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Instructions for Use - EN

Diagnostic Suite 2.11

D-0134431 -B – 2023/09

Interacoustics

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1 Introduction

This manual describes the Diagnostic Suite software version 2.11 used for transferring audiometric and tympanometry data from the Interacoustics standalone audiometers to the PC. The Diagnostic Suite allows users to display, store and print audiometric data.

2 System requirements

General computer requirements	• 2 GHz Intel Core 2 Duo CPU • 4 GB Ram • 1.5 GB available disk space
Display requirements	• 1024x768 resolution • Hardware accelerated DirectX/Direct3D graphics card
Software requirements	• Windows® 10 (x86 and x64) • Windows® 11 (x86 and x64)

- Database support:
  - OtoAccess®2.3
  - Noah 3.7 or Noah 4 (from HIMSA)
  - AuditBase System 6.5
  - Mirage
  - Practice Navigator
  - Power Office
  - AkuWin
  - He@r-O
  - Entendre 2
  - Quasar
- Instrument to PC connection support:
  - AS608e, AD226 hybrid, AD629(AD229)-b/e hybrid, AC40 hybrid, AT235(h) uses a direct USB connection (it has built-in USB)
  - Old AT235/AA222 has a build-in UCA40 with a USB connector on the rear panel, follow the UCA40 installation procedure.
  - Old AD226, old AD229b/e, old AC40, use the UCA40 USB-serial converter/adapter.
- Test measurement data support:
  - Audiometric data: Air, Bone, Speech
  - Tympanometry data: Tympanogram, Acoustic Reflex, Eustachian tube function test for the non-perforated eardrum (ETF1) and perforated eardrum (ETF2)

3 Installation and system setup

The Diagnostic Suite can be installed with either OtoAccess®2.3 or Noah or run as a standalone application.

To use the software in conjunction with a database (e.g., Noah3.7, Noah4 or OtoAccess®2.3), make sure the database is installed prior to the Diagnostic Suite installation. Follow the manufacturer's installation instructions provided to install the relevant database.

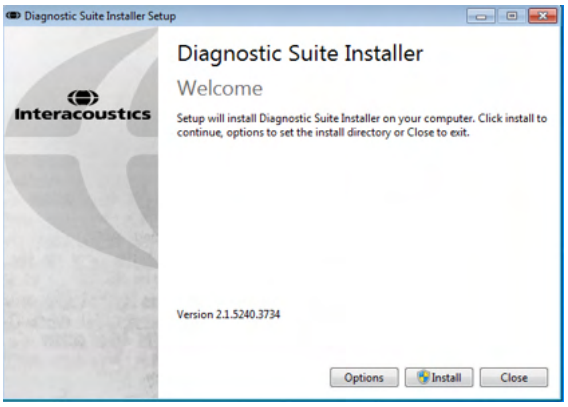
Note that if you are using AuditBase System 6.5, you must ensure to launch this office system prior to the installation of the Diagnostics Suite.

Installation on various Windows® versions
Installation on Windows®10 and Windows®11 systems are supported.

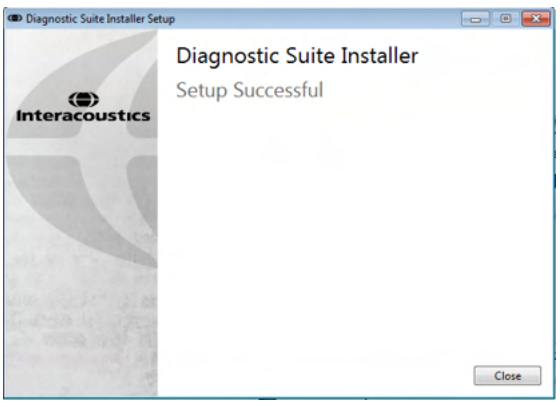
NOTICE: As a part of data protection, ensure to be compliant to all the following points:

1. Use Microsoft supported operating systems
2. Ensure operating systems are security patched
3. Enable database encryption
4. Use individual user accounts and passwords
5. Secure psychical and network access to computers with local data storage
6. Use updated antivirus and firewall and anti-malware software
7. Implement appropriate backup policy
8. Implement appropriate log retention policy

Software Installation on Windows®
Insert the installation USB and follow the steps below to install the Diagnostics Suite software. If the installation procedure does not start automatically, click "Start", then go to "My Computer" and double click the USB drive to view the contents of the installation USB. Double click the "setup.exe" file to initiate the installation.



Welcome Dialog: Press "Install"



Installation is complete. Press "Close".

Then proceed to system setup described in the next chapter.

Once the Diagnostic suite has been installed, it can be launched from either Noah or OtoAccess2.3® depending on the database you are using.

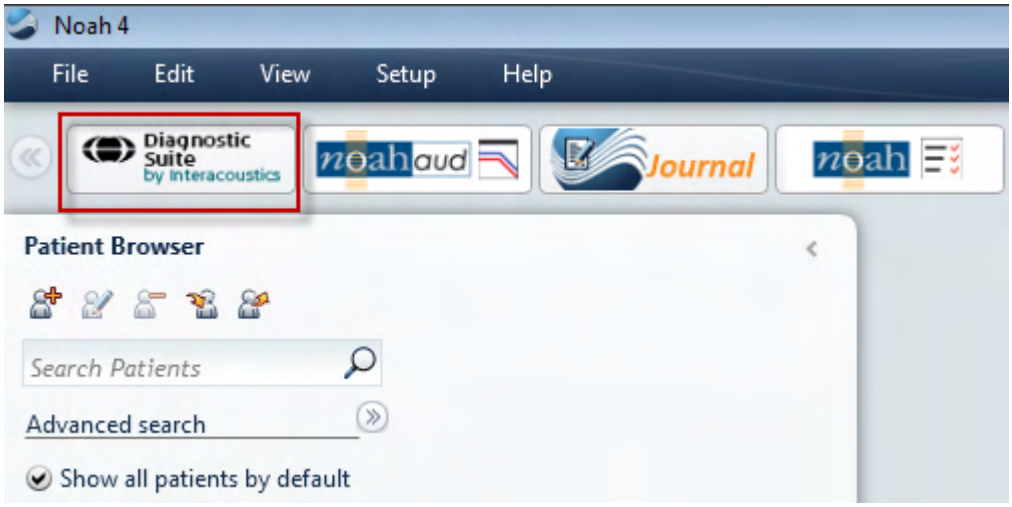
4 Starting Diagnostic Suite

The Diagnostic Suite can be run in the following 3 ways:

1) From Noah 3/4
2) From OtoAccess®2.3
3) Standalone (without a database)

4.1 Start from Noah

From Noah activate the Module Selection dialog and select the new Diagnostic Suite icon (below, right side):



4.2 Start from OtoAccess®2.3

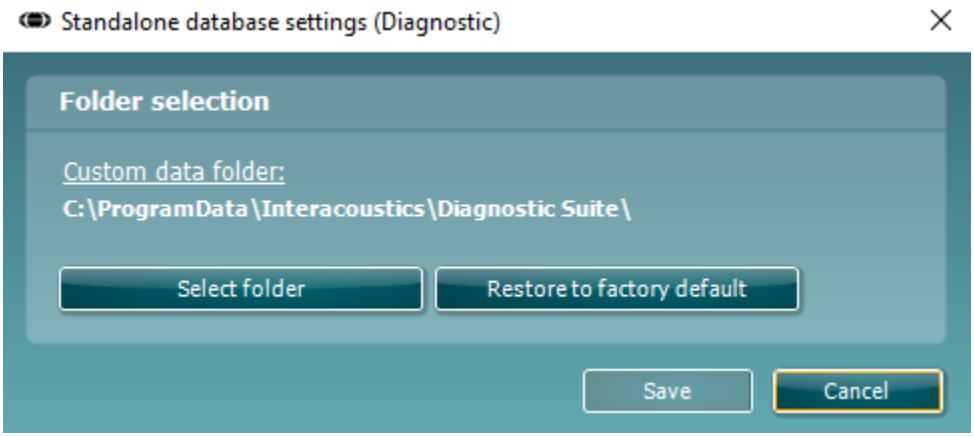
For instructions about working with the OtoAccess®2.3 database, please see the operation manual for OtoAccess®2.3.

4.3 How to configure an alternative data recovery location

The Diagnostic Suite has a backup location for data to be written in the case that the software is accidentally terminated or the system crashes. The following location is the default storage folder C:\ProgramData\Interacoustics\Diagnsotic Suite\, however this can be changed by following the below instructions.

NOTE: This feature can be used to change the recovery location when you are working through a database as well as the standalone save location.

1. Go to C:\Program Files (x86)\Interacoustics\Diagnostic Suite
2. In this folder find and launch the executable program titled FolderSetupDiagnostic.exe
3. The below pop up will appear



4. Using this tool, you can specify the location you wish to store the standalone database or the recovery data by clicking on the 'Select Folder' button and specifying the desired location.
5. Should you wish to revert the data location to the default then simply click on the 'Restore factory default button.

4.4 Start as standalone

The Diagnostic Suite application may also be run in a standalone mode, without the use of database. In this case the Suite will not handle a patient, only a list of sessions stored in a XML file located under:

\Documents and Settings\All Users\Application Data\Interacoustics\Diagnostic Suite\Data\ Standalone .xml

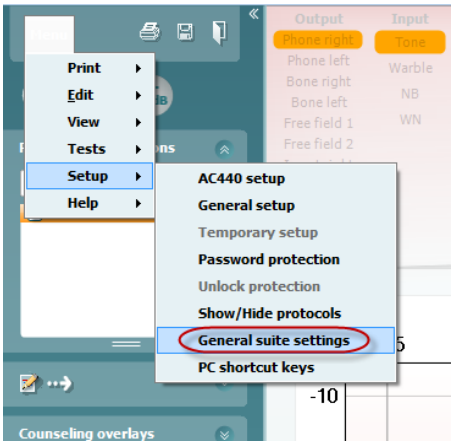
5 Diagnostic Suite – instrument configuration

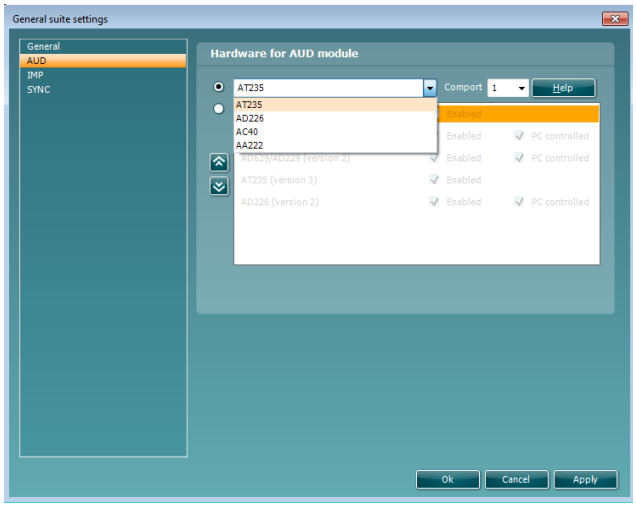
The first section describes how to transfer audiometric data from the instruments that do not support on-line/PC-operated mode: AS608e, AD226, AD229b/e, AC40 (version 1), MT10(v1), new MT10(v2), old AT235 and AA222.

The new AD629/AC40/AD226/AT235(h) supports hybrid mode (on-line / PC-controlled modes) and patient/session transfer which is described in the next chapter.

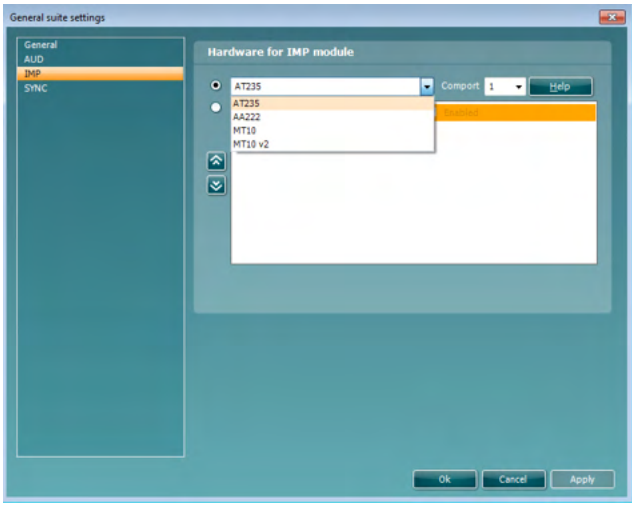
5.1 Instrument setup

The instrument setup is done in the Diagnostic Suite under **Menu | Setup | General suite settings** under the **AUD / IMP tab** section:





Hardware selection for AUD-module



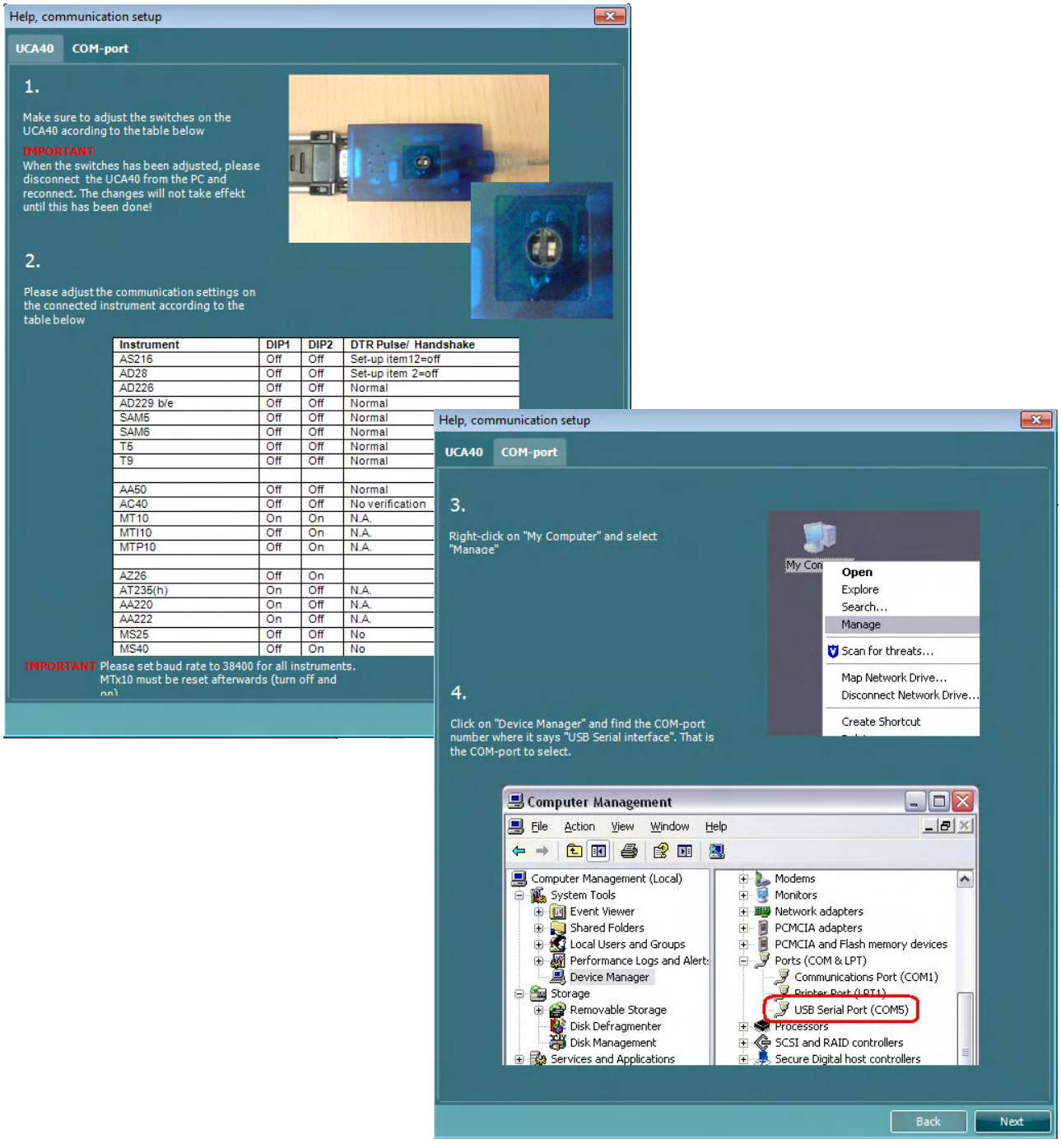
Hardware selection for IMP-module

Important: Please be sure not to select the “AD226 (version 2)”, “AD629 (version 2)” or “AC40 (version 2)” because they refer to the new generation USB-based audiometers. Please refer to the next chapter.

