

SMART TONE

Automatic Audiometer

User's Manual



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Installation

Welcome

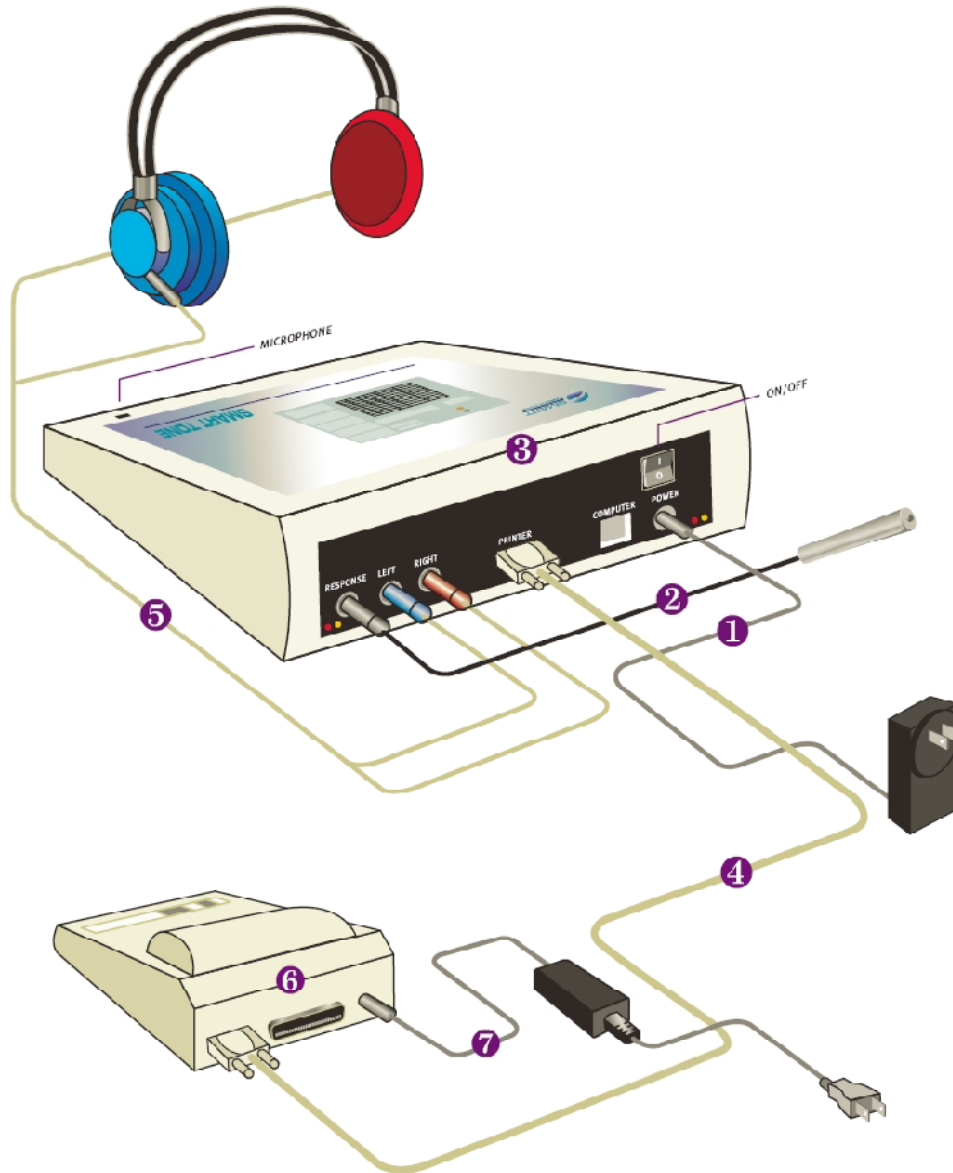
Congratulations on your purchase of the SMART TONE automatic audiometer, an advanced, easy-to-use pure-tone threshold audiometer. The intelligent features and user-friendly controls of the SMART TONE streamline the testing process to efficiently collect hearing thresholds at seven frequencies. The SMART TONE stores audiograms, and can print results to an optional external printer or transfer them to third-party software.

Audiometer Installation

To install the audiometer:

Refer to the figure below.

1. Insert the blue headset connector into the blue LEFT jack, and the red headset connector into the red RIGHT jack on the back panel.
2. Insert the connector for the response switch into the RESPONSE jack on the back panel.
If you are using an audiometric test booth, use patch cords to make connections through the booth patch panel.
3. Connect the cord of the power supply to the POWER jack on the back panel of the audiometer.
4. Plug the power supply into a wall outlet.
5. Turn on the power switch on the back panel of the instrument. The LCD display on the instrument's top panel will illuminate, indicating that the audiometer is on.



Audiometer with optional printer

Key to Numbers in Diagram

1. Power supply (audiometer)
2. Response switch
3. Audiometer
4. Serial cable
5. Headset
6. Thermal printer
7. Power supply (printer)

Connecting the Printer to the Audiometer

The supported external printer for the audiometer is a Seiko DPU-414 using 4-inch thermal paper.

For information on purchasing this printer, contact your Smart Diagnostic Devices distributor. To find the distributor nearest you, contact Smart Diagnostic Devices at (612) 548-5556.

To connect the printer to the audiometer:

- Using a cable, connect the printer to the port on the audiometer back panel labeled "PRINTER".

Printer Setup

If the printer has been purchased from Smart Diagnostic Devices or a Smart Diagnostic Devices distributor, it has already been configured according to the following procedure.

Otherwise, follow the procedure below to set up the printer. The printer must be properly configured before it can operate with the audiometer.

When completed, the configuration is stored within the printer and will not be lost if power is removed from the printer.

If any mistakes are made while executing the procedure below, simply switch the power to the printer OFF, then restart the procedure. Further information can be found in the "DPU-414 Operation Manual."

To configure the printer:

1. Switch off the printer.
2. Press and hold the ONLINE button while switching the printer back on. Release only after a list of current settings starts to print out.
Beyond the following step, configuration settings must be entered sequentially. It is not possible to undo the settings without restarting the procedure. If a mistake is made, start the procedure beginning with step 1.
3. Press the ONLINE button once to begin entering settings for DIP SW1.
4. Press the buttons EXACTLY according to the following sequence and check that the resulting message is correct:

Press button:	Verify message:
FEED	1 (OFF) : Input = Serial

ONLINE	2 (ON) : Printing Speed = High
ONLINE	3 (ON) : Auto Loading = ON
ONLINE	4 (ON) : Auto LF = ON
ONLINE	5 (ON) : Setting Command = Enable
FEED	6 (OFF) : Printing
ONLINE	7 (ON) : Density
ONLINE	8 (ON) : = 100%

5. Next, press ONLINE again to begin entering settings for DIP SW2.

6. Press the buttons, similar to step 4, and verify the message:

Press button:	Verify message:
ONLINE	1 (ON) : Printing Columns = 40
FEED	2 (OFF) : User Font Back-up = OFF
ONLINE	3 (ON) : Character Select = Normal
FEED	4 (OFF) : Zero = Slash
ONLINE	5 (ON) : International
ONLINE	6 (ON) : Character
ONLINE	7 (ON) : Set
FEED	8 (OFF) : = U.S.A

7. Press ONLINE once more to enter the settings for DIP SW3.

8. Press the buttons and verify the message:

Press button:	Verify message:
ONLINE	1 (ON) : Data Length = 8 bits
FEED	2 (OFF) : Parity Setting = Yes
FEED	3 (OFF) : Parity Condition = Even
ONLINE	4 (ON) : Busy Control = H/W Busy
FEED	5 (OFF) : Baud
ONLINE	6 (ON) : Rate
ONLINE	7 (ON) : Select
FEED	8 (OFF) : = 19200 bps

9. Press ONLINE one more time to finish. Settings are saved to memory and the entire list of current settings will print out. Double-check the re-printed

settings against the above steps. If the settings do not match, perform the procedure again beginning with step 1.

Data Transfer

Data transfer of one or more audiograms sends a copy of the audiogram(s) to the database management system that you are using on the computer. The database management system that you are using must support the RA500 communication protocol, which is the communication protocol used by the SMART TONE audiometer for data transfer. Transfer is initiated using the database.

For transfer, the audiometer must be connected to the computer with a cable. In addition, the data transfer software on the included CD must be installed on the computer. See the next sections.

In your database management system, select the RA500 as the audiometer with which the computer will communicate.

The audiometer is already set up for data transfer. No adjustments are necessary. Data transfer is initiated from the third-party software. Set the communication parameters in the third-party software to 9600 baud, 8 data bits, no stop bits, no parity.

In some database management systems, the COM port assigned to the audiometer must be between COM1 and COM4. A procedure for changing the COM port is supplied in the section called Changing the Audiometer's COM Port on the Computer on page 12.

Installing the Windows Driver for Data Transfer

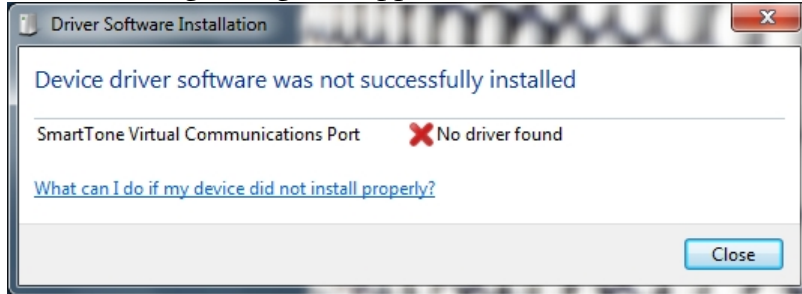
To connect the audiometer to third-party software on the computer, you will need to install the driver on the included CD onto the computer, which makes the audiometer appear as a COM port on the computer. Windows XP, Vista (32-bit or 64-bit) and Windows 7 (32-bit or 64 bit) operating systems are supported. The connection uses one USB port.

Refer to the procedures below. The instructions differ depending on which Windows operating system your PC is running.

