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Automatic Audiometry
An overview

PRODUCT INSIGHTS

Automatic audiometry includes procedures that allow the hearing threshold to be determined with minimal operator intervention, while still ensuring accurate and reproducible results. These methods are particularly useful in clinical practice, as they standardize the testing procedure and reduce the time required for assessment, without compromising diagnostic reliability.

The two tests available are:

- **Auto Threshold**, which applies a modified Hughson-Westlake technique to determine pure tone thresholds automatically.
- **Békésy Audiometry**, which provides additional diagnostic information by comparing tracings obtained with continuous and interrupted tones, allowing classification of auditory function according to Jerger's categories.

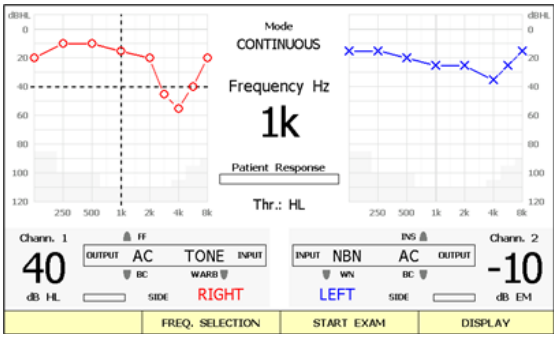
Both procedures are displayed in dedicated test windows, with results updated in real time and stored directly on the audiogram.

AUTO THRESHOLD

Auto Threshold pure tone audiometry allows the clinician to establish hearing thresholds across different frequencies through an automatic procedure. The method applied is the Hughson-Westlake technique, as adapted by Martin, which offers a modified and shortened version of the procedure described in ISO standard 8253-1 for determining air conduction thresholds without masking.

Auto Threshold Test Window

To run the Auto Threshold test, the dedicated window can be opened from the main menu. Until the automatic procedure is started, the operator may still perform a standard pure tone audiometry session from within the Auto Threshold window, using either air or bone conduction.



Auto Threshold Test Window (Inventis instruments)

Frequency selection

By pressing the Frequency Selection button, a window

opens allowing the operator to select the frequencies to be examined. The 1 kHz frequency is mandatory and cannot be deselected. Frequencies available for testing are 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz. The chosen configuration is retained even after the instrument is powered off.

Test procedure

The test begins by pressing the Start Exam button and finishes automatically once all the selected frequencies have been analysed for both ears. The procedure can be interrupted at any time by pressing the End Exam button (which replaces Start Exam once the test is in progress). Starting the exam will erase any previously saved air-conduction threshold data.

The Auto Threshold procedure includes an initial familiarization step, designed to train the patient in the response process. The patient is instructed to press the response button every time a stimulus is heard, and release it once the sound ceases. Stimuli are presented for 1.7 seconds, followed by a randomized pause between 1.7 and 2.5 seconds.

During this step, the message Familiarization appears on the display. The tone presented is always 1 kHz at an initial intensity of 40 dB HL (fixed parameter). The threshold is determined as the lowest level at which the patient responds positively to at least 2 out of 3 presentations, following the 5 dB up / 10 dB down rule. Once the familiarization threshold is identified, the test proceeds automatically.

Frequency order

Testing begins with 1 kHz, followed by higher frequencies in ascending order, then lower frequencies in descending order, and finally 1 kHz again. After all selected frequencies are tested on one ear, the procedure is automatically repeated on the opposite ear.

If the patient fails to detect a stimulus even at the maximum permissible intensity for a given frequency after 10 consecutive presentations, the tone is marked as not heard.

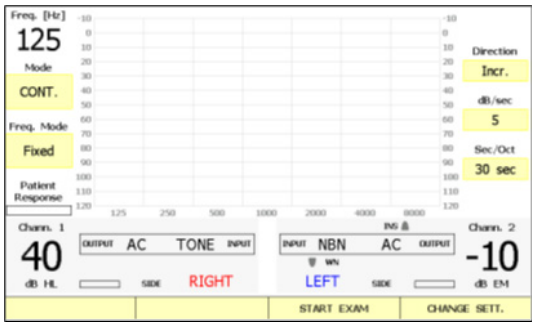
The audiogram is updated in real time during the test, displaying the results as they are obtained.

BÉKÉSY AUDIOMETRY

The Békésy test is an automatic audiometry procedure designed to provide detailed diagnostic information, primarily through the comparison between tracings obtained with continuous and interrupted tones.

In this test, the patient directly controls the tone intensity: pressing the response button decreases the intensity, while releasing it increases it. The system automatically detects the hearing threshold either at a selected set of frequencies (Fixed mode) or across a continuous frequency range (Sweep mode), with the tone varying smoothly from lower to upper limits.

The comparison between tracings obtained with continuous and interrupted tones allows classification of the results (Békésy curves) into four categories, as described by Jerger (see Bibliography).



Békésy Test Window (Inventis instruments)

Békésy Test Window

The display shows the tracing in real time along with the main test parameters.

- Tone presentation mode (left side of the screen):
  - Continuous
  - Pulsed at 2 Hz
  - Pulsed at 1 Hz with LOT (Lengthened Off Time: duty cycle reduced to 20%)

- Frequency scanning mode:
  - Fixed: the tone moves directly fro the next (or prior, if descending).
  - Sweep: the tone frequency changes continuously in 1/24-octave steps within the selected range (ascending or descending).

On the right side of the graph, the following exam parameters are displayed:

- Frequency scanning direction: ascending or descending
- Tone intensity changing rate (dB/sec)
- Frequency change rate (seconds per frequency in Fixed mode; seconds per octave in Sweep mode)

Parameter adjustments

Parameters are set by pressing Change Sett. and then selecting the relevant field on the screen. In addition, the frequencies (Fixed mode) or frequency range (Sweep mode) to be analysed can be defined directly by touching the graph. These will be highlighted once selected.

Running the test

The test is started by pressing the Start function button. Once underway, the parameters cannot be changed. The tracing is displayed continuously in real time and plotted as either:

- a continuous line (continuous tone),
- a dotted line (pulsed tone),
- or sparse dots (LOT pulsed tone).

The exam can be terminated early by pressing Stop.

All tracings obtained for the same ear are displayed together on the graph. However, if a new exam is conducted with the same combination of side, transducer, and stimulation mode, the previous tracing will be overwritten.

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PI - Automatic Audiometry An overview_Rev01_Rev01 • Date: 2025.09.10

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