

**Earscan<sup>®</sup>**  
**MP Pure Tone Audiometer**  
**OWNER'S MANUAL**



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# TABLE OF CONTENTS

## Chapter 1 INTRODUCTION

The Earscan Line.....	1-3
Earscan MP Pure Tone Audiometer.....	1-3
Contents of Earscan Package.....	1-4
The Manual.....	1-4
Contents.....	1-4
Notations.....	1-4

## Chapter 2 INSTALLATION

Connections.....	2-5
Power.....	2-5
Getting Ready to Test.....	2-6

## Chapter 3 AUDIOMETER

Programming Test Parameters.....	3-7
Accessing Programming Mode.....	3-7
Programming Mode.....	3-7
Programming Frequencies.....	3-8
Programming Stimulus Range.....	3-9
Testing Procedure.....	3-10
Control Panel Display.....	3-11
Manual Audiometry.....	3-13
Tone Stimulus Selection.....	3-13
Initiate Test.....	3-13
Frequency Select.....	3-13
Level Select.....	3-13
Ear Select.....	3-13
Tone On & Save.....	3-13
Threshold.....	3-13
Automatic Audiometry.....	3-14
Start Testing.....	3-14
Test Protocol for Automatic Testing.....	3-14
Threshold Version.....	3-14
Pass/Fail Screening Version.....	3-16
Pause.....	3-16
Abort.....	3-16
Restart.....	3-17
Retest.....	3-17
Display Thresholds.....	3-17
Hand-Recorded Reports.....	3-18
Clearing Test Data Before New Test.....	3-18

## Addendum

Keypad Summary	Abbreviations
Limited Warranty	Instrument Return

## **INTRODUCTION**

Micro Audiometrics Corporation is dedicated to hearing health care through the manufacture of microprocessor ear testing instrumentation. The Earscan hearing testing instrument line has been carefully engineered to provide proven testing features including tympanometry, reflex plots, manual, and automatic pure tone audiometry. Data management, convenience, accuracy, and ease of use are also given a high priority since these more practical considerations weigh heavily in the effectiveness of hearing health care. Features found in Earscan have taken many years of evolution to perfect and may be further improved by user suggestions. Please contact us if you have any questions or suggestions about our products.

### **THE EARSCAN LINE**

Earscan is a compact computer ear testing instrument line, which can be configured with a variety of options to fill the user's needs at a minimum initial cost. Available in the Earscan line are: manual/automatic audiometry in a threshold or screening version, tympanometry, acoustic reflex, and output to printers or computers. Any of these options may be installed at the factory or authorized service center at any time. This flexibility is made possible by using a multipurpose keypad, an alphanumeric/graphics display, and microprocessor circuitry. Earscan can display results immediately on the LCD screen, send hard copy reports to a separate printer, and transfer test results directly to a host computer for data base management.

### **EARSCAN MP PURE TONE AUDIOMETER**

This instrument is a manual/automatic air conduction audiometer, purchased in a pass/fail screening or threshold version. With either version the user may set his own test parameters prior to actual testing, thus providing maximum speed and thoroughness during the test procedure. A LCD reports stored test data, allowing the operator to recall established thresholds for both ears. You may, at any time, upgrade Earscan MP Pure Tone Audiometer with any of the options included in the Earscan line. Contact Micro Audiometrics or your distributor for additional information.

## CONTENTS of EARSCAN MP PURE TONE AUDIOMETER PACKAGE

### STANDARD

Earscan MP Pure Tone Audiometer  
 TDH-39 Earphones  
 Patient Response Button  
 Earscan Owner's Manual  
 Laminated Operating Guide

### OPTIONAL

Carrying Case  
 Noise Excluding Headphone Enclosure  
 Sound Room Cords

## THE MANUAL

### CONTENTS

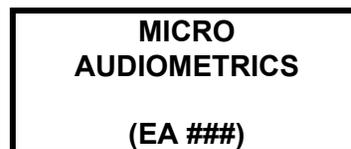
This manual is divided into chapters and an appendix. Refer to the Table of Contents for a listing of each topic and its location in the manual. The following is a summary of the contents of the manual:

<b>Introduction</b>	A basic description of Earscan and this manual.
<b>Installation</b>	Instructions for external connections and basic operation.
<b>Audiometry</b>	Procedures for operating the manual and automatic audiometer and programming test parameters.