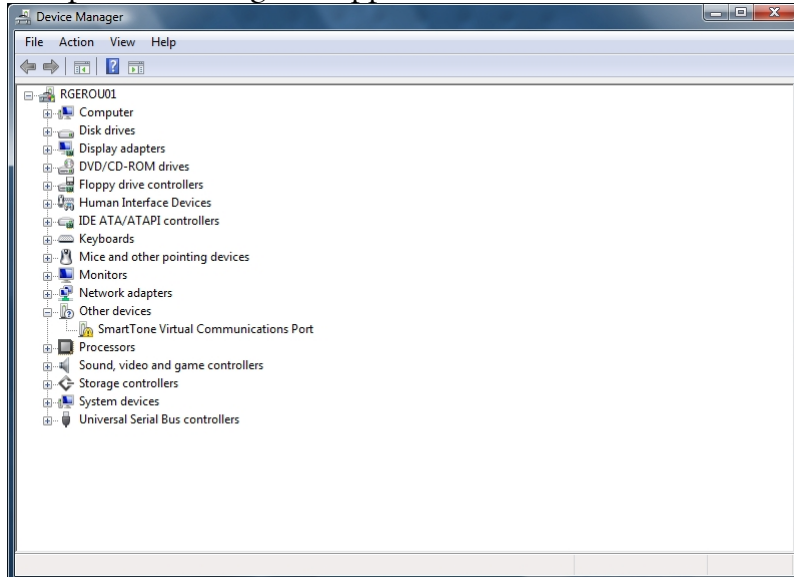
To install the driver on a computer using Windows 7:

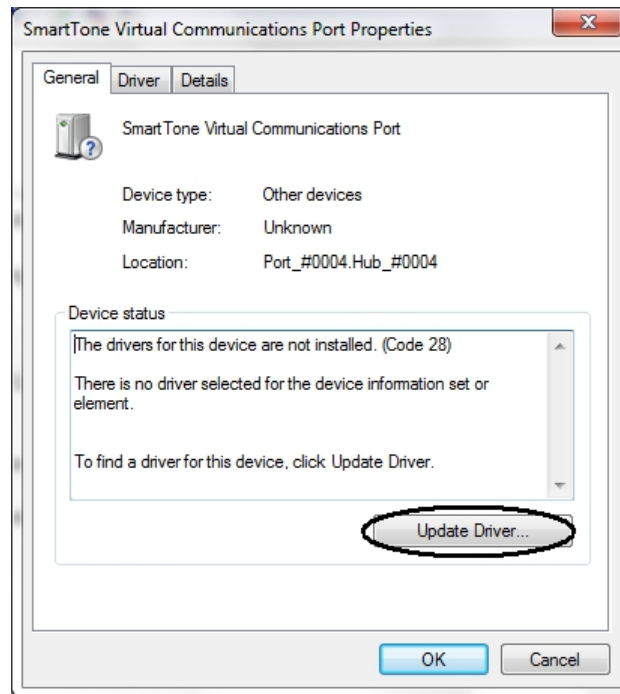
1. With the computer running, connect the audiometer to the computer using a cable, and turn on the audiometer power switch.

The following dialog box appears.



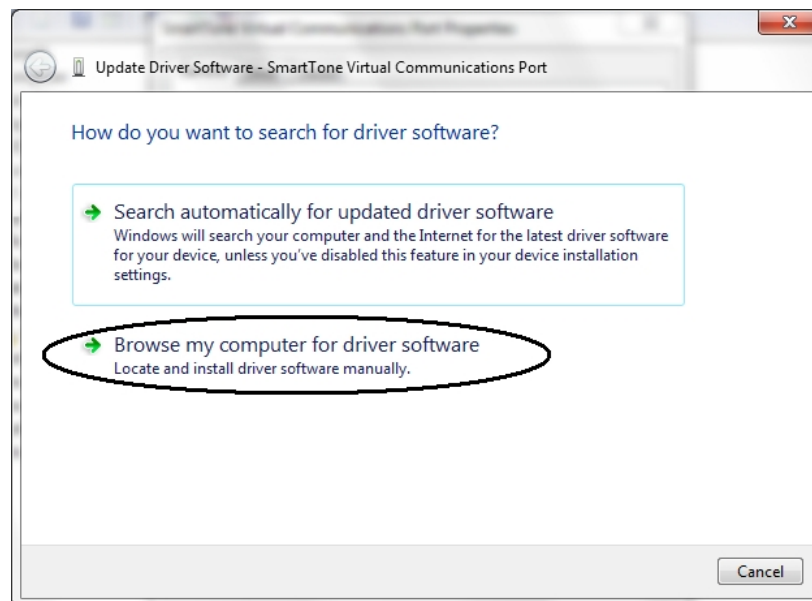
2. In order to install the driver, open the Device Manager as shown below and double-click on “SmartTone Virtual Communications Port”. The “Properties” dialog box appears:



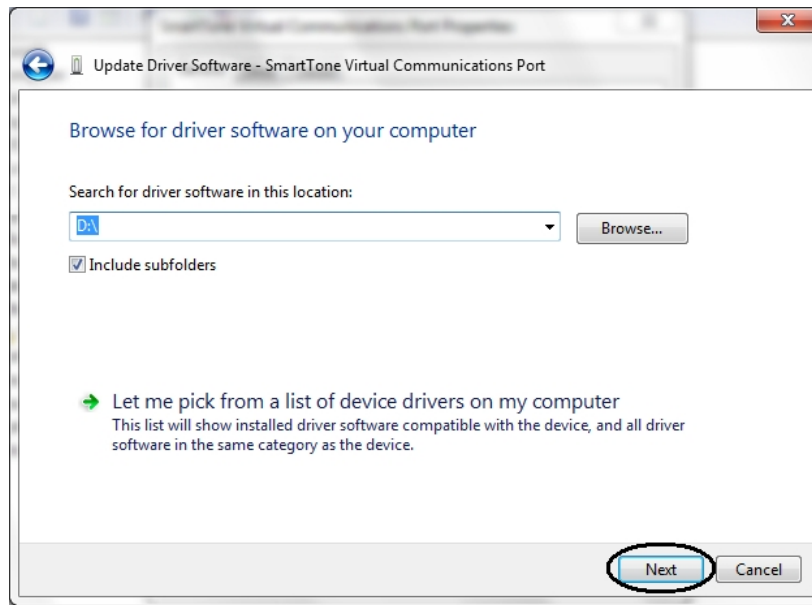


3. Click the Update Driver button.

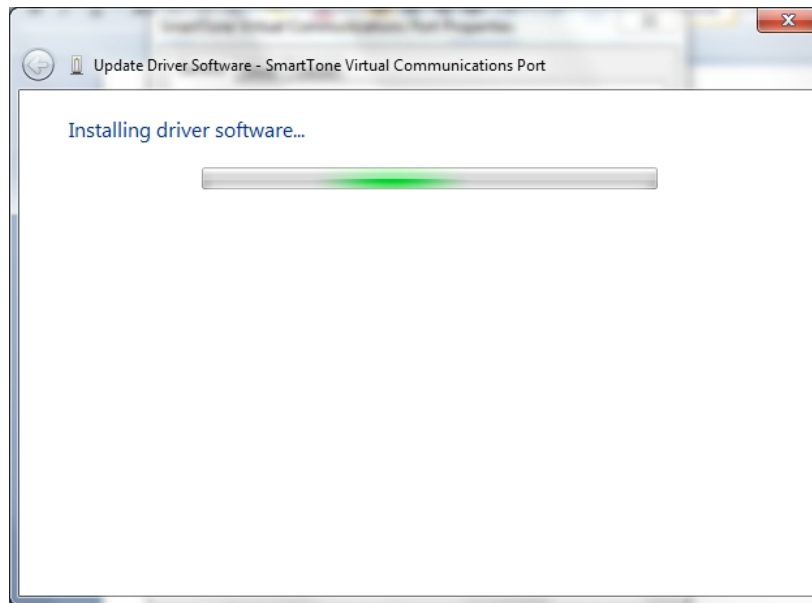
A dialog box appears, asking you the location of the driver software. Choose "Browse my computer for driver software."

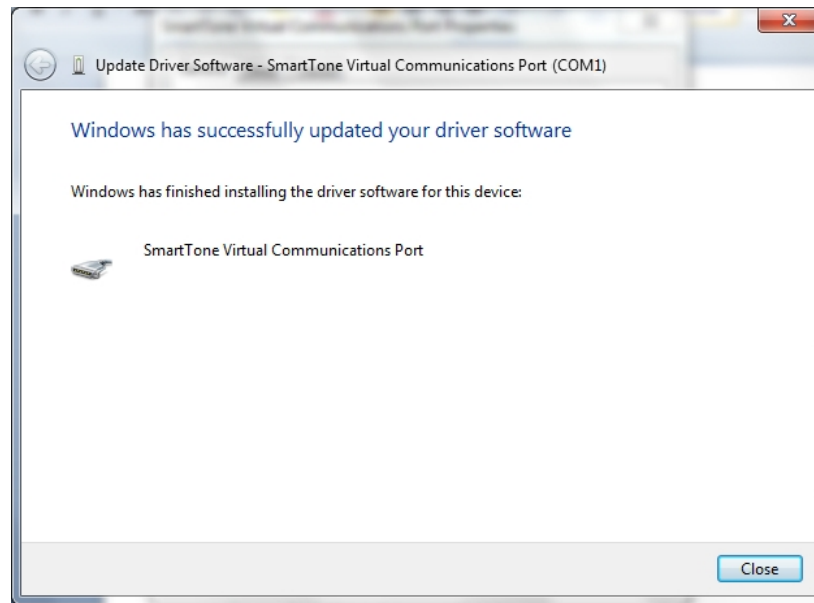


4. The drive location of the CD must be selected manually. Insert the CD that came with the audiometer. Enter the drive letter, or browse to the CD drive using the Browse button.



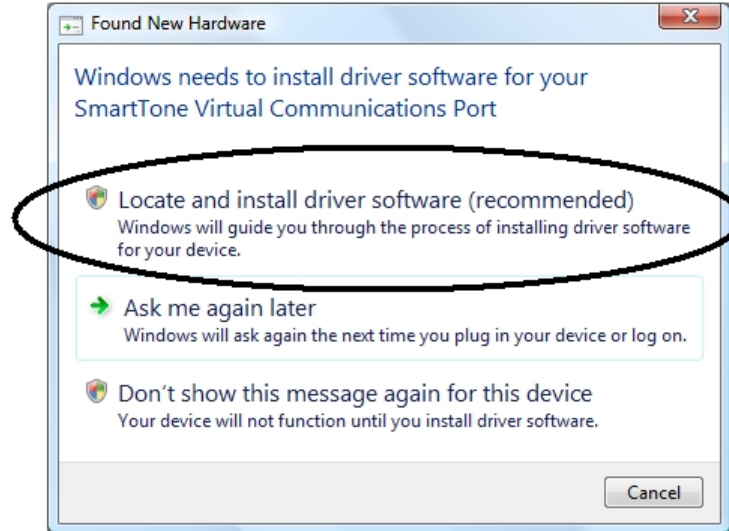
5. Click Next, then Close on the final dialog box.



