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Additional Information

MT10



D-0103729-E – 2020/05



Interacoustics

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1. Using the MT10

This instrument is equipped with a real-time clock. Before use, please set the date & time to local values in order to ensure that test data and calibration status are correctly identified.

1.1 Installing & replacing batteries

The MT10 may be powered from Alkaline 'AA' / LR6 batteries (e.g. Duracell MN1500) or rechargeable Nickel-Metal Hydride (NiMH) batteries. Four batteries are required. Use only batteries from reputable manufacturers.

If the MT10 is to be used infrequently we recommend alkaline cells are fitted. NiMH batteries have a high self-discharge rate and are likely to need recharging if left unused for several weeks. To fit the cells remove the battery compartment cover on the base of the MT10. Fit the cells as indicated inside the battery compartment.

Batteries should only be changed outside the patient environment. The operator should not touch the battery connectors and the patient simultaneously.

The type of cell fitted must be set in the CONFIGURATION menu. By default this is ALKALINE. Change the setting in the CONFIGURATION menu

A battery state indicator is shown in the top right corner of the display (except when showing test results). This shows the battery state as a progressively emptying battery. The batteries should be replaced when the symbol has an ! in front of it, or when advised to do so at switch-on. Removing the batteries does not affect the configuration, the contents of the database, the calibration settings or the results of the last test.

1.2 Controls and indicators

Press the On/Off key momentarily to turn the MT10 on (refer to the diagram below).

No warm-up time is required, although a short diagnostic routine will run for a few seconds. During this time the internal pump will operate. To switch off, again press the On/Off key momentarily.

Press the up (↑) and down (↓) navigation keys to scroll through the menus or set values.

Press the right navigation key (→) to accept a menu choice or go to the next step.

Press the left navigation key (←) to cancel an operation or go back to the



The function of the left and right keys is usually shown on the bottom line of the display. When not performing a test the MT10 will switch off automatically if no key is pressed for 90 seconds. This time can be extended to 180 seconds in the CONFIGURATION menu.

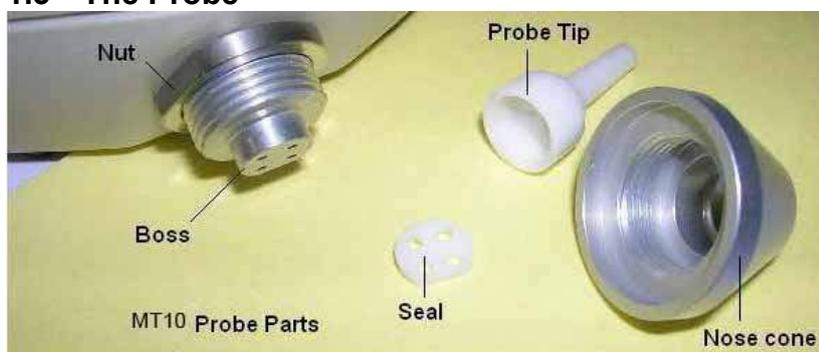


To set the operating language (English, French or German) use the options within the CONFIGURATION menu

The LEDs indicate the status of the system:

Green LED	Yellow LED	Status
Off	Off	MT10 turned off
On	Off	Idle & ready to use
Off	Slow flash	Attempting to obtain an ear seal
Slow flash	Off	Taking a measurement
Off	Fast flash	Pump error at switch-on. Measurement error, see Section 13.
On	Flickering	Sending data to a PC

1.3 The Probe



The small holes through the MT10 probe tip must be kept clear. If these become blocked a warning message will be displayed. The tip must be removed and cleaned or replaced.

To remove the tip, unscrew the nose cone and pull the tip off the probe boss. A small seal will be found in the base of the probe tip. This should be examined and replaced if it is damaged.

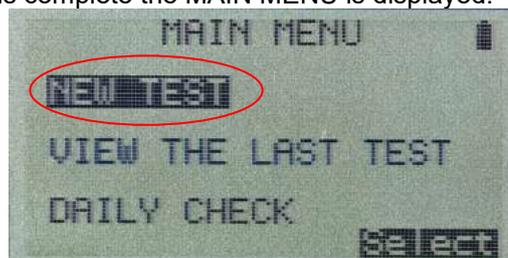
When replacing the tip, ensure that the seal is correctly inserted with its flat aligned with the flat on the probe tip. Push the probe tip over the boss and replace the nose cone. Make sure that the nose cone is screwed home firmly but do not over-tighten. Do not use any tools to tighten the nose cone.