### NOTATIONS

This manual uses the following notations to illustrate user interaction with Earscan.

<b>Key Entries</b>	appear in < > i.e. <TONE>.
<b>Multiple Entries</b>	appear in the order shown and must be keyed-in sequentially. i.e. <CLEAR>, <DISP>.
<b>Display Messages</b>	appear in the manual as shown:

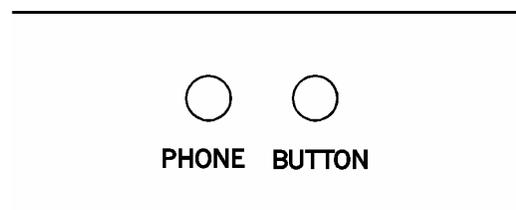


## INSTALLATION

This chapter helps you prepare the instrument for testing by explaining how to connect accessories and what happens after turning on the power.

### CONNECTIONS

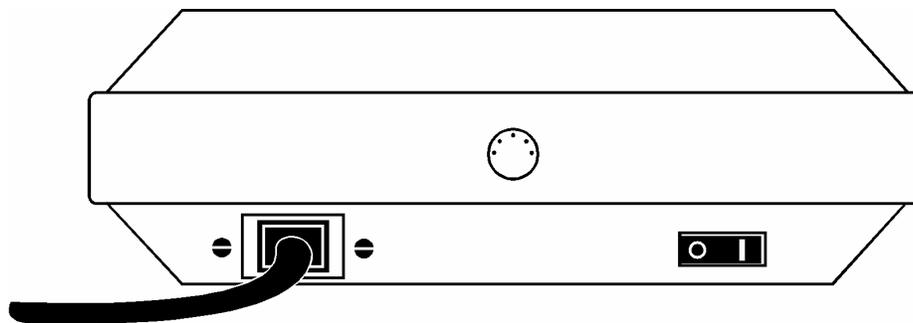
The headphones and patient response button are connected as follows: headphones connect to the jack labeled **PHONE** and the patient response button connects to the jack labeled **BUTTON**.



**NOTE:** DO NOT swap headsets among units as they are not interchangeable. Each Earscan is calibrated to match a particular headset. The last digits of the Earscan serial number are engraved on each headphone label.

### POWER

Insert the female connector of the power cord into the power receptacle of Earscan on the rear of the unit. Connect the 3-conductor power cord to a properly grounded outlet, which supplies the voltage specified on the serial number tag on the bottom of the instrument.





## AUDIOMETER

Earscan MP Pure Tone Audiometer is equipped with a pure tone manual and automatic audiometer, available in either a pass/fail screening version or a threshold version. The threshold version tests frequencies from 250 to 8K Hz, with a range from 0 to 90 dB HL (except 250 and 8K to 70 dB HL). The frequencies and hearing levels for the screening version were set at the factory to customer specifications. Both versions can store thresholds and status codes for each frequency for both ears. Audiometric results are immediately available on the LCD screen and may be hand-recorded on an audiogram pad, if necessary. Providing additional flexibility, the user may set his own test parameters prior to testing, further described below.

### PROGRAMMING TEST PARAMETERS

The user may find it advantageous to set his own frequencies and hearing levels for a particular testing situation. These user set parameters appear in both manual and automatic modes, and are held in Earscan memory until the instrument is turned off. Earscan then returns to the factory set parameters.

#### ACCESSING PROGRAMMING MODE

To activate the frequency and stimulus level programming, press and hold <MAN> until an audible alert signal announces access to the **AUDIOMETER SET-UP MODE**.

**AUDIOMETER  
SET-UP MODE  
Press <DISP>  
to scroll menu**

#### PROGRAMMING MODE

Press <DISP> to view the menu screen. The menu screen displays the following functions that may be performed when in the programming mode.