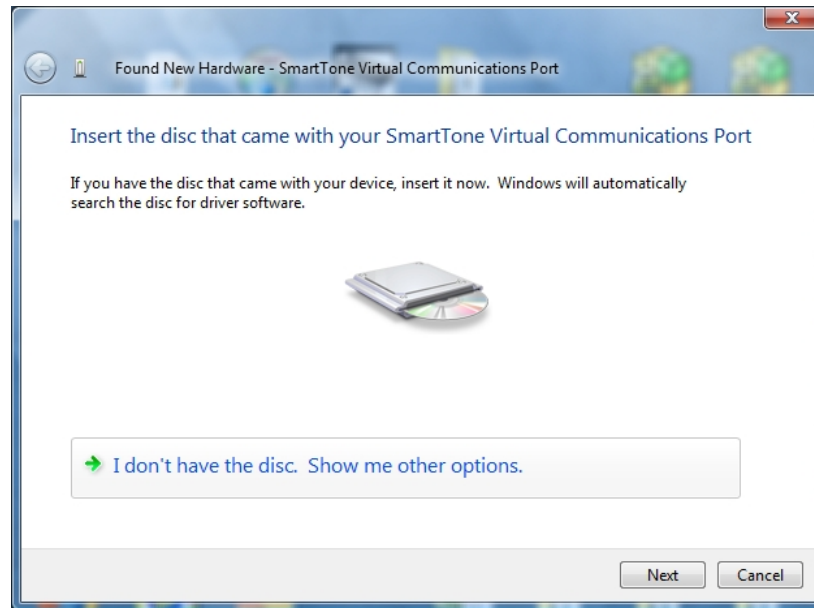


To install the driver on a computer using Windows Vista:

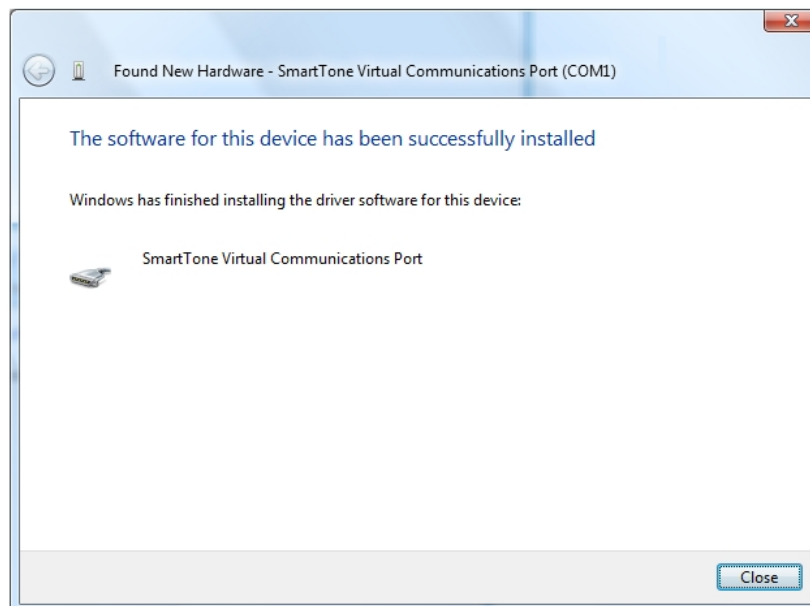
1. With the computer running, connect the audiometer to the computer using a cable, and turn on the audiometer power switch. The "Found New Hardware" dialog box appears.



2. Choose the option called "Locate and install driver software."
A dialog box appears, asking you to insert the disc that came with the audiometer.

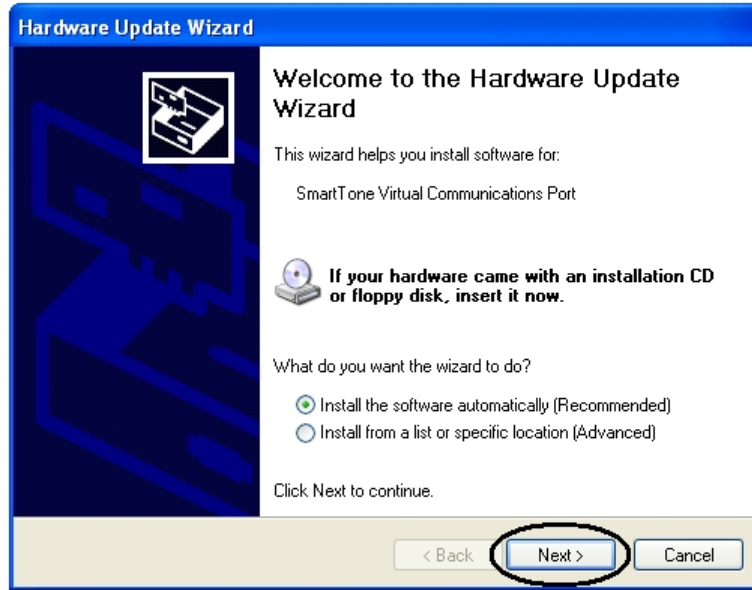


3. Insert the CD in the drive, and click Next.
4. When the installation is complete, click Close.

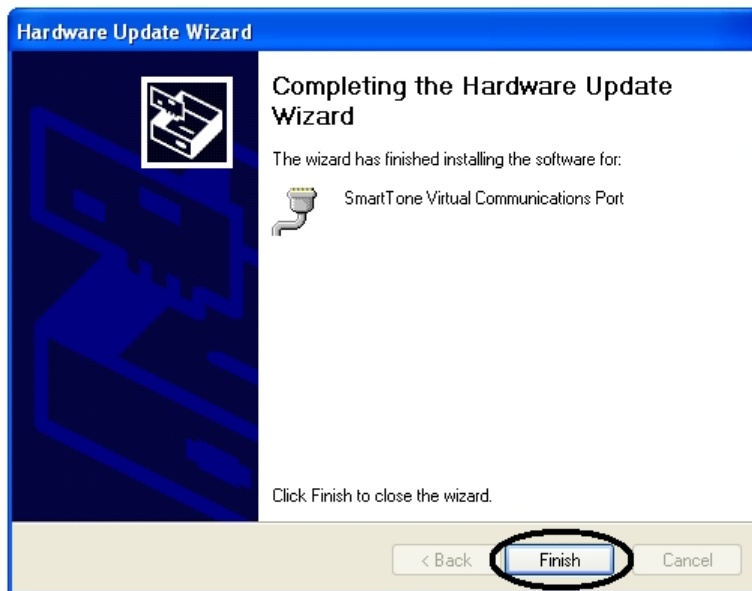


To install the driver on a computer using Windows XP:

1. With the computer running, connect the audiometer to the computer using a cable, and turn on the audiometer power switch. The Hardware Update Wizard appears, asking you to insert a disk.



2. Insert the CD that came with the audiometer into the computer's CD drive, and click Next. The software will be automatically installed. A dialog box appears, informing you that the installation was successful.



3. Click Finish.

Changing the Audiometer's COM Port on the Computer

In some database management systems, the COM port assigned to the audiometer must be between COM1 and COM4. This section explains how to change the COM port on a Windows PC.

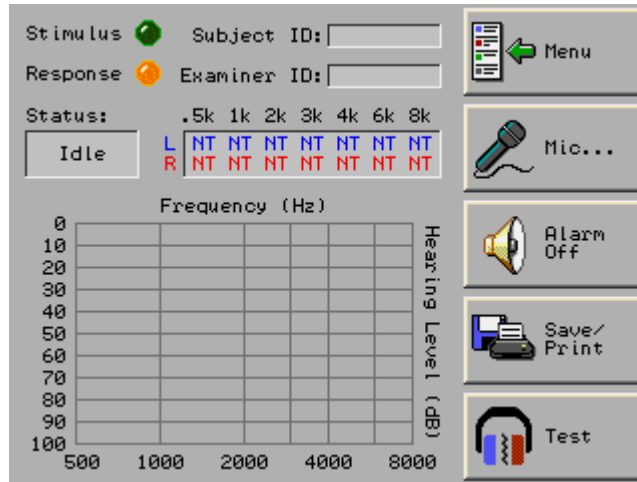
To change the audiometer's COM port on the computer:

1. Open the Device Manager.
2. Under Ports, right-click on the audiometer's COM port and choose Properties from the menu.
The Properties dialog box appears.
3. Choose the Port Settings tab.
4. Choose the Advanced button.
The Advanced Settings dialog box appears.
5. In the COM Port Number combo box, choose the desired COM port.
6. Choose OK.

Audiometer Controls

Main Screen

The main screen of the audiometer is pictured below. The audiogram information fields are at the top with the test display underneath, and the toolbar is to the right. The audiogram graph is at the bottom.



Main Screen of the Audiometer, shown in Idle status

Test Display

The on-screen display gives information on the stimulus presented, subject response, test status and progress, Subject ID, and Examiner ID.

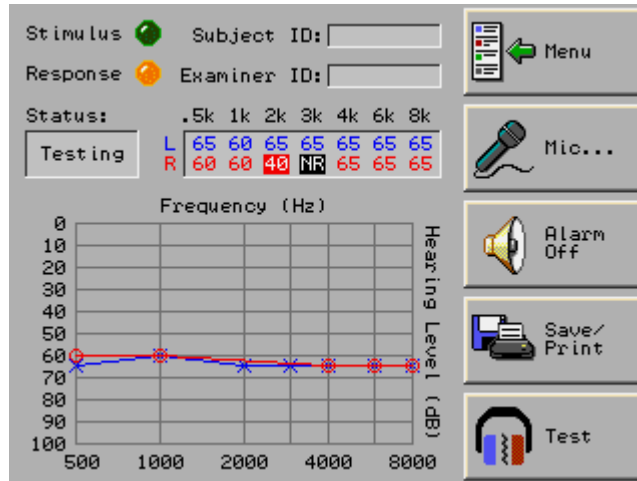
Hearing threshold levels determined manually will be updated in the Hearing Thresholds table and the graph on the main screen, provided that the “OK” button (not “Cancel”) is chosen in the Manual dialog box.

The sections displayed are described below.

