EA 87

Clinical Impedance

Audiometer

User Manual

Table of Contents

Introduction

Thank you for purchasing this product, please review the content of this manual carefully in order to install the software and faster access to software features.

EA 87 is an automatic middle ear analyzer and has the following capabilities:

❖ Ability of operating the following Tests:

- Low Frequency Tympanometry /Low Pitch Probe tone 226Hz.
- Acoustic Reflex Test (Ipsilateral)
- Acoustic Reflex Test(Contralateral)
- Eustachian Tube Function Test for Normal Tympanic Membrane.
- Eustachian Tube Function Test for Perforated Tympanic Membrane.
- Audiometry Test.

❖ Specific pages for each test.

❖ Exclusive Internal setting, Touch screen LCD 320*240.

❖ Internal memory for storing 8 patients.

❖ Ability of transferring information through USB port.

Precautions

	**Warning:** Indicate situation which if it is not avoided to be occur, may cause death or severe injuries.
	**Caution:** It is used with safety alert symbol and Indicate situations which if it is not avoided may cause moderate or minor injuries.
	**Notice:** It is used to address practices not related to personal injury

1-To prevent fire or electric shock hazard, do not expose this product to rain or moisture.

2- Do not open the device case in order to avoid the electric shock.

1- Make sure to insert the probe tip into the ear in a way that does not cause irritation or cause damage to the ear canal walls.

2- If it is possible use a new ear tip for each patient, if it not possible clean the ear tip before use for other patients.

3- In the Audiology clinics there is a risk of exposure (or exposing others) to contagious diseases. When performing otoscopy and Tympanometry, precautions must be taken for controlling contaminants in the environment. Exposure to contaminants may occur when performing a visual inspection,

handling and placing Tympanometry probe tips in ears, etc. The use of gloves is indicated in the presence of blood, mucus, ear drainage, or other body fluids.

4-Tympanometry probe tips that are contaminated may be sterilized in a soaking solution.

5-Do not use probe tip without ear tip.

6-In the Acoustic Reflex test make sure not to use stimulus with excessive intensity level.

1. The transducers (headphones, bone conductor, etc.) supplied with the instrument are calibrated to this instrument, exchange of the transducers requires re-calibration.

2-Keep away from shock and mechanical vibration

The Tympanometer display is the most sensitive part to mechanical shock. The Tympanometer display is touchable (Touch Screen) so it is too sensitive and must be push with the minimum pressure on it.

3- Before starting the test make sure that there is not any wax in the ear canal. In the Tympanometry procedure if there is wax in the canal, applying pressure may cause the wax pull into the probe tip and cause it to close.

4-Keep the device away from pouring liquids

In the case of pouring liquids on the device, turn the device off and do not turn it on until you are sure that the liquid is completely vaporized.

Terms and conditions of Guarantee

LORECa Guarantees this product for 24 months from installation date under the following terms:

1-This guarantee only cover spare parts and service charge and does not include body and accessory expenses.

2-Services provided by this guarantee are only available at LORECa authorized service center in Turkey.

3- This guarantee does not apply to the following cases:

A) Prior repairs by unauthorized centers or people.

B) Damage due to natural causes, power failure, improper usage and accidents which occur during shipment or transit.

Buttons Function

1-Tymp: Start/Stop:

Specific button for choosing the automatic mode of operating Tympanometry Test

2-Auto:

After pressing this button the Tympanometry test will run automatically and Tympanogram curve will appear on the device LCD.

***NOTICE**: To stop the tests press the TYMP button once more.

3-Expand:

If you need High Pressure level, press this button.

4- Pressure Control Dial:

For adjusting the pressure in the desired pressure level (in dapa scale).

5-Ipsi/Contra:

Specific button for selecting the Acoustic Reflex Test.

*****NOTICE:** If you want to run the test in Ipsi mode, press this button once and if you want to run the test in Contra mode press this button twice.

6- Frequency: For adjusting the pure tone frequency from 250Hz-8 KHz

7- Intensity: For adjusting the output Intensity Level. Intensity changes are adjustable in 5dB steps.

8- Tone Switch: To present the signal to the test ear.

9- Audio: EA 87 device is capable of operating the Audiometry screening test by pressing the Audio button.

Device Input and Output connections

1- Headset Connector: Output jack for connecting the Prope Set Connector

2-PC/Printer: Output jack for connecting the device to the computer or to the printer.

3-Tube: Output jack for connecting the air pressure tube

4- PC/USB: Output jack for connecting the device to the computer

5-Comp Cal: Volume meter for calibrating the compliance diameter

6-Patient Sw: Output jack for connecting the Patient signal button for recording the Audiometry test results.

7- LCD Contrast: Depending on the examiner view angle (Contrast can be adjusted accordingly.) e LCD brightness reaches the best quality.

Device External power supply components:

8-Turn on and Turn off switch

9-Power outlet connection jack

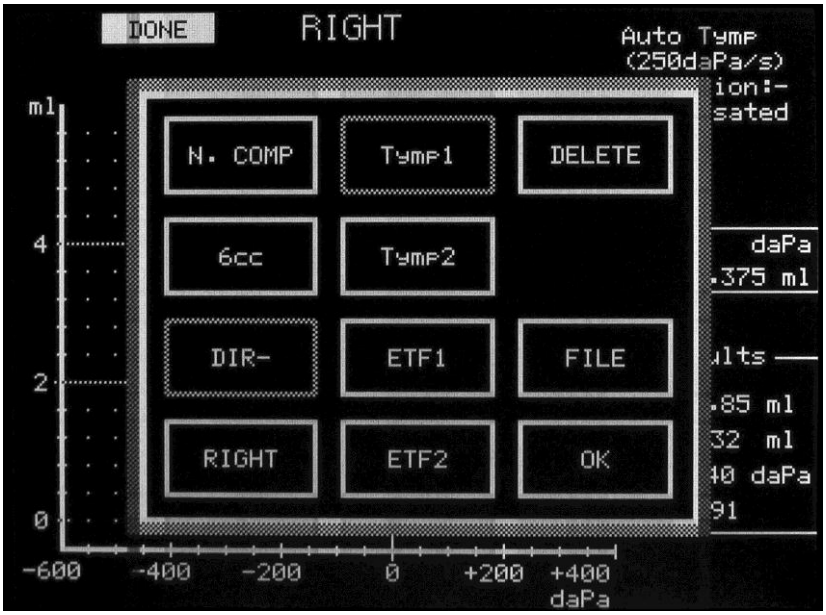
10-Fuse

Power supply input: 220 to (180-250) V 50Hz/20 VA

Basic Safety and General requirements for Medical electrical Equipment is According to IEC 60601-1

Description of Display pages

If you press the touchable LCD screen by specific pen, the list of different tests and options will be appeared and then you can choose the specific pages related to your desired test as following:



RIGHT/LEFT

This option is considered for selecting the test ear in different tests by changing the touchable button related to the left and Right ear selection.

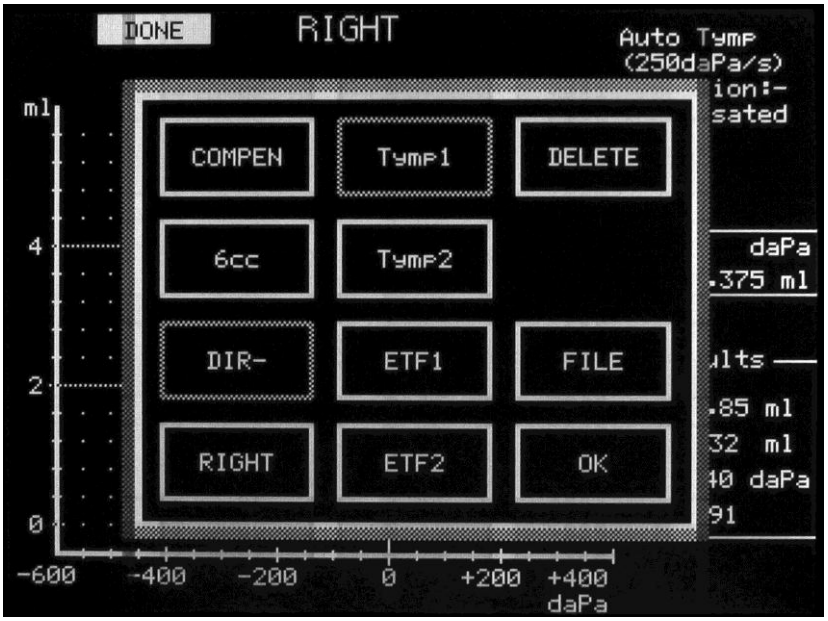
3CC

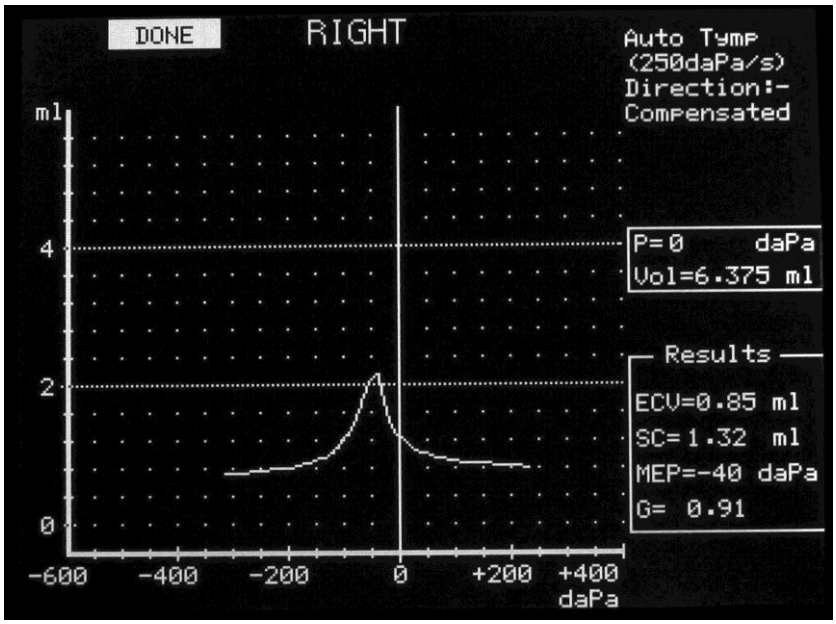
If the static compliance value has increased (like Type Ad Tympanogram) and the pick of the Tymoanogram curve exceed from the curve, by selecting the 6cc scale (by touching the LCD screen and stimulating the 3 cc option and appearing the 6 cc option) you can have the extended scale for having the best shape of the Tymoanogram curve.