After replacing the tip a Daily Check should be carried out.

1.4 Start up and menu display

When the MT10 is turned on the start-up screen is shown while internal tests are performed and the pump is initialised.

When the start up sequence is complete the MAIN MENU is displayed:



Menu items and instructions are shown in upper case text. Information and error messages are generally in lower case.



2. Taking Measurements

Safety Note:

The probe tip must be fitted with an ear tip before it is presented to a patient's ear canal. The ear tip must be fitted completely to the probe tip and must not occlude any of the four holes in the probe tip. The ear tip is chosen to suit the patient's ear and provide a comfortable pressure seal.

2.1 Prior to testing and Ambient conditions

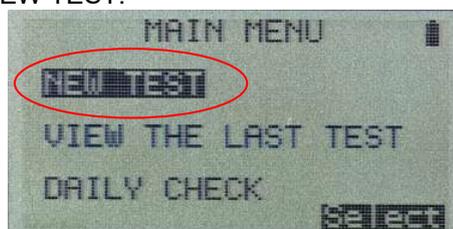
The health care professional should perform a thorough otoscopic examination to establish that the condition of the ear is suitable for the test options selected and that no contraindications are present.

Tympanometric and reflex testing should always be performed in a quiet room or in an acoustic booth.

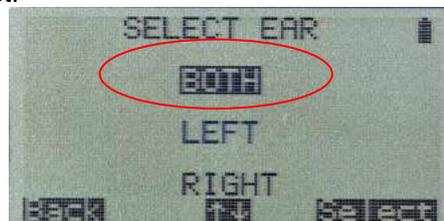
2.2 Performing a test

A typical tympanogram measurement and reflex test is carried out as follows.

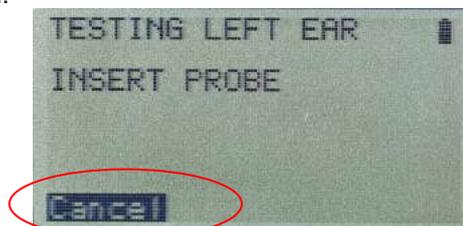
From the MAIN MENU select NEW TEST:



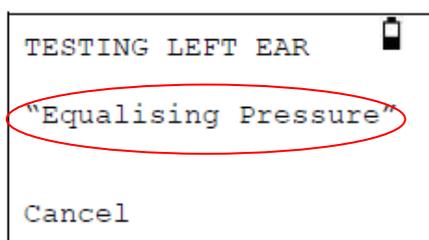
Select the ear(s) you wish to test:

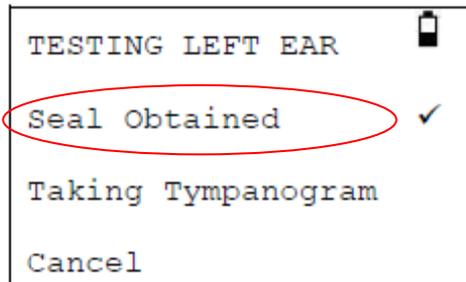
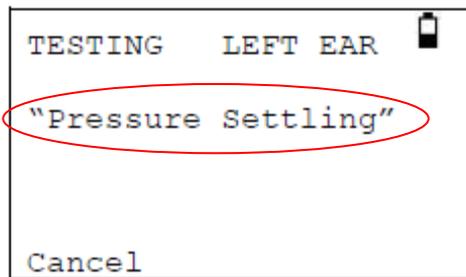


The message "Deleting last test" will be displayed momentarily. You will then be asked to insert the probe into the ear to be tested:



Present the ear tip to the ear and obtain a seal. If a good seal has been detected the following sequence of messages will be seen



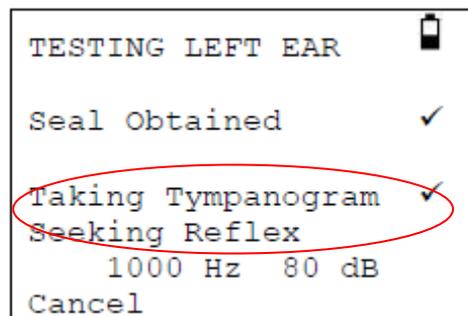


Once an adequate seal is detected the tympanogram measurement is made. This takes about 3 seconds. It is important not to move the probe and to ask the patient to remain very still during the test.