Select from the **Instrument** drop down menu to which instrument you are connected. Then select from the **Comport** drop down menu through which comport the instrument connects to your pc. Note that although your instrument might be connected through an USB connection, you still need to select through which comport the USB connection is supported. To find the appropriate comport, right click on My Computer (on your desktop or in Widows Explorer) and select “Manage”. Click on “Device Manager” and find the comport number saying, “USB Serial Port”. In general, the lowest available comport mentioned here is used.

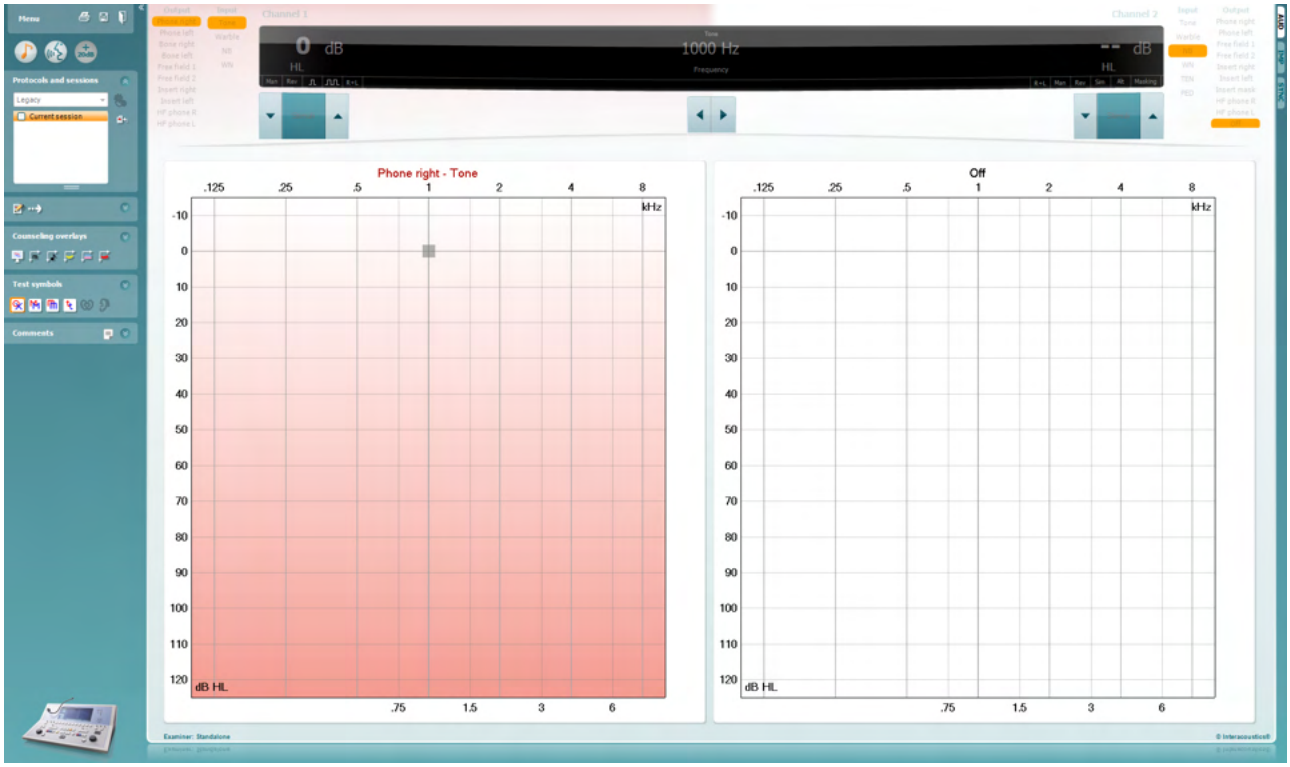
Press **OK** to save your settings and close the General suite settings window.

Press **Help** for further instructions on how to find the appropriate comport and also for the instruments which are connected through an UCA40 to find the appropriate setup.



5.2 Transferring measurement data

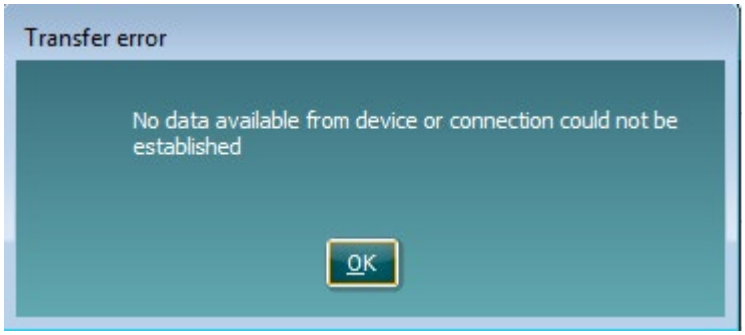
When the instrument setup is done the Diagnostic Suite is ready for retrieving the audiogram data from the selected instrument. The Diagnostic Suite main display looks like this:



For the older IA instruments, the DS application version is for transferring data from the dedicated instruments only. The top display is disabled. For the newer hybrid audiometers (AD629/AC40/AD226), the instruments can be controlled by the suite. See next chapter.

When the measurement is completed on the selected instrumented, press the following icon to transfer the data:

Important Note: If the instrument is disconnected, the following dialog is displayed when pressing the transfer button:

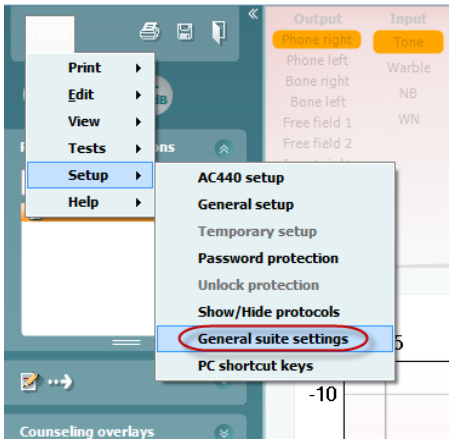


6 Diagnostic Suite setup (Sync & Hybrid mode)

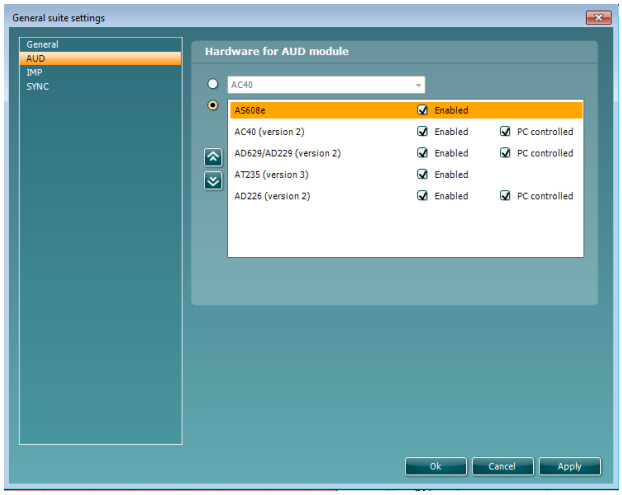
This section describes the data-transfer (SYNC) and online PC operation (hybrid mode). These functions are available depending on device and license.

The setup of SYNC or Hybrid is done from the instrument setup.

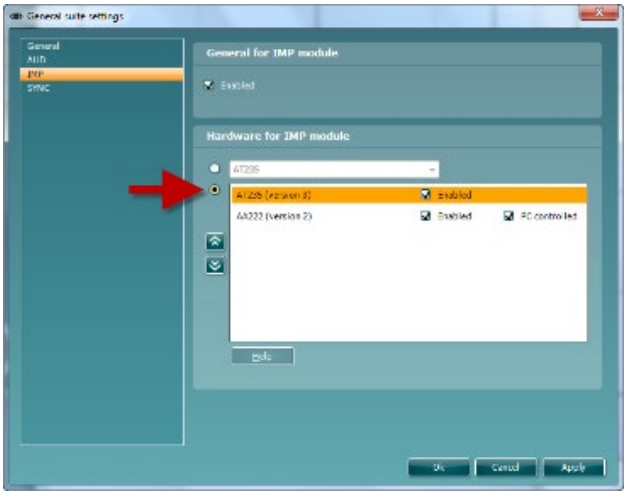
Menu | Setup | General suite settings under the **AUD / IMP tab** section:



To setup AUD devices (AD226/AD229/AD629/AC40) select the AUD tab. To setup the IMP devices (AT235/AA222) select the IMP tab. To setup a legacy device for data transfer enter the AUD or IMP tab and press the upper selection to activate the drop down menu, from where the legacy can be selected.



Hardware selection for AUD-module



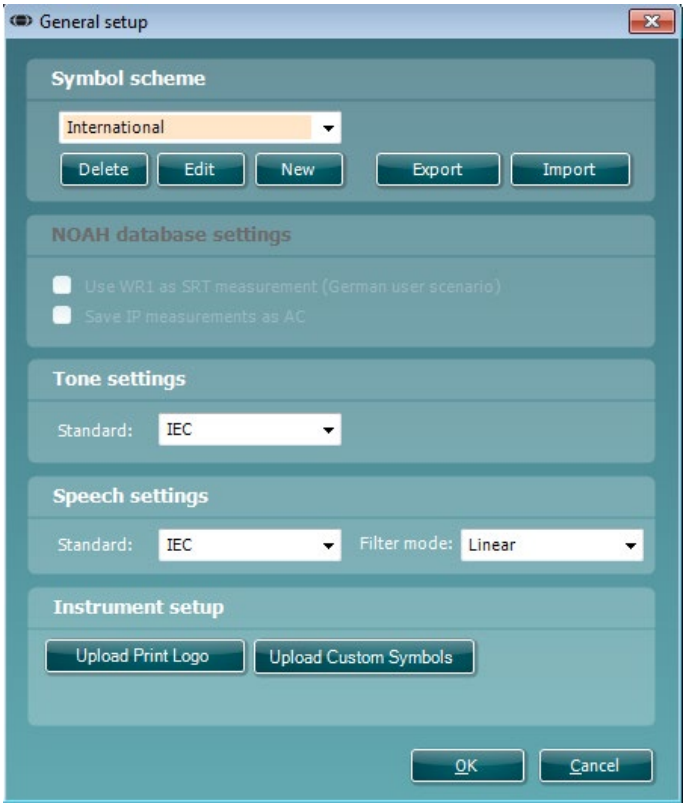
Hardware selection for IMP-module

HYBRID (PC controlled instrument): Allow the user to operate the audiometer from the PC.

SYNC: Sync mode allows for a one-click data transfer. When pressing Save Session on the instrument, the session will automatically be transferred to the Diagnostic Suite. Start the suite with device connected.

Please refer to section 6.4 / 6.6 for more information about the use of SYNC or Hybrid mode.

6.1 General setup

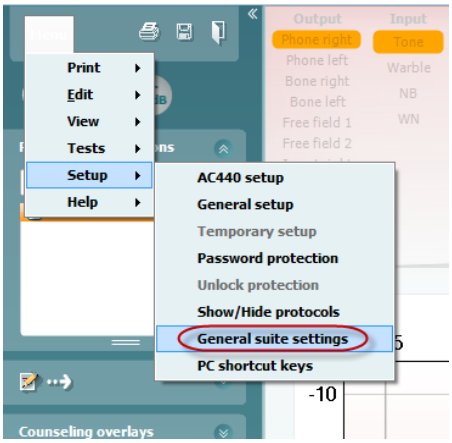


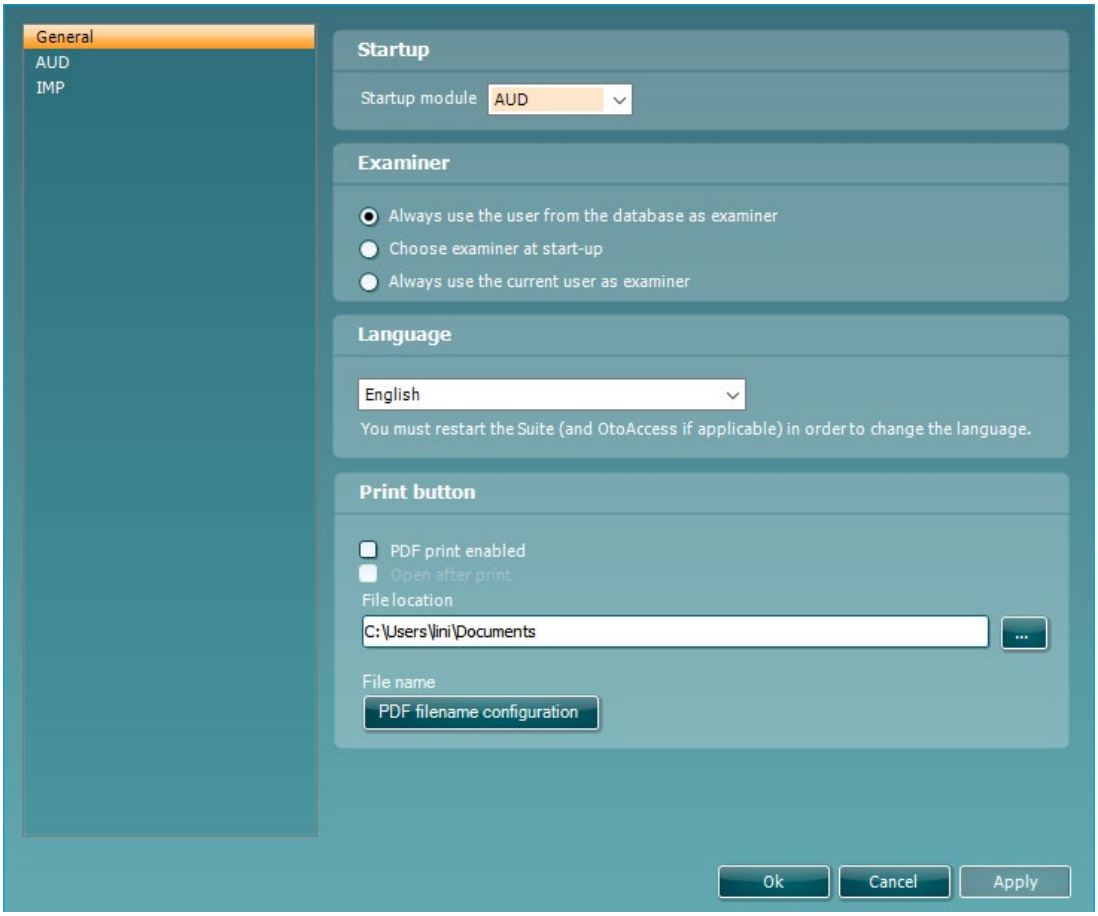
Upload Print Logo and Audiogram Symbols: A logo for direct print outs can be transferred to the New AC40/AD629/AT235(h) using the “Up Print Logo” button. The symbol scheme used in the Diagnostic Suite can be transferred to the AC40/AD629/AT235(h) (when viewing the build in audiogram) by using the “Upload Custom Symbols” button. Please refer to the AC40/AD629/AT235(h) operational manual for info on how to change the symbol scheme on the AC40/AD629/AT235(h).