COMPEN

First of all we should mentioned that displaying and saving the Static Compliance results in Tympanometry Test is applicable in two methods:

1-By choosing the **COMPEN** option which will be appeared as **SC.**

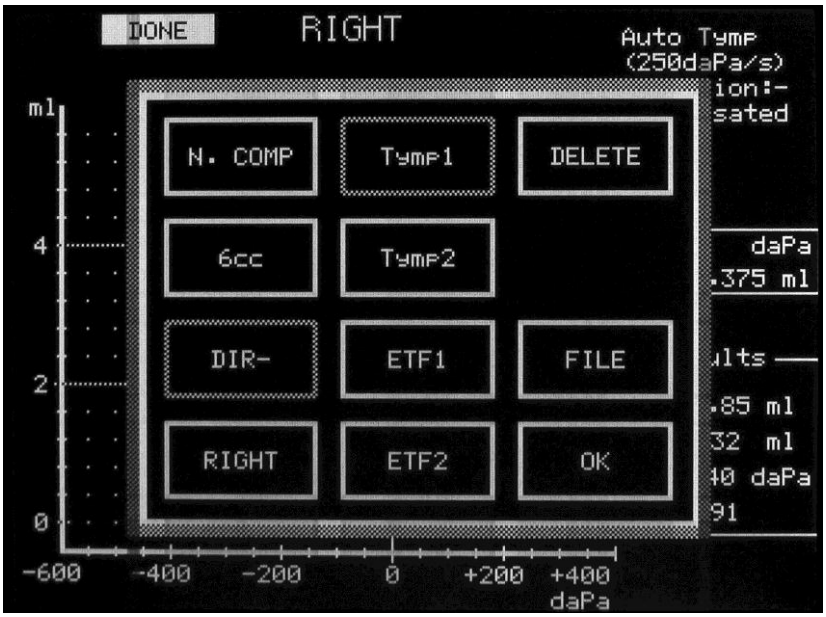


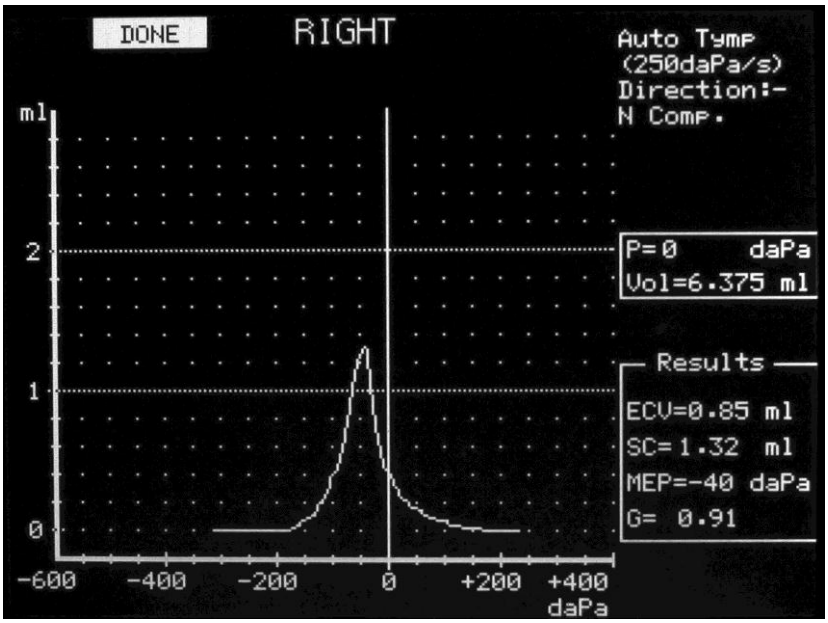


2- By stimulating the touch screen LCD and changing the **COMPEN** option to **No.COMPEN** ,static compliance result will be saved as C1 in the +200dapa pressure and C2 by changing the pressure to 0 dapa and negative pressure ranges and at the end static compliance value will be acquired through SC=C2-C1

***NOTICE:** Note that as the Tympanometry test is operated automatically therefore SC calculated automatically by device.

N. COMP





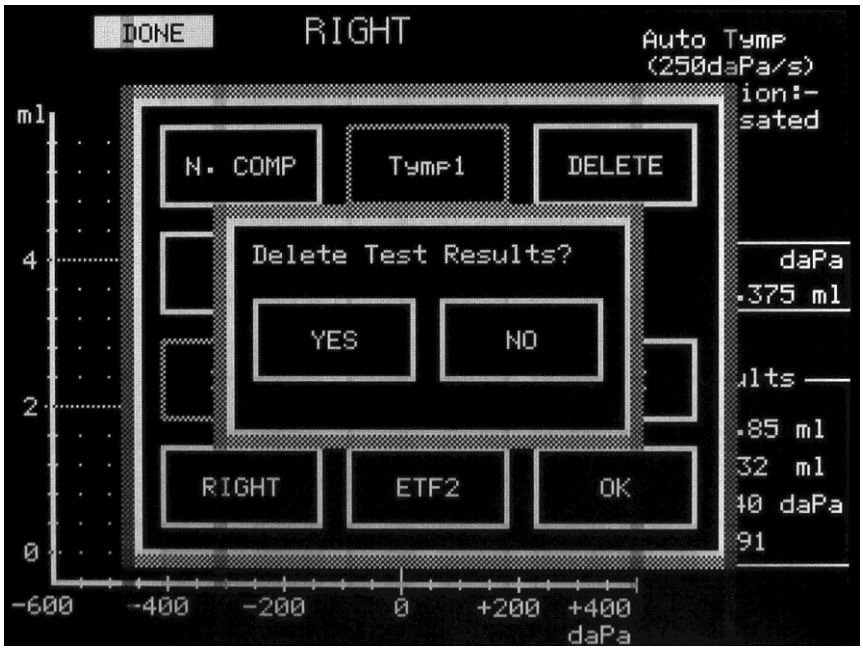
DIR-

By pressing the touch screen LCD and select the –DIR option ,Tympanogram curve will be represented on the display from the positive pressures and by pressing the –DIR once more ,the tympanogram curve will be presented on the display from the negative pressures.

Note: +DIR option is only active in the manual mode of Tympanometry test.

DELETE

In order to remove the result of each test, press the touch screen LCD and select DELET (touchable key) to remove the test result.

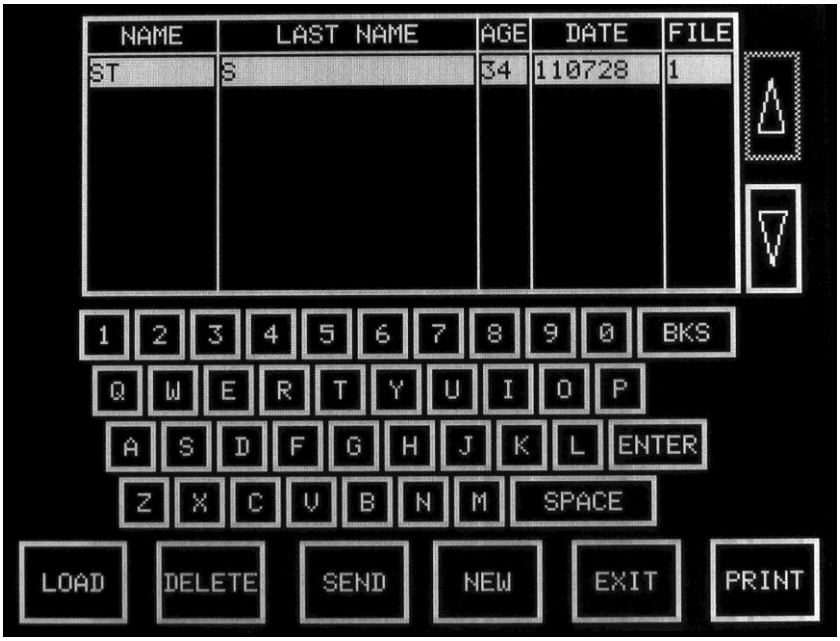


OK

In order to close the list of tests or to confirm each one the previous activity press OK.

FILE

Storing, Transmission and Loading the files



1- Browsing the data saving location (Max. 8 location)

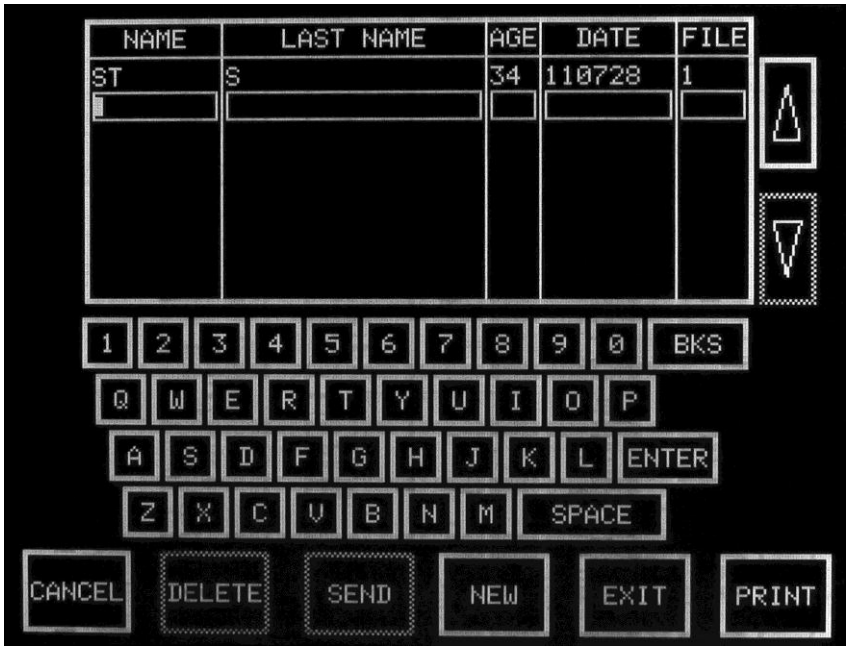
2- File Name and Number

3-Standard Touch keyboard

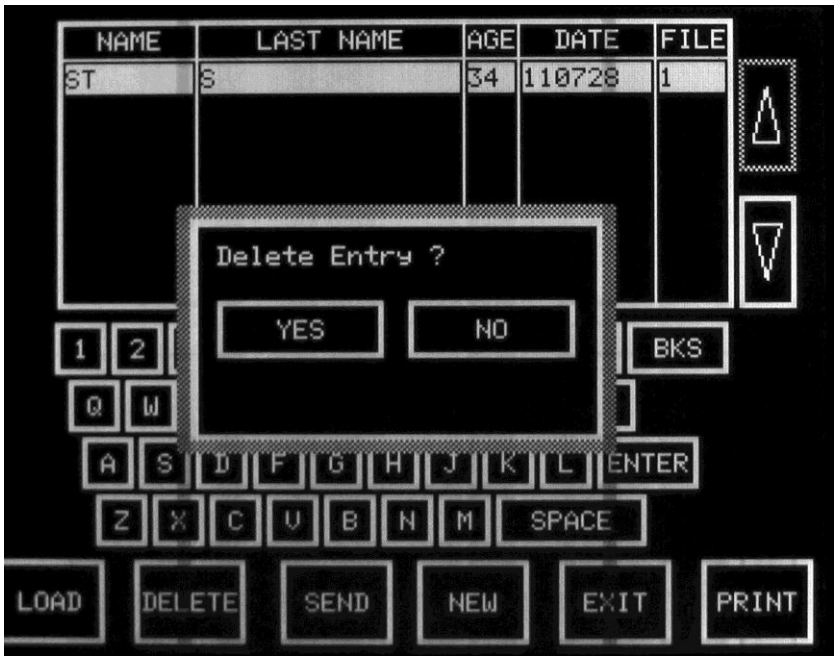
4-(Load) Opening one of previous saved files into the entire displayed page

5-(Save) saving the new results/

6-(Cancel) canceling the saving steps



7-Deleting one of the stored files



8- Sending data to the computer

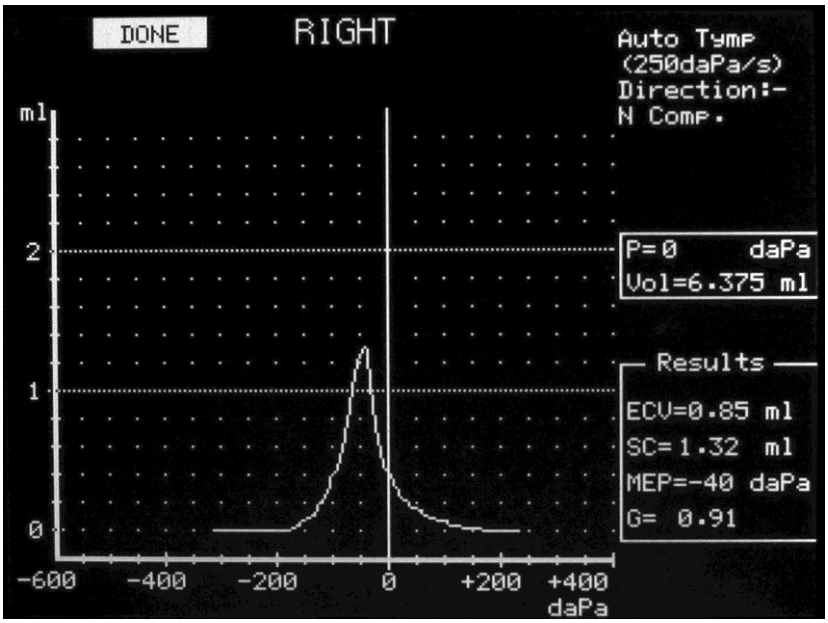
9-Clearing all of the data in the entire page

10-The number of the loaded file

11-Exit

TYMP 1

By selecting the TYMP1 touchable key, the Tympanometry test specific page will appear. Method of operating the test by selecting this option will be automatic.