When the test is complete the instrument will go on to the reflex test, if selected and if you have the version with reflexes. By default this test is only performed if a peak is found in the tympanogram.

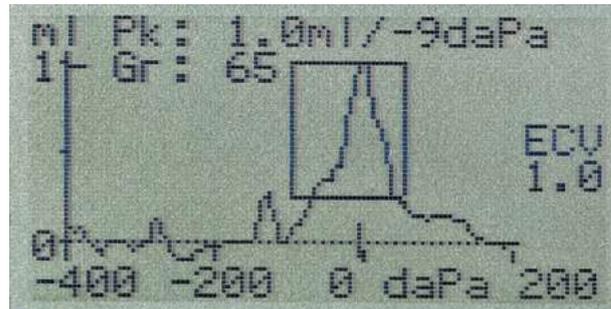
Before starting the reflex test the ear canal pressure will be set to the value that gave the peak compliance during the tympanogram test.

The instrument will then step through the tone frequencies and levels set in the CONFIGURATION menu searching for a reflex response:





When the measurement is complete the tympanogram will be displayed:



The display shows:

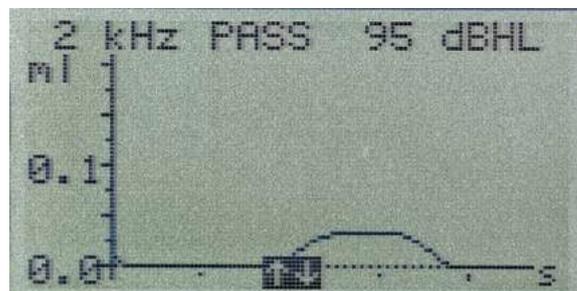
- The peak compliance, in ml (Pk)
- The pressure which gave the peak compliance in daPa
- The Gradient, in daPa (Gr)
- The Ear Canal Volume (ECV) in ml measured at 200 daPa.
- A plot of compliance against pressure.

Review the tympanogram to make sure that the peak compliance point selected by the MT10 is correct. If you are not satisfied you may select another peak using the \uparrow and \downarrow keys. The figures displayed will change to reflect the peak you select.

To repeat the test, press \leftarrow .

When you are satisfied with the tympanogram press \rightarrow .

If the reflex test was carried out the results will now be displayed:



The display shows:

- The frequency of the measurement.
- "PASS" if a reflex was found, else "NR" (No Response).
- The level of the tone for which a reflex was first found.
- A plot of compliance against time.

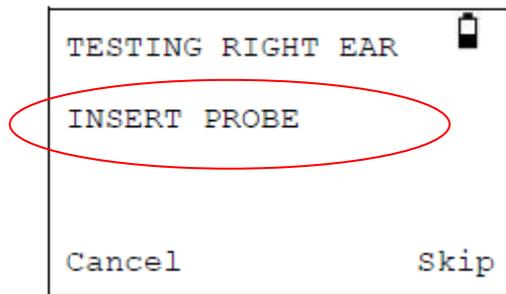
If the reflex test was performed at more than one frequency use the \uparrow and \downarrow keys to view the results for the other frequencies.

Press \leftarrow to go back and view the tympanogram or to repeat the test.

When you are satisfied with the results press \rightarrow .

The message "Saving as last test" will be displayed briefly and the results will be saved in the "last test" memory. The results will remain available until a new test is started, even if the MT10 is turned off.

If you chose to test both ears the test sequence will now be repeated for the right ear:



Press → to skip testing of the right ear and view results for the left ear.
Press ← to return to the main menu.

When all the selected ears have been tested the PROCESS RESULTS menu will be displayed. This allows you to:

- Print the test results
- Send the test results to a computer
- Save the test results in the instrument's database
- View the test results
- Return to the main menu

The results of the last test performed remain available even if the MT10 is turned off. To view these results select VIEW THE LAST TEST from the main menu. You will be asked to select the ear you wish to view and the tympanogram will be displayed. You may then view the results and select the PROCESS RESULTS menu as if the test had just been completed.

