrum: confirms that UCL is not exceeded even when the input is very powerful.

The speech spectra demonstrate microFocus' dual processing strategy: non-linear treatment of the low-frequency channel, and linear treatment of the high-frequency channel. This increases the audibility of important high frequency speech cues, and protects against upwards spread of masking.

In the Technical View, the graph option *Target IG and Simulated IG* differs from those for the linear instruments, as explained on page 95.

PrimoFocus

The PrimoFocus line of hearing instruments has been developed as a natural choice for users who emphasize comfort. PrimoFocus instruments are intended to lead to a higher level of immediate satisfaction by addressing the typical concerns of comfort, clarity and cosmetic appeal.

Unlike traditional fittings which focus on precise threshold correction, PrimoFocus emphasizes utilization of the listener's dynamic range.

In PrimoFocus, only the compression necessary to maintain comfort for louder inputs is provided. Softer sounds will always be audible - and within the dynamic range of the user. Frequency shaping is maintained for all input levels, in order to minimize modification of high-frequency speech cues which can adversely affect speech intelligibility.

Type / (Programming)	Hearing Loss	Max Fittable
CIC (HI-PRO)	Mild to moderate	65 dB HL
Pro2 (belt or HI-PRO)	Mild to severe	95 dB HL
Mini-Canal	Mild to moderate	65 dB HL
Canal	Mild to moderate	65 dB HL
Half-Concha	Mild to moderate	70 dB HL
Compact	Mild to moderate	75 dB HL
Compact MT	Mild to moderate	75 dB HL

Table 11 Audiological specifications for PrimoFocus

Slight variations may exist on some markets.

Programmable PrimoFocus Instruments

The CIC and Pro2 are digitally programmable, non-linear instruments. The Pro2 is a compact BTE with two memories. A switch on the control panel lets you lock the volume at the desired level, once suitable settings have been found.

When the volume control is unlocked, the adjustment range is usually ±14 dB, relative to the prescribed settings. This range, however, may be narrower, because it depends upon the settings of the other controls.

Several prescriptive fitting rationales are available for PrimoFocus instruments. CIC and Pro2 use NAL-RP as default, but can also be fitted by means of the **Adaptive Fitting Method**, described on page 82. This unique, interactive fitting method guides you through individual adjustment of gain and kneepoint - all other controls are set automatically.

For the CIC, the Adaptive Fitting Method provides an additional tool addressing the quality of "Own Voice" - an issue of importance to many CIC users.

Pro2 and the Program Customizer

The two built-in memories in the Pro2 allow for greater user flexibility. Initially, P1 is set for Quiet, and P2 for Speech Noise. If desired, select the Customizer button under the controls and assign other predefined listening situations to the memories. OtiSet then adjusts the controls on the basis of the situation, rationale and HTL.

Before closing the Customizer, try letting the Lifestyle Program refine your choice of listening situations. This interactive questionnaire explains what each situation entails and helps determine the client's listening needs based on lifestyle and priorities.

Together, you and the client should rank each situation by frequency and importance. OtiSet assigns the two situations the client found most important to P1 and P2 and adjusts the fitting controls accordingly.

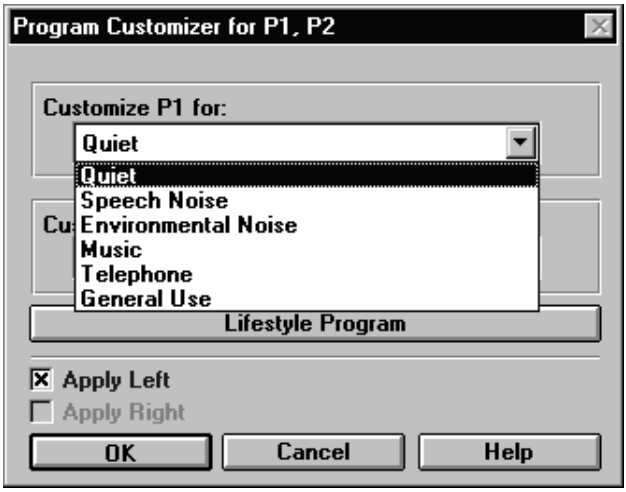


Fig. 30 A variety of predefined listening situations are available in the Program Customizer

In the OtiSet Workshop, below the controls, the name of the chosen program will appear for P1 or P2, whichever is active. This information is also available in the Binaural View.