TYMP1 page description:

1**-** Displaying the performed configuration.

2- Displaying Block and High Volume condition.

3- Displaying the pressure and volume at the moment of operating the test

4-Results

-E.C.V: Ear Canal Volume: indicates the volume of the section of the auditory canal between the ear tip and the eardrum in ml.

-S.C: Static Compliance: indicates the maximum value of the compliance from the tympanogram in ml.

-MEP: Middle Ear Pressure: indicates the pressure with the highest measured compliance.

-G: Gradient - calculations are reported as the tympanogram width at half of peak compliance expressed in dapa.

5- Displaying the Done/Rec/Pass condition.

Note: when situation for operating the tympanometry test is suitable, at the top of the page ‘’Pass ‘’ will be appeared and at the process of operating the test ‘’REC’’ will be appeared and at the end of the test ‘’done’’ will be appeared and the result will display.

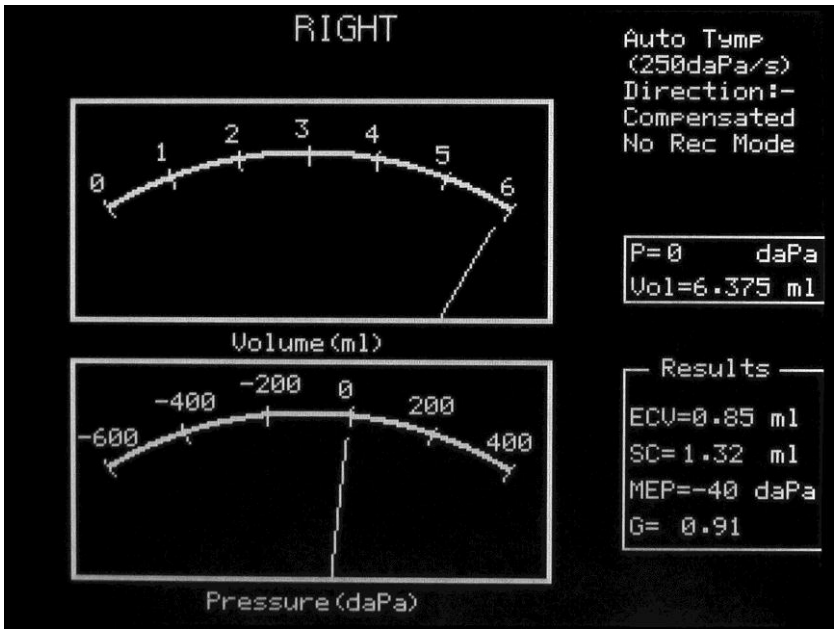
6-Tympanogram Graph related o the Test ear.

7-Vertical axis for displaying the volume (in two option: 3cc and 6 cc)

8-Horizental axis for displaying the pressure value (+400dapa to -600 dapa)

TYMP 2

If you want to perform the tympanometry test in a manual mode, select the TYMP2 touchable key from the list.



1-Displayig the adjusted configurations

2-Displaying the Block and Hi volume condition.

3-Displayig the pressure and Volume value at the moment of operating the test.

4-Results:

-E.C.V: Ear Canal Volume: indicates the volume of the section of the auditory canal between the ear tip and the eardrum in ml.

-S.C: Static Compliance: indicates the maximum value of the compliance from the tympanogram in ml.

-MEP: Middle Ear Pressure: indicates the pressure with the highest measured compliance.

-G: Gradient - calculations are reported as the tympanogram width at half of peak compliance expressed in dapa.

5- Displaying the Done/Rec/Pass condition.

***NOTE: when situation for operating the tympanometry test is suitable, at the top of the page ‘’Pass ‘’ will be appeared and at the process of operating the test ‘’REC’’ will be appeared and at the end of the test ‘’done’’ will be appeared and the result will display.

***NOTE: if you want the tympanometry cure to be appeared in the manual mode on the LCD touch screen press the touchable screen and select the Rec option, by selecting this option the graph will appears in the TYMP 1 page synchronous with displaying the results in the manual page.

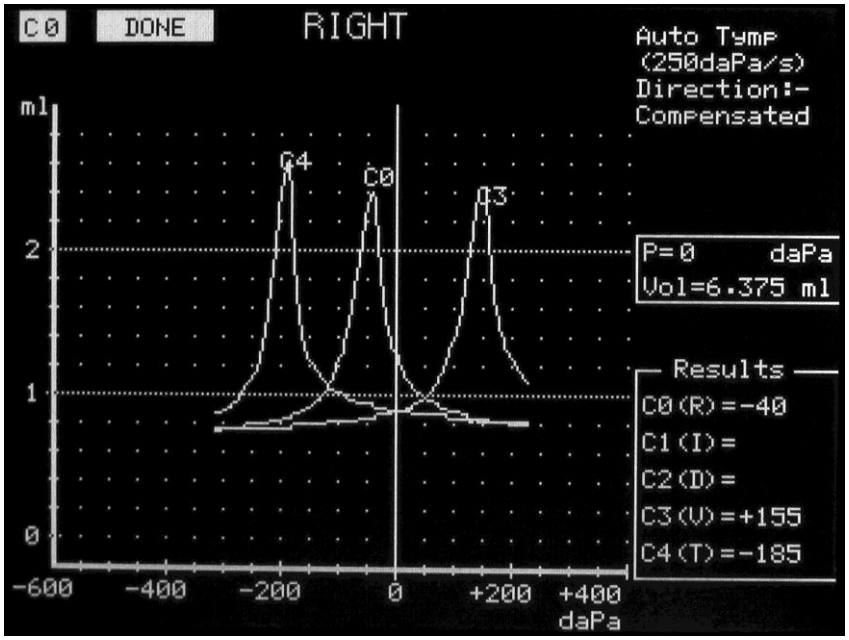
6-Tympanogram Graph related to the Test ear.

7-Vertical axis for displaying the volume (in two option: 3cc and 6 cc)

8-Horizental axis for displaying the pressure value (+400dapa to -600 dapa

ETF 1

By pressing the ETF1 touchable key, the Eustachian tube function test screen for patients with normal Tympanic membrane will appear.



ETF1 page description:

1-Displaying the adjusted configuration

2-Showing the Block and Hi Volume condition

3-Displaying the pressure and volume value at the moment of performing the test

4-Result:

-C0(R): Resting Pressure: The middle ear pressure value in dapa at the first Tympanogram

-C1 (I): Inflation: The middle ear pressure value after applying the maximum positive pressure value (+400dapa)

-C2 (D): Deflation: The middle ear pressure value after applying the maximum negative pressure (-200dapa)

-C3 (V): Valsalva Test: Displaying the pressure after performing the Valsalva test by patient.

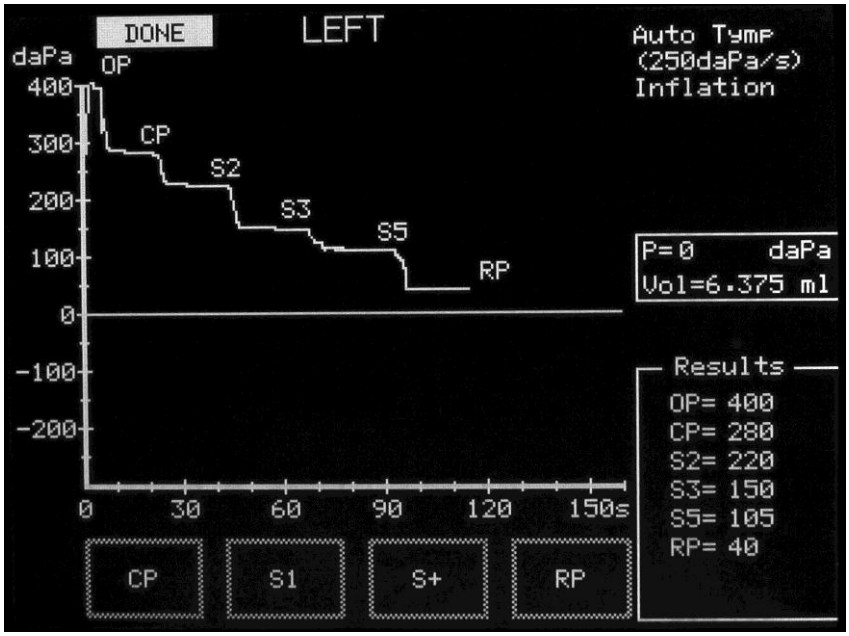
-C4 (T): Toynbee Test: Displaying the pressure after performing the Toynbee test by patient.

5-Displaying the number of the graph which is ready to be outlined.

6- Displaying the outlined graphs (Maximum 5 graph

ETF 2

By pressing the ETF2 touchable key, the Eustachian tube function test screen for patients with perforated Tympanic membrane will appear.



ETF 2 page description:

1- Displaying the adjusted configuration

2-Dispalying the pressure and volume value at moment of performing the test

3- Displaying the test results

4-Displaying the Done/Rec condition

5-Displaying the Positive pressure axis (For performing the Inflation test)

6- Graph (Drawing the pressure values in the time scale)

7- Displaying the negative pressure axis (For performing the Deflation test)

8-Time Axis (160 sec.)

9- CP: For saving the Closing Pressure

10-S1: for saving the swallow

11-S+: If the pressure did not discharge after the first swallow ,by pressing the touchable key of S+ you can save the number of swallows which the pressure were discharged with.

12-RP: for saving the Residual Pressure step.

An example of Immitance Audiometry Test

Patient Preparation

After the patient seats comfortably on the chair give some useful information about the test procedure to the patient as following:

Note: Children may feel better if they seat on their parents legs.
First of all show the probe to the patient and explain the patient the below instructions.
1- The purpose of the test is to assess the mobility of the Tympanic membrane and the Middle Ear condition.
2-I will insert the tip of the probe in your ear gently.
3- A small value of air will be flowed in your ear canal and you may have the feeling of pressing the finger gently in your ear canal.
4-You may hear one or more tones during the test procedure
5- There is no need to participate the test and you have not had to respond to the tones.
6-swalloing chewing or talking during the test procedure will disturb the test results

***Note**: before performing the test and inserting the probe tip in the patient ear canal, make sure there is not any cerumen in the ear canal by otoscopic observation, and if so refer the patient to the ENT specialist in order to bring the cerumen out of the ear and also check the perforated eardrum.

Ear Tip Selection

In order to insert the probe into the patient ear canal, choose an ear tip of the appropriate size from the ear tip set which is completely fitted with the patient ear canal size. By choosing an appropriate ear tip and placing it correctly on the probe you create the basic conditions for measurements without problems and mistakes.