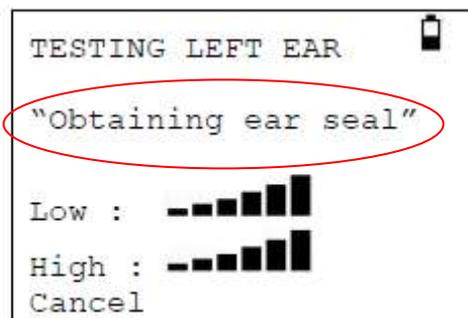
The saved results will be erased as soon as a new test is started. You should save the results to the MT10's database, print them or send them to a computer as soon as possible to ensure that data is not lost.

2.3 Ear seal check

The quality of the ear seal that is looked for when starting a test can be set through the CONFIGURATION menu.

When the EAR SEAL CHECK is set to the default QUICK option the MT10 only checks that a pressure of 100daPa can be created in the ear canal before starting the test. If the seal is not perfect it may not be possible to set the pressure at the extremes of the range. The tympanogram will be missing results at these pressures; however the result will usually be acceptable for screening purposes. If a pressure of 200daPa cannot be obtained the ear canal volume will be measured at the highest pressure achieved.

The THOROUGH option is slower but checks that the full range of pressures will be available before starting the test. When the probe is inserted the display shows the quality of the seal:



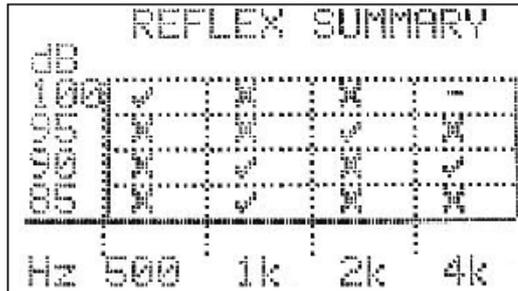


The more bars shown, the better the quality of the seal. The probe should be adjusted in the ear until two or more bars are shown.

2.4 Reflex auto stop

By default, the reflex test at each frequency will stop at the lowest sound level that produces a response. If REFLEX AUTO-STOP is set to NO in the CONFIGURATION menu the MT10 will test for reflex at all selected levels. (Note that 100dB at 4000Hz is not available).

In this case an additional display is shown following the reflex plots. This shows a summary of the levels and frequencies at which a reflex was detected:



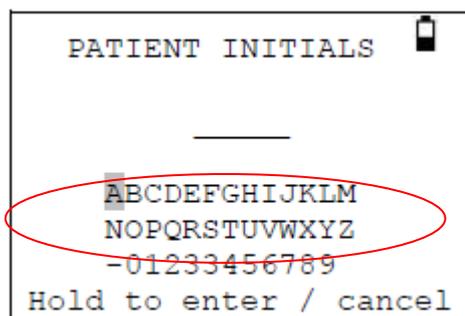




3. Saving Results in the Database

Up to 30 tests can be saved in the MT10's internal database.

To save the results of a test select SAVE RESULTS from the PROCESS RESULTS menu that is displayed on completion of a test. This menu can also be found by selecting VIEW THE LAST TEST from the main menu. You will be asked to enter a three character identifier for the record. We suggest using the patient's initials. As the tympanometer uses a combination of this identifier, the date and time to identify saved tests you may reuse the same identifier for different tests if you wish.



To enter the identifier:

Use the ↑, ↓, ← and → keys to select a character.

Press and hold the → key to enter the selected character.

Press and hold the ← key to delete the last character.

To save the test results:

Enter all three characters for the identifier.

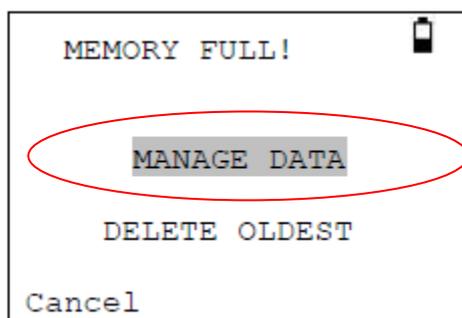
Press and hold the → key to save the record.

To cancel saving the last test:

Delete any characters that have been entered.

Press and hold the ← key.

You will be warned if the database is full when you attempt to save a test:



MANAGE DATA will take you to the DATA MANAGEMENT menu. You may then choose which records to delete to make space for the new test. Records may be printed or sent to a PC before being deleted.

DELETE OLDEST will overwrite the oldest record in memory with the results being saved.

Cancel will return you to the previous menu.