The Fine Tuning Guide reflects the settings in P1 and P2. Only questions which apply to the current situation are accessible; the rest are greyed.

At any time during the fitting, you may use the Customizer to assign other situations that might better suit the client's needs. The selected environments are saved along with the other client data.

Customizer behavior depends upon whether it was opened manually from the OtiSet Workshop, or automatically as the last step in the Adaptive Fitting Sequence:

- from the Workshop: the Customizer shows the current listening situations. Choose others, or press Cancel to leave P1 and P2 unchanged. Press OK and OtiSet will prescribe settings for the new or current situations and reset the controls.
- from the Adaptive Fitting Sequence: P1 and P2 are set to General Use, but you can assign other situations if desired. In this special case, the Customizer does not calculate prescribed settings for the chosen situations, but instead adjusts the controls in relation to the settings arrived at during the Adaptive Sequence.

What are the consequences of further tuning? If you adjust the controls after assigning a listening situation to a program, the prescribed settings are discarded. But OtiSet helps you remember them - a thin grey line appears in the control, representing the setting prescribed for the current program.

Selecting Calculate Prescribed Settings resets P1 and P2 to Quiet and Speech Noise.

The PrimoFocus ITE Options Window

PrimoFocus ITE instruments can be equipped with a variety of options. In the OtiSet Workshop, press the Options button below the fitting controls; the Options window pops up, listing setups which vary from instrument to instrument.

- Configuration

  Gain: Standard gain provides a typical first-time user with sufficient gain and output. High gain increases the gain and MPO by 6 dB.

  Response: Sloping response of about +6 dB per octave is generally suitable for first-time users. However, Flat response is more appropriate for flat or reverse losses, and will be recommended for production when Oticon receives the order.

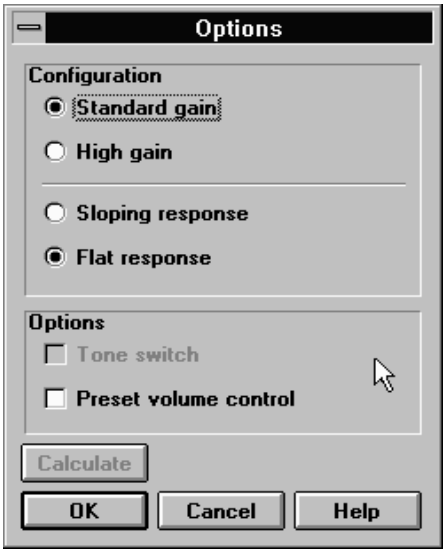


Fig. 31 A full-size Options window for a PrimoFocus ITE

- Options

  Tone switch: This switch functions like a manual tone control, letting the client adjust performance to suit the environment. Available only for Sloping response.

  Preset volume control: Specifies a preset control instead of a client-operated manual control.

As you choose the various options, the graph in the OtiSet Workshop shows the impact on instrument performance. Select the Calculate button and OtiSet recommends the most suitable configuration.

MultiFocus

The MultiFocus line of hearing instruments are suitable for flat and sloping sensorineural hearing losses ranging from mild to severe. MultiFocus instruments are fitted with a proprietary Oticon rationale, which is described on page 76.

All MultiFocus instruments are based on the same audiological concept of two-channel, non-linear signal processing. MultiFocus automatically provides a balance between speech clarity and listening comfort. And because they constantly adapt to the user's sound environment, there is no need for a manual volume control.

Name / Type	Hearing Loss	Min / Max Fittable
MultiFocus Classic BTE	Moderate	Min: 40 dB HL Max: 80 dB HL
MultiFocus Classic Power BTE	Moderate to severe	Min: 45 dB HL Max: 90 dB HL
MultiFocus Compact Mini BTE	Moderate	Min: 40 dB HL Max: 80 dB HL
MultiFocus Compact Power Mini BTE	Moderate to severe	Min: 45 dB HL Max: 90 dB HL
MultiFocus Compact Mild Mini BTE	Mild to moderate	Min: 25 dB HL Max: 65 dB HL
MultiFocus ITE ITE	Moderate	Min: 40 dB HL Max: 80 dB HL
MultiFocus ITE Mild ITE	Mild to moderate	Min: 25 dB HL Max: 65 dB HL

Table 12 Specifications for the MultiFocus series

For information about colors, standard features, options and accessories, see the product information available from your local Oticon supplier.