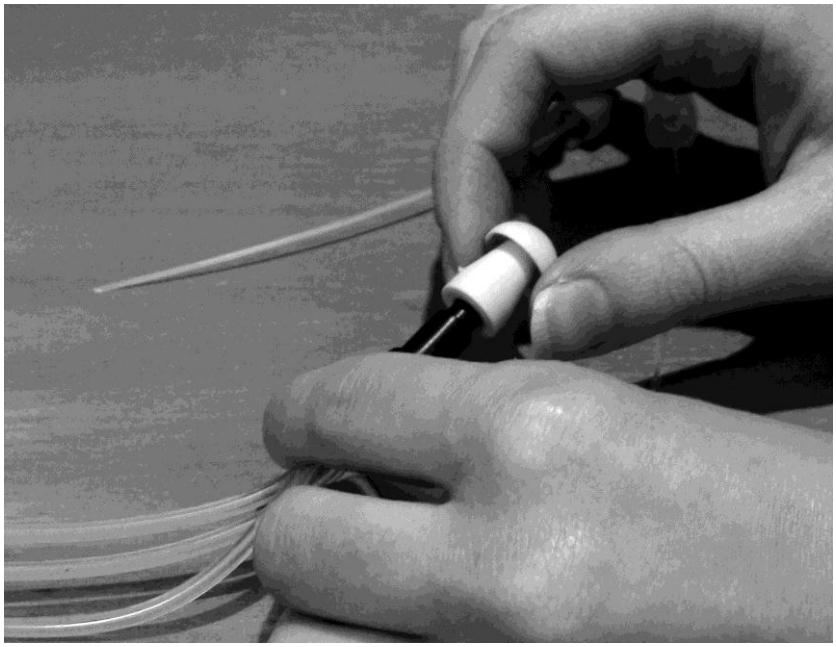
Tympanometer Probe and Ear tip caring

1-Handle the Probe carefully and do not drop the Probe

2-Don’t forget to clean the probe cone periodically in order to get rid of any wax or dirt. For cleaning the probe cone, first remove the ear tip and then twist the probe cone clockwise and remove the probe, insert the pipe cleaner through the opening and clean the Probe cone.

3- In order to prevent infections, clean the ear tip before each tympanometry.

4-For cleaning the ear tip, first remove the ear tip from probe then wash the ear tip with alcohol pad and wait until the ear tip is completely dry and then placing it back on to the probe.



Tympanometry Test

For the better understanding of the Tympanometry test procedure we explain some basic concepts related to the test:

Tympanometry is the objective measurement of the middle ear mobility (Compliance) and the middle ear pressure. In order to perform the Tympanometry test, first the small and specific amount of air pressure will be presented to the external ear canal. This energy will pass the external ear canal and reach the eardrum and the eardrum transmits the majority of the sound via the middle ear to the inner ear and at the end due to the acoustic resistance of the middle ear few amount of this energy will be reflected. The stiffer the eardrum, the more sound is reflected and the less sound reaches the inner ear.

In the process of Tympanometry test a 226Hz low-pitches probe tone is presented to the outer ear canal and produce different SPLs depending to the ear canal volume. This tone measures the compliance changes in the middle ear system when we presenting the high positive or high negative pressure to the outer ear canal. The highest Compliance or the lowest Impedance is obtained when the air pressure in the middle ear cavity is equal to the outer ear canal and this place is the peak of Tympanogram curve and it is displayed as Static Compliance in the Tymoanogram curve.

Tympanometry Test /Automatic Mode

For performing the Tympanometry Test automatically:

1- To perform the test in the automatic mode, press the TYMP button on the device panel and also there is another way to reach the Tympanometry test page by stimulating the touch screen LCD and selecting the TYMP1 touchable key.

2-Indicate the test ear by touching the LCD screen and choose the Right and Left selection touchable key.

3-Press'' Auto'' button of the device panel in order to make the device start the test automatically.

4- When the Tymp curve has been drawn press ''Auto'' again.

5- Do the previous performed steps for the other ear too.

6-When an airtight fit has been obtained the tympanometric test is ready to be performed at the left top of the Tympanometry page ''pass'' will appear and in the process of performing the test ''Rec'' will appear and at the end of the test ''done'' will appear; Note that before ''Rec '' appears you cannot perform the Tympanometry.

***NOTE: If there is a need to apply extended pressure, stimulate the touch screen LCD and select ''DELET'' in order to remove the obtained curve and then press the ''Expand'' button on the device panel and perform the test in the extended pressure range.

TYMP 1 page description:

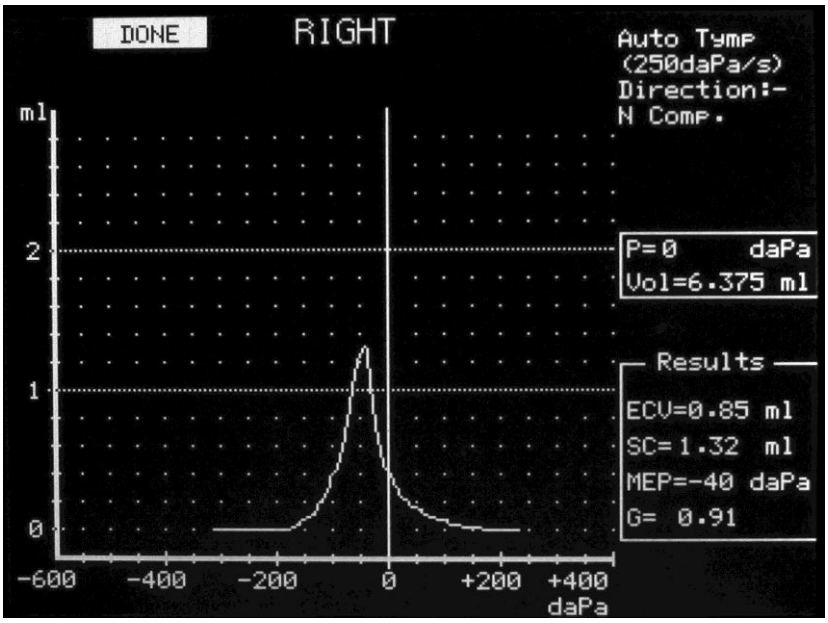
Result:

1- E.C.V: Ear Canal Volume: Displaying Tympanometric peak pressure (TTP) or middle ear pressure (MEP) is the ear canal pressure at which the peak of the tympanogram occurs

2-S.C: Static Compliance: Displaying the equivalent volume or maximum compliance in ml.

3- MEP: Middle Ear Pressure: Displaying the equivalent middle ear pressure at the peak of the Tympanogram curve in dapa.

4-G: Gradiant: calculations are reported as the tympanogram width at half of peak compliance expressed in dapa.



Tympanometry Test/Manual mode

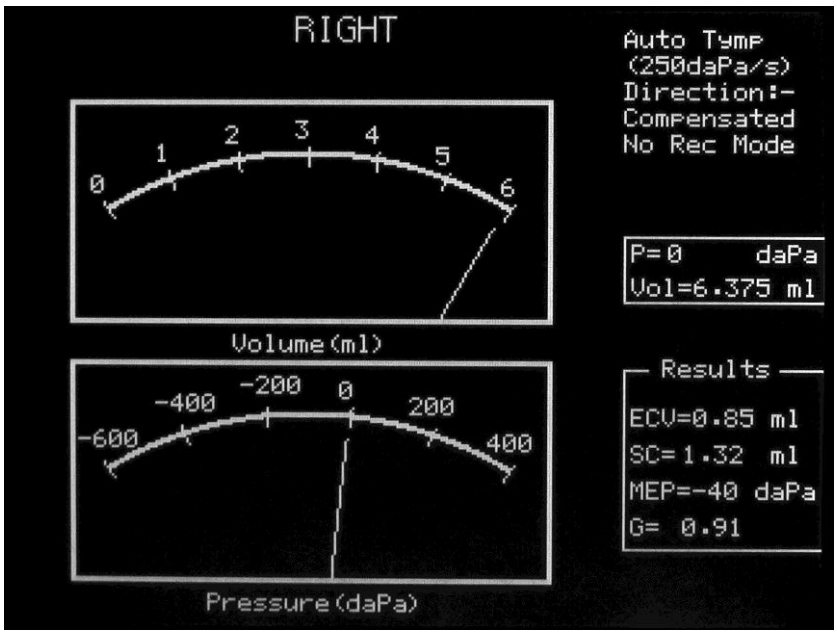
Follow these procedures:

1-First press the touch screen LCD and select the ‘’TYMP2 ‘button from the list.

2-Adjust the pressure control dial on +200dapa and consequently air pressure of +200dap will be presented to the patient ear and then check the compliance value from the volume scale and write it down as C1.This reading also represents the equivalent physical volume of the system.

3-And then air pressure is gradually reduced by pressure control dial from +200 dapa to 0 dapa and negative pressures until it reaches the point where the amount of reflected energy is the lowest and the static admittance is the highest .Check the compliance value from the volume scale and write it as C2.

4-Subtract these two values and write it as Sc which indicates that the air pressure between the external canal and middle ear cavity are equal and it is the Tympanometric peak pressure



Classification of Tympanogram

Tympanograms are divided according to the Static Compliance (S.C) or the height of the peak of the tympanogram, Middle ear equivalent pressure (MEP) and the shape of the tympanogram to A,B,C,D groups.

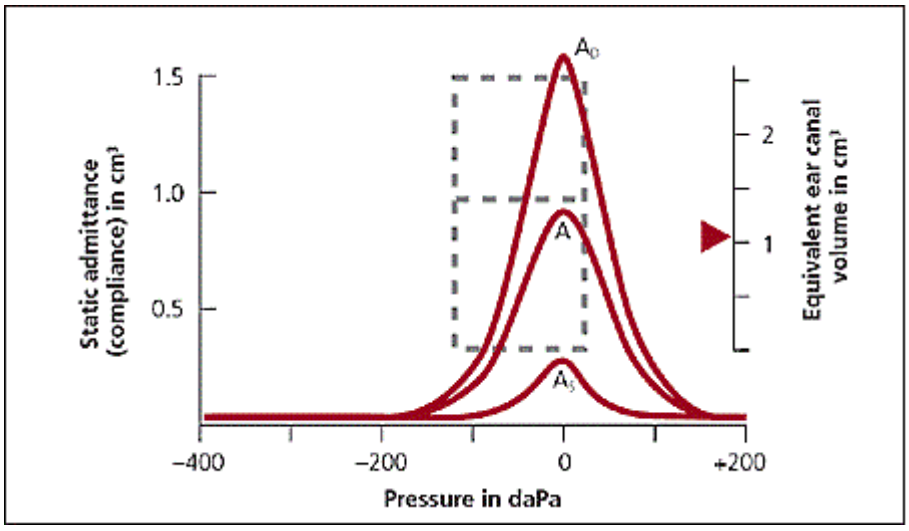
Group A:

This group has the specified peak in the normal pressure range (+50 dapa -50dapa) and divided into the following groups:

Type An⟶This group of tympanograms has a peak in the normal pressure range and have static compliance in the range of 0.3-1.6 cc and is usually related to the patients with normal middle ears.

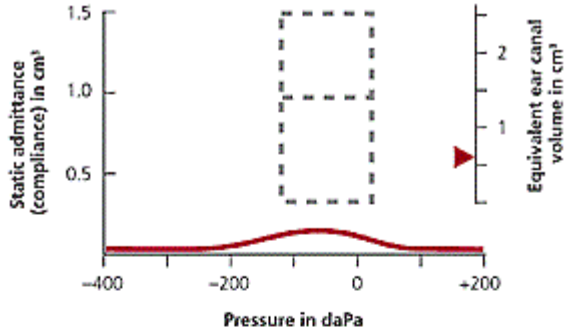
Type As ⟶This group of tympanograms has a peak in the normal pressure range with decreased static compliance less than 0.3 cc and is usually related to diseases which increase the stiffness of the middle ear such as otosclerosis

Type Ad⟶ This group of tympanograms has a peak in the normal pressure range with increased static compliance more than 1.6 cc and is usually related to diseases which decrease the stiffness of the middle ear such as ossicular discontinuity, flaccid eardrum or a combination of both.