Section	Description	
Subject ID	Displays Subject ID if one has been entered.	
Examiner ID	Displays Examiner ID if one has been entered.	
Left	Displays test data or progress by frequency for the left ear.	
	Number (blue)	Threshold in dB HL
	Number (white on blue background)	current stimulus in dB HL being presented.
	NT	Not tested. Indicates that a frequency has not been tested, or was not selected for test.
	NR	No response. The subject did not respond to two stimulus presentations at the maximum intensity.
	MR	Multiple response. The subject responded twice or more to a single stimulus presentation.
	SE	Subject error. A threshold was not determined in 20 stimulus presentations.
	CR	Continuous response. The hand switch was not released since the start of the previous stimulus presentation.
	RN	Retest not valid. The threshold of the 1kHz programmed retest varied by more than 5 dB.
	PT	Presentation time-out. More than sixty seconds have elapsed from the start of a threshold determination without a threshold being established.
Right	Displays test data or progress by frequency for the right ear, with red used instead of blue. See above for explanation of contents.	
Status	Displays current audiometer status. One of five messages is displayed:	
	Idle	not testing
	Testing	automatic test in progress
	Finished	automatic test is complete
	Error	the test has stopped because of an error that occurred during automatic testing
	Mic On	talk-over microphone is enabled

Audiogram Graph






A graph displaying the audiogram thresholds for the left and right ears appears on the main screen. Left ear hearing levels are marked with an "X" and plotted in blue. Right ear hearing levels are marked with an "O" and plotted in red.



*Main Screen with Audiogram Graph
showing Left Ear and Right Ear plotted*

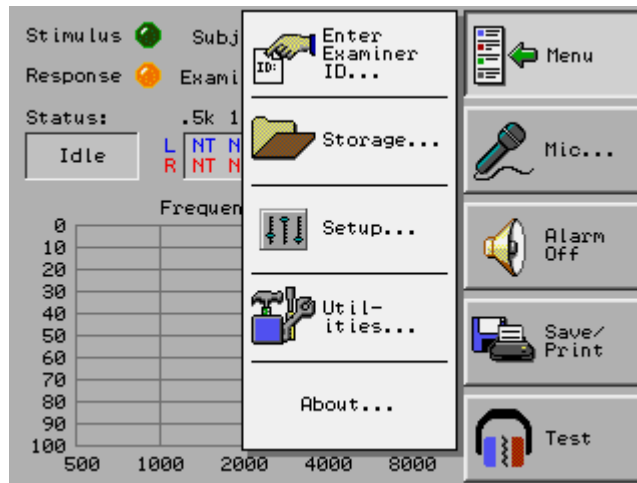
Toolbar Buttons

The toolbar buttons on the main screen are listed below, together with an explanation of their function and a section reference.

Button Name	Function	Section
 Menu	Enter Examiner ID; access to Storage, audiometer setup, and Utilities.	Menu Toolbar Button, page 16
 Mic	Turns on the microphone.	Microphone, page 16
 Alarm Off	Turns off the alarm.	Microphone, page 16
 Save/Print	Save or print an audiogram.	Saving an Audiogram, page 36 Printing the Current Audiogram, page 37
 Test	Testing controls.	Test Toolbar Button, page 18

Menu Toolbar Button

The Menu toolbar button on the main screen, when pressed, displays the following menu items, which are listed with their function and a section reference in the table below.



Menu Toolbar Button with menu items

Menu Item	Function	Section reference
Enter Examiner ID	Enter Examiner ID.	Examiner ID, page 19
Storage	Access to stored audiograms.	Storage, page 39
Setup	Access to test configuration and error alarm settings.	Audiometer Setup, page 25
Utilities	Annual calibration, set date and time, touchscreen calibration, and adjust display settings.	Annual Calibration, page 53 Setting the Date and Time, page 25 Touchscreen Calibration, page 45 Setting the Display Brightness, page 45

Microphone

The talk-over microphone enables you to speak to the subject in a test booth through the headset. For automatic audiograms, the microphone is enabled by the Mic toolbar button on the audiometer's main screen. For manual audiograms, the microphone is enabled by the Mic button in the lower left

corner of the Manual dialog box. In both cases, the Microphone On dialog box appears. This dialog box will remain on the screen until the microphone is disabled.

When the microphone is enabled, an automatic test is stopped, and the Status box in the Test Display shows “Mic On”. The threshold that was currently being determined is reset in the Test Display to the previous threshold determined or “NT.”

When the microphone is disabled, the automatic test remains stopped, and the word “Idle” appears in the Status box. In order to continue testing after using the microphone, choose Start Audiogram from the Test toolbar button menu.

The Microphone On dialog box contains a slide volume control: adjust this control either by touching the desired setting, or by pressing the arrow keys. The Volume box shows the current level.

The dialog box also contains a Mic Off button, which will turn off the microphone when it is pressed.

Refer to the procedures below for microphone controls.

To enable the microphone during an automatic audiogram:

- On the main screen, press the Mic toolbar button. This action also stops the test.

To enable the microphone during a manual audiogram:

- In the Manual dialog box, press the Mic button at lower left.

To turn off the microphone:

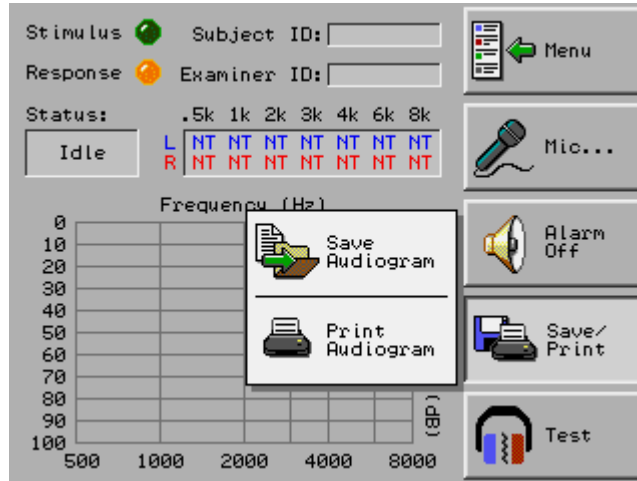
- In the Microphone On dialog box, press the Mic Off button.

To adjust the volume of the microphone:

- In the Microphone On dialog box, move the slide control by touching the desired setting, or by pressing the arrow keys.

Save/Print Toolbar Button

The Save/Print toolbar button on the main screen, when pressed, displays a menu, shown below. The menu items are listed with their function and a section reference in the table below.

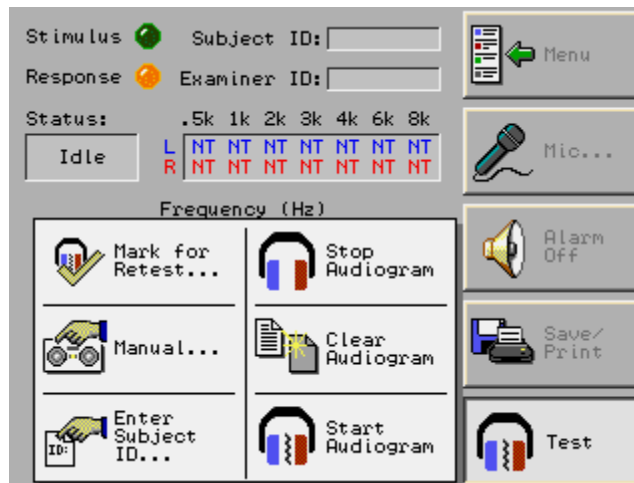


Save/Print toolbar button, showing menu

Menu Item	Function	Section reference
Save Audiogram	Saves Current Audiogram	
Print Audiogram	Prints current audiogram to optional external printer	

Test Toolbar Button

The Test toolbar button on the main screen, when pressed, displays a menu, shown below. The menu items are listed with their function and a section reference in the table below.



Test toolbar button, showing menu

Menu Item	Function	Section reference
Mark for Retest	Automatically retests a given ear/freq. at the end of an auto-test.	Audiometer Control Functions, page 19
Manual	Manually (re)test a subject.	Manual Testing, page 31
Enter Subject ID	Enters a Subject ID for the current audiogram.	Subject ID, page 24
Stop Audiogram	Stops (or pauses) the audiogram.	Audiometer Control Functions, page 19
Clear Audiogram	Clears the audiogram from the audiometer.	Audiometer Control Functions, page 19
Start Audiogram	(Re-)starts an automatic audiogram.	Audiometer Control Functions, page 19

Audiometer Control Functions

This section describes in detail the audiometer controls. A table of common testing tasks with instructions for performing them is included in the next section.

Start Audiogram

The Start Audiogram menu item (press the Test toolbar button) commences automatic testing. If the thresholds are all NT (Not Tested), the automatic test performed is the one specified in the Setup dialog box (see the Test Configuration section on page 27). If one or more frequencies are marked for automatic retest (indicated by inverse coloring of display), those frequencies will be tested first in order from left to right. This is followed by testing of all frequencies without thresholds in order from left to right. This button also restarts an automatic test that was stopped with the Mic toolbar button.

Stop Audiogram

The Stop Audiogram menu item (press the Test toolbar button) stops the automatic test if the audiometer status is Testing. Otherwise this menu item has no effect. You can restart a stopped test with no loss of the thresholds that have been determined.

Clear Audiogram

The Clear Audiogram menu item (press the Test toolbar button) stops testing, removes all marks for retest, and clears the audiogram from the audiometer to make it ready for testing a new subject. If talk-over was in use, it is disabled.

Microphone (Mic)

The Mic toolbar button on the main screen enables the talk-over microphone during an automatic audiogram. If an automatic test was in progress when the Mic button is pressed, the test is first stopped before the talk-over is enabled. The audiometer is left idle after talk-over is disabled.

To disable talk-over, press the Mic Off button in the Microphone On dialog box.

Use Start Audiogram (press the Test toolbar button) to restart an automatic test that was stopped with the Mic toolbar button.

Mark for Retest

The Mark for Retest menu item (press the Test toolbar button) allows the marking of a given ear and frequency for automatic retesting. If an automatic test is in progress when the frequency is marked, the retest occurs after all frequencies have been tested. If the audiometer status is Idle, the retest occurs immediately after a test is re-started. The retests are handled in order from left to right on the display.

Any hearing level that has been marked for retest is highlighted in the hearing thresholds table with white text and black background.

Even if a frequency that was marked for retest had a previously determined threshold, the threshold that is determined during the retest is the one that is retained.

Manual

The Manual menu item (press the Test toolbar button) allows you to control the audiometer like a manual audiometer. See the Manual Testing section on page 31.

