Tremetrics RA650

MICROPROCESSOR GROUP AUDIOMETER OPERATIONS MANUAL

TREMETRICS®

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Seller also warrants said goods to be free of defective materials and workmanship.

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TREMETRICS RA650 AUDIOMETER

This pure tone air conduction Audiometer manufactured by TREMETRICS was designed primarily for use in determining hearing threshold levels in comparison with standard reference threshold levels. The Audiometer is a screening device that, if properly operated, maintained, and calibrated, will allow the operator to screen subjects for shifts in hearing acuity. The Audiometer is used to record the subject's current threshold, which may be affected from day to day by noise exposure, colds, sinus infections, or other problems.

Testing, as referred to in this manual, is the screening procedure used to establish thresholds (hearing levels) and is in no way trying to diagnose, monitor, or treat any medical problem, disease or injury. If a problem is suspected, the subject should be referred to an audiologist or medical doctor for evaluation.

The audiograms obtained from this screening procedure provide a way for records to be maintained for the subject and for the company where the subject works, in order that an audiologist or medical doctor may more fully evaluate and prevent major hearing problems.

To guarantee accuracy, each audiometer must be re-calibrated at least once each year and receive an exhaustive calibration every two years. Daily biological tests through the use of an Electro-Acoustic Ear (for daily comparisons to acoustic ear baseline obtained at time of calibration) and the operator listening to each frequency and verifying the attenuator operation, ensures accuracy and purity of the audiometer tones.

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LIST OF FIGURES

Introduction

This operations manual is intended as a guide in using the RA650 Microprocessor Group Audiometer. It includes detailed descriptions of the operation of all hardware and software components, as well as procedures for audiometer testing and calibration. If major difficulties arise, it is recommended that you contact Customer Service at TREMETRICS. Please be ready to give a complete and accurate detail of the problem encountered.

1. Hardware Operation

This section describes the operation of the following hardware component:

1.1 Electro-Acoustic Ear (Oscar™)

This section also describes the final pre-operation check of the following three hardware components:

1.2 RA650 Audiometer Chassis
1.3 RA650 Audiometer Control Module
1.4 RA650 Audiometer Module

1.1 Electro-Acoustic Ear (Oscar™)

Oscar™ is a portable Electro-acoustic ear. Oscar performs the daily biological check for audiometer quality assurance. Oscar serves as a substitute subject with a known hearing threshold level. When connected to the RA650 Group Audiometer station, the unit automatically provides reference audiogram for comparison to the baseline established during installation and calibration. The test data establishes a permanent running log verifying the audiometer's calibration.

To perform a biological check of a RA650 Group Audiometer station, perform the following procedure:

1. Turn the Oscar power switch to **on** position.
2. Confirm that the earphone to be tested has the same serial number as the audiometer module to be tested.
3. Place the earphones in the proper coupler on either side of the Oscar, making sure that they are firmly seated.
   Confirm that the left (blue) ear of the earphones is matched with the Left Ear side of the Oscar.
   Confirm that the right (red) ear of the earphones is matched with the Right Ear side of the Oscar.
4. Substitute the handswitch cord from the Oscar for the handswitch of the station to be tested.
5. Perform an Electro-acoustic test on the selected station.
6. Save the test for comparison to the baseline audiogram.
7. When testing is complete, turn the Oscar power switch to the **off** position.

Note: Your biological audiometer check is considered acceptable if the variation in threshold readings is less than 10 dB, deviations of 10 dB or greater are not acceptable. If the difference for any frequency is greater than 10 dB than inspect the placement of the earphones on the Oscar couplers, ensuring that the cushions are properly seated. Also ensure that outside noise is not erroneously triggering the Oscar. Re-run the test, then if the problem persists, you should contact your technical support resource and report the problem. DO NOT USE THE STATION.

The baseline for the Oscar is typically between 60 and 80 dB. This baseline should be established immediately after audiometer calibration. Battery replacement should occur at the same time. A blinking low battery light indicates that battery replacement is necessary.

1.2 RA650 Audiometer Chassis

Refer to Figure 1 below which displays a RA650 Audiometer Chassis with an installed controller and four audiometer modules.

1. Stations 1-4

   Ensure that the Control Module is installed in Chassis A and is connected to the computer via an RS-232 cable.

2. Stations 4-8 (Optional)

   Ensure that the Control Module in Chassis A is connected to the Control Module installed in Chassis B using a cable with RJ-45 connectors attached to the 4+4 jacks.