4. Sending the Results to a Printer

A thermal printer (Sanibel MPTII should be configured as Martel MCP8830) may be used with the MT10 both of which communicate via an infra-red link. The printer model is selected when ordering and will be correctly configured.

The printed report provides a patient summary that can be filled in by the clinician, plus all the analysis results and the graphical displays. The MT10 sends data to the printer through the small window to the right of the probe. The data is received through the window in the front of the printer below the on/off switch. The environment in which the MT10 and printer are used can affect the printing process. The following are recommendations but may need to be modified depending on the environment.

- The MT10 should be placed on the desk 10-20 cm in front of the Printer
- The two communication windows should be in line and pointing directly at each other.
- Both units must be out of direct sunlight for optimum communication.
- Ensure that no printer other than the one to be used is within range
- Similarly, do not have a PC with a plugged-in IRDA device within range

To print the results of the latest test:

1. Select “Send to Printer” on the right key.
2. Aim the MT10 at the infrared port at the MPTII printer and press the right key.
3. The printer is now printing. During printout make sure that the infrared connection is kept.



The same option is available through the VIEW THE LAST TEST and DATA MANAGEMENT options in the MAIN MENU.

Press ← to cancel printing.

The infra-red link must not be broken once a connection between the printer and the MT10 has been established. If the printer or MT10 are moved, or an object between them breaks the link, the printed results may be corrupted or the MT10 may not respond to the controls until the printing process has timed-out (this could take 30 to 40 seconds). This may occur if the printer batteries are discharged while attempting to print.



Once the printing process has timed-out the resulting error message can be cleared and the results re-sent to the printer. If the printed text is still corrupted select Cancel on the MT10 and then send the results to the printer again.



5. Sending the Results to a Computer

The MT10 can send test results to a computer via an infra-red link for inclusion in a NOAH database or for use by other applications.

If your computer does not have an infra-red port you will need a suitable infra-red adapter. The MT10 has been tested with the Actysis ACTIR2000U USB adapter and we recommend that you use this device. This may be purchased from Interacoustics. IR data transfer to the laptop is only possible by connecting the IR-sensor to the USB-port on the laptop. If the laptop is in a docking station, use the USB-port on the laptop.

Please refer to the operating manual for your Interacoustics MT10 module for NOAH to ensure that all necessary software is correctly installed on your computer. The MT10 sends test results to a computer through the small window to the right of the probe. The MT10 should be placed on the desk 10-20cm from the computers infra-red receiver and pointing directly at it. The receiver and the MT10 must be out of direct sunlight, to ensure good communication.

To send the results of the last test select SEND TO COMPUTER from the PROCESS RESULTS menu on completion of the test. The same option is available through the VIEW THE LAST TEST and DATA MANAGEMENT options in the main menu.

After confirming that you wish to send data the message “Trying to connect...” will be displayed.

This will change to “Connection OK” when a connection to the computer has been made, and then to “Sending record...”. A message will appear on the computer screen asking if you wish to accept the data. Click the “Yes to all” button and the data will be transferred.

When the data has been sent you will be returned to the previous menu.

Press ← at any time to stop sending data.

The transmitted results are placed in a folder called “Interacoustics”. By default this is placed on the current users desktop. If the folder already exists subsequent data will be saved in folders called “Copy 1 of Interacoustics”, “Copy 2 of Interacoustics” and so on.

Each test is stored in a separate file within the folder. Files are named thus:

nnn_DDMMYYYY_HHMM.APX (default)
or
nnn_MMDDYYYY_HHMM.APX

where nnn is the identifier entered when you stored the test in the tympanometer, or "xxx" if no identifier is available. DDMMYYYY (or MMDDYYYY) is the date the measurement was saved and HHMM is the time the measurement was saved.

If you get a “Device not found” message while trying to send data check the following:

- The MT10 is pointing directly at the computer’s infra-red receiver from no more than 10-20cm away.
- The computer has its IrDA software properly installed and the interface enabled.
- If the computer has been in “Hibernate” mode the IrDA interface is not always re-enabled. Try restarting your computer.
- The IrDA adapter on your computer is compatible with the MT10.



Turn the MT10 off and on again before trying to send the data again. If communication is lost while sending the data you will get a “Link was unreliable” message. Press ← to cancel sending the data and start the operation again.

If you see any other messages while sending data, turn the MT10 off and then on again. Try sending the data again. If the problem persists contact your Interacoustics service centre.