Changing standards: after changing tone or speech standards the suite must be restarted.

6.2 Suite settings

Menu | Setup | General suite settings under the **AUD / IMP tab** section:



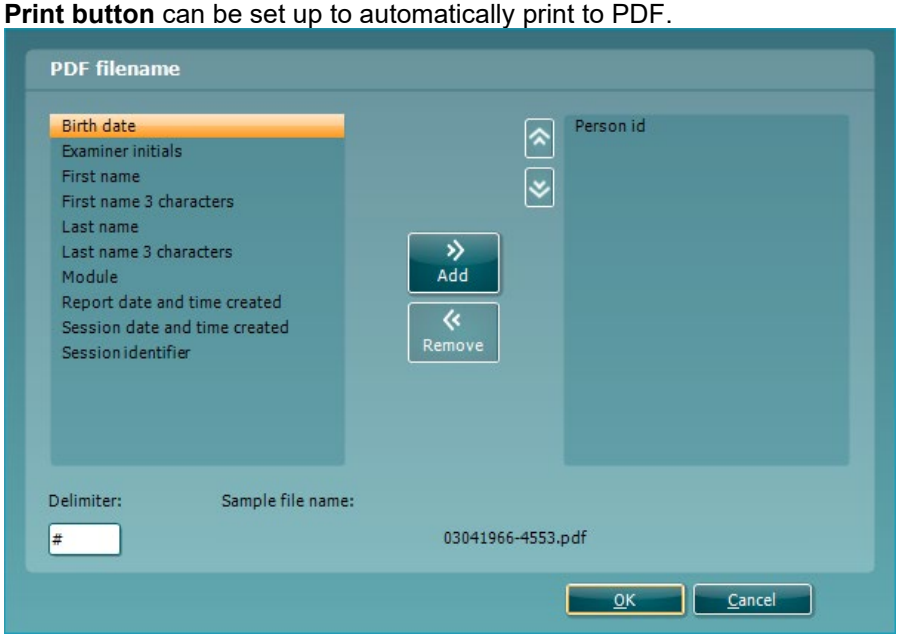


Startup: you can select which module must be displayed when opening the suite

Language: select language. The suite must be restarted in order to change the language.

Print button: when “PDF printer enabled” is selected the print icon on the front screen will activate the PDF printer.

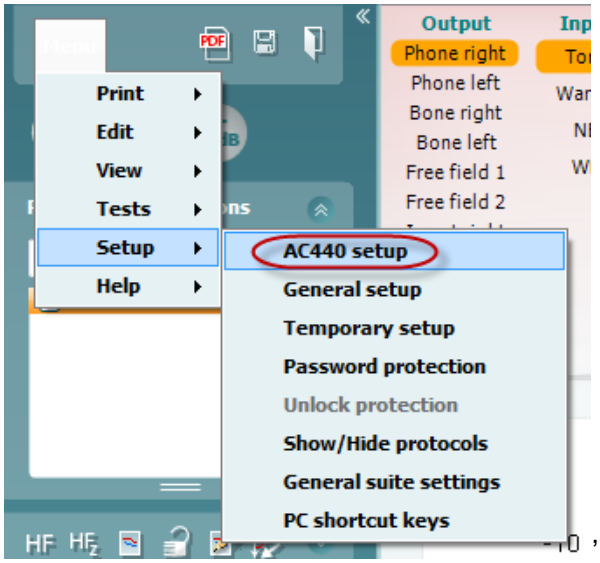
Print button can be set up to automatically print to PDF.



1. Check the **PDF print enabled** box to set the print icon to print to PDF functionality.
2. Check the **Open after print** box to open the PDF document after printing.
3. Select the **File location** to where the PDF document should be saved.
4. Select PDF time name configuration to define the name of the file. Selecting the button will open another window to set the fields defining the name of the PDF file.
   A field called “ID Number” must be added to the PDF file. Use the arrow keys to add fields to the file name. The adjustable delimiter will separate the different fields from one another.

6.3 Protocol setup

The protocol settings of the Diagnostic Suite AUD module can be modified under the AC440 setup:



Please refer to Additional Information document for more information about protocol configuration.

6.4 SYNC mode

6.4.1 One click data transfer (SYNC mode)

When SYNC is activated, it is possible to transfer the current session data from the device to the suite by pressing save session on the standalone device. This can be done from the AUD tab or IMP tap depending on the device connected.

6.4.2 The Sync tab

If there are several sessions stored on the instrument (under one or more patients) then the Sync tab must be used. The screen shot below shows the Diagnostic Suite with the SYNC tab open (underneath the AUD and IMP tabs in the upper right corner).

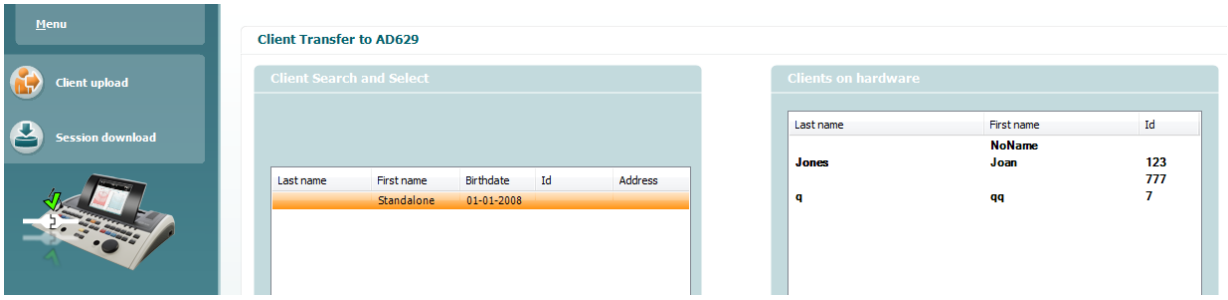
The SYNC tab provides the following possibilities:

Client upload is used for uploading clients from the database (Noah or OtoAccess2.3®) to the audiometer.

Session download is used to download sessions (audiogram data) stored in the instrument memory into to Noah, OtoAccess2.3® or XML (when running Diagnostic suite without a database).

6.4.3 Client upload

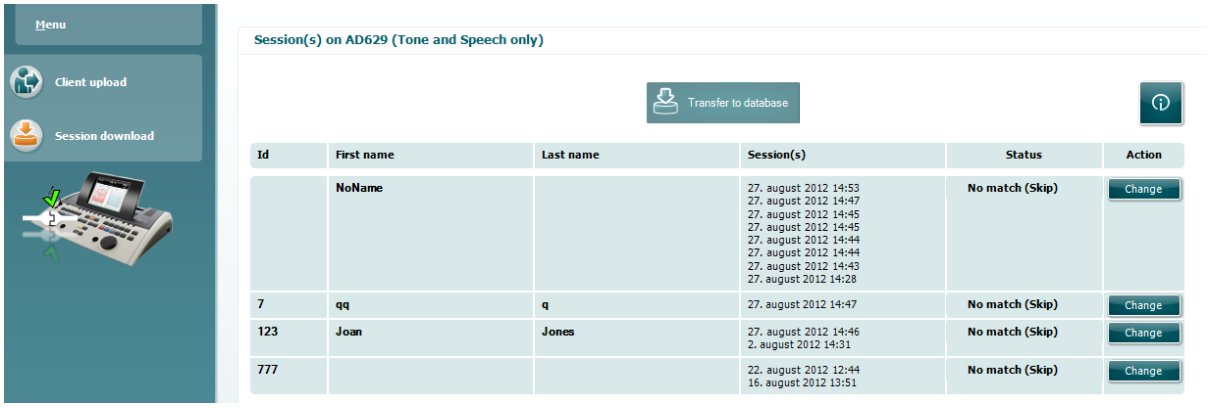
The following screen shot shows the client upload screen:



- On the left side it is possible to search for the client in the database to transfer to the database using different search criteria. Use the “Add” button to transfer (upload) the client from the database to the internal instrument memory
- On the right side the clients currently stored on the internal instrument memory (hardware) is down. It is possible to remove all clients for individual clients using the “Remove all” or “Remove” buttons

6.4.4 Session download

The following screen shot shows the session download screen:



When pressing the icon the functionality of the “Session download” screen is described:

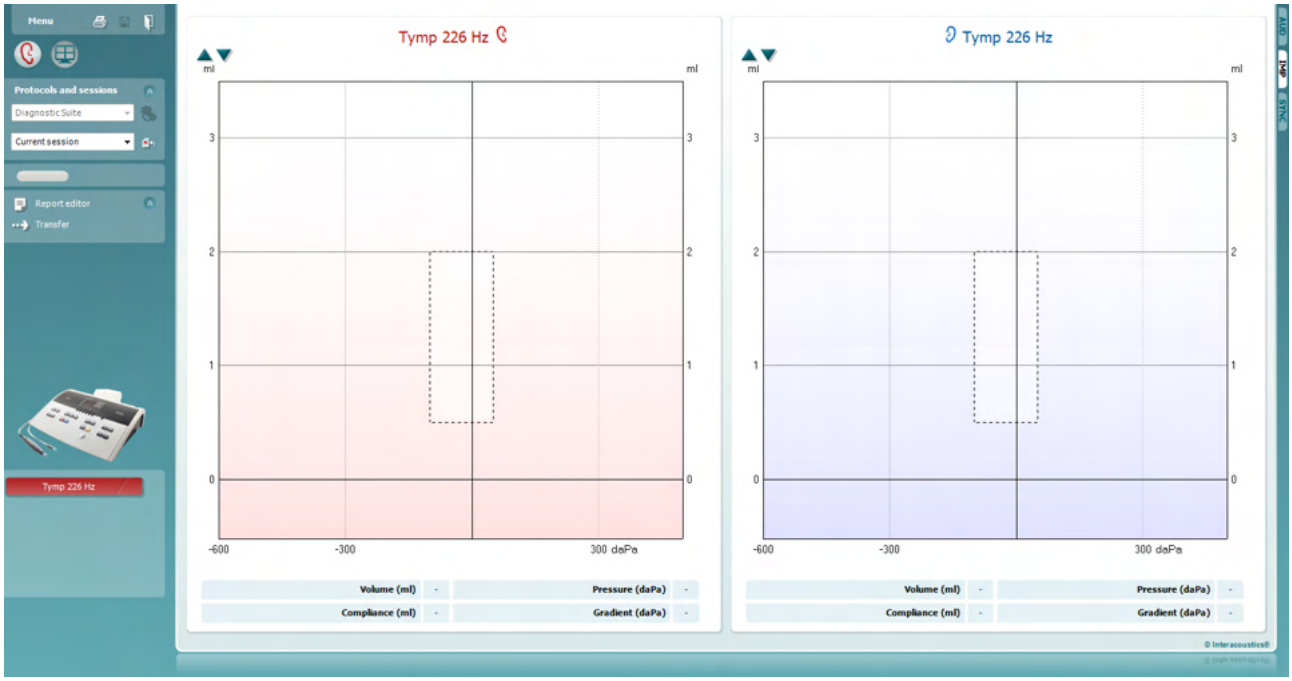
Status	Meaning
Match (Transfer)	This client on AC40 (version 2) was found (matched) in the database and the measurement will be transferred (downloaded) into the database after pressing 'Transfer to database'.
No match (Skip)	This client on AC40 (version 2) was not found (not matched) in the database and the measurement will not be transferred (downloaded) into the database after pressing 'Transfer to database'.
Download complete	The client measurement data stored on AC40 (version 2) was successfully transferred (downloaded) to the selected client in the database.

A client on the AC40 (version 2) can be transferred (downloaded) into a different (existing or new) client in the database by selecting "Change" under the "Action" column. This will open a new dialog for changing the client selection.

6.5 Quick start – transferring and saving tympanometry data

Diagnostic Suite allows you to transfer data, view data, add a report and save your data and report and/or print it with a customized print template.

To transfer tympanometry data, you need to be in the **IMP** tab. At startup it will show empty graphs like below.



Press the arrow icon, , in order to transfer data from your equipment to your pc.

On the new AT235(h) the transfer can also be done by pressing ‘Save session’ on the unit.

When the equipment is not yet connected or switched on or if the instrument setup is incorrect, a message will inform you to check the communication port.

Press the report icon, , in order to open the report editor and add notes to the transferred data.

Press the print icon, , in order to open the print wizard from which you can select according to which template to print.

Press the save icon, , to save or the save and exit icon, , to save and exit.

6.6 Hybrid (online/PC-controlled) mode

6.6.1 Using the tone screen

The following section describes the elements of the tone screen.

Menu provides access to Print, Edit, View, Tests, Setup, and Help

Print allows for printing the session's acquired data.

Save & New Session saves the current session in Noah or OtoAccess2.3® and opens a new one.

Save & Exit saves the current session in Noah or OtoAccess2.3® and exits the Suite.

Collapse the left side panel.

Go to Tone Audiometry activates the tone screen when in another test.

Go to Speech Audiometry activates the speech screen when in another test.

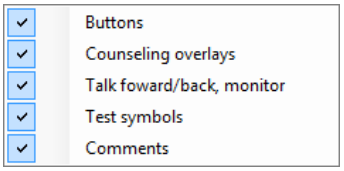
Extended Range +20 dB extends the testing range and can be activated when the testing dial setting gets within 55 dB of the maximum level of the transducer.

Note that the extended range button will flash when it needs activation for reaching higher intensities.

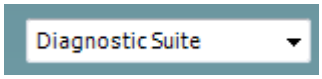
To switch on the extended range automatically, select the **Switch extended range on automatically** by going to the setup menu.

Fold an area so that it only shows the label or the buttons of that area.