Alarm Off

The Alarm Off toolbar button on the main screen turns off the alarm that sounds when a test is complete or when an error occurs.

Instructions for Common Audiometer Tasks

The following table lists common audiometer functions in the left column and shows how to perform these functions in the right column. The "toolbar buttons" mentioned in the table are on the main screen.

Function	Control
To (re-)start an automatic test:	Test toolbar button > Start Audiogram
To stop or pause the test:	Test toolbar button > Stop Audiogram
To clear the audiometer:	Test toolbar button > Clear Audiogram
To automatically retest a given ear/freq. at the end of an auto-test:	Test toolbar button > Mark for Retest; in the Mark/Unmark for Retest dialog box, press the ear/freq. to be retested
To manually (re)test a subject:	Test toolbar button > Manual
To turn on the microphone during an automatic audiogram:	Mic toolbar button
To turn on the microphone during a manual audiogram:	"Mic" button in the Manual dialog box
To turn off the microphone:	"Mic Off" button in the Microphone On dialog box
To turn the alarm off:	Alarm Off toolbar button






Keypad

Several dialog boxes contain a numeric keypad with a backspace key and arrow keys, pictured below. The table below shows the non-numeric keys with a description of their function.

A cursor (a blinking blue box) appears in dialog boxes that allow you to enter numbers using the keypad.



Keypad

Key	Function
	Moves left one space without deleting.
	Moves right one space without deleting.
	Moves cursor to the previous edit box.
	Moves cursor to the next edit box.
	Moves left one space while deleting. If the cursor is at the leftmost position, then the number to the right is deleted.

Utilities

The Utilities menu (accessed by pressing the Menu toolbar button on the main screen, then choosing Utilities) displays the following items. The menu items are listed in the table below along with their function and a section reference.



Utilities menu

Menu Item	Function	Section reference
Set Display Brightness	Adjust brightness of the screen display.	Setting the Display Brightness, page 45
Set Date/Time	Set the correct date and time.	Setting the Date and Time, page 25
Upgrade Firmware	Allows loading new firmware	For authorized service center use; see service manual.
Calibrate Audiometer	Puts the audiometer into Annual Calibration Mode.	For authorized service center use only; see service manual.
Calibrate Touchscreen	Launches Touchscreen Calibration.	Touchscreen Calibration, page 45

Examiner ID

The Enter Examiner ID menu item (accessed by pressing the Menu toolbar button on the main screen) displays the Enter Examiner ID dialog box. To enter the Examiner ID, the procedure below.

Since the same examiner may be performing multiple audiograms, the Examiner ID will remain on the screen even if an audiogram is cleared. If an Examiner ID is entered, it will remain on the screen until it is changed or removed, or until the audiometer is turned off and re-started.

Use the keypad to enter numbers in the Examiner ID edit box. The Examiner ID edit box can contain up to 9 numeric characters.

To enter an Examiner ID:

1. On the main screen, press the Menu toolbar button, and choose Enter Examiner ID.
2. In the Enter Examiner ID dialog box, use the keypad to enter numbers in the Examiner ID edit box.
3. Choose OK.

Subject ID

A Subject ID is a unique identifier for a subject that can be associated with audiograms. It can be entered for an audiogram before, during, and after the test before saving, and as long as the audiometer has not been cleared, by pressing the Test toolbar button, then choosing Enter Subject ID.

Use the keypad to enter numbers in the Subject ID edit box. The Subject ID edit box can contain up to 9 numeric characters.

The Require Subject ID button in the Setup dialog box, when selected, will cause the Enter Subject ID dialog box to be displayed automatically when an audiogram is started for the first time. You can enter the Subject ID while the audiogram is in progress. If the audiogram is saved, this Subject ID will be saved along with it in Storage. See the Test Configuration section on page 27.

Stored audiograms can be filtered for a certain Subject ID, making it easy to see all the audiograms of a given subject. See the section on Filtering Audiograms by Subject ID on page 43.

Audiometer Setup

Audiometer Setup

To see the Setup dialog box, press the Menu toolbar button on the main screen, and choose Setup from the menu.

The items in the Setup menu are listed below with a section reference.

Menu Item	Section
Require Subject ID	Test Configuration, page 27
Pulse Tone	Test Configuration, page 27
Test 8000 Hz	Test Configuration, page 27
Automatic Save on Test Complete	Test Configuration, page 27
Automatic Print on Test Complete	Test Configuration, page 27
Alarm Mode	Alarm Mode, page 26

Setting the Date and Time

It is necessary for the user to set the correct date and time, so that the audiograms will be associated with the date and time when they occurred, and the correct date appears on print outs.

Use the 24-hour clock for the Time field. For example, 4:00 PM would be entered as 16:00:00.

The date format is mm/dd/yyyy (month/day/year), and the time format is hh:mm:ss (hours:minutes:seconds). Entries are validated when you press the OK button.

To set the date and time:

1. On the main screen, choose the Utilities menu toolbar button, and choose Set Date/Time from the menu.
2. The Set Date/Time dialog box appears.
3. Enter the date in the Date edit box.
4. Enter the time in the Time edit box.
5. Press OK.

Alarm Mode

The Alarm Mode setting controls the duration of both the alarm, which sounds when an error occurs when a test is finished. You can set the alarm to sound continuously until turned off, to sound for only a few seconds, or not to sound at all.

The alarm is controlled by the Alarm Mode combo box in the Setup dialog box. To see the Alarm Mode combo box, press the Menu toolbar button and choose Setup. The choices are Continuous, On, and Off.

The Alarm Off button on the main screen turns off the alarm when it is triggered, and resets it.

You may also turn off the alarm by restarting an audiogram, clearing an audiogram, entering manual mode, or turning on the microphone.

Errors are discussed in the Errors section on page 27.

Automatic Testing

Test Configuration

To see the test configuration settings, press the Menu toolbar button and choose Setup.

In the Setup dialog box, if the Require Subject ID button is selected, the Enter Subject ID dialog box will be automatically displayed when a test is started.

The audiometer can present a pulsed or continuous stimulus. If the Pulse Tone button is selected, the audiometer will present a pulse stimulus during testing. A pulse stimulus is three short beeps of 200ms duration with 200ms between pulses. A pulse tone can often allow subjects with tinnitus to distinguish the stimulus from 'ringing in the ears.' If this button is not selected, a continuous tone will be presented. Continuous stimulus is a single tone of one-second duration.

If the Test 8000 Hz button is selected, the test sequence will include 8000 Hz.

If the Automatic Save on Test Complete button is selected, the audiogram will be automatically saved to Storage when it is finished.

If the Automatic Print on Test Complete button is selected, the audiogram will be automatically printed when it is finished. The printer must be already installed and set up as described in the sections beginning with Connecting the Printer to the Audiometer on page 3.

When finished with the dialog box, choose OK.

Errors

An error is an indication that the test may be producing inaccurate results. Potential sources of these inaccuracies are subject errors in following instructions (e.g., not releasing the response switch), or trying to 'outsmart the test' (e.g., randomly pressing the response switch).

If an error occurs, the technician is notified by the appearance of an error code in that ear and frequency in the Test Display. Certain errors under certain circumstances, as detailed below, cause the test to stop immediately, an alarm to sound (unless the error alarm has been set to Off; see the Alarm Mode section on page 26), and the word "Error" to be displayed in the Status box:

- if a Continuous Response (CR), Multiple Response (MR), or Subject Error (SE) occurs

- if No Response (NR) is detected at 1 kHz during the initial determination attempt, or during the first determination attempt after a re-start
- after the determination of any threshold, if the audiometer determines that the number of test sequence frequencies having NR is greater than or equal to twice the number of times the error alarm has previously been triggered due to NR

The table below lists the possible test errors, their codes, and the conditions under which they occur. Error codes appear in the test display.

Name	Error code	Description
No Response	NR	The subject did not respond to two stimulus presentations at the maximum intensity.
Multiple Response	MR	The subject responded more than once to a single stimulus presentation.
Subject Error	SE	A threshold was not determined within twenty stimulus presentations.
Continuous Response	CR	The response switch was not released since the start of the previous stimulus presentation.
Retest Not Valid	RN	The threshold of a 1kHz programmed retest varies by more than 5 dB.
Presentation Timeout	PT	More than sixty seconds have elapsed from the start of a threshold determination without a threshold being established.

The error alarm can be set to Off, On, or Continuous in the Setup dialog box; see the Alarm Mode section on page 26.

Test Sequence

The test sequence is shown below. 8000 Hz will be tested only if the 'Test 8000 Hz' button is selected in the Setup dialog box. To see the Setup dialog box, press the Menu toolbar button on the main screen, and choose Setup.

Ear	Frequency	Start
Left	1000	40
	500	VSL
	1000	VSL
	2000	VSL
	3000	VSL
	4000	VSL
	6000	VSL
	*8000	VSL
	Right	500
1000		VSL
2000		VSL
3000		VSL
4000		VSL
6000		VSL
*8000		VSL

Test Sequence

*tested only if 'Test 8000 Hz' button is selected in the Setup dialog box

VSL stands for Variable Starting Level. VSL is used to determine the starting level relative to the previous threshold. Using a variable starting level in determining each threshold reduces the time needed to complete an automatic test. Rather than presenting the initial stimulus of a threshold determination at a predetermined level, the audiometer begins by presenting a tone that is 5dB above the previous threshold. Except in cases of abnormal hearing loss, this feature reduces the overall duration of the test considerably.

After an error, the starting intensity will be 40dB HL.

To see the Setup dialog box:

- Press the Menu toolbar button on the main screen, then choose Setup.

Automatic Retests

At the completion of a test, the audiometer will perform an automatic retest of all thresholds that could not be determined due to subject errors. The automatic retest will take place at the end of the normal automatic test sequence if errors have occurred. The test sequence for an automatic retest contains only those frequencies which have previously registered an error. For information on errors, see the Errors section on page 27.

These errors are highlighted in the hearing thresholds table in the Test Display with white text and black background, and are automatically retested at the conclusion of the audiogram.

If errors occur during the automatic retest, the alarm sounds according to the conditions described in the Errors section on page 27.

Threshold Determination

The procedure used to define a hearing threshold is the modified Hughson-Westlake method. The hearing threshold at a frequency is defined as the lowest level at which a response occurs in at least half of the ascending trials, with a minimum of two out of three, or two consecutive responses at a single level.