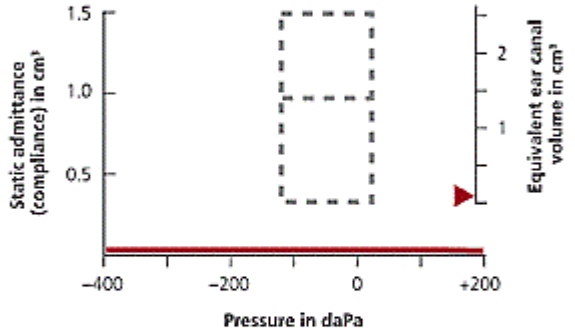


Group B:

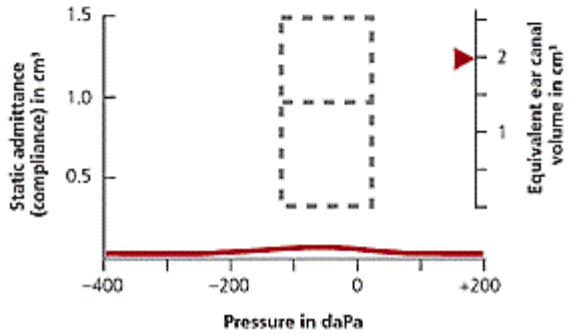
In this group of tympanograms the value of static compliance has decreased and there is no specified peak and the equivalent middle pressure is indeterminate. This group of tympanogram usually consisted in the middle ear system and the tympanic membrane pathology and tympanic membrane has a very limited movement in this condition.



A. Type B tympanogram, normal ear canal volume.



B. Type B tympanogram, low ear canal volume.



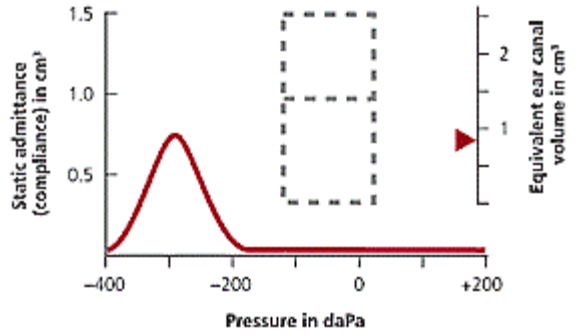
C. Type B tympanogram, high ear canal volume.

Group C:

This group of tympanograms has a static compliance in the normal range (0.3 -1.6 cc) but in the negative pressure range Type C tympanograms indicate the poor Eustachian Tube function and the possibility of causing middle ear effusion. Group c divided into the following groups:

Type C1 ⟶ This group of tympanograms has a static compliance of the normal range in the negative pressure of -100dapa to -200dapa.

Type C2 ⟶ This group of tympanograms has a static compliance of the normal range in the negative pressure of more than -200dapa.



Type C tympanogram with significantly negative peak pressure.

Group D:

This group of tympanograms identified with a deep curve and a notch in the peak which makes the curve to have two peaks. It can be seen in the healed perforation of tympanic membrane or in the slight ossicular discontinuity.

Group E:

These groups of tympanograms are narrow shape of group D tympanogram. It can be seen in complete ossicular discontinuity or expanded Neo tympan.

Acoustic Reflex Test

Acoustic Reflex measurement is applicable through Impedance Audiometer device. Acoustic Reflex test should be performed after Tympanometry test in order to be performed in the equivalent middle ear pressure. EA 87 capable of performing Ipsilateral and also contralateral reflexes.

For performing the Acoustic Reflex test press the Ipsi/Contra button from the device panel. By pressing this button once the device is set up for performing the Ipsilateral acoustic Reflex test and the light indication in the Ipsi/contra key is yellow and by pressing the button twice the device is set up for performing the Contralateral Acoustic Reflex test and the light indication in the Ipsi/contra key is green.

Signal presentation in Contralateral mode is applicable through Headphone in HL dB and in Ipsilateral mode is applicable through probe in Sp.L dB

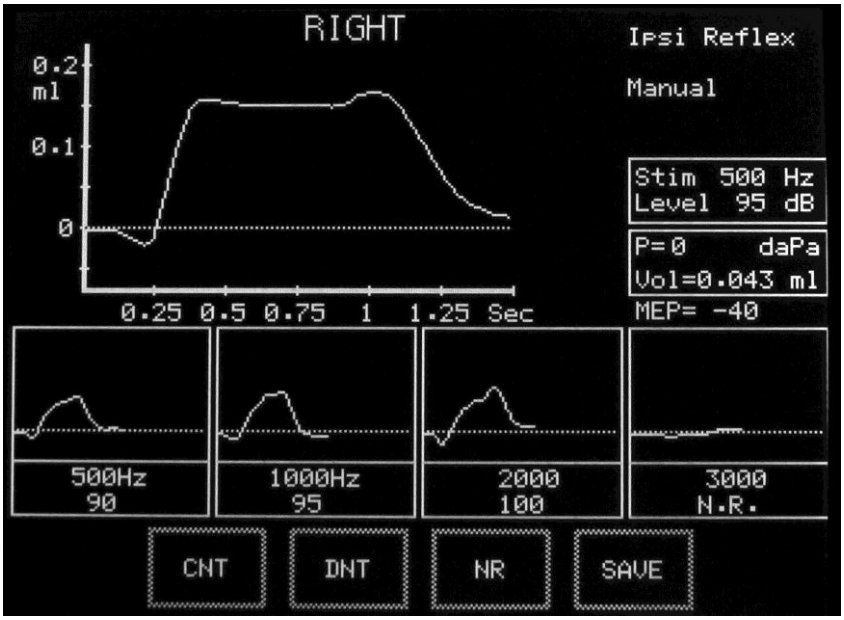
The main purpose of Acoustic Reflex measurement is to assess the absence or presence of acoustic reflex and indicating the threshold of Acoustic Reflex.

Acoustic Reflex Threshold is the lowest level of stimulus which can elicit the acoustic reflex. Acoustic Reflex threshold for normal ears is about 85 dB HL (70 dB - 100 dB) for normal ears

***Note** that performing acoustic reflex test is applicable manually via EA 87.

In order to establish the acoustic reflex threshold in each frequency present the signal through Tone switch of the device panel and change of the reflex parameters is applicable via “Frequency Decr / Incr” buttons and the “Intensity Decr / Incr” buttons in the device panels which has been reviewed in the function of panel buttons.

Acoustic Reflex Test Procedure



1- At the beginning of the test explain the test procedure to the patient and ask the patient not to talk or swallow and move during the test.

2-Select the frequency from “Frequency Decr / Incr” button from the device panel

3-In order to change the intensity use Intensity Decr / Incr” buttons

4- In each frequency select your desired intensity and present the signal via pressing the Tone switch key and acoustic reflex curve will be appeared on the device display and if it is needed, change the intensity and perform the test once more

5-In each test frequencies after indicating the threshold of acoustic reflex select ‘’SAVE’’ touchable key in order to store the result.

6-If you don’t perform the test in one or more frequency, press the touch screen LCD and Select ’’DNT’’ for storing the result.

7-If the acoustic reflex is absent, press the touch screen LCD and select ‘’NR’’.

8-If there is not a suitable circumstance to perform the acoustic reflex test or the patient is not capable of performing the test select, press the touch screen LCD and select ''CNT''.

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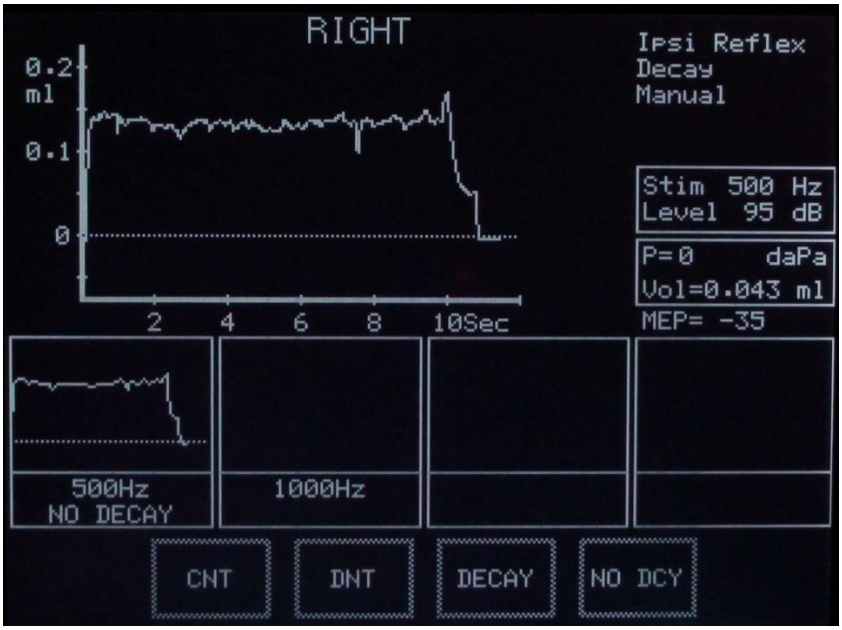
Ipsi/Contra Acoustic Reflex maximum output for test frequency

Frequency	Ipsi/Max. Output	Contra/Max Output
500Hz	110dB	110dB
1000Hz	110dB	120dB
2000Hz	100dB	120dB
4000Hz	85	120dB

Reflex Decay Test



In order to indicate the possibility of VIIIth nerve disorders, assess the reflex decay test.

Evaluating Reflex Decay in the frequencies below 1000H (500Hz and 1000 Hz) has diagnostic value and a high reflex decay indicate the presence of retro cochlear lesion.

In EA 87 Impedance Audiometer device there is a separate part for performing Reflex Decay test.

In order to perform Reflex Decay press the Touch screen LCD and change the NO DECAY option to Decay by pressing the NO DECAY key once and press ok to enter the Acoustic Reflex page.

For performing the test present the stimuli with frequencies below 1000 Hz with 10 db intensity level above the acoustic Reflex threshold in those frequencies for 10 second to the test ear.

If the size of the acoustic reflex threshold reduced up to 50% or more there is a possibility of reflex decay.

In order to establish the reflex decay test result if the Reflex Decay is present press Decay from the acoustic reflex display page and if there is not any Reflex Decay press NO DECAY.

***NOTE: Make sure that the obtained decay is not due to bad and incomplete probe seal because improper probe seal cause similar action to reflex decay procedure.

Eustachian Tube Function Tests

The Eustachian tube connects the middle ear cavity with the nasopharynx. It aerates the middle ear system and clears mucus from the middle ear into the nasopharynx.

Opening and closing functions of the Eustachian tube are physiologically and pathologically important. Normal opening of the Eustachian tube equalizes atmospheric pressure in the middle ear; closing of the Eustachian tube protects the middle ear from unwanted pressure fluctuations and loud sounds.

Mucociliary clearance drains mucus away from the middle ear into the nasopharynx, thus preventing infection from ascending to the middle ear.

There are several common abnormalities related to Eustachian Tube function. Among the most common dysfunctions is anatomic abnormality, local mucosal changes created by otitis media or allergies, patulous Eustachian tubes, or palatal myoclonus.

The presence of ET dysfunction can be determined subjectively through a history of patient symptoms or objectively by means of direct or indirect measures.

In the most basic sense, Eustachian tube function can be assessed with conventional Tympanometry.

If the tympanogram demonstrates pressure more than -250 dapa middle ear Eustachian Tube function is presently abnormal.

For evaluating the Eustachian Tube Function perform ETF2 test as the following:

Eustachian Tube Function Test for Normal Eardrum

For evaluating the Eustachian Tube function perform the following steps:

1-Press the device touch screen LCD and select ETF1 option

2-The most important stage in ETF2 is to indicate the middle ear equivalent pressure thus press ‘’Auto’’ to perform Tympanometry test. In the result part of the ETF1 page the middle ear equivalent pressure will be stored as C0 or Resting Pressure.