Unfold an area so that all buttons and labels are visible

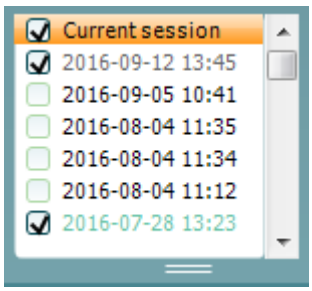


Show/hide areas can be found by right mouse clicking on one of the areas. The visibility of the different areas as well as the space that they take on the screen is locally saved to the examiner.



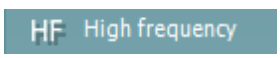
List of Defined Protocols allows for selecting a test protocol for the current test session. Right mouse click on a protocol allows the current examiner to set or deselect a default startup protocol. Please refer to “Additional Information” document for more information on protocols and protocol setup.

Temporary Setup allows for making temporary changes to the selected protocol. The changes will be valid for the current session only. After making the changes and returning to the main screen, the name of the protocol will be followed by an asterisk (*).



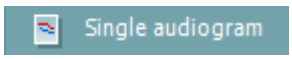
List of historical sessions accesses historical sessions for comparison purposes. The audiogram of the selected session, indicated by the orange background, is shown in colors as defined by the used symbol set. All other audiograms that are selected by check marks shown on screen in the colors as indicated by the text color of the date and time stamp. Sessions not having an element to present in the current test screen is dimmed, e.g., a session only containing speech results will be dimmed when in the tone screen. Right click on a session to see a full list of the tests part of that session. Note that this listing can be resized by dragging the double lines up or down.

Go to Current Session brings you back to the current session.



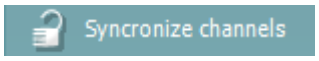
High Frequency shows frequencies on the audiogram (up to 20 kHz for the AC40/AD629). However, you will only be able to test in the frequency range the selected headset is calibrated for.

High Frequency Zoom[1] activates high frequency testing and zooms in on the high frequency range.



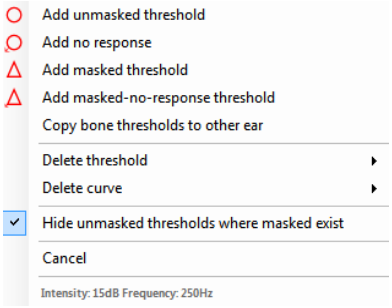
Single audiogram toggles between viewing the information of both ears in a single graph and two separate graphs.

Multi frequencies[2] activate testing with frequencies in between the standard audiogram points. The frequency resolution can be adjusted in the AC440 setup.



Synchronize channels locks the two channels together. This function may be used to perform synchronous masking.

Edit Mode button activates the editing function. Left clicking on the graph will add/move a point to the position of the cursor. If right clicking on a specific stored point a context menu appears offering, you the following options:



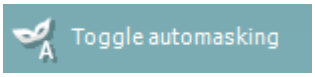
Mouse controlled audiometry enables you to do the audiometry using the mouse only. Left click on the mouse to present the stimulus. Right click on the mouse to store the result.

The **dB step size** button indicates to which dB step size the system is currently set. It rotates between 1 dB, 2 dB and 5 dB step sizes.

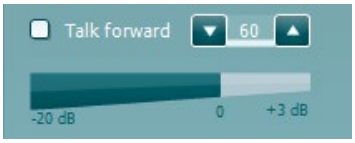
The **hide unmasked threshold** will hide those unmasked thresholds where masked thresholds exist.

Toggle Masking Help will activate or deactivate the Masking Help feature.

For more information on Masking Help, please refer to the “Additional Information” or the “Masking Help Quick Guide” documents.



Toggle Automasking will activate or deactivate the Automasking feature. For more information on Automasking, please refer to the “Additional Information” or the “Masking Help Quick Guide” documents

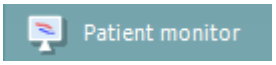


Talk Forward activates the Talk Forward microphone. The arrow keys can be used to set the talk forward level through the currently selected transducers. The level will be accurate when VU meter indicates to be at zero dB.

[1] HF requires an additional license for the AC440. If not purchased, the button is grayed out.
[2] MF requires additional license for the AC440. If not purchased, the button is grayed out.

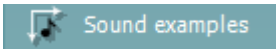
Selecting the **Monitor Ch1** and/or **Ch2** check boxes allow you to monitor one or both channels through an external loudspeaker/headset connected to the monitor input. The monitor intensity is adjusted by the arrow keys.

The **Talk back** check box enables you to listen to the patient. Note that you need to be equipped with a microphone connected to the talk back input and an external loudspeaker/headset connected to the monitor input.



The **Patient monitor** opens an always-on-top window with the tone audiograms and all its counseling overlays shown. The size and position of the patient monitor gets saved for each examiner individually.

The **Phonemes** counseling overlay shows phonemes as it is set up in the protocol that is currently in use.

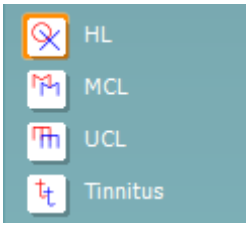


The **Sound examples** counseling overlay shows pictures (png-files) as they are set up in the protocol that is currently in use.

The **Speech banana** counseling overlay shows the speech area as it is set up in the protocol that is currently in use.

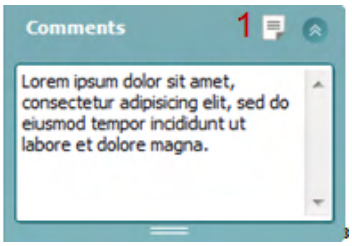
The **Severity** counseling overlay shows the degrees of hearing loss as it is set up in the protocol that is currently in use.

The **Max. testable values** show the area beyond the maximum intensity the system allows. This reflects the transducer calibration and depends on the extended range being activated.



Selecting **HL**, **MCL**, **UCL** or **Tinnitus** sets the symbol types that are currently in use by the audiogram. HL stands for hearing level, MCL stands for most comfortable level and UCL stands for uncomfortable level. Note that these buttons show the unmasked right and left symbols of the currently selected symbol set.

Each type of measurement is saved as a separate curve.



In the **Comments** section you can type comments related to any audiometric test. The used space by the comments area can be set by dragging the double line with your mouse. Pressing the **Report editor** (1) button opens a separate window for adding notes to the current session. The report editor and comment box contain the same text. In case the formatting of the text is important, this can only be set within the report editor.

After saving the session, changes can only be made within the same day until the date changes (at midnight).**Note:** these timeframes are limited by HIMSA and the Noah software, and not by Interacoustics.

The **Output** list for channel 1 provides the option to test through headphones, bone conductor, free field speakers or insert phones. Note that the system only shows the calibrated transducers.

The **Input** list for channel 1 provides the option to select pure tone, warble tone, narrow band noise (NB) and white noise (WN).

Note that the background shading is according to the side that is selected, red for right and blue for left.

The **Output** list for channel 2 provides the option to test through headphones, free field speakers, insert phones or insert masking phone. Note that the system only shows the calibrated transducers.

The **Input** list for channel 2 provides the option to select pure tone, warble tone, narrow band noise (NB), white noise (WN) and TEN noise[3].

Note that the background shading is according to the side that is selected, red for right, blue for left, and white when off.

Pulsation allows for single and continuous pulsating presentation. The duration of the stimulus can be adjusted in the AC440 setup.

Sim/Alt allows toggling between **Simultaneous** and **Alternate** presentation. Ch1 and Ch2 will present the stimulus simultaneously when Sim is selected. When Alt is selected, the stimulus will alternate between Ch1 and Ch2.

Masking indicates if channel 2 is currently in use as a masking channel and in that way makes sure masking symbols are used in the audiogram. For example, in pediatric testing through free field speakers, channel 2 can be set as a second testing channel. Note that a separate store function for channel 2 is available when channel 2 is not used for masking.

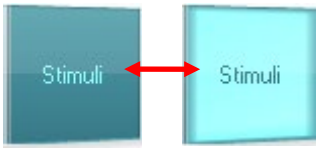
The **Right + Left** allows for presenting tones in both ears in channel 1 and noise in both ears in channel 2.

dB HL Increase and **Decrease** buttons allows for increasing and decreasing the intensities of channel 1 and 2.

The arrow keys on the PC keyboard can be used for in-/decreasing channel 1 intensities.

PgUp and PgDn on the PC keyboard can be used for in-/decreasing channel 2 intensities.

[3] TENs test requires an additional license for the AC440. If not purchased, the stimulus is grayed out.



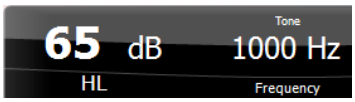
Stimuli or **attenuator** buttons will light up when the mouse goes over and indicates the active presentation of a stimulus.

A right mouse click in the Stimuli area will store a no response threshold. A left mouse click in the Stimuli area will store the threshold at the current position.

Channel 1 stimulation can also be obtained by pressing the space bar or left Ctrl key on the PC keyboard.

Channel 2 stimulation can also be obtained by pressing the right Ctrl key on the PC keyboard.

Mouse movements in the Stimuli area for both channel 1 and channel 2 can be ignored depending on the setup.



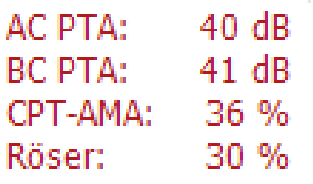
Frequency and Intensity display area shows what is currently presented. To the left the dB HL value for channel 1 is shown and to the right for channel 2 in the center the frequency is displayed.

Notice that the dB dial setting will flash when trying to go louder than the maximum available intensity.

Frequency increase/decrease increases and decreases the frequency respectively. This can also be obtained using the left and right arrow keys on the PC keyboard.

Storing thresholds for channel 1 is done by pressing **S** or by a left mouse click in the Stimuli button of channel 1. Storing a no response threshold can be done by pressing **N** or by a right mouse click on the Stimuli button of channel 1.

Storing thresholds for channel 2 is available when channel 2 is not the masking channel. It is done by pressing **<Shift> S** or by a left mouse click on the Stimuli button of channel 2. Storing a no response threshold can be done by pressing **<Shift> N** or by a right mouse click in the attenuator of channel 2.



AC PTA: the pure tone average for air conduction is calculated based on the frequencies set for the calculation in the tone settings.
BC PTA: the pure tone average for bone conduction is calculated based on the frequencies set for the calculation in the tone settings.
CPT-AMA: When enabled in the tone settings, the European CPT-AMA is then displayed. CPT-AMA is used as an average, indicating the severity of the hearing loss.
Rôser: Calculated PTA score based on Röser publication 1980

The hardware indication picture indicates whether the hardware is connected. **Simulation mode** is indicated when operating the software without hardware.

When opening the Suite, the system will automatically search for the hardware.

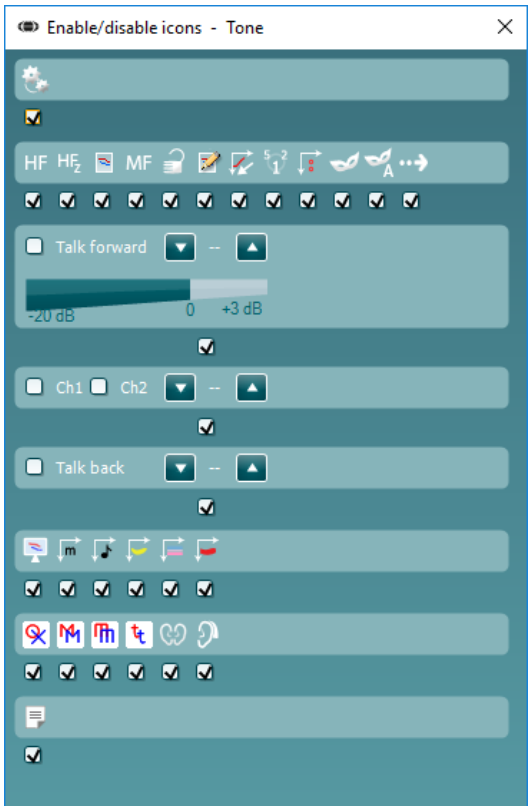
The **Examiner** indicates the current clinician who is testing the patient. The examiner is saved with a session and can be printed with the results.

For each examiner is logged how the Suite is set up with regards to the use of space in the screen. The examiner will find that the Suite starts up looking the same as the last time they used the software. An examiner can also select which protocol must be selected at start up (by right mouse click on the protocol selection list).

6.6.2 AUD – icon setup

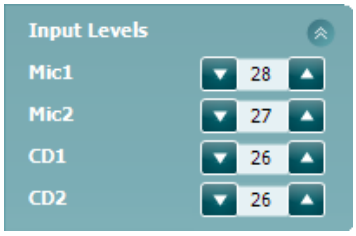
The Icon setup allows the user to only show relevant icon in the navigation bar in the right side of the AUD screen.

Go to AUD module │Menu │ Setup │Enable/disable Icons

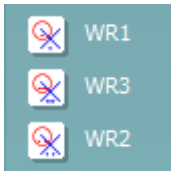


6.6.3 Using the speech screen

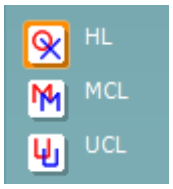
The following section describes the elements of the speech screen in addition to the tone screen:



Input levels sliders allow for adjusting the input level to 0 VU for the selected input. This ensures that correct calibration is obtained for Mic1, Mic2, CD1, and CD2.



WR1, **WR2** and **WR3** (Word Recognition) allows selecting different speech list setups as defined by the selected protocol. The labels of these lists which go along with these buttons can also be customized in the protocol setup.



Selecting **HL, MCL and UCL** sets the symbol types that are currently in use by the audiogram. HL stands for hearing level, MCL stands for most comfortable level and UCL stands for uncomfortable level.

Each type of measurement is saved as a separate curve.

Binaural and **Aided** function allows for indicating if the test is performed binaurally or while the patient is wearing hearing aids. This feature is only active in the Speech Audiometry screen.

The **Output** list for channel 1 provides the option to test through the desired transducers. Note that the system only shows the calibrated transducers.

The **Input** list for channel 1 provides the option to select white noise (WN), speech noise (SN), microphone 1 or 2 (Mic1 and Mic2), CD1, CD2 and wavefile.

Note that the background shading is according to the side that is selected, red for right and blue for left.

The **Output** list for channel 1 provides the option to test through the desired transducers. Note that the system only shows the calibrated transducers.

The **Input** list for channel 2 provides the option to select white noise (WN), speech noise (SN), microphone (Mic1 and Mic2), CD1, CD2 and wavefile.

Note that the background shading is according to the side that is selected, red for right, blue for left, and white when off.

Play: Press play to start the track of speech material

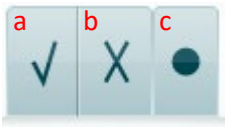
Pause: Press pause to pause the track of speech material

Stop: Press stop to stop the track of speech material

Randomize: Press randomize to present the speech track in random order.

The randomize symbol is emphasized in yellow when randomized is on. If activated by default in the protocol setup this is indicated with a yellow frame around the button.

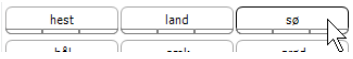
Speech Scoring:



a) **Correct:** A mouse click on this button will store the word as correctly repeated. You can also click on the **Left** arrow key to store as correct.