To determine a threshold the audiometer presents a tone as specified by the test sequence. If no response is recorded, the stimulus level increases by 20dB until a response is obtained. The audiometer then follows the modified Hughson-Westlake procedure (10dB down, 5dB up) until a threshold is determined as defined above.

At the completion of an audiogram, the audiometer will perform an automatic retest of all thresholds that could not be determined due to subject errors.

Manual Testing

The Manual menu item (in the Test menu, accessed by pressing the Test toolbar button) allows you to control the audiometer like a manual audiometer. You may use the manual mode to test subjects who are difficult to test with an automatic test, or to present tones and watch for responses as part of explaining the test to the subject. Talk-over is available in this mode.

The Manual dialog box is shown below.



Manual dialog box

After manual testing is finished, pressing OK in this dialog box will cause all manual test results to be shown in the thresholds table and graph in the Test Display. Pressing Cancel discards all thresholds that were determined manually.

The Freq Up and Freq Down buttons will move the frequency control. You can also move the control by touching it near the desired frequency.

The HL (Hearing Level) Up and HL Down buttons will move the stimulus intensity control. You can also move the control by touching it near the desired hearing level.

Left ear hearing levels appear in blue; right ear hearing levels appear in red.

The Stimulus light will light up when there is a stimulus presented.

The Response light will light up when the subject presses the response switch.

The frequency and ear currently being tested is highlighted.

Refer to the table below for a description of the manual audiogram controls.

Button	Description
Present Stimulus	presents the specified stimulus when your finger is lifted from the button
Mic	enables talk-over microphone. to disable the microphone, press Mic Off button in the Microphone On dialog box.
Set Thresh	records the threshold as the current setting of the knobs
Set NR	records the threshold as No Response on the current frequency and ear
Set NT	cancels test results on the current frequency and ear, and returns the setting to Not Tested

To determine a threshold manually:

1. Enter manual mode by pressing the Test toolbar button on the main screen, and choosing Manual from the menu.
2. In the Manual dialog box, select the ear to test by pressing either the Left Ear or the Right Ear button.
3. By touching the frequency and hearing level controls near the desired settings, or by using the Up and Down button controls, select the frequency and the initial stimulus intensity.
4. Press the Present Stimulus button to present the stimulus.
The Stimulus indicator flashes to show stimulus presentation. The Response indicator flashes as the subject responds.
Use the controls to vary the intensity and present stimuli until you have determined the threshold.
5. Press the Set Thresh button.
The threshold is recorded in the appropriate position near the top of the dialog box. It is highlighted (inverted in color).
➤ To determine another threshold manually, go to step 2, above.
6. When finished with the test, press OK to accept the manually determined thresholds.
Pressing Cancel will cause the thresholds to be lost.

Printout

Audiograms can be printed using the optional external printer. A sample audiogram printout is shown below.

To print the audiogram that has just finished, see the section called Printing the Current Audiogram on page 37. To print a stored audiogram, see the section called Printing a Stored Audiogram on page 43.

For information on the printer, see the sections beginning with Connecting the Printer to the Audiometer on page 3.

```

11/6/2009
-----
Subject ID: 000000000
Examiner ID: 000000000

Audiogram:
Date: 5/28/2009
Time: 15:03:43

                Freq (Hz)
      Left   .5k  1k  2k  3k  4k  6k  8k
      Right  15  15  10  10  15  5  10

Model: SmartTone
Serial Number: 60000
Calibration Date: 1/11/2009
ANSI S3.6-1989
-----
Examiner          Date
-----
Subject          Date
-----
    
```

Sample Audiogram Report

At the top of the report is the date on which the report was printed.

The Subject ID is shown, if an ID was entered for this audiogram.

The Examiner ID is shown, if an Examiner ID was entered.

The Audiogram Date and Time, using the 24-hour clock, are given. The time shown is the time that the test was first saved, printed, or transferred, either manually or automatically.

The hearing threshold levels are provided. If an error occurred, and a threshold could not be determined, an error code appears in place of a hearing threshold level: NR, MR, CR, SE, PT, RN. See the Errors section on page 27 for more information. NT (Not Tested) can also appear if an ear/frequency was not tested.

The audiometer model and serial number are listed.

The Calibration Date is the date of the audiometer's last annual calibration.

Space is provided at the bottom for the examiner and subject to sign and date the printout, if desired.

Typical Procedure of Operation

Verifying Correct Audiometer Setup

To verify correct audiometer setup:

1. On the main screen, press the Menu toolbar button and choose Setup.
2. In the Setup dialog box, make sure the desired test configuration features are selected. If not, select the desired features.
See the sections beginning with Test Configuration on page 27 for information on features.
3. Choose OK.
4. Set the Examiner ID by pressing the Menu toolbar button on the main screen and choosing Enter Examiner ID, then entering the ID and pressing OK.

Verifying Correct Audiometer Operation

The accuracy of the tests results is dependent on the correct functioning of the audiometer as well as the correct technique. The electronic circuitry of the audiometer is state of the art, and very stable. However, the headset transducers and cabling can become faulty while still appearing to be in good repair.

In order to ensure that the audiometer is correctly functioning, the operator should test a person with known, stable hearing and compare the results with a previously performed test on this individual. Shifts of more than 5 dB from the previous results, or any unwanted sounds during the test, call into question the operation of the audiometer, and may indicate that the audiometer's calibration should be checked by an authorized service technician. This check should be done each day that the audiometer is used, and before testing is done that day.

As an alternative, the optional bio-acoustic simulator may be used to do this daily operational check. See Daily Calibration Check, p. 48.

Performing an Audiogram

The typical method of performing an audiogram is described in the section below.

Before beginning an audiogram, make sure the audiometer calibration is current. Whenever an audiogram is started, an Annual Calibration Warning

will appear if the current date is 30 or fewer days prior to the annual calibration anniversary, or if the current date is more than one year after the last calibration. See the Annual Calibration Mode section on page 50 for more information.

Beginning Automatic Testing

To begin automatic testing:

1. Seat the subject comfortably and fit the headset for his or her head.

The ear cushion should be placed directly over the subject's ear canal. The subject should not place or adjust the headset since this may result in incorrect placement of the headset.

2. Start the automatic test by choosing the Test toolbar button on the main screen, then choosing Start Audiogram.

You may enter a Subject ID for this audiogram while the test is in progress by choosing the Test toolbar button on the main screen, then choosing Enter Subject ID from the menu.

Saving an Audiogram

In order to save an audiogram to Storage, follow the procedure below. For information on Storage, see the Storage section starting on page 39.

If "Automatic Save on Test Complete" is selected in the Setup dialog box, the audiogram will be automatically saved when it is finished. See the Test Configuration section on page 27.

If you wish to enter a Subject ID before saving the audiogram, press the Test toolbar button on the main screen, then choose Enter Subject ID, and enter the Subject ID in the dialog box that appears. For more information, see the Subject ID section on page 24.

If you wish to enter an Examiner ID before saving the audiogram, press the Enter Examiner ID toolbar button on the main screen, and enter the Examiner ID in the dialog box that appears.

The test time is the time that the test was first saved, printed, or transferred, either manually or automatically.

To save a audiogram:

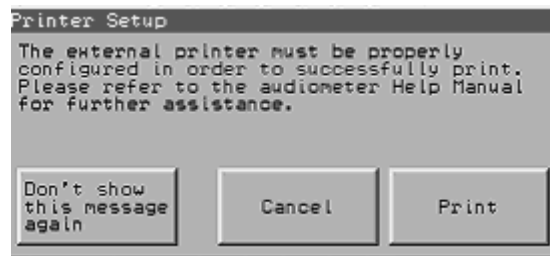
1. When the test status indicates Finished, press the Save/Print toolbar button on the main screen, then choose Save Audiogram.
The audiogram is now saved in Storage.

2. If you wish to print the audiogram on the external printer, press the Save/Print toolbar button and choose Print Audiogram.
3. If you wish to clear the audiometer for testing another subject, press the Test toolbar button and choose Clear Audiogram.

Printing the Current Audiogram

In order to print the audiogram that has just completed and is currently on the main screen, the optional external printer must be connected. For information on the printer, see the sections beginning with Connecting the Printer to the Audiometer on page 3.

The first time “Print Audiogram” is chosen from the Test menu, a dialog box with a message about printer setup appears.



Printer Setup dialog box

The “Don’t show this message again” button will disable the dialog box so that it will never appear again.

The “Print” button will exit this dialog box and print.

“Cancel” exits this dialog box and does not proceed to printing.

It is possible to print while an automatic audiogram is in progress. The report will reflect the current test data (as displayed on the screen).

If Automatic Print on Test Complete has been selected for the test configuration, an audiogram will be printed automatically when it is finished. See the Test Configuration section on page 27.

The procedure below is for printing audiogram data that are currently on the main screen. For information on printing a stored audiogram, see Printing a Stored Audiogram on page 43.

To print the current audiogram:

- Press the Save/Print toolbar button on the main screen, then choose Print Audiogram.

Procedures for Data Transfer

Data transfer of one or more audiograms sends a copy of the audiogram(s) to the database management system that you are using on the computer. Transfer is initiated from the computer. Procedures for both real-time transfer and batch transfer are given in the following sections.

The setup requirements for data transfer are described in the sections beginning with Data Transfer on page 5.

Real-Time Transfer

Real-time transfer will copy the audiogram data that is currently displayed on the main screen to the computer. Data will not transfer when the Calibrate Touchscreen utility is running.

Follow the procedure below.

To do a real-time transfer of an audiogram to the computer:

- In the database management system on the computer, select “Get Audiogram” or the equivalent.
The audiogram data will be transferred to the computer.

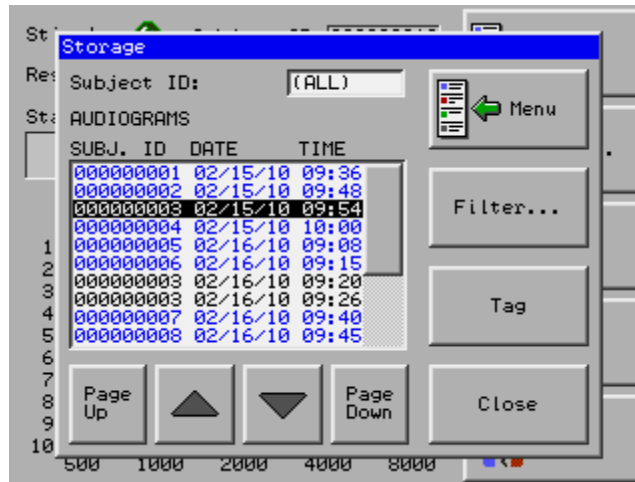
Batch Transfer

To do a batch transfer of audiograms to the database management system on the computer, follow the procedure specified in your third-party database software. The transfer is initiated from the computer; no action is necessary on the audiometer. Data will not transfer when the Calibrate Touchscreen utility is running.