**<TONE> ---ADD  
<CLEAR> ---REMOVE  
<MAN> ---EXIT  
<DISP> ---(more)**

- <TONE> Add frequency to your test parameters.
- <CLEAR> Remove frequency from your test parameters.
- <MAN> Exit programming mode.
- <DISP> Display next screen.
- <AUTO> Set selected frequency as starting frequency in test sequence.

**NOTE:** Entering the Audiometer Programming Mode automatically clears any threshold previously tested.

## PROGRAMMING FREQUENCIES

```

<←,⇒>-SEL FREQ
↓
-
250 1K 500 1K
    *  *
  
```

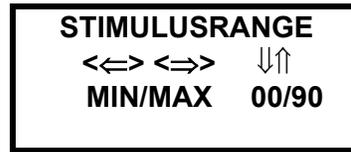
```

<←,⇒>-SEL FREQ
↓
2K 3K 4K 6K 8K
    *  *  *
  
```

Select a frequency to be programmed by pressing <Hz ⇐> or <Hz ⇒>, thus moving the pointer (↓) on the screen to the desired frequency. When the (↓) is displayed above the desired frequency, press <TONE> to add the frequency, or press <CLEAR> to remove the frequency from the sequence. Repeat this procedure for each frequency to be changed. The starting frequency in the test sequence is indicated by (-) and is set by pressing <AUTO>. The (\*) indicates frequencies to be included in the test sequence.

Press <DISP> to continue programming, or press <MAN> to exit the programming mode.

## PROGRAMMING STIMULUS RANGE



Press <Hz => to select the '**minimum stimulus range**' position on the screen. Set the desired minimum dB level by pressing the <dB⇅> and <dB⇅> keys.

Press <Hz => to select the '**maximum stimulus range**' position on the screen. Set the desired maximum dB level by pressing the <dB⇅> and <dB⇅> keys.

Press <DISP> to continue programming, or press <MAN> to exit the programming mode.

(⇅) indicates the range selected; minimum or maximum.

**NOTE:** The dB level for the '**minimum stimulus range**' can not be set higher than the dB level for the '**maximum stimulus range.**' Conversely, the dB level for the '**maximum stimulus range**' can not be set lower than the dB level for the '**minimum stimulus range.**' Example: If the dB level for the '**maximum stimulus range**' is set to 50 dB HL, then the dB level for the '**minimum stimulus range**' can not be set higher than 50 dB HL.

## TESTING PROCEDURE

Audiometric testing entails the following steps:

1. Ensure that the headphones are connected to the jack labeled PHONE and the patient response button is connected to the jack labeled BUTTON before testing.
2. Seat the patient so the patient cannot see the front panel of the audiometer. If doing manual audiometry, instruct the patient to raise his hand on the same side the sound is coming from, or press the patient response button when tone is heard. When the patient response button is pressed, an asterisk (\*) will be displayed on the LCD. If doing automatic audiometry, instruct the patient to press and release the patient response button when the tone is heard.
3. Place headphones securely over the ears, making sure the red phone covers the right ear and the blue phone covers the left ear.
4. Press **<DISP>**, then press and hold **<CLEAR>** until **NEW TEST** appears.
5. Conduct test by following the procedures described in the section on Manual Audiometry or Automatic Audiometry. Earscan functions the same as any conventional audiometer, but is controlled by pressing keys instead of turning knobs.
6. Press **<DISP>** to cycle display of thresholds. Retest any results in question.
7. Audiometric results may be hand-recorded on a hearing test results pad, if necessary.

## CONTROL PANEL DISPLAY

The display shows the operator selections during the course of testing or a detailed review of the stored data.

<b>R</b>	<b>M</b>
<b>FREQ. = 1000 Hz</b>	
<b>LEVEL = 25 dB</b>	
<b>UNTESTED</b>	

The first line displays the ear and testing mode selected.

<b>&lt;RIGHT/LEFT&gt;</b>	R	Right Ear
	L	Left Ear
<b>&lt;MAN&gt;</b>	M	Manual Mode
<b>&lt;AUTO&gt;</b>	A	Automatic Mode

The second line displays the frequency selected.