CommuniCare

CommuniCare offers a complete series of custom ITE hearing instruments ranging from Mini-Canal to Power Low-Pass versions. The line of instruments now available also includes the first anatomically shaped, full-modular canal instrument.

The CommuniCare series is a versatile line of instruments that are suitable for flat to steeply sloping hearing losses in the mild to severe range.

The CommuniCare line consists of:

- Full Concha
  - CommuniCare Power Low-Pass
  - CommuniCare Wide Range
- Half-Concha
  - CommuniCare Half Concha
- Canal
  - CommuniCare Canal
  - CommuniCare Mini-Canal
  - CommuniCare Logic

Technical Specifications

All CommuniCare ITE instruments are linear push-pull amplifiers with varying levels of gain and MPO, and with different output limiting systems.

Name / Type	Max Fittable	Peak Gain 2cc / (711)	Standard features (optional features)
CommuniCare Mini Canal	65 dB HL	43 / (54) dB	P-P, DVP, Roll-Off, (FC)
CommuniCare Logic/ (modular)	65 dB HL	36 / (46) dB	P-P, DVP, Roll-Off, AGCi, A-Gram
CommuniCare Canal	65 dB HL	43 / (54) dB	P-P, DVP, Roll-Off, A-Gram, (FC)
CommuniCare Half Concha	75 dB HL	43 / (54) dB	P-P, DVP, Roll-Off, AOL, A-Gram (FC, ASP, NS, Telecoil)
CommuniCare Wide Range I22P	80 dB HL	55 / (65) dB	P-P, DVP, A-Gram, AOL, FC, (ASP, NS, Telecoil)
CommuniCare Power Low-Pass I22PL	90 dB HL	54 / (60) dB	P-P, DVP, A-Gram, AOL, FC, (ASP, NS, Telecoil)

Table 13 Specifications for the CommuniCare series

Note: Not all models are available in all markets.

Explanation of standard and optional features:

P-P: Push-Pull amplifier

DVP: Dynamic Voice Processing

FC: Feedback Control

AGCi: Automatic Gain Control, input controlled

A-Gram: Third-order Active Tone Control

AOL: Active Output Limiting

ASP: Automatic Signal Processing

NS: Noise Suppressor

Selecting a Fitting Rationale

The following rationales are available for CommuniCare instruments: POGO II, NAL-RP, Berger and Libby.

The mathematical basis of each rationale is described on page 76. If no rationale is selected, OtiSet defaults to POGO II.

The CommuniCare Options Window

CommuniCare instruments (with the exception of Logic) can be equipped with a variety of options. In the OtiSet Workshop, press the Options button below the fitting controls, and the Options window pops up, listing different setups.

The Options window shown in Figure 32 contains three sections; depending upon the instrument, one, two or all three sections will be present.

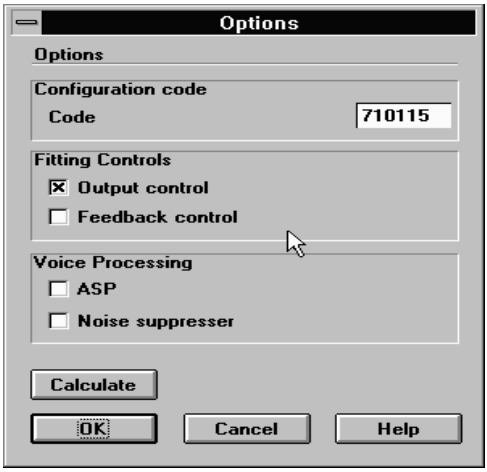


Fig. 32 A full-size Options window for a CommuniCare Half Concha

- Configuration Code

  Based on the nature of the instrument and the audiogram, OtiSet calculates a code that suggests the optimal internal configuration of the instrument. OtiSet

then uses the code to prescribe initial settings, and displays the output in the graph. The code consists of 6 or 7 digits (leading zeroes are suppressed).

Changes to the code are reflected immediately by changes in the graph. To return to the original code, select the Calculate button.