Batch transfer will copy only tagged audiograms to the computer. For information on tagging, see the sections beginning with Tagging Audiograms on page 41.

Storage

The Storage dialog box, pictured below, allows you to store audiograms in the audiometer. After audiograms have been stored, you may view, print, or transfer them to a PC running appropriate software.



Storage dialog box

The Subject ID box displays the word “(ALL)” if no Subject ID filter has been set. If a filter has been set, that Subject ID appears in the Subject ID box.

The Audiograms List shows stored audiograms with their Subject ID (if an ID has been associated with them), and their date and time. The audiograms that appear in the list are those whose Subject ID matches the current filter.

The audiogram that is currently selected in the list appears in white text on a black background (or blue background if the audiogram is tagged). To select an audiogram in the list, use the arrow buttons and the Page Up and Page Down buttons to move to it.

The Menu toolbar button displays the Storage Menu.

The Filter button allows you to filter the audiograms by Subject ID.

The Tag button tags an untagged audiogram that is currently selected in the list, or clears the tag from a tagged audiogram that is currently selected.

Check to see how many audiograms you have stored by pressing the Menu toolbar button in the Storage dialog box and choosing Memory Usage. The Memory Usage dialog box will list the number of audiograms stored out of the maximum number. The number given refers to all audiograms contained within the Storage database, without respect to the the current Subject ID filter.

To see the Storage dialog box, press the Menu toolbar button on the main screen, and choose Storage.

Audiograms

Audiograms may be stored with or without a Subject ID.

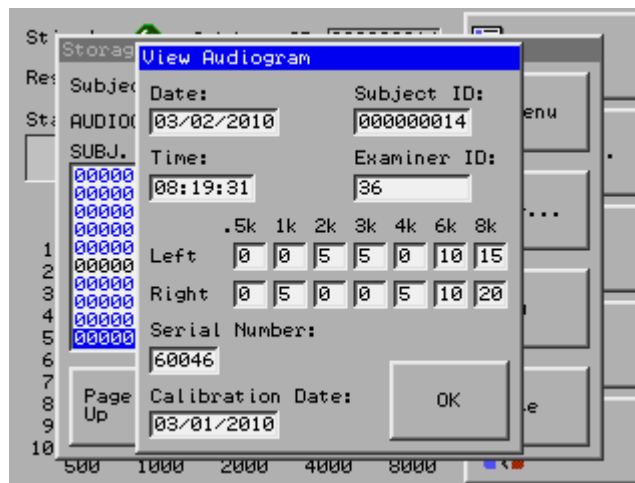
The time associated with the audiogram is the time that the test was first saved, printed, or transferred, either manually or automatically. Times are given using the 24-hour clock; for example, 4:00 PM appears as 16:00:00.

Viewing a Stored Audiogram

You can view a stored audiogram by choosing View from the Storage Menu.

(To see the Storage dialog box, press the Menu toolbar button on the main screen and choose Storage.)

The View Audiogram dialog box is pictured below.



View Audiogram dialog box

To view a stored audiogram:

4. In the Storage dialog box, select the audiogram in the list that you wish to see.
5. Press the Menu toolbar button, then choose View.

Storage Menu

The Storage Menu, accessed by pressing the Menu toolbar button in the Storage dialog box, allows you to view, print, or delete stored audiograms; tag audiograms for batch transfer, or clear tags; or check memory usage.

The menu items are listed below with a description of their function.

Menu Item	Function
View	Displays the currently selected audiogram.
Print	Prints the currently selected audiogram.
Delete	Deletes the currently selected audiogram.
Delete All	Deletes all the audiograms currently present in the Audiograms list.
Tag All	Tags all the audiograms currently present in the Audiograms list.
Clear All Tags	Clears the tags from all audiograms currently present in the Audiograms list.
Memory Usage	Shows the number of stored audiograms and the maximum number possible.

Storage Menu

To see the Storage Menu:

1. Press the Menu toolbar button on the main screen, and choose Storage. The Storage dialog box appears.
2. Press the Menu toolbar button.

Tagging Audiograms

Batch transfer will send only tagged audiograms. Audiograms are automatically tagged when they are saved, and untagged when transferred. Audiograms can also be tagged manually, either individually, or all at once. A tagged audiogram is displayed in blue text on a white background (or in white text on a blue background if it is currently selected).

The “Tag All” menu item (in the Storage Menu) tags all the audiograms that are currently present in the Audiograms list in the Storage dialog box. Therefore, if you have set up a Subject ID filter, choosing “Tag All” will tag only the audiograms with that ID. In order to tag all the stored audiograms at the same time, clear any Subject ID filter that you have in place; “(ALL)” should appear in the Subject ID box.

Refer to the procedure below for tagging audiograms.

For information on clearing tags, see the following section.

To tag one or more audiograms:

1. Press the Menu toolbar button on the main screen, and choose Storage.

2. In the Storage dialog box, select the audiogram in the list that you wish to tag, and press the Tag button.
3. Repeat as necessary.

To tag all audiograms currently present in the Audiograms list:

- In the Storage dialog box, press the Menu toolbar button and choose “Tag All”.

Clearing Audiogram Tags

The “Tag” button in the Storage dialog box “toggles” the selection. That is, when it is pressed, the button affects the currently selected audiogram as follows:

- if the audiogram is not tagged, the Tag button will apply a tag to it
- if the audiogram is already tagged, the Tag button will clear the tag

The “Clear All Tags” menu item (in the Storage Menu) clears the tags from all the audiograms that are currently present in the Audiograms list in the Storage dialog box. Therefore, if you have set up a Subject ID filter, choosing “Clear All Tags” will clear tags only from the audiograms with that ID. In order to clear tags from all the stored audiograms at the same time, clear any Subject ID filter that you have in place; “(ALL)” should appear in the Subject ID box.

To see the Storage dialog box, press the Menu toolbar button on the main screen, then choose Storage.

To clear audiogram tags, follow the procedure below.

To clear the tag from an audiogram:

In the Storage dialog box, select the tagged audiogram in the list.

Press the Tag button.

To clear all tags:

- In the Storage dialog box, press the Menu toolbar button and choose “Clear All Tags”.

Deleting an Audiogram

The action of deleting an audiogram cannot be undone.

To delete an audiogram:

1. Press the Menu toolbar button on the main screen, and choose Storage.
2. In the Storage dialog box, select the audiogram you wish to delete.
3. Press the Delete Audiogram button.

4. When finished with the Storage dialog box, choose Close.

To delete all audiograms:

1. Press the Menu toolbar button on the main screen, and choose Storage.
2. In the Storage dialog box, press the Delete All Audiograms button. You will be asked to confirm your choice.
3. When finished with the Storage dialog box, choose Close.

Printing a Stored Audiogram

To print a stored audiogram, follow the procedure below.

(To see the Storage dialog box, press the Menu toolbar button on the main screen and choose Storage.)

To print a stored audiogram:

1. Select the test in the Storage dialog box.
2. Press the Menu toolbar button in the Storage dialog box and choose Print.

Filtering Audiograms by Subject ID

The Filter by Subject ID button in the Storage dialog box allows you to see only the stored audiograms of one subject. When you set up a filter for a certain Subject ID, the list box will show only the audiograms that are associated with that ID, and the Subject ID edit box in the Storage dialog box will display the ID.

When there is no filter, the Subject ID edit box will contain the word “(ALL)”, and the list box will show all the stored audiograms.

Any filter that is currently in place is automatically cleared when you close the Storage dialog box.

(To see the Storage dialog box, choose Storage from the Menu toolbar button on the main screen.)

To filter the audiograms by Subject ID:

1. In the Storage dialog box, press the Filter button.
2. In the Select Subject dialog box, use the keypad to enter the ID of the subject whose audiograms you wish to see.
You cannot filter audiograms without a Subject ID.
3. Choose OK.
In the Storage dialog box, the ID you entered will appear in the Subject

ID box, and the audiograms associated with this Subject ID will appear in the list.

To turn off a filter:

1. In the Storage dialog box, press the Filter button.
2. In the Select Subject dialog box, delete the numbers from the Subject ID edit box.
3. Choose OK.

--OR--

- Close the Storage dialog box and reopen it.

Data Validation

Dates and times will be validated each time the OK button is chosen in a dialog box that contains Date and Time edit boxes. If a field contains invalid data, a message box appears, asking you to enter a valid date or time. Click OK in the message box to return to the dialog box. The date format is mm/dd/yyyy (month/day/year), and the time format is hh:mm:ss (hours:minutes:seconds).

Memory Usage

The Memory Usage feature allows you to see how many audiograms you have stored out of the maximum number.

To see the memory usage in Storage:

On the main screen, press the Menu toolbar button, and choose Storage. The Storage dialog box appears.

Press the Menu toolbar button, and choose Memory Usage. A maximum of 300 audiograms may be stored.

Touchscreen Care and Calibration

Touchscreen Use and Care

The touchscreen is designed to be operated by fingertip. Devices such as pens should not be used.

Plain water or a 50:50 solution of isopropyl alcohol and water is recommended for cleaning the touchscreen. Pour the solution onto a soft cloth rather than pouring it on the screen; then clean the screen with the cloth. Take care to follow the alcohol manufacturer's precautions and directions for use.

Avoid using caustic chemicals on the touchscreen.

For information on care of the audiometer, see Audiometer Care and Cleaning.

Setting the Display Brightness

The display brightness of the audiometer screen can be adjusted by the user. Refer to the procedure below.

To set the display brightness:

1. On the main screen, choose the Utilities menu toolbar button, and choose Set Display Brightness from the menu.
2. The Set Display Brightness dialog box appears.
3. Use the controls to set the display brightness to the desired level, and press OK.

Touchscreen Calibration

The touchscreen will require calibration if there seems to be an offset between the finger touch point and the place where the touch is registered by the audiometer (for instance, if the press of a button is not registered directly under your finger). Calibration is also necessary if your touch is not registered at the edges of the screen.

