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Performing Tympanometry: a Guide to Controls and Settings

PRODUCT INSIGHTS

INTRODUCTION

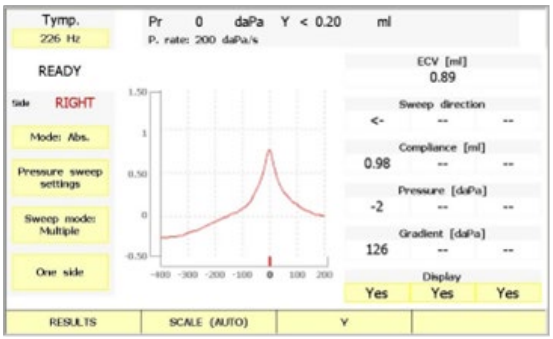
Tympanometry is one of the cornerstone tests in middle ear assessment, providing information on ear canal volume, middle ear pressure, compliance, and the morphology of the tympanogram. The graphical interface of Inventis middle ear analyzers includes all the essential parameters expected for this type of examination, while advanced functions such as high-frequency probe tones and multi-component admittance measurements are available in specific models like Inventis Clarinet Plus. This Product Insight outlines the structure of the tympanometry window, the test parameters, and the examination workflow, highlighting both the standard features common across Inventis devices and the advanced options available on higher-end configurations.

TYMPANOMETRY WINDOW

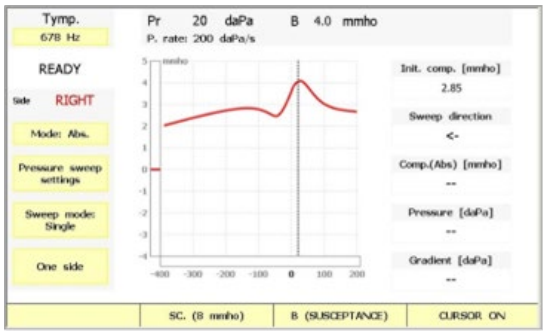
To perform a tympanometry test, the operator simply presses the corresponding button on the keyboard.

The graphical interface of the tympanometry window is illustrated below:

226 Hz tympanometry test window



678 Hz tympanometry test window



At the top left of the screen, the name of the current test is displayed. Immediately below, the system shows information about the probe status and the progress of the test.

Further down, parameters specific to tympanometry are displayed, including:

- the stimulated ear;
- the tympanogram display mode (compensated or absolute);
- the rate of the pressure sweep;
- selection of single or multiple scans;
- the graph display mode (single or bilateral).

The central portion of the screen is occupied by the tympanogram of the selected ear, or by graphs of both ears when bilateral display is enabled. The horizontal axis corresponds to the applied pressure, from the initial positive value to the final negative value set in the instrument settings. In absolute mode, a marker on the right side of the graph indicates the current measurement component (Admittance Y, Susceptance B, or Conductance G).

On the right side of the screen, the numerical results of the test are displayed.

TEST PARAMETERS

- The default probe tone frequency is always 226 Hz. On Clarinet Plus only, it can be switched to 678, 800 or 1000 Hz. Values can be changed by pressing on the relative yellow-highlighted area in the top-left part of the screen.

- Multi-component tympanometry (Admittance Y, Susceptance B and Conductance G) is available only on Clarinet Plus. Press the third soft-touch button to decide which one to show. If "single sweep mode" is selected, components B and G can also be displayed together.

- By touching the dedicated yellow-highlighted area (PRESSURE SWEEP SETTINGS), it is possible to set:
  - **Start pressure:** initial positive test pressure, between +50 and +400 daPa, in 50 daPa steps (default: +200).
  - **Stop pressure:** final negative test pressure, between –50 and –600 daPa, in 50 daPa steps (default: –400).
  - **Pressure rate:** rate of variation of the applied pressure. Selectable values: 15, 50, 100, 200, 300, 400, 600 daPa/sec, or 200–600 daPa/sec. In this latter mode, the rate is automatically regulated at 200 or 600 daPa/sec according to the compliance variation (higher rate for low variation, lower rate for high variation). The rate set is displayed above the graph.