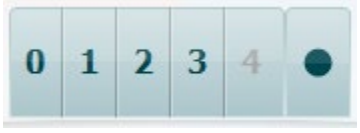
b) **Incorrect:** A mouse click on this button will store the word as incorrectly repeated. You can also click on the **Right** arrow key to store as incorrect

c) **Store:** A mouse click on this button will **store** the speech threshold in the speech graph. A point can also be stored by pressing **S**.



In order to start the list with a word in the middle of the list press the word and then press play.

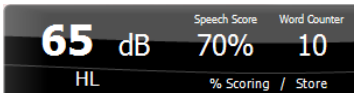
Phoneme scoring:



a) **Phoneme scoring:** If phoneme scoring is selected in the AC440 setup, mouse click on the corresponding number to indicate phoneme score. You can also click on the **Up** key to store as correct and **Down** key to store as incorrect.

b) **Store:** A mouse click on this button will store the speech threshold in the speech graph. A point can also be stored by pressing **S**.

When the word is scored with the use of phonemes, the number of correct phonemes in the word will appear below the word.



Frequency and Speech score display shows what is currently presented. On the left the dB value for channel 1 is shown and on the right side for channel 2.

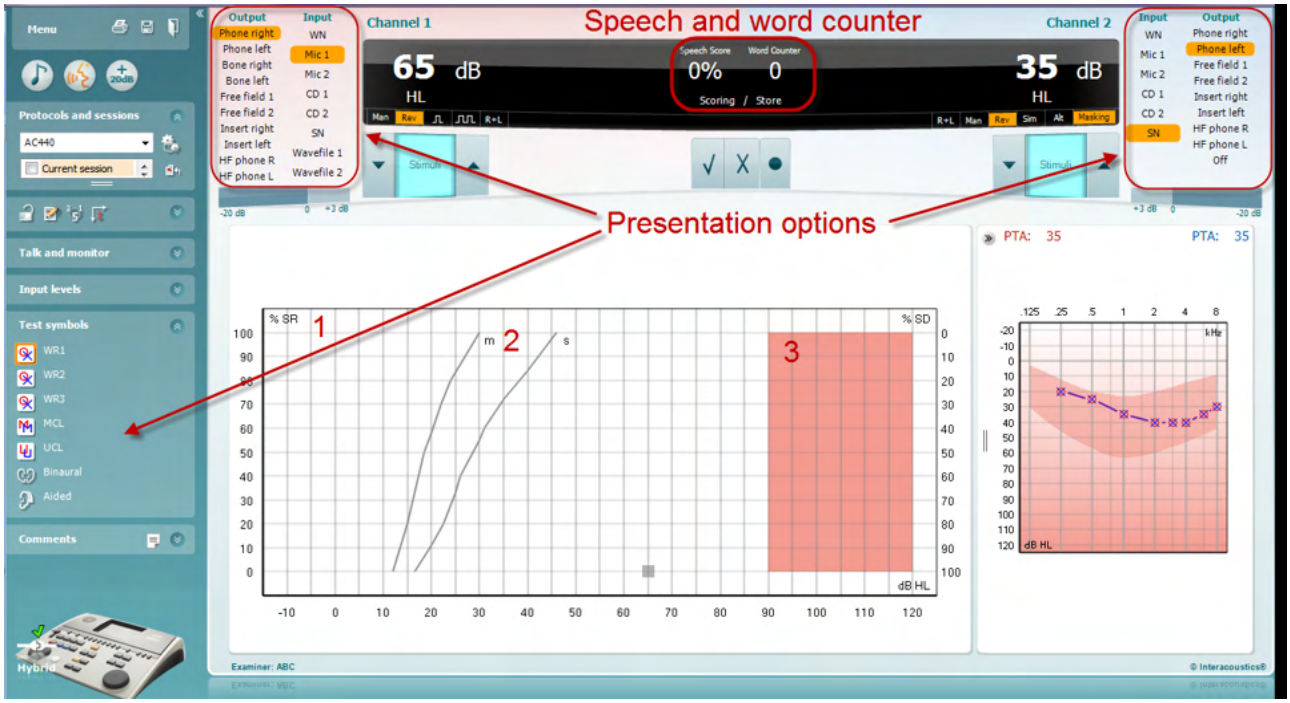
In the center of the current *Speech Score* in % and the *Word Counter* monitors the number of words presented during the test.

WR1 SRT (s) = 46,3 dB
WR weighted 80%

Show calculated SRT in graph mode when enabled in the speech setup, the SRT score can be calculated based on the recorded WR curve.

WR weighted is calculating a score based on Bönninghaus u. Röser publication 1973

6.6.4 Speech audiometry in graph mode



Graph mode presentation settings under “Test Symbols” and in the presentation options (Ch1 and Ch2) in the upper part of the screen shows where you can adjust the test parameters during the test.

1) **The graph:** The curves of the recorded speech graph will be displayed on your screen.

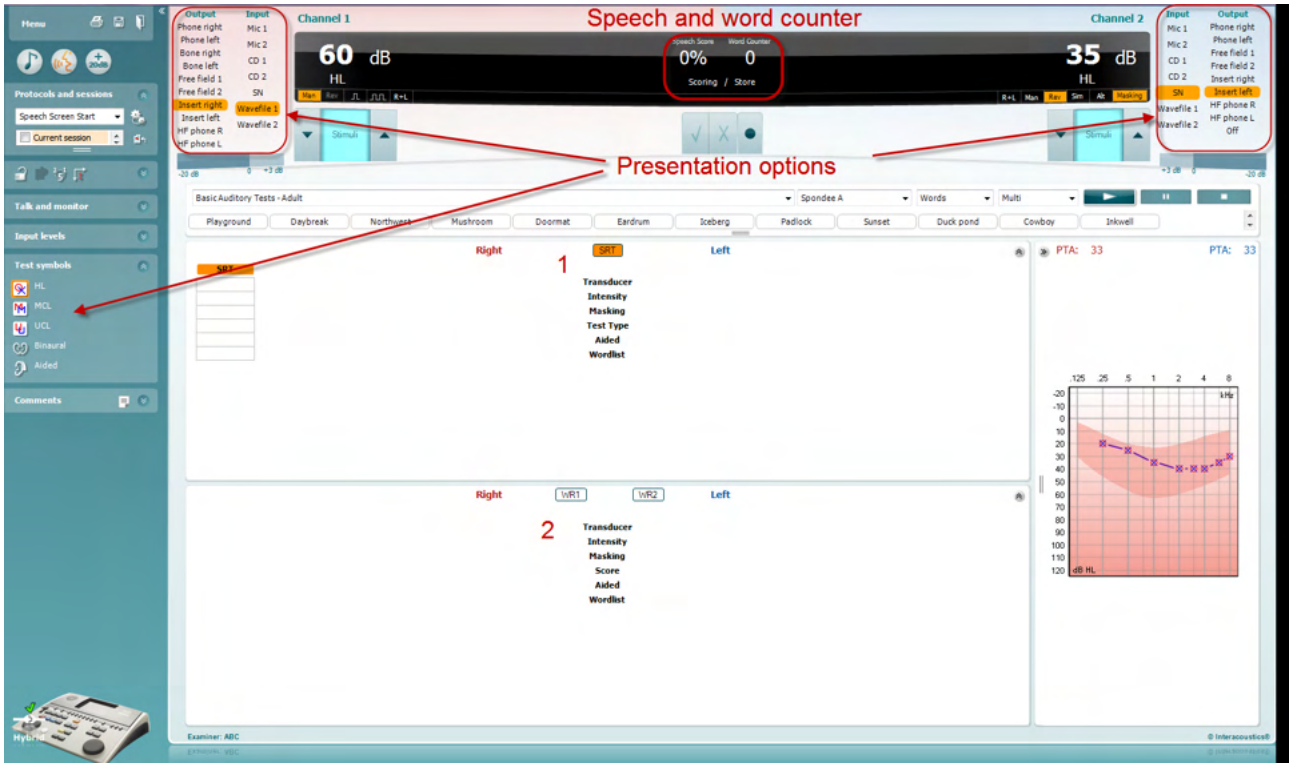
   The x-axis shows the intensity of the speech signal, and the y-axis shows the score in percent.

   The score is also displayed in the black display in the upper part of the screen, along with a word counter.

2) **The norm curves** illustrate norm values for **S** (Single syllabic) and **M** (Multi syllabic) speech material respectively. The curves can be edited according to individual preferences in the AC440 setup.

3) **The shaded area** illustrates the maximum intensity the system will allow. The *Extended Range +20 dB* button can be pressed to go higher. The maximal loudness is determined by the transducer calibration.

6.6.5 Speech audiometry in table mode



The AC440 Table Mode consists of two tables:

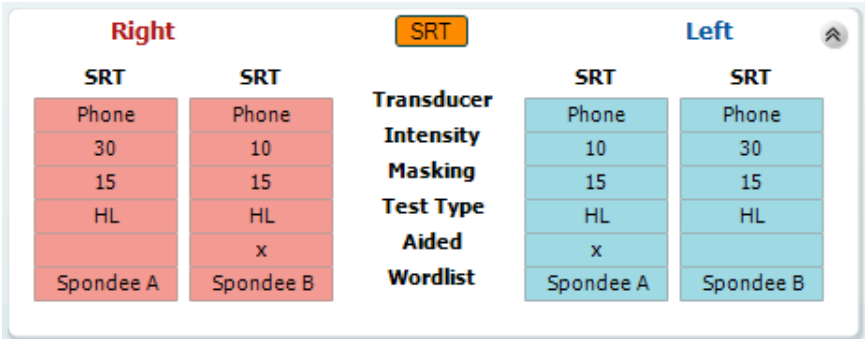
1) The **SRT** (Speech Reception Threshold) table. When the SRT test is active, it is indicated in orange SRT

2) The **WR** (Word Recognition) table. When WR1, WR2, or WR3 is active the corresponding label will be orange WR1

The SRT table

The SRT table (Speech Reception Threshold table) allows for measuring multiple SRTs using different test parameters, e.g., *Transducer, Test Type, Intensity, Masking,* and *Aided*.

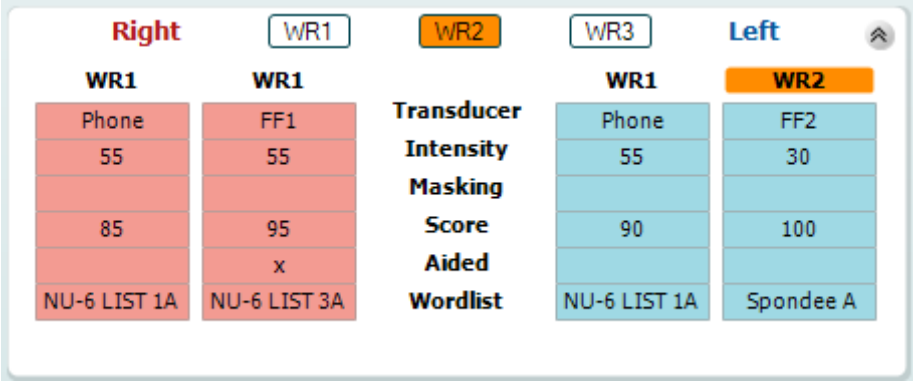
Upon changing *Transducer, Masking*, and/or *Aided* and re-testing, an additional SRT entry will appear in the SRT table. This allows for multiple SRT measurements to be shown in the SRT table.



The WR Table

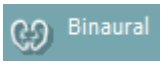
The word recognition (WR) table allows for measuring multiple WR scores using different parameters (e.g., *Transducer, Test Type, Intensity, Masking,* and *Aided*).

Upon changing Transducer, Masking, and/or Aided re-testing an additional WR entry will appear in the WR table. This allows for multiple WR measurements to be shown in the WR table.

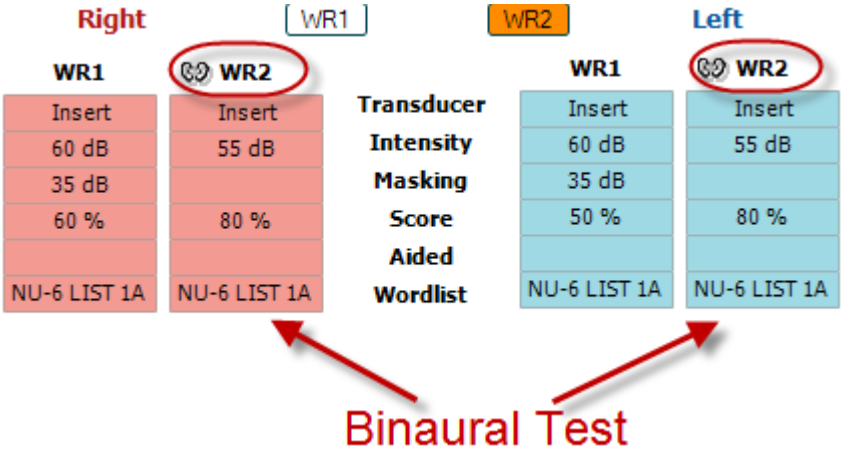


Binaural and aided options

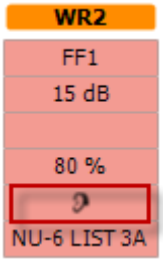
To perform binaural speech tests:

1. Click on either SRT or WR, to choose the test to be conducted binaurally
2. Ensure that the transducers are set up for binaural testing. For example, insert Right in channel 1 and insert Left in channel 2
3. Click on 

4. Proceed with the test; when stored, results will be stored as binaural results



To perform an aided test:



1. Select the desired transducer. Typically, aided testing is done in the Free Field. However, in certain conditions, it could be possible to test deeply inserted CIC hearing instruments under headphones, which would show ear-specific results
2. Click on the Aided button
3. Click on the Binaural button if the test is done in the Free Field so that the results are stored for both ears at the same time
4. Proceed with test; results will then be stored as aided by showing an Aided icon

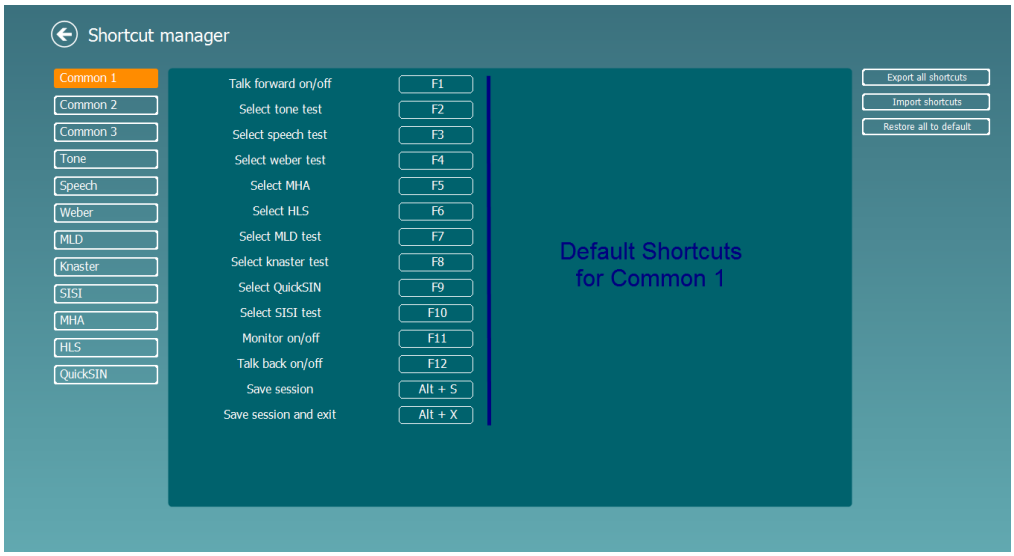
6.6.6 PC keyboard shortcuts manager

Diagnostic suite comes with a default set of shortcuts definded by the overview (see appeldix 1). To change the shortcuts use the PC shortcut Manager. To access the PC Shortcut Manager:

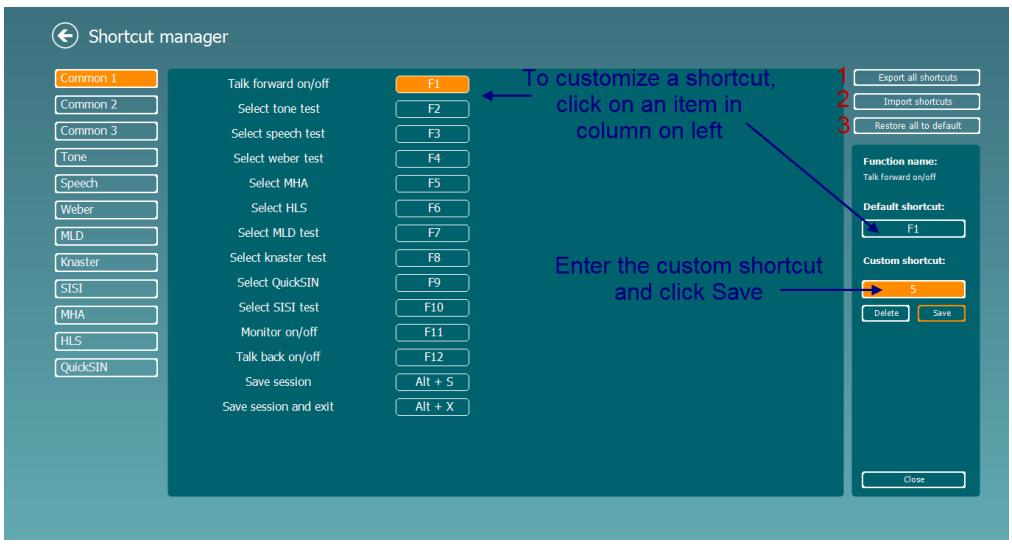
Go to AUD module │Menu │ Setup │PC Shortcut Keys

Or by using the combined shortcut keys: Alt + Ctrl + Shift + S

To view the default shortcuts, click on the items in the left hand column (Common 1, Common 2, Common 3, etc.)



To personalize a shortcut, click on the column in the middle and add the custom shortcut in the field on the right hand of the screen, note that a shortcut cannot be applied if it has already been assigned for another function.



1. **Export all shortcuts**: Use this function to save custom shortcuts and transfer them to another computer
2. **Import shortcuts**: Use this function to import shortcuts that have already been exported from another computer
3. **Restore all defaults**: Use this function to restore the PC shortcuts to Factory Settings default

7 Special tests screens

7.1 Weber

The Weber test distinguished between conductive and sensorineural hearing loss through use of a bone conductor. Use the indications to show where the tone is perceived. If the patient hears the tone better in the poorer ear the hearing loss is conductive, and the tone is heard better in the better ear the hearing loss is sensorineural at the given frequency.

Test Procedure:

1) Open the AUD and enter the Weber screen by selecting **Menu | Tests | Weber**
2) Input and Output selections for **channel 1/channel 2** are fixed *Tone* and *Bone*.
3) Place the bone conductor on the patient's forehead and instruct them to tell you if the tones presented are heard better to the *Right, Left, Centre* or if it is *Not heard* at all.
4) Present a tone at a level of 10 dB above the worst BC threshold using the **dB HL Decrease/Increase** buttons or the PC keyboard. You can select whether you want a **Tone** or **Warble** stimulus.
5) Await response from the patient and click on the corresponding button above the graph.

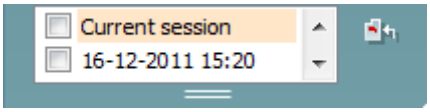
6) If the patient hears the tone better in the poorer ear the hearing loss is conductive, and the tone is heard better in the better ear the hearing loss is sensorineural at the given frequency.
7) During the testing the frequency and intensity can be adjusted manually (see illustration).
8) Save the Weber test by clicking **Save**

7.2 HLS

The HLS offers a simulation of the hearing loss through the audiometric headphones or the high frequency headset and is primarily aimed at the family members of the hearing impaired. It is a valuable tool as a hearing loss in many families may result in frustrations and misunderstandings. Knowing what the hearing loss actually sounds like gives an impression of what the hearing impaired goes through every day.

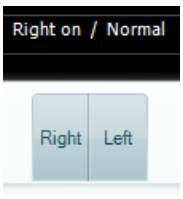
Test Procedure:

1) Open the AUD. To perform the HLS counselling, an audiogram is needed. You should therefore start by performing *Air Conduction Audiometry* or retrieving an old audiogram in the **List of historical sessions**.



2) When an audiogram is present, enter the HLS screen by selecting **Menu | Tests | HLS.**
3) Select headphones or inserts in the **channel 1** output dropdown list.
4) Select *CD, Microphone* or *Wave files* in the **channel 1** input dropdown list.
   If using CD press *play* on the CD player, and if using wave files, the wave files must be pre-loaded to the audiometer before they can be used within the suite - play them in the bottom of the screen.
5) Before mounting the headset on the friend or relative explain the audiogram. Use examples of what the hearing impaired may not be able to hear anymore such as some speech sounds and other sounds that are likely to occur in everyday surroundings.
6) It may be advisable to start the simulation session by letting the relative listen to the input signal with his or her natural hearing for a moment. This is likely to have a strong effect when having to compare with the simulation.

Start simulating by clicking the **Right** and/or **Left** buttons corresponding to the ear to be simulated. The text above each button will then change from *Normal* to *ON.*

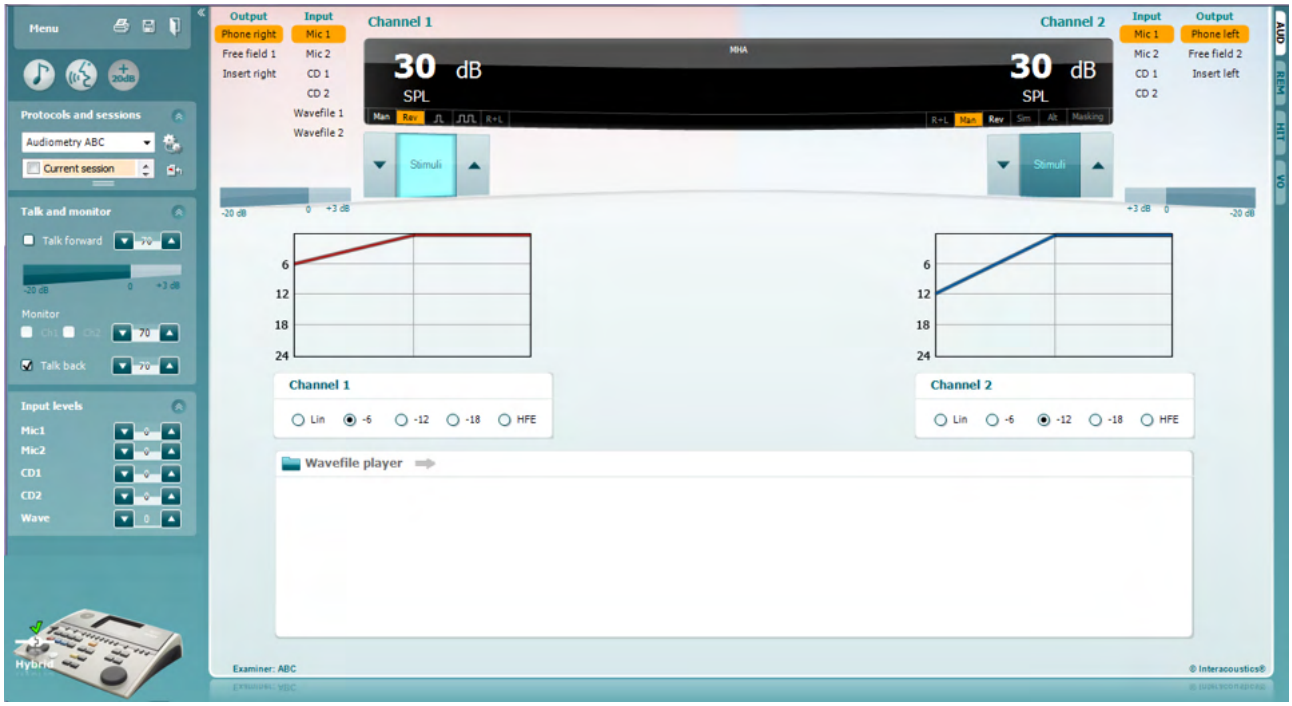


During the simulation it is possible to adjust the volume of the signal using the **dB HL Decrease/Increase channel 1/channel 2** buttons.

7.3 MHA

MHA is a hearing aid fitting procedure consisting of three hearing aid simulated high pass filters of -6 dB, -12 dB, -18 dB per octave and a HFE filter (High Frequency Emphasis) equivalent to -24 dB per octave through the audiometric headphones. This gives a rough sense of the benefits of a hearing aid and what could eventually be gained by getting properly fitted hearing aids. The filters can be activated individually on both channels enabling the audiometer to serve as a 2 channel master hearing aid.

Test Procedure:



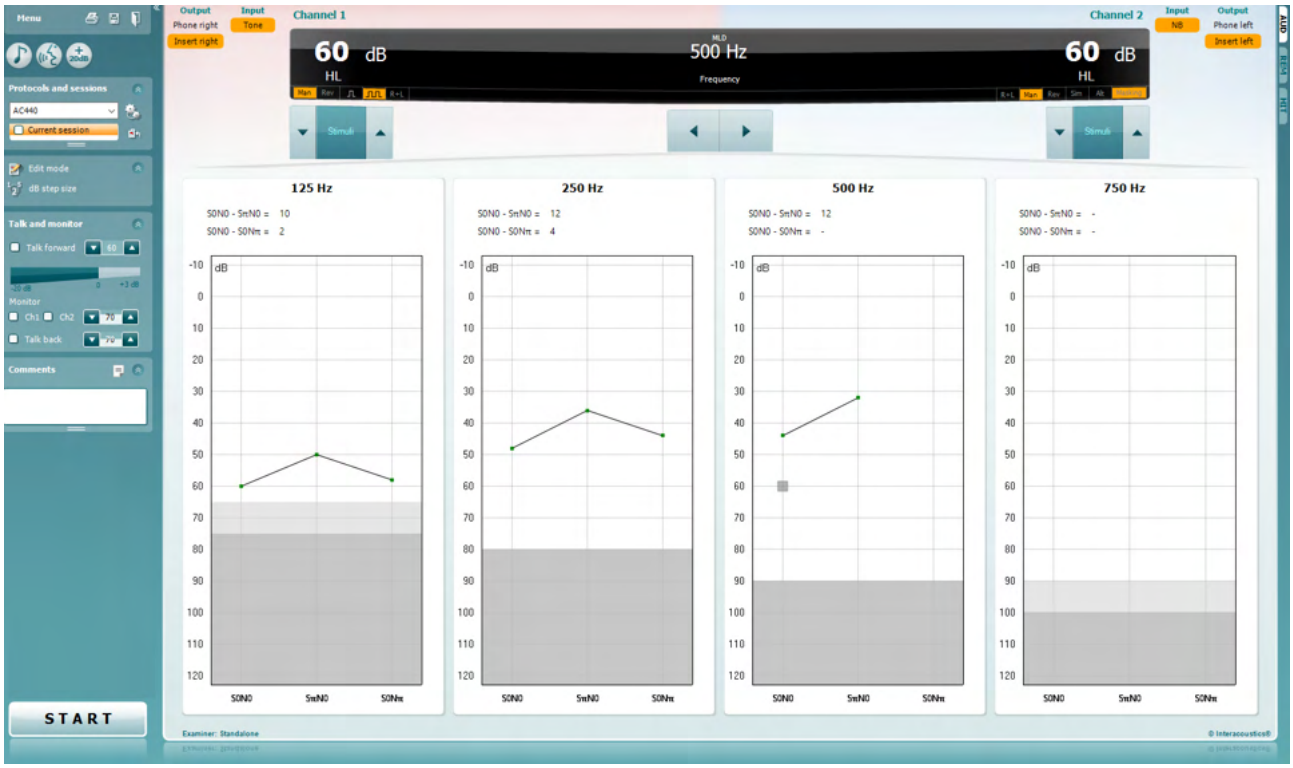
1) Open the AUD and enter the MHA screen by selecting **Menu | Tests | MHA**.
2) Select headphones or inserts in the **channel 1** output list.
3) Select *CD, Microphone* or *Wavefile* **in the channel 1** input list.
   If using CD press *play* on the CD player, and if using wave files, the wave files must be pre-loaded to the audiometer before they can be used within the suite - play them in the bottom of the screen.
4) The selected MHA filter can be visualized in the graph. Toggle between the filters and see the effect.
5) During the simulation it is possible to adjust the volume of the signal using the **dB HL Decrease/Increase channel 1/channel 2** buttons.

7.4 MLD

MLD refers to the improvement in speech intelligibility in noise when a tone is presented in and out of phase respectively. It aims to assess central auditory function, but peripheral changes may also affect the MLD.

The auditory system has the ability to perceive differences in timing of a sound reaching the two ears. This helps to localize low frequency sounds that reach the ears at different times due to the longer wavelength.

It is measured by simultaneously presenting a 500 Hz interrupted and narrow band noise at 60 dB to both ears in phase and finding the threshold. Then the phase of one of the tones is inversed and the threshold is found once again. The improvement in sensitivity will be greater in the out-of-phase condition. The MLD equals the difference between the in-phase and out-of-phase thresholds or more formally the MLD may be defined as the difference in dB between the binaural (or monaural) in phase condition (SO NO) and a particular binaural condition (e.g., Sπ NO or SO Nπ).