The touchscreen calibration utility automatically terminates any audiometer activity. Therefore, any audiogram that is currently in progress will be stopped and discarded if you choose Calibrate Touchscreen from the Utilities menu. Likewise, any audiogram that has been completed but not saved will be discarded if the touchscreen calibration utility is launched.

It is recommended that you use a stylus, such as the tip of a pen cap, instead of your finger for touchscreen calibration.

Touchscreen calibration is initiated by choosing Calibrate Touchscreen in the Utilities menu (accessed by pressing the Utilities menu toolbar button on the main screen). During calibration, icons appear one after another on the screen. The first icon will appear on the left side of the screen. Press the stylus firmly on the icon for three seconds, then take it off the screen. Another icon will appear elsewhere on the screen. Press the stylus firmly on that icon for three seconds, then lift it up. Continue to press on the icons until calibration is complete.

Safety and Audiometer Care

Power Supply Safety

The power supply is intended for indoor use only.

When using an electrical appliance, basic safety precautions should always be followed, including the following. Read all instructions before using power supplies.

WARNING—To reduce the risk of burns, fire, electric shock, or injury to persons:

- Do not allow to be used as a toy.
- Use this power supply only for its intended use as described in this manual. Use only attachments recommended by the manufacturer as contained in this manual.
- Never operate this power supply if it has a damaged cord or plug, if it is not working properly, if it has been dropped or damaged, or fallen into water. In such cases, return the appliance to the nearest authorized dealer or service center for examination, repair, electrical or mechanical adjustment.
- Use only the supplied power supply with this instrument.
- Never drop or insert any object into any openings.
- Do not use outdoors.
- Do not operate where aerosol (spray) products are being used or where oxygen is being administered.

Audiometer Care

Recommendations for care of the audiometer are given below. For information on touchscreen care and calibration, see the sections beginning with Touchscreen Use and Care on page 45.

- Clean connections with LPS1 Greaseless Lubricant or equivalent.
- Make sure the audiometer has adequate ventilation, and is not surrounded by equipment or furniture.
- Do not use the recommended touchscreen cleaning solution (a 50:50 solution of isopropyl alcohol and water) on any other surfaces of the audiometer.
- Avoid using caustic chemicals on the audiometer case or screen.
- Do not use liquids or chemicals on or near headset transducers.
- Do not rest objects on top of the touchscreen. Heavy objects can damage it, and certain materials that contact the touchscreen may chemically interact with it, causing stains. We recommend saving the original packaging for use in shipping or storage.

Daily Calibration Check

Users complying with certain occupational hearing conservation regulations are required to check the operation of the audiometer each day it is used for testing. A convenient method to perform this check is to use the optional D-Check bio-acoustic simulator.

Daily Calibration Check Using the Bio-Acoustic Simulator

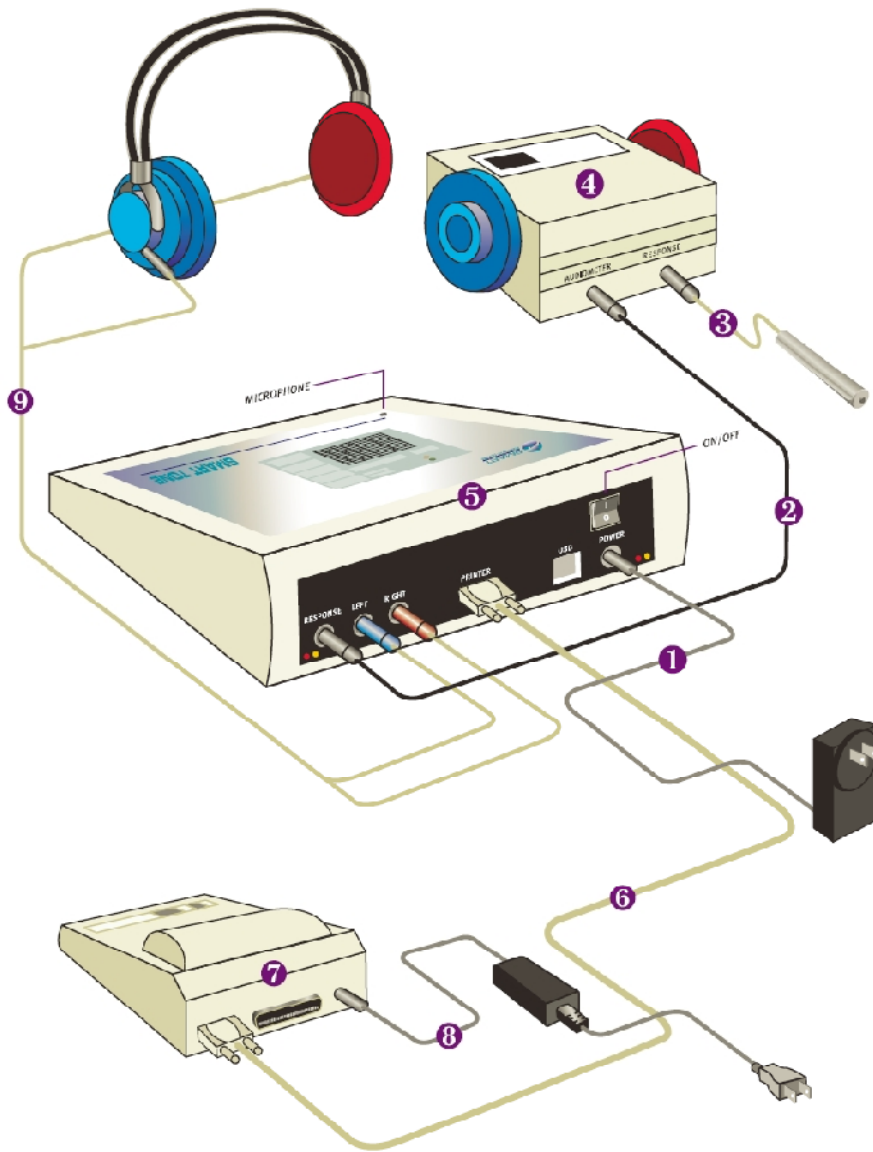
To perform a daily calibration check using the Bio-Acoustic Simulator:

1. Set up the simulator(s).
Configure the system as described in the section called Installing the Bio-Acoustic Simulator on page 48, below. Remove the response cord from the simulator jack and place the headphones on the simulator. Extend the headband as necessary so that the ear cushions are centered.
2. Begin the automatic testing by pressing the Test button, then choose Start Audiogram.
3. When the audiometer Status field indicates 'Finished', print the test. Compare this test to your reference test to ensure that no more than the allowed shift has occurred at all frequencies.
4. To prepare for subject testing, plug the response cord into the Response jack of the simulator.
The power indicator will go out, signaling that the simulator is out of the circuit and will not affect subject testing.

Installing the Bio-Acoustic Simulator

The Bio-Acoustic Simulator can be left installed at all times for additional convenience and time savings and may either sit on a table or shelf or be mounted on the wall with the included wall mounting bracket. The simulator operates with power supplied from the audiometer so there is no need to check that the unit is switched off when not in use or change batteries.

Refer to the figure below. The supplied interconnect cable is plugged into the RESPONSE jack of the audiometer and the AUDIOMETER jack of the simulator. For daily calibration checks the response switch is disconnected from the simulator. For subject testing, the response switch is inserted into the RESPONSE jack of the simulator. Internal switching removes the simulator from the circuit so that it may be left installed at all times with no effect on testing.



Audiometer with optional printer and simulator

Key to Numbers in Diagram

1. Power supply (audiometer)
2. Simulator interconnect cable
3. Response switch
4. Simulator
5. Audiometer
6. Serial cable
7. Thermal printer
8. Power supply (printer)
9. Headset

Annual Calibration Mode

Annual Calibration Mode is for use by an authorized service center. It is described in the service manual.

Postponing the Annual Calibration Warning

The Annual Calibration Warning can be postponed by the user for a two-week period, using the following procedure. After the two weeks have elapsed, if the warning conditions as described in the section Performing an Audiogram on page 35 are still in effect, the Annual Calibration Warning will be automatically displayed. If the warning conditions are no longer in effect two weeks after the warning was postpone, the Annual Calibration Warning is automatically re-enabled.

To temporarily postpone the annual calibration warning:

1. When the Annual Calibration Warning dialog box automatically appears, press the "Remind me again in two weeks" button.
2. Choose OK.

Trademarks

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Warranty

Smart Diagnostic Devices warrants that all hardware products will be free from defects in material and workmanship for a period of one year from date of purchase. We will repair or replace, at our option, hardware that is returned freight prepaid to us during this period. You must obtain return authorization by contacting Smart Diagnostic Devices before returning any products.

Smart Diagnostic Devices warrants that all software drivers will perform substantially in accordance with these electronic instruction files for a period of one year from date of purchase. We will replace software that does not perform as described above as your sole remedy. In no case will Smart Diagnostic Devices be responsible for damages beyond the replacement of software, or beyond the purchase price of the instrument.

Smart Diagnostic Devices does not warrant these products' fitness for use for any particular application. It is your responsibility to determine fitness for use for your particular application.

Abbreviations

The table below shows the abbreviations that are used in the audiometer and in this instruction manual. Descriptions are given in the right column.

Abbreviation	Explanation
CR	Continuous Response
dB SPL	decibel Sound Pressure Level
dB HL	decibel Hearing Level
L	left ear
MR	Multiple Response
NR	No Response
NT	not tested
PT	Presentation Timeout
R	right ear
RN	Retest Not Valid
SE	Subject Error

Audiometer Specifications

The audiometer meets or exceeds ANSI S3.6-1989.

Dimensions:	8" x 11" x 3"
Weight:	5 lbs. with accessories
Case:	Composite aluminum / ABS (Color: PC Bone)
Storage Temp. Range:	14–122° F (-10–50° C)
Operating Temp. Range:	41–104° F (5–40° C)
Operating Humidity:	Less than 80%, non-condensing
Test Frequencies:	500, 1k, 2k, 3k, 4k, 6k, 8kHz, crystal-controlled
Stimulus:	Continuous (1 second) or Pulsed (200ms pulse, 2.5 pulses/second)
Output Level:	0–95 dBHL \pm 3dB, 5dB step
Output Rise/Fall Time:	Not greater than 50msec, nor less than 20msec, 30msec typ.
Distortion:	Less than 3% at full output
Output On/Off Ratio:	Greater than 70dB, 95dB typ.
Transducer:	Telephonics TDH39 10-ohm earphones with MX41/AAR cushions
Power requirements:	120VAC nominal, 23 Watts max.