5. Data Management

Up to 30 patient records can be stored in the database in the MT10. Records can be listed, viewed, printed, and sent to a PC or through the DATA MANAGEMENT option of the main menu:



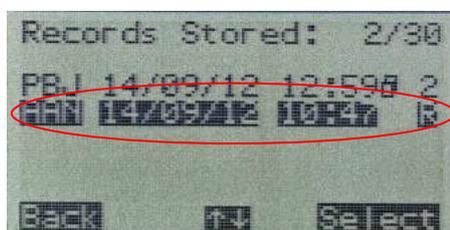
Scroll down to see the remaining choice:



If you wish to work with the record of an individual test, select LIST RECORDS. All other options operate on groups of records.

5.1 List records

LIST RECORDS shows the saved tests, 6 at a time, most recent first:



Each entry shows:

- Three-letter patient identifier entered when the test was stored;
- Date and time of the test
- Whether the test has been printed ()
- Whether the test has been sent to a PC ()
- Whether the test is for the Left (L), Right (R) or both (2) ears

Press ↑ or ↓ to scroll through the records

Press → to select the highlighted record

When you select a record the PROCESS RECORD menu will be displayed.

This allows you to:

- View the selected record
- Send the selected record to a PC
- Print the selected record
- Delete the selected record



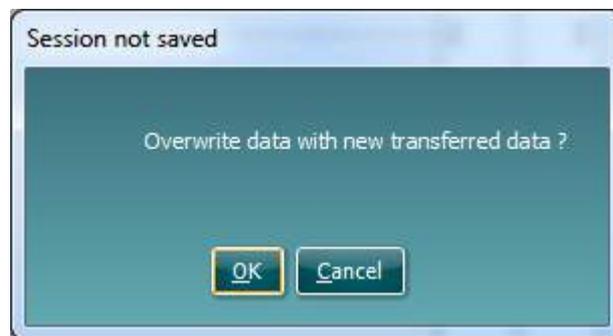
5.2 Print records

PRINT RECORDS allows you to send a group of records to the printer. You may choose to send all stored records or all records that have not already been printed. Refer to section 8 for more information.

5.3 Send records to a PC

Notice: It is advised not to transfer several records to the PC at the same time (Diagnostic suite) as the system is not prepared for this.

If you select "Send records to PC" and transfer "all records"/"Unsent records", you get the message in the Diagnostic Suite view: "Overwrite data with new transferred data"? Hence, all the records will be sent to the dedicated folder on the PC and the Diagnostic Suite will ask if you want to overwrite the current data on the screen. So "all records"/"Unsent records" will be allocated to the patient you have opened in the database (OtoAccess). Meaning the system cannot allocate the different records to the different patients. So it's recommended to send the individual records by selecting "List records" (in "Data Management") and selecting the preferred record. (NB: Remember to start Diagnostic Suite/Imp Module before transferring the record)



5.4 Delete records

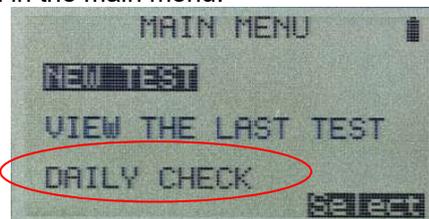
DELETE RECORDS allows you to delete a group of records. You can choose to delete all records, all records that have been printed or all records that have been sent to a computer.

You will be asked to confirm the deletion before any records are erased.

5.5 Performing daily checks

We recommend that the calibration of the MT10 is checked daily using the 4 in 1 test cavity.

Select the DAILY CHECK option in the main menu:

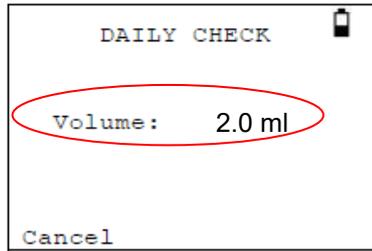


Wait until "Open" is displayed.

Insert the probe, without an ear tip, into the hole at the 2 ml end of the test cavity. Make sure that the probe is pushed fully home and is held tight against the stop. The probe must be square to the end of the test cavity.



The display should show the volume of the test cavity to within ± 0.1 ml.



Remove the probe and repeat the test with the three remaining test cavities. The display should show the volume of the 0.2ml and 0.5ml test cavities to within ± 0.1 ml. The 5.0ml test cavity should be within ± 0.25 ml.