Sequence	250, 1K, 500, 1K, 2K, 3K, 4K, 6K, and 8K Hz
<b>&lt;Hz =&gt;</b>	Moves selection right in the sequence.
<b>&lt;Hz &lt;=&gt;</b>	Moves selection left in the sequence.

The third line displays the level in dB HL and is calibrated to comply with ANSI S3.6-1996 when used with Telephonics TDH-39 earphones.

<b>&lt;dB ↑&gt;</b>	Increases level by 5 dB HL.
<b>&lt;dB ↓&gt;</b>	Decreases level by 5 dB HL. (10 dB HL for industrial)

The fourth line displays a message about the test; in this example the frequency has not been tested. They are:

<b>UNTESTED</b>	Indicates that the frequency for the ear shown has not been tested and stored in memory.
<b>-ON-</b>	Indicates that a tone is being presented at the specified frequency and level.
<b>NO RESPONSE</b>	Indicates that no response was obtained at the maximum output level.
<b>BUTTON DOWN</b>	Indicates that an automatic test has been terminated because the patient response button was held down.
<b>NOT CONSISTENT</b>	Indicates that 18 tone presentations have not detected two consistent thresholds.
<b>FALSE RESPONSE</b>	Response button randomly pressed twice outside of the response window during the testing of a given frequency.

**VALIDITY ERROR** Indicates that a threshold difference greater than 5 dB was obtained during the 1K validity check. **NOTE:** The validity error check is not pre-programmed at the factory unless specified. This error check is not user programmable.

If no message is displayed, the frequency has been tested and recorded in memory according to the dB level, the R/L ear, and the A/M audiometry mode as displayed.

An individual level or message may be removed from memory by pressing <**CLEAR**>.

## MANUAL AUDIOMETRY

While in this mode the audiometer is under the operator's control. Earscan manual audiometer is activated upon power-up, or by pressing the <MAN> key, and then manipulating the <Hz ⇔>, <Hz ⇒>, <dB ↑>, <dB ↓>, <RIGHT/LEFT>, <TONE>, <DISP>, and <CLEAR> keys. The controls are:

### STONE STIMULUS SELECTION

The Manual Audiometer can present the stimulus as a 3-pulsed tone or continuous tone by toggling <TONE MODE>. Normal default is to the 3-pulsed tone.

### INITIATE NEW TEST

Press <DISP>, then press and hold <CLEAR> until an audible alert signal is sounded and **NEW TEST** appears.

### FREQUENCY SELECT

The <Hz ⇔> and <Hz ⇒> keys are used to select successively lower or higher frequencies from the sequence:

250, 1K, 500, 1K, 2K, 3K, 4K, 6K, and 8K Hz

**Note:** The sequence ...1K, 500, 1K...is part of the automatic audiometry validity check and therefore appears in the manual mode as well.

### LEVEL SELECT

The <dB ↑> <dB ↓> keys are used to increase and decrease level by +5 and -5 dB HL (-10 dB HL for industrial). Increment levels beyond the maximum level will display **NO RESPONSE** (NR).

### EAR SELECT

Pressing <RIGHT/LEFT> toggles the earphone selection between Right and Left.

### STONE ON & SAVE

The <TONE> key presents the stimulus as a 3-pulsed-tone when it is pressed and released, or as a continuous tone for the duration it is pressed, depending upon the stimulus option chosen. It also stores the level in memory as a threshold and erases previous levels at that frequency.

### THRESHOLDS

To establish a threshold for later printing or review, test the frequency, establish threshold, present the tone at the threshold, and move to a new frequency. Each time Earscan moves to a new frequency, it "remembers" the last decibel level of the "old" frequency. To record a "no response" condition (NR), increment the level until the display message reads **NO RESPONSE**, then present the tone <TONE>.

## AUTOMATIC AUDIOMETRY

In this mode the audiometer is controlled by the computer. Changes in level are made based upon the patient's response and a threshold is determined for each frequency for both ears.