Test Procedure:

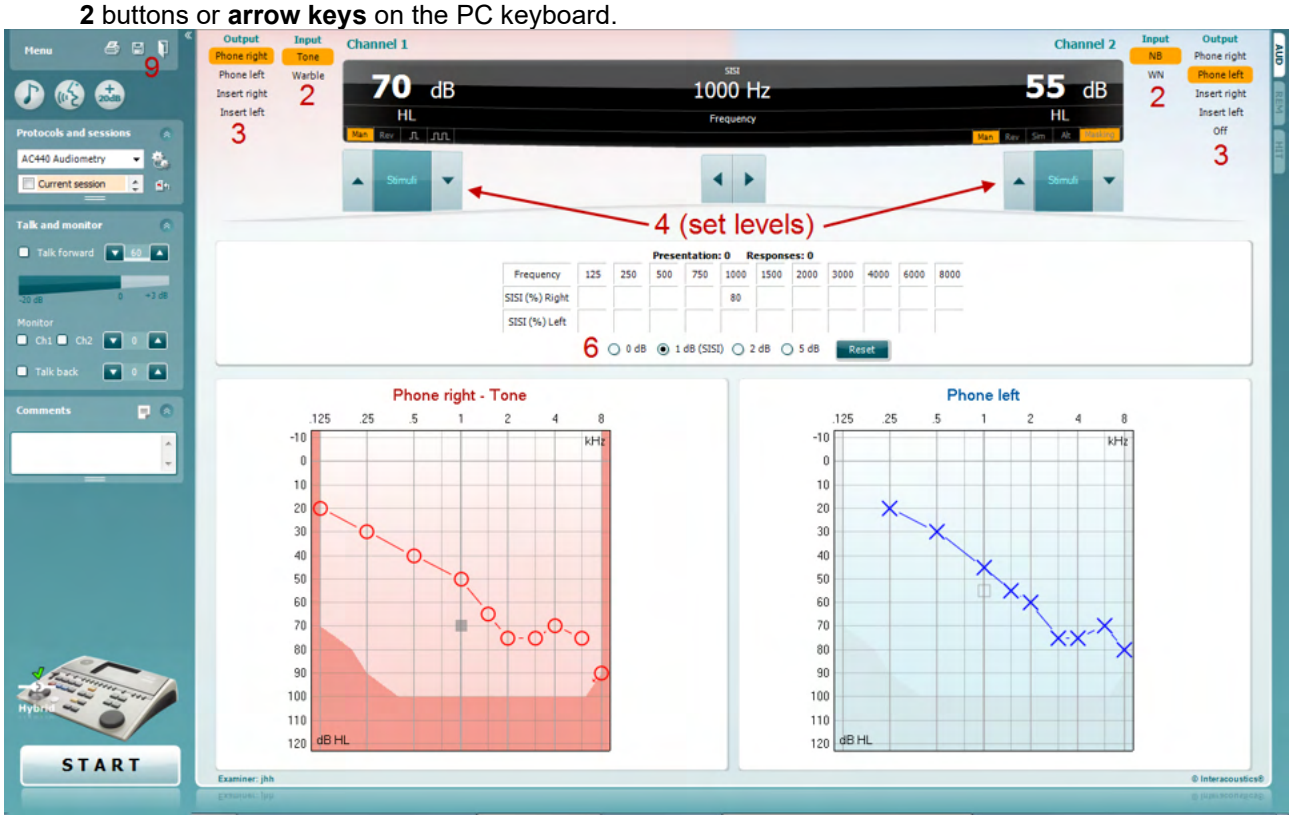
1) Open the AUD and enter the MLD screen by selecting **Menu | Tests | MLD**.
2) Select headset or inserts in the **channel 1** output list.
3) Select the frequency you would like to test; 250 Hz or 500 Hz is a good starting point
4) Set the intensity level to be the same level in both ears (50, 60 or 65 dB).
5) Press **START** and the signal will be presented to both ears in phase (SoNo condition).
6) Do a masked threshold search. Typically, the masked threshold for the SoNo condition will be equal to the noise level. When you have established a threshold, click in the Stimuli area for **Store** or press S on the PC keyboard. Once the SoNo condition has been stored, the cursor will automatically jump to the SπNo condition, in which the signal is out of phase and the noise is still in phase. Leaving the intensity of the noise at the same level, perform a threshold again, press **Store,** and the cursor will switch to SoNπ. Where the signal is in phase and the noise in reversed phase.
7) Establish the threshold once more.
8) Press **STOP** to end the test.
9) The MLD will be the difference between the threshold of the the homophasic condition (SoNo) and the threshold of one of the antephasic conditions (SoNπ or SπNo)
10) Save the MLD test by clicking **Save**

7.5 SISI

SISI is designed to test the ability to recognize 1 dB increase in intensity during a series of bursts of pure tones presented 20 dB above the pure tone threshold for the test frequency. It can be used to differentiate between cochlear and retrocochlear disorders as a patient with a cochlear disorder will be able to perceive the increments of 1 dB, as where a patient with a retrocochlear disorder will not.

Test Procedure:

1) Open the AUD and enter the SISI screen by selecting **Menu | Tests | SISI.**
2) Select Tone or Warble Tone in the **channel 1** input list. If needed masking can be selected in the **channel 2** input dropdown list.
3) Select headphones or inserts in the **channel 1/channel 2** output lists
4) Set the input level to 20 dB above threshold using the **dB HL Decrease/Increase channel 1/channel 2** buttons or **arrow keys** on the PC keyboard.



5) Explain to the patient that they will now hear a series of tones. If suddenly one tone seems louder that the other ones the response button should immediately be pushed.
6) Select the preferred type of SISI test. Setting the system to *1 dB* increments is considered to be the classical SISI. If the patient is able to hear these increments and scores high, cochlea damage is likely. You may also choose 0 dB, 2 dB, or 5 dB increments.
   If the patient does not manage to get a high score on the SISI test this could be indicative of retro-cochlear damage.
7) Start the test by pressing **START**. During the testing the frequency and intensity can be adjusted manually (see illustration). The system will automatically count the number of reactions from the patient. Note that the system needs 20 presentations to calculate a SISI score.
8) Press **STOP** to end the test.
9) Save the SISI test by clicking **Save**

7.6 QuickSin

Difficulty with hearing in background noise is a common complaint among hearing aid users. Therefore, the measurement of SNR loss (signal-to-noise ratio loss) is important because a person's ability to understand speech in noise cannot be reliably predicted from the pure tone audiogram. The QuickSIN test was developed to provide a quick estimate of SNR loss. A list of six sentences with five key words per sentence is presented in four-talker babble noise. The sentences are presented at pre-recorded signal-to-noise ratios which decrease in 5-dB steps from 25 (very easy) to 0 (extremely difficult). The SNRs used are: 25, 20, 15, 10, 5 and 0, encompassing normal to severely impaired performance in noise. For more information please refer to Etymotic Research's *QuickSINTM Speech-in-Noise Test* manual, version 1.3.

Test Procedure

1) Open the AC440 and enter the QuickSIN screen by selecting **Menu | Tests | QuickSIN**
2) Select the output level. For the majority of the tracks the channels are synchronized to ensure that the correct SNR level is achieved. Note: the 'Speech and Babble' Lists are not synchronized and will require the user to manually alter these to ensure the correct SNR setting for the test.
3) Select a list in the corresponding dropdown. e.g., "QuickSIN (List 2)".
4) Instruct the patient to repeat the sentences and try to ignore the noise that they will also hear through the headphones.
5) Press **START** to begin the test
6) The number of words in bold the patient repeats correctly should be scored by clicking on the score buttons.
7) When 6 sentences are scored a total score will be calculated.
   Note that if you press **Stop** before the 6 sentences of the list have been played and scored, no total score will be calculated.
8) The total score can be compared to the "SNR loss definitions".
9) Save the QuickSIN test by clicking **Save**

Comparing Aided and Unaided QuickSIN scores over time:

Clinicians are now able to compare the Unaided and Aided SNR scores.

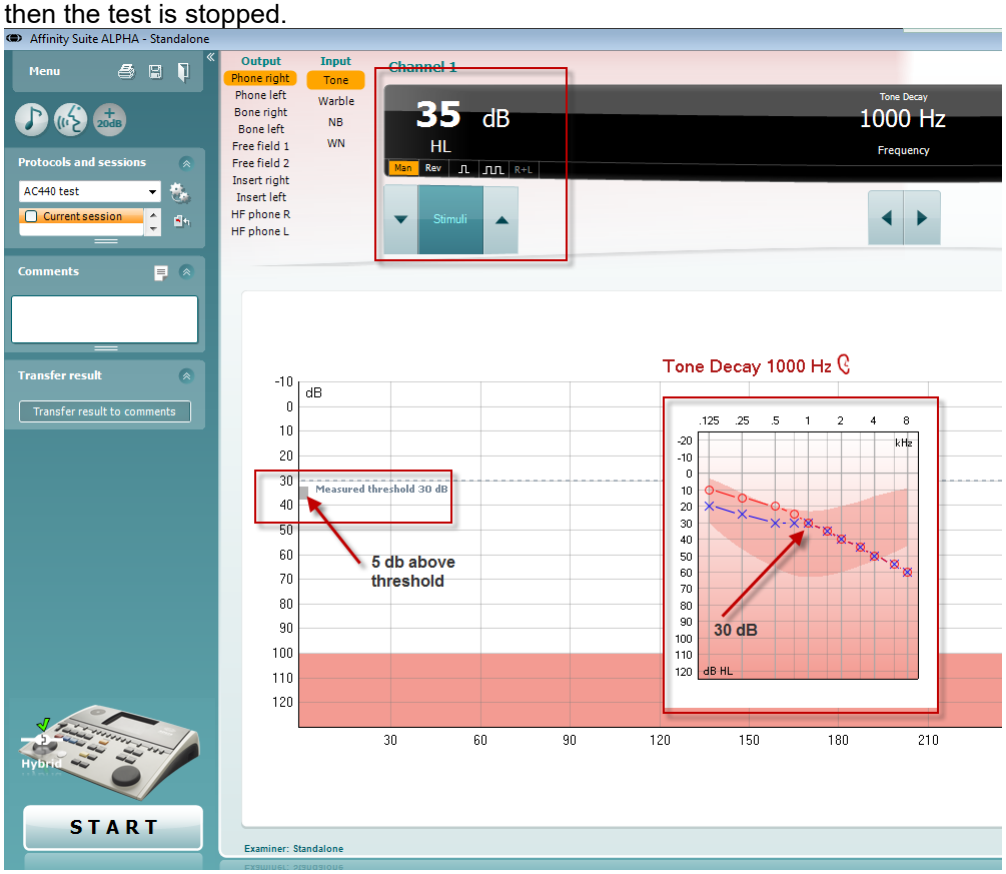
To view the scores in a graph view, click on the graph icon

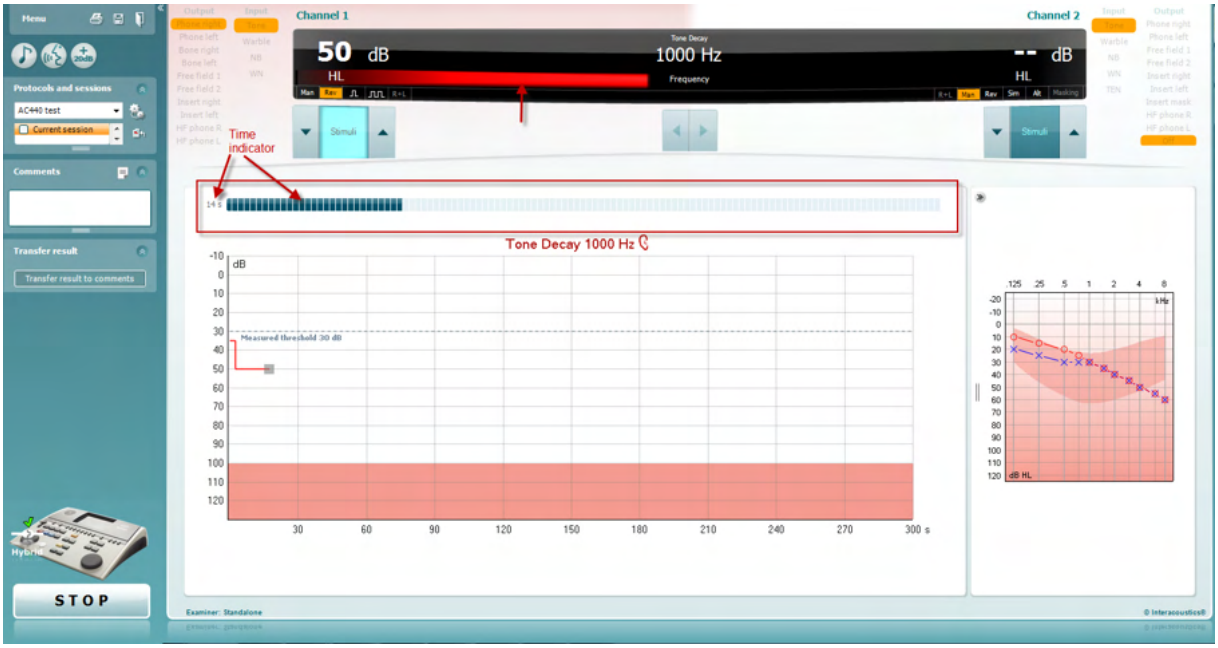
7.7 Tone decay

This is a test to help identify the adaptation of the auditory system (Carhart, 1957). It involves measuring the perceptual reduction in a continuous tone over time. This can indicate towards a cochlear or neural cause of deafness.

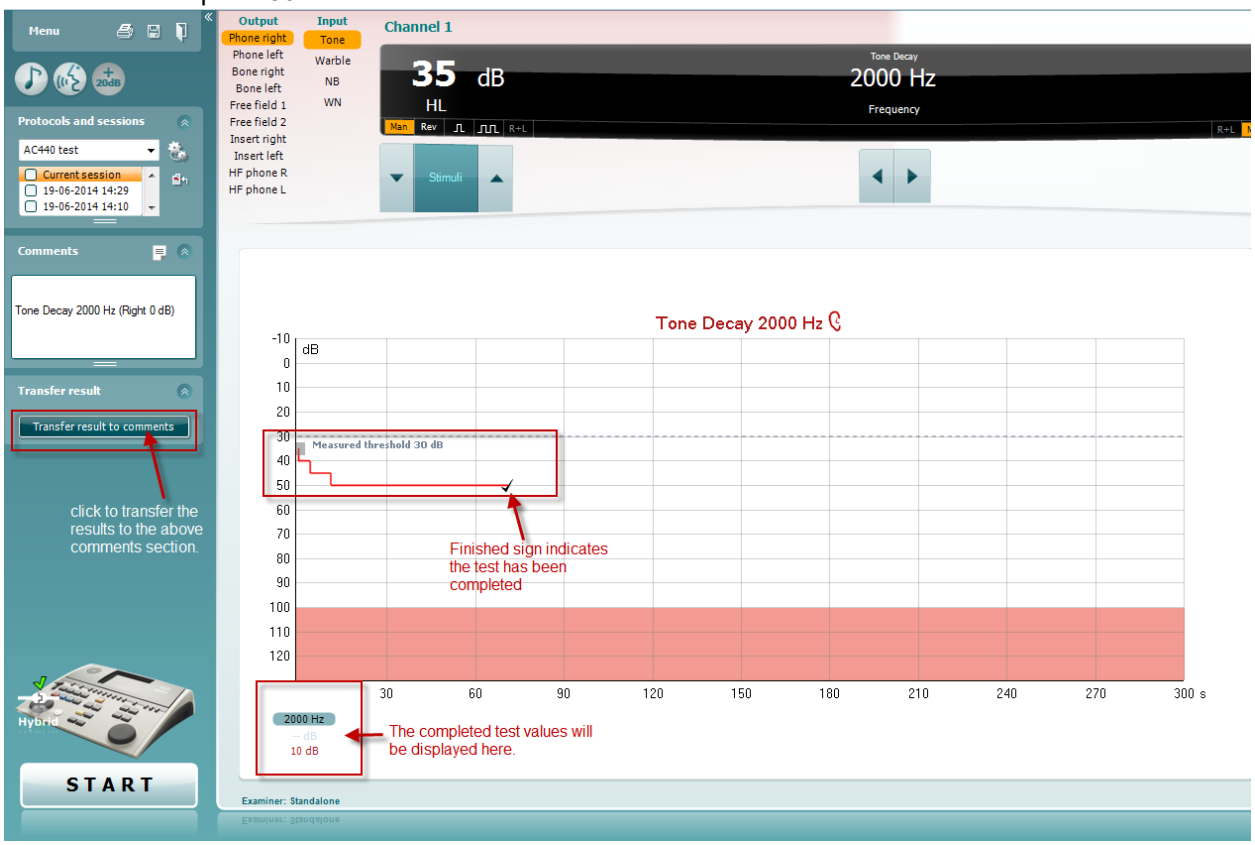
Test Procedure

1. The patient's Audiometry is obtained.
2. The patient is then instructed to continuously respond to the tone if they hear it and not respond as the signal fades/is absent.
3. The test is administered with a pure tone 5 dB below the subject's established threshold and then ascended in 5 dB steps without interruption until the subject responds. As soon as the subject responds, the system will begin timing (this is shown in the image below). If the tone is heard for a full one minute, then the test is stopped.