When the checks have been completed press ← return to main menu.





6. Error Messages

Message	Meaning / Action
PROBE NOT CLEAR Please ensure the probe is not blocked or obstructed	Examine the probe tip for blockages. If necessary take it off and clean or replace it. If the problem persists, contact your Interacoustics service center
PUMP ERROR. Unknown pump fault. Restart unit. If problems persists, contact Interacoustics	
WARNING! CALIBRATION EXPIRED Recalibration needed before further tests are performed	The current date is later than the next calibration date. Check that the clock is set to the correct date. If so, arrange for the instrument to be recalibrated. Tests can still be performed.
WARNING! BATTERIES LOW. Replace batteries before performing tests.	Replace the batteries immediately.
Power down	The MT10 is turning off because the batteries are spent. Replace the batteries.
PUMP ERROR. Cannot determine pump direction. If problem persists, contact Interacoustics.	
Measurement timed out	This occurs when the ear seal check is set to THOROUGH if: <ol style="list-style-type: none"> 1) The pump failed to achieve the starting pressure within 4 seconds. This may be because the probe was moved in the ear. 2) The pressure failed to reach -400daPa within 12 seconds. Retry the test. If the problem persists, contact your Interacoustics service center.
WARNING! DEVICE UNCALIBRATED. One or more default values require recalibration before further tests are performed.	This message should never normally be seen. If it occurs contact your Interacoustics service center.
WARNING! DEFAULTS RELOADED. Default configuration settings reloaded. Check before making new tests.	This message should never be seen. Check all the CONFIGURATION settings before taking any measurements. If the error persists, contact your Interacoustics service center.
ERROR Transfer failed No device found	The MT10 was unable to send data to the computer.
ERROR Transfer failed Link was unreliable	
WITHDRAW PROBE	The probe has been moved during measurement. Re-insert the probe to repeat the test.
Volume outside range WITHDRAW PROBE	The ear canal volume is above the 5ml. This message also occurs when the probe is not properly inserted into the ear.
Blocked probe WITHDRAW PROBE	The ear canal volume is below 0.1ml. This message also occurs when the probe tip is blocked. Check that the probe is correctly inserted into the ear. Check that the probe is not blocked.
INSERT PROBE	The seal was lost. Reinsert the probe to repeat the test.





7. Recommended Litterature

Arlinger, Stig:

Manual of Practical Audiometry, Vol.1 (Taylor & Francis. 1989.)

Bess, Fred H. and Hall III, James W.:

Screening Children for Auditory Function. (Bill Wilkerson Center Press 1992)

Biswas, Anirban:

Clinical Audiovestibulometry, (Bhalani Medical Book House, Bombay, India 1995)

Borg, Erik et al.:

Audiological Aspects of Secretary Otitis Media. (Scand. Aud. Supp. 26. 1985)

Brask, T.:

Extratympanic Manometry in Man. (Scandinavian Audiology, supp. 7. 1978)

Feldmann and Laura Ann Wilber:

Acoustic Impedance Admittance - the measurement of middle ear function. (Williams & Wilkins 1976)

Fiellau-Nikolajsen, Mogens:

Tympanometry and Secretary Otitis Media. (Acta Oto-L. 1983)

Harford, Earl R.:

Impedance Screening for Middle Ear Disease in Children. (Grune & Stratton. 1978)

Jerger, J.:

Clinical Experience with Impedance Audiometry. (1970)

Katz:

Handbook of Clinical Audiology, Fourth Edition 1994 (Williams & Wilkins 1985)

Kunov, H.:

The "Eardrum Artifact" in Ipsilateral Reflex Measurements. (Scand. Aud. 6. 1977)

Liden, G. et al.:

International Symposium on Impedance Audiometry and Pediatric Audiology Göteborg 1982. (Scandinavian Audiology supp. 17. 1983)

Liden, G. et. al.:

Automatic Tympanometry in Clinical Practice. (Audiology 13. 1974)

Liden, G. et. al.:

Tympanometry for the Diagnosis of Ossicular Disruption. (Arch Otolaryngol vol.79 1974).

Liden, G.:

Audiology (Almqvist & Wiksell. 1985) (Swedish language)

Popelka, G. R. et al.:

Hearing Assessment with the Acoustic Reflex. (Grune & Stratton 1981)