When you receive the finished instrument from your local Oticon dealer, you may discover that - depending upon how the instrument is configured - a new code has been assigned. If you do receive a new code, please enter it in this field. It would then be wise to choose Calculate Prescribed Settings from the Fitting menu, so that OtiSet can generate optimal control settings.

- The Fitting Controls panel offers one or both of the following options:

  Output control: an MPO control which works with Oticon's AOL to expand the distortion-free dynamic range when the MPO level is reduced.

  Feedback control: an active control that enables reduction of up to 16 dB in the high-frequency response of the instrument.

- The Voice Processing panel offers a choice between:

  ASP: this circuitry automatically reduces low-frequency amplification by up to 26 dB at 500 Hz in noise, and improves discrimination by minimizing distortion.

  Noise suppressor: a switch that has the same effect as setting the tone control to maximum cut-off. It functions like a manually-operated ASP. If you click this option, a switch appears in the fitting control panel, set to off. Click the solid black dot to turn it on.

Click the different options to see how your choices influence instrument performance. Click OK to accept the current settings.

PerSonic

The PerSonic series of linear mini BTE instruments is suitable for almost every sensorineural hearing loss. There are PerSonic instruments to compensate for losses ranging from mild to profound, and for those concentrated in the high frequencies.

The following table lists the specifications for all PerSonic models. The applied rationale is POGO II.

Name / Type	Hearing Loss			Output Limiting System
	Category	Slope	Max. Fittable	
PerSonic 400 Classic NS Mini BTE	Mild to moderate	Reverse to steep	80 dB HL	AGC i
PerSonic 410 Classic Mini BTE	Mild to moderate	Reverse to steep	80 dB HL	AGC i
PerSonic 420 Power Mini BTE	Moderate to severe	Reverse to steep	90 dB HL	Active Output Limiting
PerSonic 425 Power Plus Mini BTE	Moderate to profound	Reverse to steep	95 dB HL	Active Output Limiting
PerSonic 430 High Tone Mini BTE	High frequency	----	----	Active Output Limiting
PerSonic 440 High Comfort Mini BTE	Mild to moderate	Reverse to steep	80 dB HL	Active Output Limiting

Table 14 Technical specifications for PerSonic

Note: Not all models are available in all markets.

For information about colors, standard features, options and accessories, please contact your local Oticon supplier.

Selecting a Fitting Rationale

The following rationales are available for PerSonic instruments:

- POGO II
- NAL-RP
- Berger
- SSM - Speech Spectrum Method (PerSonic 420/425)
- Libby
- VHF (PerSonic 430)

The mathematical basis of each rationale is described on page 76. If no rationale is selected, OtiSet defaults to POGO II.

Acoustic Parameters


Acoustics

When you open the Acoustic Parameters window, you will discover that defaults have been selected, as described in Chapter 7. Special attention, however, should be paid to the vent:

Note! PerSonic 430 - special venting:

Successful fitting of the PerSonic 430 High-Frequency instrument is highly dependent on a specific earmold and vent. Use either an Oticon FlexiTip or a custom-made earmold. Violation of Oticon's recommendation may cause:

- Acoustical feedback
- Occlusion
- Negative insertion gain between 1 and 2 kHz.

See your local Oticon dealer for details.

Power

Oticon offers a wide range of Power BTE instruments for severe and profound hearing losses.

In the Select Oticon Hearing Instrument window, Power instruments can be displayed either by style, or by audiological criteria. When audiological criteria are used, Power instruments are divided into two groups:

- Severe Hearing Losses
  - MultiFocus Classic Power
  - Multifocus Compact Power
  - PerSonic 420 Power
  - PerSonic 425 Power Plus
  - 300P Power
  - 380P Broad Band
  - 390PL Low Pass
- Profound Hearing Losses
  - PerSonic 425 Power Plus
  - 380P Broad Band
  - 390PL Low Pass

Any severe hearing loss can usually be fitted with several Oticon Power instruments. The final selection of a specific instrument will depend on factors such as size, cost, cosmetics, established sound preferences and the availability of special options and accessories. These aspects are best considered by individual client counselling.