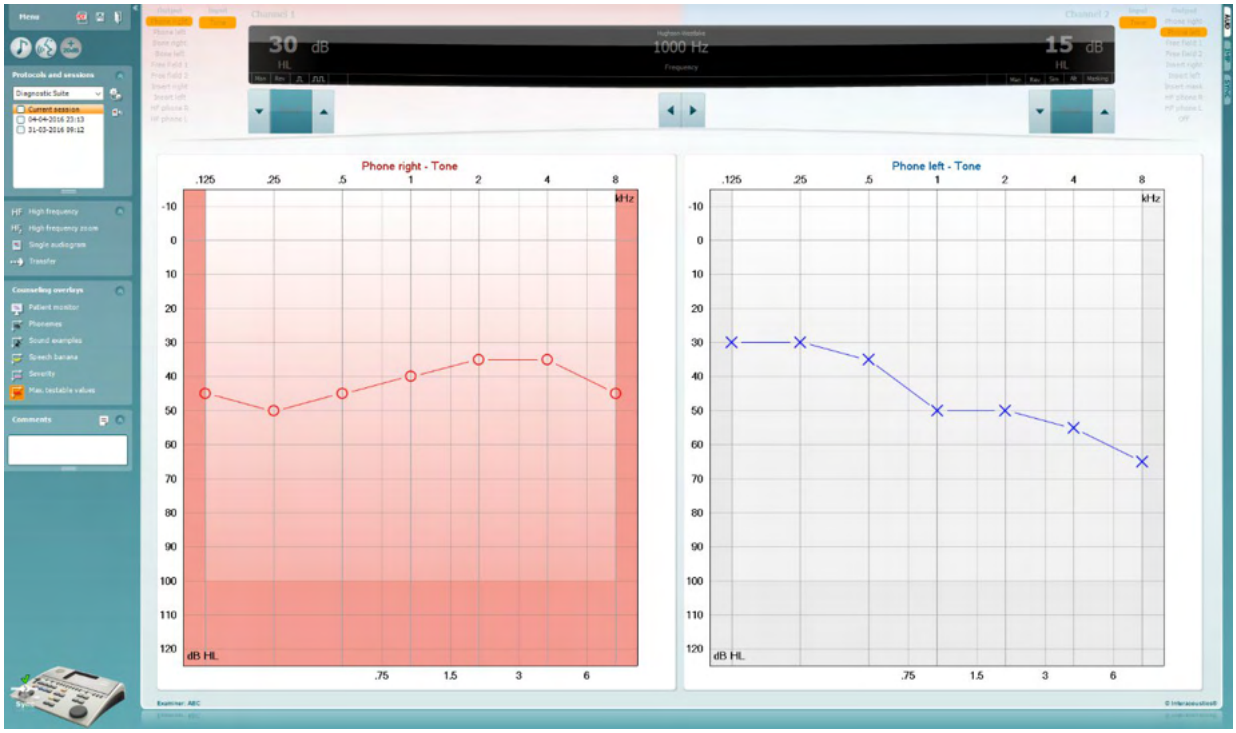


4. But if the subject indicates that they no longer hear the tone before the minute criteria is reached, then the intensity of tone is increased by 5 dB without interrupting the tone, but the timing at the top of the screen is reset.
5. The tone is continued to be raised in 5 dB steps until an intensity is reached that allows the subject to perceive the tone for full minute. The amount of decay occurring at each level suggests/indicates the amount of decay the subject is showing.
6. As a time saving measure, Carhart (1957) suggested that the test should be terminated when the subject fails to respond 30 dB above threshold.



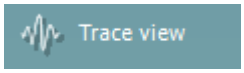
7.8 Hughson-Westlake

Hughson Westlake test screen can display Hughson-Westlake data obtained on standalone audiometers. If no pure tone audiogram exists, the Hughson-Westlake audiogram will be stores in the database as a tone audiogram.



7.9 Békésy

Békésy test screen can display Békésy data obtained on standalone audiometers. If no pure tone audiogram exists, the Békésy audiogram will be stored in the database as an averaged tone audiogram.



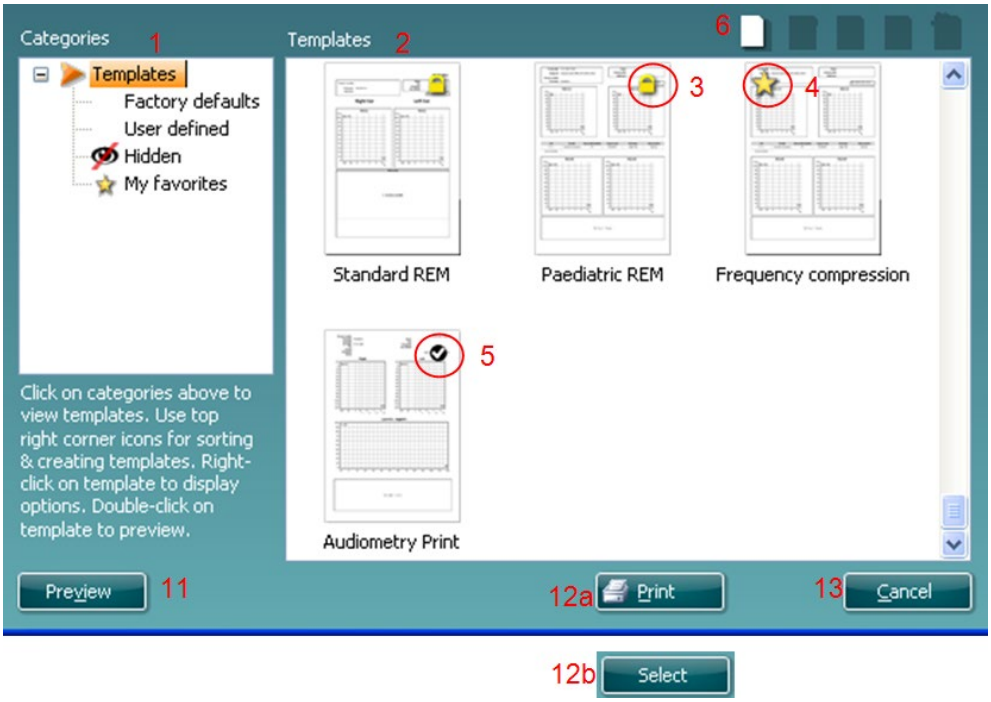
Toggle between audiogram view and Trace view.

8 Using the print wizard

In the Print Wizard you have the option to create customized print templates which can be linked to individual protocols for quick printing. The Print Wizard can be reached in two ways.

a. If you want to use a template for general use or select an existing one for printing: Go to **Menu/ File/Print Layout…** in both AUD and IMP tabs.
b. If you want to create a template or select an existing one to link to a specific AUD protocol: Select a specific protocol and select **Menu | Setup | AC440 setup**. Select the specific protocol from the drop down menu and select **Print Setup** at the bottom of the window.

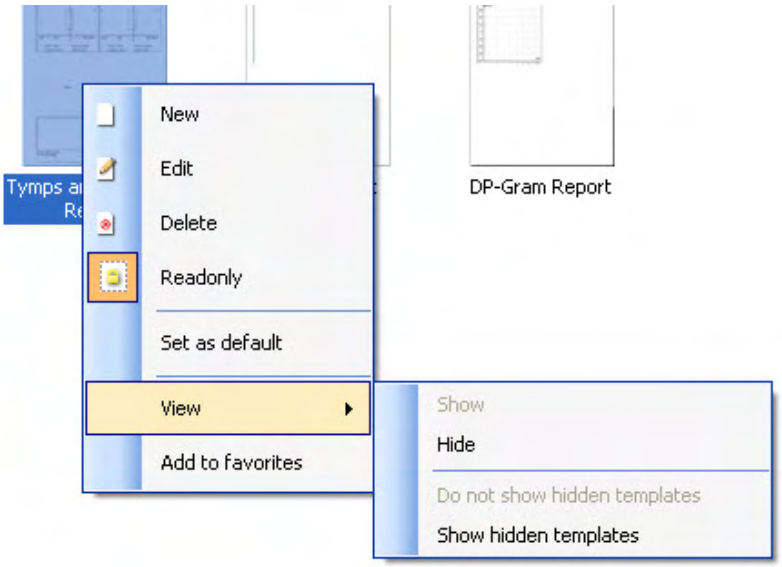
Now the **Print Wizard** window opens and shows the following information and functionalities:



1. Underneath **Categories** you can select
   - **Templates** to show all available templates
   - **Factory defaults** to show only standard templates
   - **User defined** to show only custom templates
   - **Hidden** to show hidden templates
   - **My favorites** to show only templates marked as a favorite
2. Available templates from the selected category are shown in the **Templates** viewing area.
3. Factory default templates are recognized by the lock icon. They ensure that you always have a standard template and do not need to create a customized one. However, in order to edit these default templates, they need to be saved under a new name. **User defined**/created templates can be set to **Read-only** (showing the lock icon), by right clicking on the template and selecting **Read-only** from the drop down list. **Read-only** status can also be removed from **User defined** templates by following the same steps.
4. Templates added to **My favorites** are marked with a star. Adding templates to **My favorites** allows quick viewing of your most commonly used templates.
5. The template that is attached to the selected protocol when entering the print wizard is recognized by a checkmark.
6. Press the **New Template** button to open a new empty template.
7. Select one of the existing templates and press the **Edit Template** button to modify the selected layout.

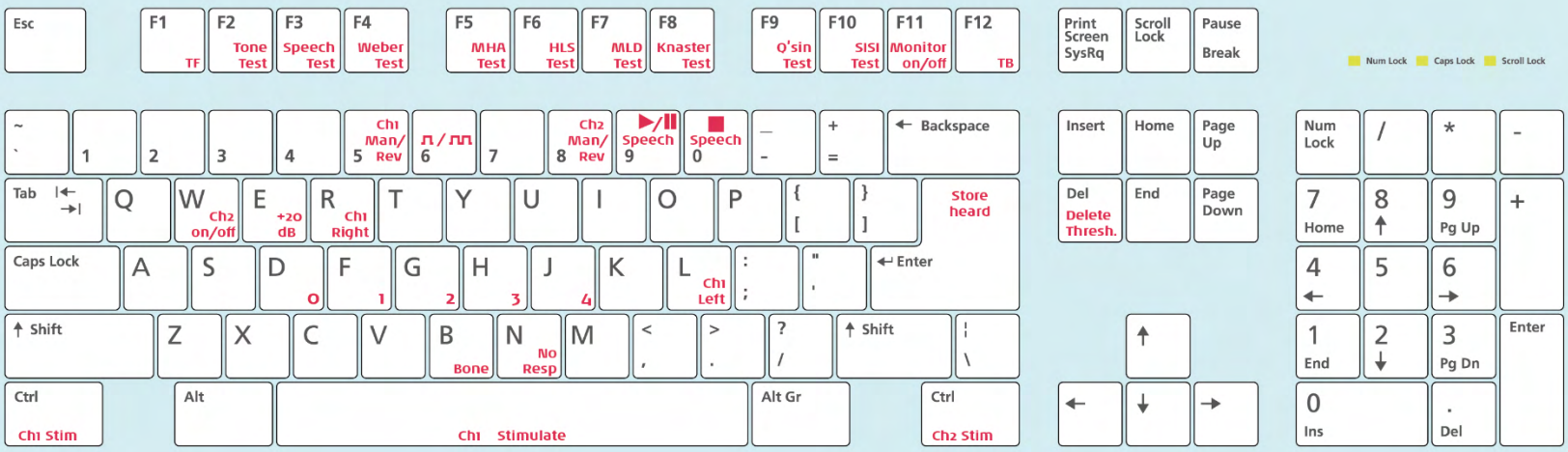
8. Select one of the existing templates and press the **Delete Template** button to delete the selected template. You will be prompted to confirm that you want to delete the template.
9. Select one of the existing templates and press the **Hide Template** button to hide the selected template. The template will now be visible only when **Hidden** is selected under **Categories**. To unhide the template, select **Hidden** under **Categories**, right click on the desired template and select **View/Show**.
10. Select one of the existing templates and press the **My Favorites** button to mark the template as a favorite. The template can now be quickly found when **My Favorites** is selected under **Categories**. To remove a template marked with a star from My Favorites, select the template and press the **My Favorites** button.
11. Select one of the templates and press the **Preview** button to print preview the template on screen.
12. Depending how you reached the Print Wizard, you will have the option to press
    a. **Print** for using the selected template for printing or press
    b. **Select** for dedicating the selected template to the protocol from which you got into the Print Wizard.
13. To leave the Print Wizard without selecting or changing a template press **Cancel**.

Right clicking on a specific template provides a drop down menu offering an alternative method for performing the options as described above:



For more information related to the Print reports and Print Wizard, please refer to the Additional Information document or the Print Report Quick Guide on www.interacoustics.com

Keyboard Shortcuts



TONE

Up arrow	:	Ch1 down
Down arrow	:	Ch1 up
Left arrow	:	Freq down
Right arrow	:	Freq up
Page up	:	Ch2 down
Page down	:	Ch2 up
Shift + A	:	Single/dual audiogram
Shift + H	:	HF on/off
Shift + Z	:	HFz on/off
Shift + H	:	MF on/off

Speech graph view

Up arrow	:	Correct
Down arrow	:	Incorrect
Left arrow	:	Ch1 down
Right arrow	:	Ch1 up
Page up	:	Ch2 up
Page down	:	Ch2 down

Speech table view

Up arrow	:	Ch1 up
Down arrow	:	Chl down
Left arrow	:	incorrect
Right arrow	:	correct
Page up	:	Ch2 up
Page down	:	Ch2 down

Save & print

Save session	:	Alt+s
Save & Exit	:	Alt+x
Print	:	Alt+p

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