### START TESTING

To clear old test data press <**DISP**>, then press and hold <**CLEAR**> until an audible alert signal is sounded and **NEW TEST** appears. Testing the "Better Ear First" is possible by allowing the user to toggle <**RIGHT/LEFT**>, therefore selecting which ear to begin testing with. Press <**AUTO**> to start automatic testing.

### TEST PROTOCOL for AUTOMATIC AUDIOMETRY (THRESHOLD VERSION)

1. The automatic test starts at a stimulus level of 25dB at the start frequency pre-programmed at the factory, or at the start frequency selected in the programming mode.
2. The stimulus increment and decrement size is initially set to +20 dB and -10 dB, respectively, for the start of each frequency. The increment size remains at +20 dB until a positive response is detected from the Patient Response Button. After a positive response, the increment size is set to +5 dB, and remains set at this level until the threshold is established for this frequency, or until the test is aborted.
3. After each stimulus presentation, Earscan will either decrease the level by 10 dB if a positive response is detected, or increase the level by 5 dB if a negative response is detected (20 dB if no previous response has been detected for a given frequency).
4. Two ascending thresholds are required at a given level for Earscan to record that level as a threshold. An ascending threshold occurs when a positive response to a stimulus presentation immediately follows a 'negative response' to the previous stimulus presentation.
5. If the stimulus is presented at 90 dB HL and there is no response, Earscan will display the message **NO RESPONSE** and again present the stimulus. If no response is still detected, Earscan will record the threshold as **NO RESPONSE**, NR, and continue testing with the next frequency in the test sequence.
6. The next frequency in the test sequence will start at a level 5 dB greater than the threshold for the preceding frequency. However, there is a minimum and maximum starting level of 20 dB HL and 60 dB HL, respectively. Ex: if a threshold has been established at 60 dB HL or greater, then Earscan will start the next frequency at a level of 60 dB HL. If the threshold for the previous frequency is less than 20 dB HL, Earscan will start the next frequency at 20 dB HL.
7. After the last frequency in the test sequence has been tested for the selected ear, Earscan will review each frequency in the test sequence, starting with the first frequency in the test sequence; 250, 1K, 500, 1K, 2K, 3K, 4K, 6K, 8K, and test any frequencies for that ear that have not been tested.

8. After all of the frequencies have been tested for one ear, Earscan will check the other ear to see if all of the frequencies have been tested. If both ears have not been tested, Earscan will select the other ear, start testing at the frequency and level as indicated in step (1) above, and continue testing in the manner as described. If both ears have been tested, Earscan will emit an audible 'End of Test' signal, and display:

**TEST  
COMPLETE**  
**(Select Mode)**

9. The results can be displayed from the Display Mode by pressing <**DISP**>, or from the Manual Audiometry Mode by pressing <**MAN**>.

**TEST PROTOCOL for AUTOMATIC AUDIOMETRY (PASS/FAIL SCREENING VERSION)**

1. The automatic screening test starts testing at the minimum stimulus level and 'start' frequency pre-programmed at the factory, or re-programmed by the user.
2. The stimulus level is incremented in 5 dB steps until a positive response is detected, or until the maximum level is presented.
  - a. If a positive response is detected, the stimulus level at that presentation is recorded (corresponding to a PASS condition), and the next frequency in the sequence is tested.
  - b. If the maximum stimulus level is presented and no response is detected, the stimulus is again presented with a **NO RESPONSE** message displayed.
  - c. If there is a positive response this time, the stimulus level is recorded, and the next frequency in the sequence is tested.
  - d. If there is still no response, the stimulus level is recorded as NR (corresponding to a FAIL condition), and the next frequency in the sequence is tested.
3. The test proceeds in this manner for each frequency in the test sequence until the last frequency is tested for the selected ear. Earscan will then review each frequency, starting with the first, and test any frequencies that have not been tested.
4. After completing the first ear, Earscan will test the other in the same manner as described above.
5. Upon completion of both ears, Earscan will emit an audible 'end of test signal' and display:

<p style="text-align: center;"><b>TEST COMPLETE</b> <b>(Select Mode)</b></p>
--

6. The results can be reviewed from the Display Mode by pressing **<DISP>**, or from the Manual Audiometry Mode by pressing **<MAN>**.