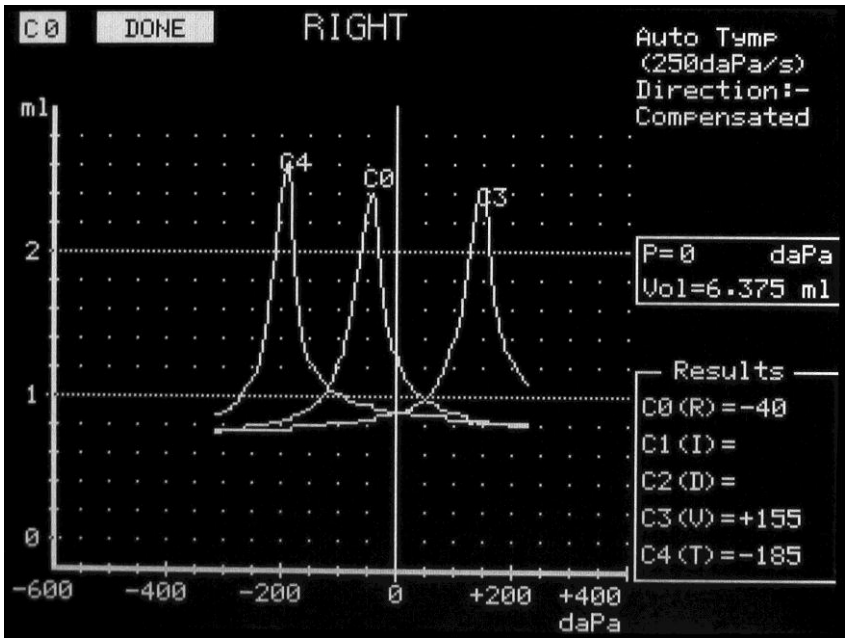
3-Inflation: Press the device touch screen and select C1(I) and then set the pressure control dial which is located on the device panel on +200dapa and ask the patient to swallow and press ‘’Auto’’ button and perform Tympanometry test. In the result part of the ETF1 page the middle ear pressure will be store as C1. By performing the Inflation middle ear pressure will be more negative.

4-Deflation: Press the device touch screen and select C2 (D) and then set the pressure control dial which is located on the device panel on -200dapa and ask the patient to swallow and press ‘’Auto’’ button and perform Tympanometry test. In the result part of the ETF1 page the middle ear pressure will be store as C2. By performing the deflation middle ear pressure will be more positive.

5- Valsalva Test: Press the device touch screen LCD and select C3 (V) and ask the patient to perform the Valsalva Maneuver (by closing your nostrils and blowing air into your cheeks as if you were trying to ‘pop’ or unblock your ears) and press ‘’Auto’’ and perform Tympanometry test.

6- Toynbee Test: Press the device touch screen and select C4 (T) and ask the patient to keep her nose with two fingers and swallow (Toynbee test produce

negative pressure in the middle ear cavity) and press ''Auto'' and perform Tympanometry test.



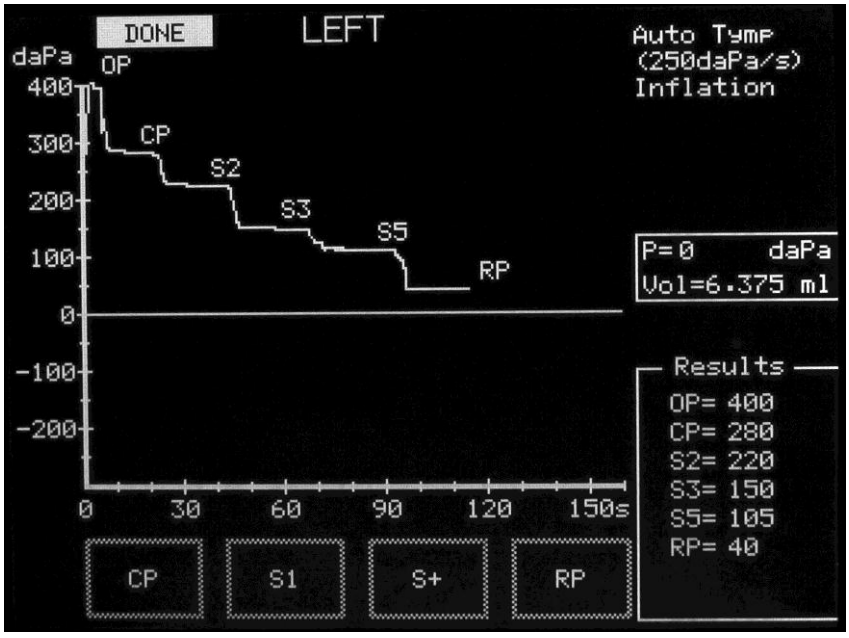
Eustachian Tube Function Test for Perforated Eardrum

Eustachian Tube Function assessment in patients with perforated Eardrum include two phases: Inflation and Deflation.

For performing the test with EA 87, first press the touch screen LCD and select ETF2 option and enter the ETF2 test page and perform the following steps:

***Note:** By selecting ETF2 from the display, Expand button will be activated automatically.

Inflation Phase:



1-Adjust The Pressure control Dial on +400 dapa (Maximum pressure)and hold the TYMP button of the device panel in order to apply the pressure to the outer ear canal.

2-Whenever the Eustachian Tube automatically opens, stop applying the positive pressure (stop holding the TYMP button).The point where the

Eustachian Tube opens is called ‘’opening pressure’’ or ‘’OP’’ and opening of Eustachian Tube in this situation is a passive procedure.

3- Opening of the Eustachian Tube makes the applied positive pressure to be discharged until the Eustachian Tube passively closes which is called the ‘’Closing Pressure or ‘’CP’’.

4-Ask the patient to swallow, after each swallow the Eustachian tube will open and discharge the pressure .If pressure were discharged with the first swallowing select the S1 button from the touch screen LCD and store the changes in the pressure and if pressure has not discharge with the first swallowing and there is a need to swallow again, write down the number of swallowing which make the Eustachian tube to open, by selecting the S+ button from the touch screen LCD. (Active)

5- At the end of test there will be amount of residual pressure which is not dischargeable by swallowing and it is called ‘’Residual Pressure’’ or ‘’RP’’. Select the RP button from the display to store it.

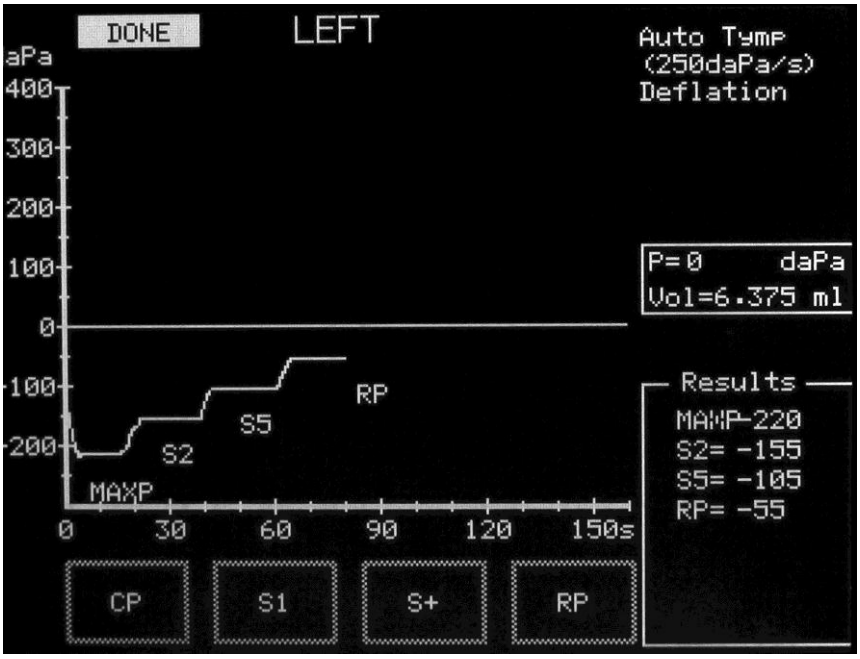
Deflation Phase:

In this phase the active function of Eustachian Tube is evaluated.

1- Adjust the Pressure Control Dial at -200dapa and hold the TYMP button of the device panel in order to apply the pressure to the outer ear canal.

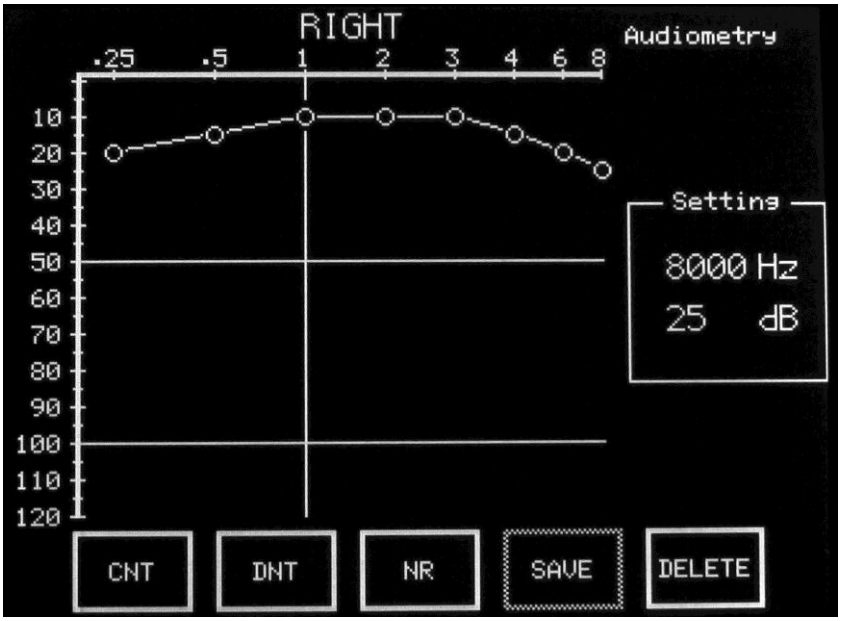
2-Patient should balance the negative pressure by swallowing. Select the S1 button from the Touch screen LCD in order to save the changes in the pressure level after each swallow. (Active Procedure)

3- At the end of test there will be amount of residual pressure which is not dischargeable by swallowing and it is called ‘’Residual Pressure’’ or ‘’RP’’. Select the RP button from the display to store it.



If the Eustachian Tube has the ability of balancing the pressure in both Inflation and Deflation phases and the amount of Residual Pressure is little, the Eustachian Tube Function considered Normal.

Audiometry



In the EA 87 Device there is a separate part for performing the Audiometry Screening test for evaluating the ‘’AC’’ Air conduction thresholds.

In order to perform the Audiometry test:

1-Press the ‘’Audio ‘’button on the device panel, indication light of the’’ Audio ‘’button will be activated .By activating this button the Audiometry test page can be viewed in the display.

2-For selecting the Test ear like the previous tests press the touch screen LCD and select your desired test ear and put the Headphone of the device headset on the test ear.

3- Connect the Patient Signal to the device.

4- In order to perform the Audiometry threshold test present the signal via Tone Switch and select the frequency from Frequency Decr / Incr” button from the device panel and for a given frequency change the Intensity via Intensity

Dec/Inc'' button from the device panel and perform the test according to the Hughson Westlake (HW) test procedure. The HW test procedure is defined as 2 out of 3 correct responses at a certain level in a 5 dB increase and 10 dB decrease test procedure.

5- For a given frequency after obtaining the threshold save the obtained threshold by pressing the display and select ''SAVE'' option.

6-If you did not perform the test in specific frequency select ‘’DNT'' option.

7-For a given frequency if there is not any response select the ‘’NR'' option.