3. Turn the Audiometer Chassis on/off switch to **on**.

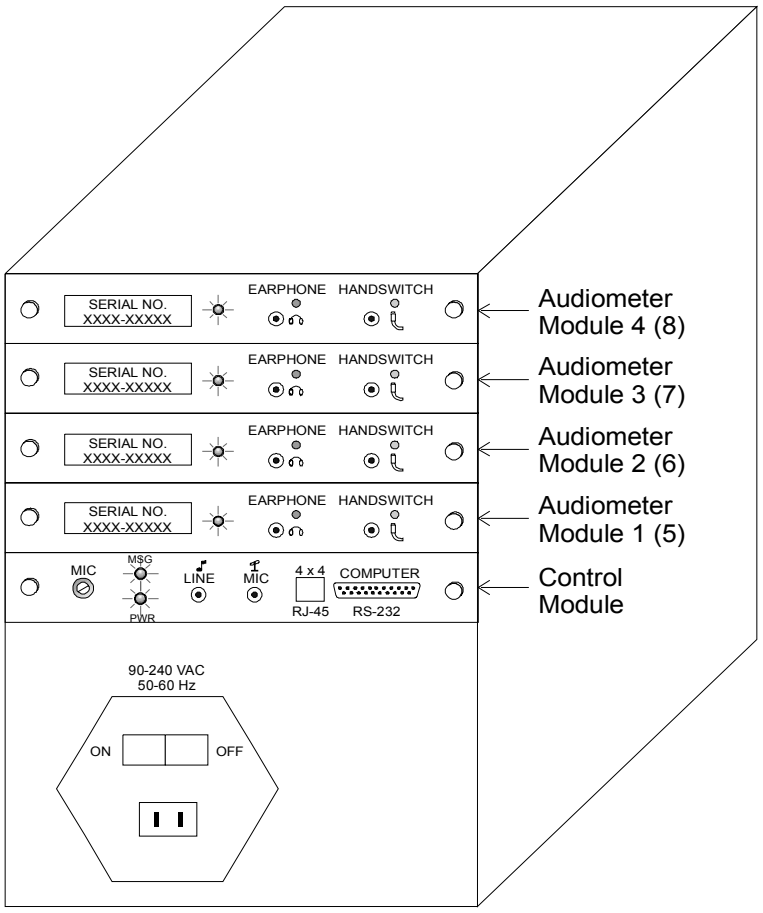

Figure 1

RA650 Audiometer Chassis with Installed Controller and Four Audiometer Modules

1.3 RA650 Audiometer Control Module

Refer to Figure 2 below which displays a RA650 Audiometer Control Module.

1. Stations 1-4

   Ensure that the Control Module is installed in Chassis A and is connected to the computer via an RS-232 cable.

2. Stations 4-8 (Optional)

   Ensure that the Control Module in Chassis A is connected to the Control Module installed in Chassis B using a cable with RJ-45 connectors attached to the 4+4 jacks.

3. Ensure that the Line jack is connected to the multimedia connector on the computer.
4. Ensure that the MIC jack is connected to the microphone.
5. Use a screwdriver to adjust the microphone volume at the MIC set screw.
6. Confirm that the MSG and PWR lights are working.

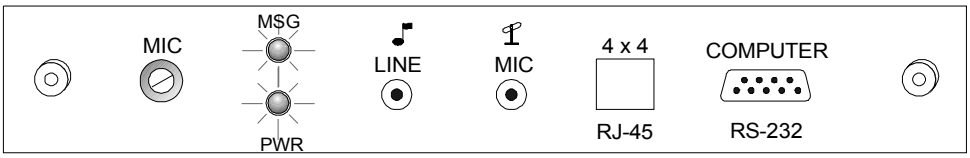

Figure 2
RA650 Audiometer Control Module

1.4 RA650 Audiometer Module

Refer to Figure 3 below which displays a RA650 Audiometer Module.

1. Confirm that the Audiometer Serial Number matches the headphone serial number.
2. Confirm that the Earphone with the same serial number is plugged into the Earphone jack.
3. Confirm that the station Handswitch is plugged into the Handswitch jack and activates the LED for the Audiometer module.
4. Repeat Steps 1 through 3 for each station audiometer module.

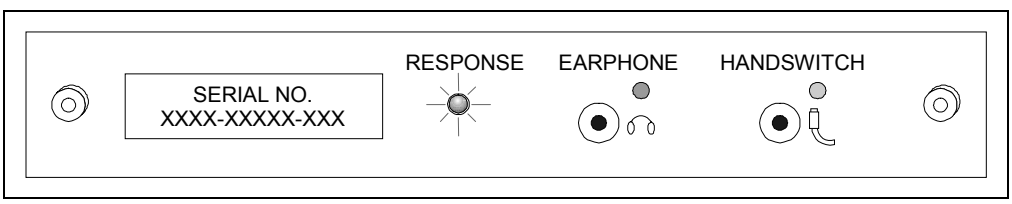

Figure 3
RA650 Audiometer Module

2. Software Operation

This section describes the operation of the following seven software features:

2.1 All Station Display Main Window
2.2 Station Popup Menus
2.3 Menu Commands
2.4 Control Buttons
2.5 Dialog Boxes
2.6 Procedures
2.7 Fault Codes

2.1 All Station Display Main Window

The Main window displays all stations and provides full control of the functions and features of the RA650 Group Audiometry System. In addition, it allows the operator to monitor the testing progress of test subjects at all stations simultaneously.

This window contains the following controls and displays:

2.1.1 Menu Commands

2.1.2 Station Number

2.1.3 Pulse or Continuous Tone Display

2.1.4 Status Display

2.1.5 Left Ear Testing Display

2.1.6 Right Ear Testing Display

2.1.7 Examiners SSN Display

2.1.8 Subject SSN Display

2.1.9 Control Buttons

2.1.1 Menu Commands

See the separate section in this document describing the various tool bar menus and their commands.