- The tympanometry test can be performed in single scan mode (one descending sweep) or repeated up to three times with ascending or descending sweep. This option is selected by touching the yellow-highlighted area on the screen. Multiple scan mode cannot be used when both tympanograms are displayed. If the test is interrupted in multiple scan mode, it can be resumed maintaining the previous traces by pressing the START/STOP control.

- To adjust the compliance scale, press the SCALE function button. The selectable values depend on whether the tympanogram is displayed in compensated or absolute mode. The Auto option automatically selects the scale to ensure the highest possible resolution.

- The tympanogram display can be switched between compensated and absolute by touching the yellow-highlighted area of the screen. In absolute mode, measured compliance values are displayed directly; in compensated mode, they are shown minus the equivalent ear canal volume (ECV).

- The display mode for the graphs (single or bilateral) can also be toggled from the corresponding yellow-highlighted area.

All parameters are saved automatically by the instrument and retained at each power-up.

The Clarinet middle ear analyzer can also display the results of the tympanometry test at 226 Hz together with

those of the acoustic reflex test. The screen is accessible by pressing the RESULTS function key.

TEST RESULTS

The results of the tympanometry examination are displayed on the right-hand side of the window. The following values are calculated:

ECV (Ear Canal Volume)

This is the compliance value measured at the start pressure of the test, i.e., the highest pressure within the selected test range. This parameter is also referred to as the equivalent volume.

Scan Direction

Indicates whether the pressure sweep was applied in an ascending or descending direction. This information is not shown when bilateral viewing mode is selected.

Compliance / Compliance (Abs)

The amplitude of the tympanogram peak measured against the ECV. In absolute mode, this corresponds to the compliance at the tympanogram peak. Compliance values are not displayed when B and G components are shown together.

Pressure

The pressure value recorded at the tympanogram peak.

Gradient

The gradient of the tympanogram can be calculated using two different methods, selectable from the settings screen.

- Method 1: Width of the tympanogram at 50% of b, where a represents the peak amplitude of the tympanogram and b is the difference between a and the ECV (expressed in daPa).
- Method 2: c is the average compliance measured at +50 daPa and -50 daPa relative to the peak. The gradient is calculated as:

$$Gradient = \frac{a-c}{b}$$

If the compliance or the tympanogram peak pressure cannot be determined, the value will be replaced with "N.F." (Not Found).

Cursor

The cursor function allows the operator to check each individual value of the displayed component. It can be activated using the fourth soft key on the right-hand side of the screen. The right-hand knob is then used to move the cursor position, with the current component value shown in the upper part of the screen.

HOW THE EXAMINATION IS CONDUCTED

Ear tip and probe placement

The first step is to select the most suitable ear tip for the patient and insert the probe with the ear tip into the ear canal until a secure pressure seal is achieved.

Automatic mode

After selecting the ear to be tested (left or right) and the scan mode, the procedure can be started simply by pressing the START/STOP button or the corresponding button on the control box (CB).

For multiple scans, once the initial descending sweep has been completed, the direction can either be maintained or reversed. Additional scans are then activated by pressing the PRESSURE SWEEP or START/STOP buttons on the CB.

If enabled in the test settings, the examination can also be configured to start automatically as soon as the instrument detects proper probe placement in the ear canal.

Manual mode

After selecting the test side (left or right) and the scan mode, pressing the PRESSURE button primes the system and starts the procedure. Once the maximum pressure value is reached (as defined in the settings), this value can be manually adjusted by turning the right-hand knob on the instrument. Each adjustment updates the current compliance value, which is plotted on the graph in real time.

For multiple scans, the system automatically moves to the next test when the rotation direction of the knob is reversed.

During the test, the instrument first raises the pressure in the ear canal to the predefined maximum positive value. The tympanogram recording then begins and continues until the pressure decreases to the minimum value at the selected rate. At this point, the indices described previously are calculated and displayed, and the ear canal pressure is returned to atmospheric, marking the end of the test.

Throughout the test, the current pressure value is indicated by a vertical dash below the "x" axis of the tympanogram. By default, the graph is shown in absolute (uncompensated) mode, and will appear in compensated mode, if selected, only once the examination has concluded.

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