Technical Specifications

Power BTE instruments (apart from the MultiFocus family) are all linear push-pull amplifiers with varying levels of gain and MPO, and with different output limiting systems,

Table 15 specifies the maximum fittable hearing loss and other technical details of each Oticon Power instrument. The instruments have been ranked according to maximum fittable HL, and the applied rationale is POGO II.

Name / Type	Max. Hearing Loss	Peak Gain 2cc (711) MPO 2cc (711)	Output Limiting System
MultiFocus Classic Power BTE	90 dB HL	Input dependent	2-channel signal processing
MultiFocus Compact Power Mini BTE	90 dB HL	Input dependent	2-channel signal processing
PerSonic 420 Mini BTE	90 dB HL	65 (71) dB 135 (140) dB SPL	Active Output Limiting
300 P Small BTE	90 dB HL	67 (72) dB 136 (140) dB SPL	Peak Clipping
PerSonic 425 Mini BTE	95 dB HL	71 (77) dB 135 (140) dB SPL	Active Output Limiting
E38P 380P BTE	105 dB HL	76 (82) dB 140 (143) dB SPL	Speech Programmed Compression (PC + AGCo)
E39 PL 390 PL BTE	105 dB HL	75 (79) dB 140 (143) dB SPL	Speech Programmed Compression (PC + AGCo)

Table 15 Technical specifications for Power

Note: Not all models are available in all markets.

Selecting a Fitting Rationale

After selecting instruments, you will want to consider a suitable rationale. Clients suffering from hearing losses ranging from severe to profound can be fitted according to any of the following fitting rationales: POGO II, NAL-RP, Berger and SSM (Speech Spectrum Method).

The mathematical basis of each rationale is described on page 76. The default rationale is POGO II.

Fine Tuning the Settings

OtiSet displays the control settings in dB HL and the impact of changes made to them are illustrated by the Output Spectrum. Input can be altered by selecting among the various input spectra to assess the predicted performance of the instrument.

A Power client may experience a high input - such as Traffic Noise - as uncomfortably loud. However, he will often prefer to regulate this himself with the volume control, rather than having a lower MPO, as this can affect the sound quality of other higher level inputs, such as own voice.


Acoustics

Acoustic Parameters

Upon opening the Acoustic Parameters window, you will discover that defaults have been selected. The MultiFocus vent is based on the HTL. For the linear instruments, the default vent is based on the HTL and the POGO II fitting rationale - even if another rationale has been chosen. The default sound hook and earmold are those which are most suitable for the chosen instrument.

You may want to experiment with other vent sizes, or try sound hooks with various degrees of damping. The impact of each adjustment can be seen in the Output Spectrum.

Note, however, that when the hearing loss exceeds 70 dB HL in frequencies below 1kHz, Power clients do not experience occlusion and a vent is not needed. Inclusion of a large vent in a very powerful instrument will invariably result in feedback.

Vents are discussed in detail on page 96.

After changing the acoustics for linear instruments, it can be useful to select Calculate Prescribed Settings in the Fitting menu. This will cause OtiSet to calculate new optimum settings based on the modified acoustic parameters.

Classic

The wide range of Classic BTE instruments are designed for a large population of hearing-impaired persons with mild to profound hearing losses. All instruments use linear amplification, and offer varying levels of gain and MPO with different output limiting systems.

The default fitting rationale for Classic instruments is POGO II, but other rationales may be chosen.

CB Type	Max fittable hearing loss	Hearing Loss Category	Fitter Controls
60, 60+T	80 dB HL	Mild to moderate	LF Tone
65, 65+T	85 dB HL	Mild to moderate	LF Tone, MPO
65 AGC, 65 AGC+T	85 dB HL	Mild to moderate	LF Tone, MPO
70	90 dB HL	Moderate to severe	LF Tone, MPO
80	100 dB HL	Severe to profound	LF Tone, MPO
90	105 dB HL	Severe to profound	LF Tone, MPO

Table 16 Specifications for CB instruments

Acoustic Parameters

Hook, earmold and vent may be accessed from the Acoustic Parameter window. Initially, the parameters are hook with no damping, earmold with 2 mm continuous tubing and vent size based on the actual hearing loss. Experiment with the different options, and the result will immediately appear in the graph.

Note that when a hearing loss exceeds 70 dB HL in frequencies below 1 kHz, the user normally does not experience occlusion, thus no vent is required. Inclusion of a large vent in very powerful instruments will invariably result in feedback.