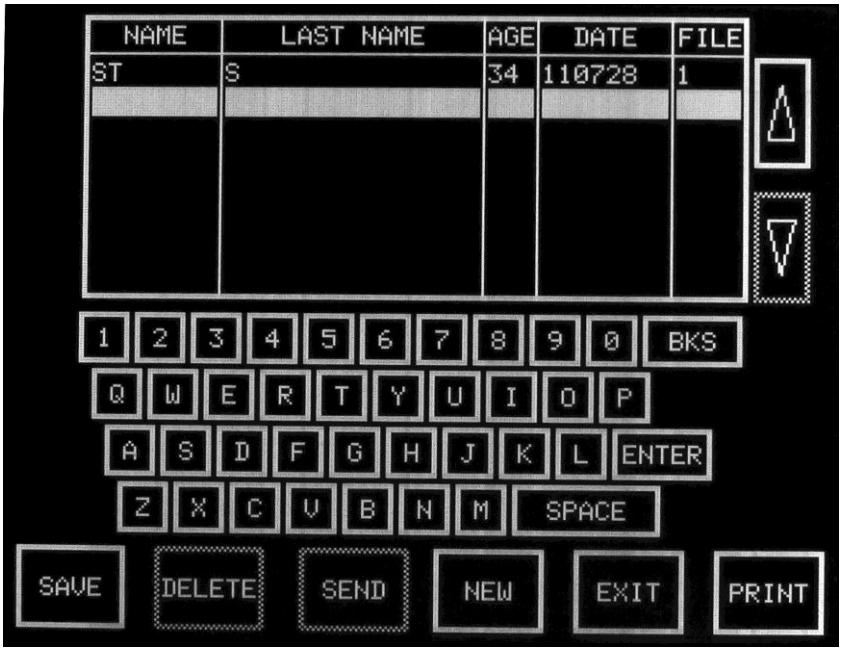
8-If there is not an appropriate situation to perform the test in one frequency or the patient does not participate actively in the test select ‘’CNT'' option.

9- In order to remove the test result press the display and select ‘’DELET''.

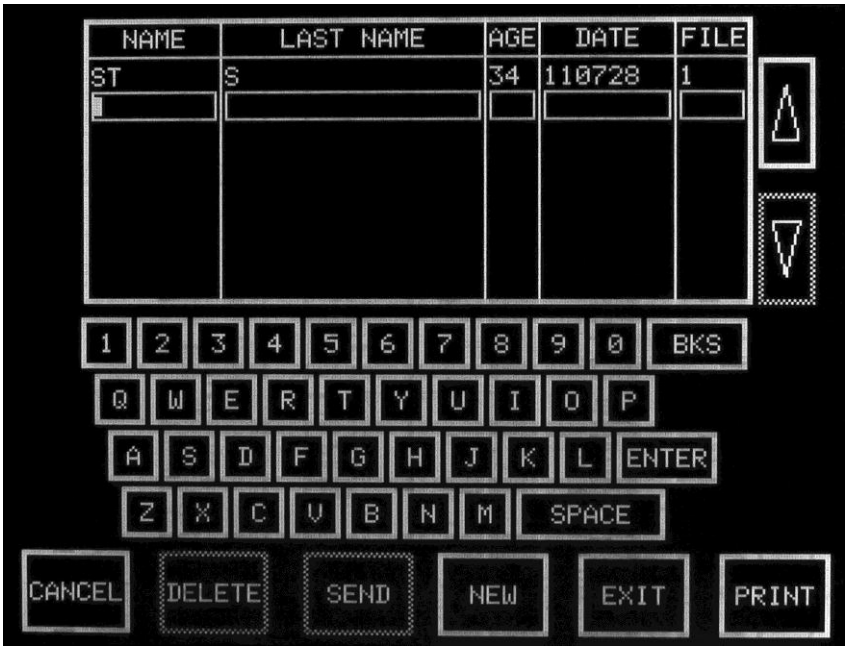
Permanently saving the result

At the end of the test by pressing the ‘’F’’ switch and in the FILE page and continue the following steps:

1- With arrow keys select an empty space (the SAVE button will be appeared)



2-Press the **SAVE** switch (Typing location will be got focus on)



3-Type the **NAME**

4-Press **ENTER** key

5-Type **LAST NAME**

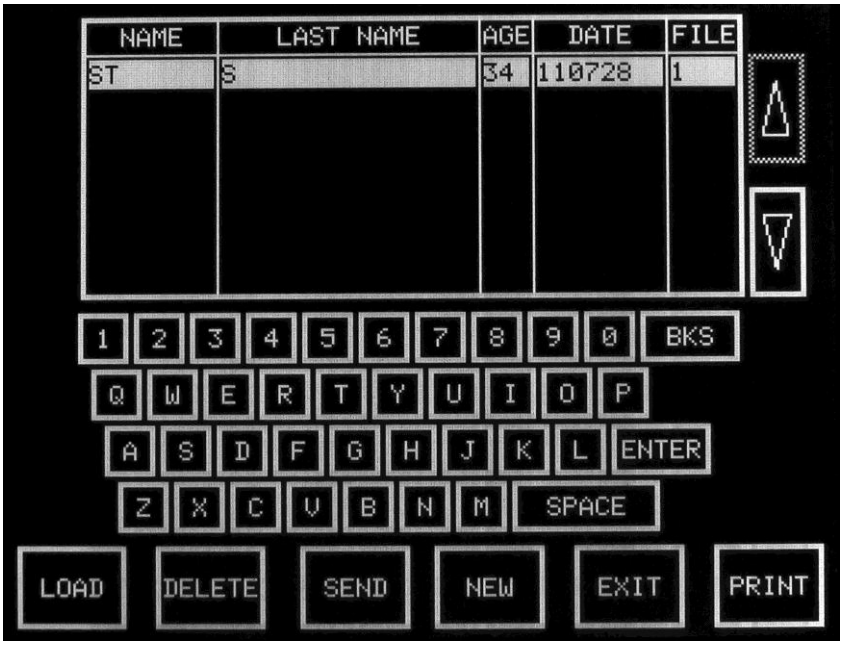
6-Press **ENTER** key

7- Type **AGE**

8-Press **ENTER**

5-In the case of need enter the file number

6- Press **ENTER** key (Saving massage will be appeared)



LOAD:

For loading the saved files follow the below steps:

1- Select the file you want to load by arrow keys

2-Press LOAD key. (Loading massage will be appeared)

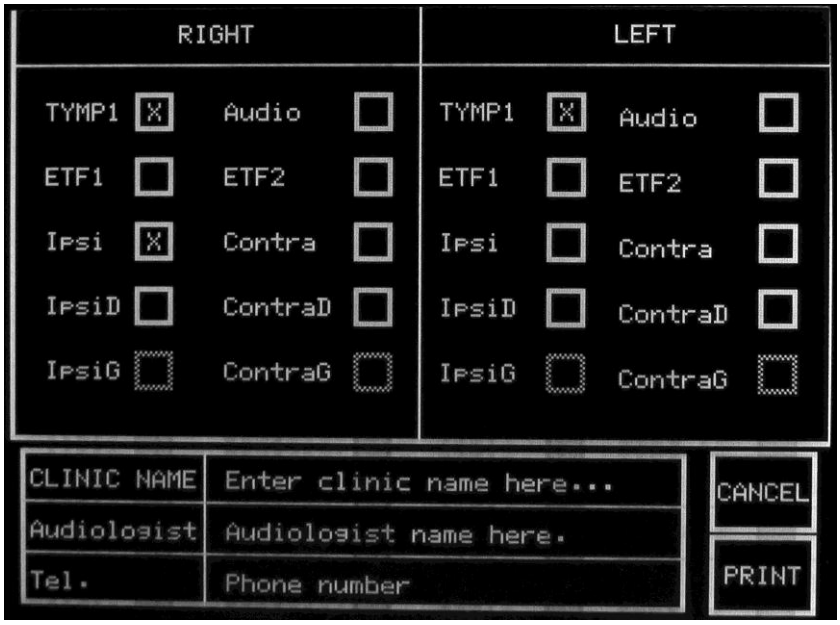
*Note: By loading the file, the current data will be replaced. So if the current data is valuable before loading the file save them with previous steps.

Printing the test results

In order to print the test results press the touch screen LCD and select ‘’FILE’’ option and enter the File page and follow the below steps:

1- Select ‘’PRINT ‘’ touchable key

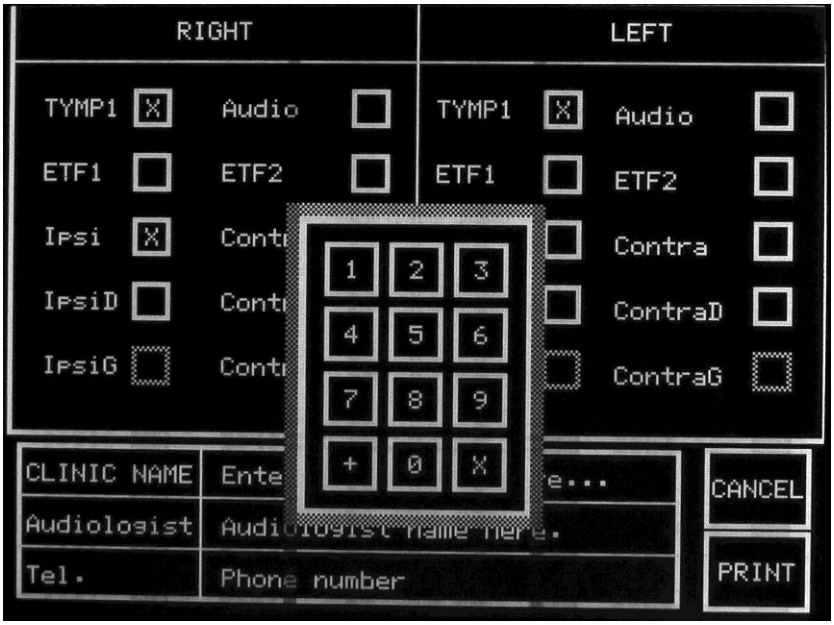
2-By selecting PRINT option, the list of Impedance Audiometry tests will be appeared.



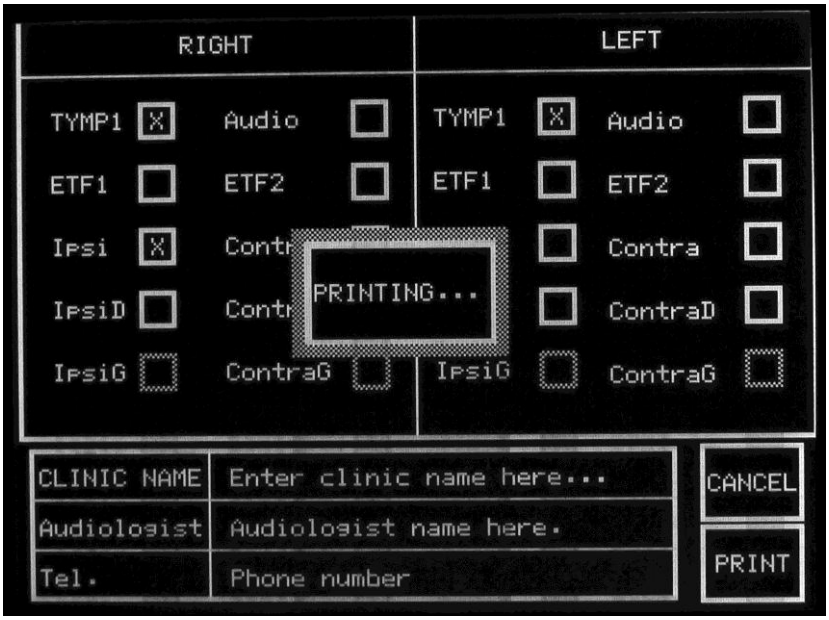
3- Select tests that you want to be included in the print page.

4-At the end of the Print page you can write the name of your Clinic in the ‘’**CLINIC NAME**’’ section and write you name in the **’’AUDIOLOGIST’’** section.

5- Write the clinic phone number in the **’’TEL’’** section.