**PAUSE**

Press **<MAN>** once to stop the automatic test. You may display audiometric results, test in the manual mode, or restart the automatic sequence as desired.

**ABORT**

The automatic sequence is aborted when the patient response button is held down continuously, two false responses have been detected, or when 18 tone presentations have not resulted in a threshold. The test will stop, an audible signal will emit, and the LCD will display the error condition as **BUTTON DOWN, FALSE RESPONSE, OR NOT CONSISTENT**, respectively.

**RESTART**

Once the automatic sequence has been aborted the operator should re-instruct the patient and press **<CLEAR>** to return the audiometer to the manual mode. You may review the current test status by pressing the **<DISP>** key or manipulating the **<Hz>** and **<RIGHT/LEFT>** keys to cycle through each frequency. Restart the automatic test by pressing **<AUTO>** and the sequence will start at the ear, frequency, and level indicated on the display, skipping any frequencies already tested.

**RETEST**

Locate the desired frequency and ear by using the appropriate keys and press the **<CLEAR>** key. This removes the entry from memory and may be repeated for as many questionable thresholds as desired. All cleared values will be retested when the automatic test is started by pressing **<AUTO>** or may be retested manually by the operator.

**DISPLAY THRESHOLDS**

Press **<DISP>** when in the manual audiometry mode to view thresholds.

	1K	.5K	1K	2K
RT	10	05	10	20
LT	05	00	05	15

Press **<DISP>** again and view:

	3K	4K	6K	8K
RT	40	65	NR	NR
LT	25	50	55	65

In addition to these screens of information you may also review both threshold and status messages using the **<Hz ↔>** and **<Hz ⇒>** keys in the manual audiometry mode. This is the only way to see 250 Hz.

## **HAND-RECORDED REPORTS**

While viewing results on the LCD screen, a record may be hand-recorded on a hearing test results pad. If recording on an audiogram, a "O" is plotted for the right ear, and a "X" for the left ear.

## **CLEARING TEST DATA BEFORE NEW TEST**

After testing is complete and the information has been recorded, if necessary, press **<DISP>** and then press and hold **<CLEAR>** until an audible alert signal is sounded. The LCD will momentarily display **NEW TEST** and then return you to the audiometry mode.



**-NEW TEST-**

This 2-key sequence erases all test data. After clearing, Earscan is ready to test a new person. It is not necessary to clear between each person tested although it does guarantee that no data from the previous person will appear in the new test data. Retesting will overwrite any old information.

## KEYPAD SUMMARY

<AUTO>	Automatic audiometer.
<MAN>	Manual audiometer. Stop automatic, revert to manual audiometry mode.
<DISP>	Display audiometric thresholds.
<CLEAR>	Reset/Erase/Abort key. Clear single thresholds in manual audiometry mode. Exit error condition during "automatic" testing.
<DISP><CLEAR>	Clears old test from memory to start a new test.
<Hz ⇐>	Decrement stimulus frequency in manual audiometry.
<RIGHT/LEFT>	Select earphone.
<dB ↑>	Increment stimulus level in manual audiometry.
<TONE>	Present stimulus tone in manual audiometry.
<dB ↓>	Decrement stimulus level in manual audiometry.
<TONE MODE>	Toggles manual audiometer stimulus between 3-pulse tone and continuous tone.
<HZ ⇒>	Increment stimulus frequency in manual audiometry.

## **ABBREVIATIONS AND THEIR DEFINITIONS**

<b>dB</b>	<b>Decibel:</b> The unit of measurement for intensity (loudness) of pure tones.
<b>HL</b>	<b>Hearing Level:</b> Refers to decibel level of hearing based on widely accepted normative values, i.e. 0 dB HL is the softest sound a normal good ear can hear.
<b>Hz</b>	<b>Hertz:</b> A unit of measurement for frequency (pitch) of pure tones, i.e. 2000 Hz; equivalent to cycles per second.
<b>LCD</b>	<b>Liquid Crystal Display:</b> A low power graphics display which emits no light.