Ergo

Ergo is a range of programmable, single channel, low distortion linear instruments, suitable for mild to profound steeply sloping, flat and reverse sloping sensorineural and conductive hearing losses. In the table below, T stands for telecoil and P for power options.

Ergo Style	Max fittable loss	Hearing Loss Category	Fitter Controls
BTE Power (13 battery)	100 dB HL	Mild to profound steep slope, flat and reverse slope, sensorineural and conductive	A-Gram slope Gain (dB) UCL (dB HL) MPO method Volume Feedback Manager Telecoil options
BTE (13 battery)	90 dB HL	Mild to severe steep slope, flat and reverse slope, sensorineural and conductive	
Concha Concha T (13 battery)	85 dB HL	Mild to severe steep slope, flat and reverse slope, sensorineural and conductive	
Canal P Canal P T Canal Canal T (312 battery)	75 dB HL 70 dB HL	Mild to moderate steep slope, flat and reverse slope, sensorineural and conductive	
Mini Canal Mini Canal T (10A battery)	65 dB HL		
CIC (10A battery)	60 dB HL	Mild to moderate steep slope to flat sensorineural and conductive	A-Gram slope Gain (dB) UCL (dB HL) MPO method Feedback Manager

Table 17 Specifications for Ergo instruments

Using OtiSet, the following controls can be adjusted:

- A-Gram Slope: a 4th order LF or 4th order HF filter, used to adjust the overall frequency response according to the overall slope of the hearing loss
- Gain: preset, adjustable in 1 dB steps; 12-26 dB range in ITEs (model dependent), 27 dB range in BTE
- UCL: 22 dB range in ITEs, 32 dB range in BTE

  PC: the UCL functions as a Peak Clipper

  AGC (fast): the UCL functions as a fast-acting output AGC

  AGC (slow): the UCL functions as a slower-acting output AGC
- Telecoil switch and beep: the M-MT-T switch can be set in any combination. When the user presses the telecoil push button on the instrument, a beep will sound. OtiSet lets you use the Beep Controls to choose among 7 different intensity levels or OFF.
- Telecoil Boost: when enabled, gives a +6 dB boost to the telecoil setting relative to the microphone. Not available in Ergo Power BTE.
- Volume: allows the volume level to be adjusted during the fitting. The volume control on the instrument itself should not be adjusted during the fitting process; any volume control adjustments should be made in OtiSet.
- Feedback Manager: eliminates acoustic feedback by reducing the level of high-frequency gain at higher volume levels. The value in this control indicates the level on the volume control beyond which the high-frequency response will not increase.

  The Feedback Manager in Ergo CIC - which does not have a Volume control - lowers the high-frequency gain to eliminate feedback.

A Quick Fitting Guide - available from the Help menu - suggests fitting flow and strategy. You may want to print these pages and consult them as you move from step to step.

Programming Interface

Ergo BTEs are fitted by means of HI-PRO and cable 3 with the programming shoe.

Ergo ITEs are fitted by means of HI-PRO and cable 3 with a FlexConnect adaptor, as explained below:

1. Connect the large jack on cable 3 to the HI-PRO. Connect the small plug to the black connector on the FlexConnect, taking care to align the red dots.
2. Insert a new battery in the instrument. With the battery door slightly open, insert the gold end of the FlexConnect into the space between the battery door and hinge. Make sure the dot is facing away from the door. The dot serves as a "depth stop" for the FlexConnect. Close the battery door.

Ergo Fitting Rationales

By default, Ergo uses NAL-RP, however other linear fitting rationales are available (all of which are suitable for sensorineural hearing losses). If the loss has a conductive element (air-to-bone gap greater than 10 dB HL) then NAL-RP or Corell are recommended.

Ergo and the OtiSet Workshop

The Audiological View lets you evaluate the fitting in several acoustic input spectra. These demonstrate how Ergo amplifies sound, in terms of audibility (related to HTL curve) and comfort (related to UCL and MCR).

Use Technical View to compare Target IG with Simulated IG. For additional testing without client participation, for example, by means of an acoustical test box, choose Tech-

nical Measurements, from the Fitting menu. This feature allows the instrument to be tested at Full-on or Reference test gain settings for comparison with service data.