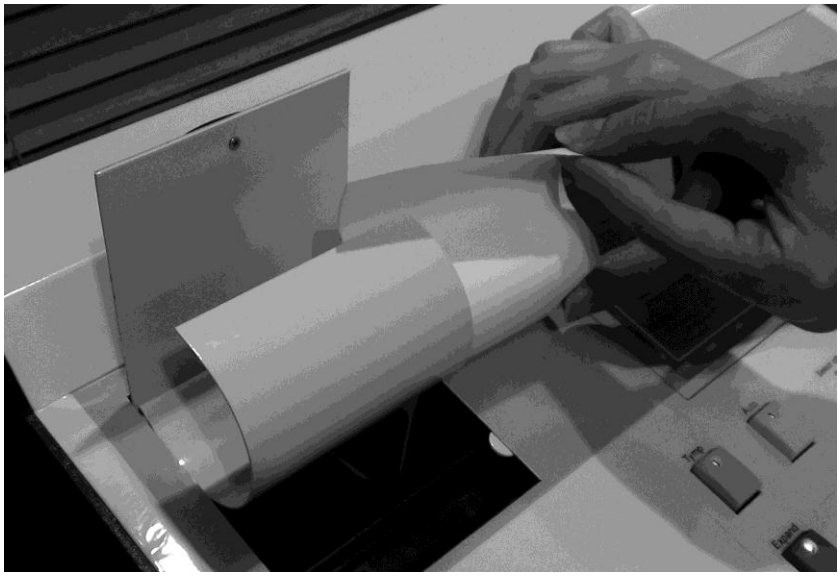
5-Press Print



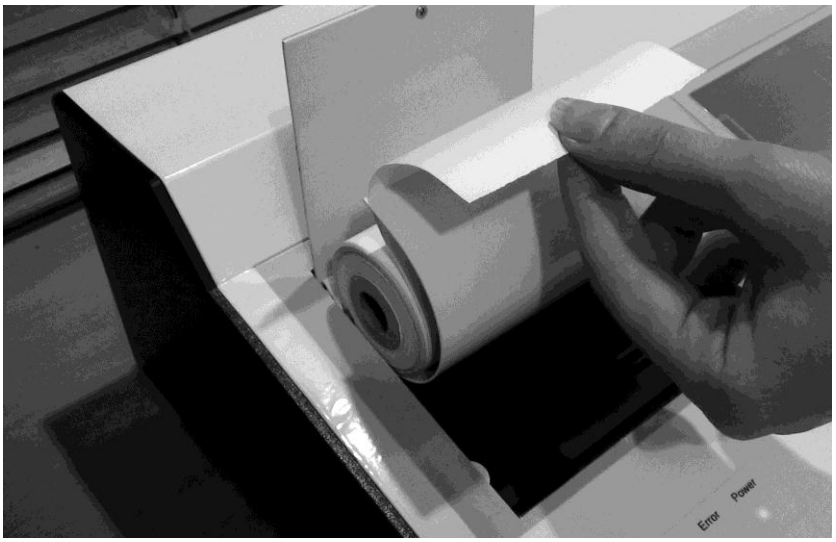
Installing Printer Paper

1- Open the door on the front of the unit (paper cradle of the EA 86 printer)

2- As you can see in the following picture insert the paper.



Note: Make sure to pull out an extra 10 to 15 centimeters of paper out of the door.



Transferring Data to the computer

1- Select your desired file from the FILE page.

2- Press **SEND (Waiting** message will appear**)**

3- Press **Download File** from Case history page of EA 87 software.

4- **Waiting** message will turn into **Sending** message and after a few seconds data will be transformed to the computer.

*** In order to cancel the transformation procedure, press any point of the Touch screen LCD

*** If the device is not connected appropriately to the computer **waiting** position will not turn to **Sending** position.

Dictionary

Acoustic Admittance: The ease with which sound waves flow through a medium, as the eardrum membrane. See Acoustic Immittance.

Acoustic impedance: Acoustic impedance indicates how much sound pressure is generated by the vibration of molecules of a particular acoustic medium at a given frequency

Acoustic Immittance: Refers collectively to acoustic impedance and / or acoustic admittance.

Compliance: 1) Ease with which air moves (e.g. influenced by the eardrum and middle ear mechanism). **2)** Often used to indicate the equivalent volume of air in the middle ear.

Ear Canal Volume - volume measured between the tip of the probe and the tympanic membrane at the start of the tympanogram

Gradient – an indication of the shape of the tympanogram by measuring the pressure width at one-half of its peak height.

Pressure Peak – pressure value where maximum mobility occurs in a tympanogram; approximates pressure within the middle-ear space.

Probe tone - the low pitch tone (usually 226 Hz) that is audible when the probe fit with an Eartip is introduced to the ear canal. Monitoring of the tone's intensity variation with pressure change measures middle-ear mobility

Contralateral: A CONTRA-lateral reflex responses occur on the OPPOSITE-side of the stimulus presentation.

Ipsilateral: An IPSI-lateral reflex is a response that occurs on the SAME-side as the stimulus is *presented.*

Ear Tip*: Tympanometry ear tips were placed on the end of the probe tip to allow for a pressure seal when placed in the participant's ear.*

ETF (Eustachian Tube Function): This test is a dynamic assessment to ensure that the Eustachian tube is functioning properly.

Tympanometry: Tympanometry is a method of measuring the stiffness (or it's inverse, compliance) of the ear drum. It is a quick test that is part of most basic hearing assessments. A large amount of useful information about the middle ear can be gained from this brief short and easy test.

Tympanogram - a tracing or graph produced by a tympanometer depicting the results of middle-ear assessment. It may be displayed electronically or as a printout.

Toynbee's maneuver: It is used in ETF2 by swallowing with the mouth and nose closed to draw air out of the middle ear.

Oseocular discontinuity: As the conduction of sound from the outer ear to the inner ear is dependent on the bones of hearing or *ossicles*, a disruption of the ossicles will result in conductive hearing loss. In cases of severe head trauma, the connection between the incus and stapes, which is fragile, can be separated. In other cases, the incus bone itself is fractured producing a separation between the incus and the stapes

Otosclerosis: is an abnormal growth of bone near the middle ear. It can result in hearing loss. Otosclerosis can result in conductive and/or sensor neural hearing loss. The primary form of hearing loss in otosclerosis is conductive hearing loss (CHL) whereby sounds reach the ear drum but are incompletely transferred via the ossicular chain in the middle ear, and thus partly fail to reach the inner ear (cochlea). This usually will begin in one ear but will eventually affect both ears with a variable course

Valsalva's Maneuver: It is used in ETF2 by closing your nostrils and blowing air into your cheeks as if you were trying to ‘pop’ or unblock your ears.

Device Maintenance

Please take into consideration the following precautions to avoid damages:

1- Keep away from shock and mechanical vibration.

The Impedance Audiometer display is the most sensitive part to mechanical shock. The audiometer display is touchable (Touch Screen) so it is too sensitive and must push the minimum pressure on it.

2- Put the device in the suitable place which air can flow under the device.

3- Electrical cables should be intact.

Inappropriate power plugging may cause power swing and cause damage.

4- Turn off the device whenever there is a possibility of electric shock.

5-Do not expose the device to the intensive sunshine.

6-Use the device in appropriate degree temperature (15 to 35 degree).

7- Keep the device in a dry place and do not use it in the environment with 90% humidity and for long period storage: Keep it in the environment with less than 40 % humidity.

8- Keep the device away from sharp items, rough surfaces. For cleaning the panel use the cotton soaked in alcohol or in Liquid Glass Cleaner and keep panel away from other chemical substances.

9- Keep device away from pouring liquids.

In the case of pouring liquids on the device, turn the device off and do not turn it on until you are sure about the completely vaporization of the liquid.

10-Take care of the device communication cables, Keep the Cables away from wrapping, stretching.

11- Applying mechanical shocks to the additional component of the device may cause internal damage those components. In this case the calibration is out of order.

12- EA 87 Middle ear analyzer is calibrated in the standard air pressure of 98 to 104 KPa and if you want to use the device in different air pressure you should calibrate it with error coefficient.

Frequently asked questions

1-Does EA 87 unit include a Printer?

Yes, an internal thermal printer is included in the instrument.

2-Is there any Guarantee?

Yes, this guarantee is valid for 24 months from the instalation date.

3-What should I do in order to have extra ear tips and thermal printer paper?

Ask LORECa Company for ordering additional ear tips and printer paper, and getting information about the price.

4-Is it possible to conduct daily calibration in the clinic?

To keep the test accurate on a daily basis you can perform a daily calibration. For daily calibration you can use 2cc Coupler for performing the volume calibration.

5- How do I change from Ipsi to Contra reflex testing?

As we said before, by pressing the Ipsi/Contra button you can select the mode of performing Acoustic Reflex test, By pressing this button once the device is set up for performing the Ipsilateral acoustic Reflex test and the light indication in the Ipsi/contra key is yellow and by pressing the button twice the device is set up for performing the Contralateral Acoustic Reflex test and the light indication in the Ipsi/contra key is green.

6-How do I clear the tests?

In order to clean the test result, press the touch screen LCD and select **FILE** option and in the File window press **NEW** for removing the test results.

7- Is it possible to perform High Frequency Tympanometry with EA 87 middle ear analyzer?

No, EA 87 is designed to perform only Low frequency Tympanometry.

Troubleshooting

Q: Whenever I insert the probe in the ear I get a High volume message, what should I do?

A: 1- Check the probe tip to be fitted completely in the ear canal cavity. You should, insert the probe tip in the ear once more with a better sealing and you can check the size of the ear tip ,maybe it is not appropriate for your patient' ear canal size. Change the ear tip and try again.

2-If the Probe tubes were damaged, change the tubes and use the device additional extra tubes. **Don not cut the probe tubes.**

4-If the Air tube of the device was damaged, cut the tube from the damaged part and connect the air tube to the device again.

Q: when I insert the probe in the ear I get a Blocking message

A: It maybe because of the following mistakes:
1-The probe tip maybe blocked by wax, remove the ear tip from probe and check the probe tip openings and if there is wax or dirt in the probe tip openings, clean them with cleaner tube.

2- Because of the mistaken insertion of probe tip into the ear canal. Bring out the probe and insert the probe again.

Q: No Tympanic Curves are drawn

A: You should check several options as the following:

1- Check the probe tip in order to be sure of a perfect seal.

2- Check the probe system to be connected to the device panel.

3- If you don't remove the result of the previous unfinished test, you cannot perform Tympanometry and consequently there will be no displayed Tympanic curve .Therefore, before performing the test once more, you should press the touch screen LCD, press DELETE option and remove the results of

the previous test. (When there is a performed test on the display, **''Done''** message will be appeared at the Left top of the device display)

4- Make sure the air tube of the device headset to be connected to the back of the device panel as the following picture:

Q: The printer is turned on but by pressing the Print option of the Touch screen LCD, there is not any action.

A: Check the Printer cable to be connected appropriately to the device.

Q: Printer is working but the test result is not appeared on the paper

A: The printer paper is not installed correctly. Turn around a paper roll and try again.

Q: According to my patient case history and Tympanometry test, the acoustic reflex should be present but according to the Contralateral Acoustic Reflex test t, Acoustic Reflex is absent in all test frequencies.

A: Make sure that the headphone jack is connected to the headset.

Q: Tone is not presented in Ipsilateral Acoustic Reflex Test

A: 1-Check the device connection at the back of the device

2-Make sure that the signal presentation tube of the Probe to be open completely.

Q: There is no Probe Tone

A: 1- Check the presence of Probe Tone by 2cc coupler

2- Make sure that the Probe tubes are not blocked by wax or dirt

3- Make sure that the Probe tubes are not damaged

Q: I have problem with LCD brightness, it is sometimes too bright and I cannot see the display clearly

A: You can check the following options:

1-It is possible to adjust the LCD brightness with LCD contrast adjustable switch which is available at the back of the device panel.

2- The standard appropriate degree temperature for the device best performance is 15 to 35 degree. You should pay attention if the degree temperature is below 5 degree , LCD will be too bright which make the situation difficult to see the display.

3- Do not use it in the environment with 90% humidity and for long period storage which can affect the brightness quality of the device’s LCD. Keep it in the environment with less than 40 % humidity.