Optimizing Ergo Performance

OtiSet recommends initial control settings that attempt to match the target gain prescribed by the chosen rationale. Instruments with a Volume control will be set to 3 whenever possible (allowing 10 dB reserve gain). These settings should provide a good initial fitting of the instrument based upon the audiometric data entered. However you may wish to further adjust the settings in the fitting control panel to better meet client needs. Thin grey lines in the controls indicate the original OtiSet prescribed setting.

The sliding A-Gram Slope control adjusts the frequency response to match the slope of the audiogram. The flattest frequency response is given when the A-Gram Slope control is above the flat pictogram (N). Moving A-Gram Slope to the left of N will cut the low frequencies (LC-1 to LC-19); moving A-Gram Slope to the right of N cuts the high frequencies (HC-1 to HC-10).

The sliding Gain control adjusts the preset gain of the instrument in 1dB steps, independent of the Volume control. Highest gain is with the bar at the top and lowest gain is with the bar at the bottom (MIN). For instruments with a Volume control, further adjustment can be made beyond this range. In rare cases, a very high UCL setting can limit access to very low Gain values. To decrease Gain further, the UCL setting must be reduced as indicated by a flashing arrow on the UCL control. Alternatively, to maintain the UCL value, simply lower the Volume control setting (for example, less than 3).

The UnComfortable Level (UCL) control indicates the maximum power output of the hearing instrument in dB HL and is adjustable in steps of 2 dB. In rare cases, a very low Gain setting can limit access to high UCL control values. This will

be indicated by a flashing arrow on the Gain control. To increase UCL further, raise the Gain setting. To maintain the same loudness for the client after increasing Gain, reduce the recommended Volume control setting (for example, less than 3).

UCL can be limited in three ways; peak clipping (PC), fast output compression (AGC fast) and slow output compression (AGC slow). See the section below on Ergo Output Limiting for more information.

The Volume control in OtiSet represents the control on the hearing instrument. OtiSet recommends and defaults to Volume control 3 for general use. For clients needing very high or very low gain, it may be necessary to supplement Gain control adjustments by changing the Volume control.

The Feedback Manager eliminates feedback by reducing the level of high-frequency gain at higher volume levels. It is not possible to increase the high frequencies with the volume control above the feedback limit, however it is possible to do so with the Gain control. If you increase the gain beyond the feedback limit, we recommend you conduct a new feedback test.

Before finally programming the Ergo, you may wish to take advantage of the Fine Tuning Guide, to make any fine adjustments based on the client's responses.

ERGO Output Limiting Methods

AGC slow: designed to protect the listener from loud sounds with optimal sound quality. A slower attack time prevents very brief speech sounds from activating the output AGC circuit. As a result, these sounds achieve full amplification and audibility, while a "back-up" PC prevents the output from reaching an uncomfortable level for the listener. The long release time minimizes pumping effects associated with the return of full gain after compression. Slow AGC time constants provide optimal sound quality and, to-

gether with the security of PC for protection, make this limiting method ideal for many clients.

AGC fast: provides your client with distortion-free protection from loud sound. The fast attack time of the output AGC results in rapid gain reduction, preventing loudness discomfort problems for your client. The release time is also fast so that the gain for subsequent speech sounds is not unnecessarily decreased, which is mostly an issue when the dynamic range is severely reduced.

PC: typically used for severe-profoundly hearing impaired clients who find the output of AGC-limited hearing instruments too low. PC is recommended for clients who need more "loudness" than is possible with AGC slow or AGC fast.

Swift

SWIFT is a range of programmable, single-channel, low distortion linear instruments, suitable for mild to profound, steeply sloping to flat and reverse sloping sensorineural and conductive hearing losses.

Swift Style	Max fittable loss	Hearing Loss Category	Fitter Controls
Swift 100 Swift 100+ (13 battery)	100 dB HL	Mild to profound steep slope, flat and reverse slope, sensorineural and conductive	A-Gram slope HL (Gain/MPO) AGC (on/off) Volume
Swift 90 Swift 90+ (13 battery)	90 dB HL	Mild to severe steep slope, flat and reverse slope, sensorineural and conductive	
Swift 70 Swift 70+ (13 battery)	70 dB HL	Mild to moderate steep slope, flat and reverse slope, sensorineural and conductive	
Swift Canal+ Swift Canal+T (312 battery)			

Table 18 Specifications for Swift instruments

Using OtiSet, the following controls can be adjusted:

- A-Gram Slope: a 4th order LF or HF filter, used to adjust the frequency response according to the overall slope of the hearing loss.
- HL control: used to simultaneously adjust the Gain/MPO. For 70, 90 and 100, MPO is limited by PC alone. In 70+, 90+ 100+, Canal+ and Canal+T, the limitation is made by low distortion output AGC.

- AGC: on + instruments, the output AGC can be deactivated.
- Volume control: enables on-screen control of the volume setting of the hearing instrument.

BTEs are fitted with HI-PRO using cable 3 with the programming shoe.

ITEs are fitted by means of HI-PRO and cable 3 with a FlexConnect adaptor, as explained below:

1. Connect the large jack on cable 3 to the HI-PRO. Connect the small plug to the black connector on the FlexConnect, taking care to align the red dots.
2. Insert a new battery in the instrument. With the battery door slightly open, insert the gold end of the FlexConnect into the space between the battery door and hinge. Make sure the dot is facing away from the door. The dot serves as a "depth stop" for the FlexConnect. Close the battery door.

A Quick Fitting Guide - available from the Help menu - suggests fitting flow and strategy. You may want to print these pages and consult them as you move along.

SWIFT Fitting Rationales

By default, Swift uses NAL-RP, however other linear fitting rationales (all of which are suitable for sensorineural hearing losses) are available. If the loss has a conductive element (air-to-bone gap greater than 10 dB HL) then NAL-RP or Corell are recommended.

SWIFT and the OtiSet Workshop

The Audiological View lets you evaluate the fitting in several acoustic input spectra. These demonstrate how SWIFT amplifies sound, in terms of audibility (related to HL curve) and comfort (related to UCL and MCR).

Use Technical View to compare Target IG with Simulated IG. For additional testing without client participation, for example, by means of an acoustical test box, choose Technical Measurements, from the Fitting menu. This feature allows the instrument to be tested at Full-on and Reference test gain settings for comparison with service data.

Optimizing SWIFT Performance

OtiSet recommends initial control settings that attempt to match the amplification prescribed by the chosen rationale. These settings should provide a good initial fitting of the instrument based upon the audiometric data entered. However you may wish to further adjust the settings in the fitting control panel to better meet client needs. Thin grey lines in the controls indicate the original OtiSet prescribed setting.

The sliding A-Gram Slope control adjusts the frequency response to match the slope of the audiogram. The flattest frequency response is given when the A-Gram Slope control is above the flat pictogram (N). Moving A-Gram Slope to the left of N will cut the low frequencies (LC-1 to LC-19); moving A-Gram Slope to the right of N cuts the high frequencies (HC-1 to HC-10).

The sliding HL control adjusts the Gain/MPO independent of the Volume control. Highest preset Gain/MPO is achieved with the bar at the top and lowest preset Gain/MPO with the bar at the bottom. To adjust Gain beyond this range, use the Volume control. To increase MPO without increasing Gain, increase HL and lower the Volume control setting. To decrease MPO without decreasing Gain, reduce the HL control and raise the Volume control setting.

In SWIFT+ instruments MPO can be limited in two ways; by peak clipping (PC) or output compression (AGC). The limitation method defaults to AGC to provide clear, distortion-free sound quality even when the instrument is in saturation. However, this may be deactivated depending on user

preference/needs - if AGC is deselected in the control panel, OtiSet uses PC.

Before finally programming the SWIFT, you may wish to take advantage of the Fine Tuning Guide, to make any fine adjustments based on the client's responses.

SWIFT Output Limiting Methods

AGC: provides your client with distortion-free protection from loud sound. The fast attack time of the output AGC results in rapid gain reduction, preventing loudness discomfort problems for your client. The release time is also fast so that the gain for subsequent speech sounds is not unnecessarily decreased, which is mostly an issue when the dynamic range is severely reduced.

PC: typically used for severe-profoundly hearing impaired clients who find the output of AGC-limited hearing instruments too low. PC is recommended for clients who need more "loudness" than is possible with AGC.

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