2.1.2 Station Number

This part of the Main window displays the active testing station numbers. Inactive testing stations are shown grayed out. You can right-click the mouse button on any active station number to display the Station Popup menu, which allows you to select station-specific functions.

2.1.3 Pulse or Continuous Tone Display

This part of the Main window displays whether the hearing test pulse for a specific station is pulse [P to the left of the station number] or continuous [C].

2.1.4 Status Display

This part of the Main window displays the current status of a specific testing station. At any time, each station has one of the following statuses:

Offline	The station has been removed from the list of available testing stations.
Paused	The station is in a temporary pause state.
Reset	This station has just been reset and is ready for the next hearing test.
Testing	This station is currently testing a subject.
Saved	This hearing test data for this station has been saved.
Error	An error condition has occurred at the station. See Fault Code Instructions and Responses for further explanation.

2.1.5 Left Ear Testing Display

The left ear is usually tested first, then the right ear. This display allows you to monitor the hearing thresholds at each frequency as data are captured automatically by the RA650 system. As the test proceeds, the AA in the screen changes to the level being tested. For example the level detected for station 1 may be 35 dB at 1K (1000 Hz). A level displayed with a green background signifies, a bad, or no response at that level, while a blue background signifies a good response. The operator can monitor the progress of the test. As thresholds are established, the results are stored for the frequency specified. The test results usually proceed from left to right on the display. However, the right ear can be tested first by using the "Right Ear First" command from the Stations menu.

2.1.6 Right Ear Testing Display

See Left Ear Testing Display above.

2.1.7 Examiners SSN Display

The examiner must enter his or her social security into the database before saving a test. To change the current social security number, left-click the mouse button on the Examiners SSN text box to open the Enter Examiners SSN dialog box.

2.1.8 Subject SSN Display

The social security number of each test subject must be entered into the test records prior to the saving of a hearing test. To change the current social security number, left-click the mouse button on the station number to the left of the subject social security number to open the Enter SSN for Station dialog box.

2.1.9 Control Buttons

See separate section in this document containing descriptions of the various Control Button functions.

2.2 Station Popup Menu

This popup menu is activated by right-clicking the mouse button on one of the station numbers, [1-8] in the Main window. The following commands in the menu are then active only for the selected testing station:

Commands	Function Key
Start/Resume	F2
Play and Start	F4
Pause	F6
Talk-over	F5
Reset	F8
Save	F10
Print	F11
Restart	F7
Manual	F9
Enter Data	F3
Enable/Disable Station	
Daily Biological:	

2.3 Menu Commands

The following menus are provided in the RA650 operating software:

2.3.1 File Menu
2.3.2 Edit Menu
2.3.3 Functions Menu
2.3.4 Setup Menu
2.3.5 Calibrate Menu
2.3.6 Help Menu

2.3.1 File Menu

The File menu provides the following commands:

Command	Shortcut Key	Function
Print command	F11	This command prints a report of the stations that are currently being tested. Use the Print Setup command to open the Print Setup dialog box so that you can set printing parameters.
Print Setup command		Allows you to set printer type, orientation, paper size, and paper source.
Exit command		Allows you to close the RA650 software application.

2.3.2 Edit Menu

The Edit menu provides the following commands:

Command	Shortcut Key	Function
Cut command		Not active at this time.
Copy command		Not active at this time.
Paste command		Not active at this time.

2.3.3 Functions Menu

The Functions menu provides the following commands:

Command	Shortcut Key	Function
Start/Resume command	F2	Starts the audiometry test, for all test subjects. or resumes all paused audiometer tests. Alternatively, you can use the Start/Resume button. Double-clicking the left mouse button on the desired station will also start or resume a test.
Play and Start command	F4	Allows you to play multimedia instructions prior to the start of a test. When the instructions are completed the hearing test is initiated.
Pause command	F6	Temporarily stops the selected audiometry test(s). This command can be used if a problem occurs during the administration of one or more audiometry tests. Alternatively, you can use the Pause button. Double-clicking the left mouse button on the desired station will also pause a specific test in progress.
Talk-over Individual command	F5	Pauses the test and allows you to talk over the microphone to a single audiometry test subject.
Talk-over All command	Alt + F5	Pauses the test and allows you or the multimedia to talk over the microphone to all audiometry test subjects simultaneously. Alternatively, you can use the Talk Over All button.
Reset command	F8	Clears all subject information and all audiometry testing information so that you can start another group of subjects. Alternatively, you can use the Reset button.
Save Test command	F10	Allows you to save the current audiometry test data to the computer hard drive.
Restart command	F7	Resets audiometry test data for the selected test subjects, but does not change subject information that has been previously entered. Alternatively, you can use the Restart button.
Manual command	F9	Allows you to administer the hearing test manually. This is accomplished by specifying the ear, frequency, and initial presentation level. You can use the keyboard or mouse, to present the first tone. You can also initiate subsequent tones. The level of the tone is a function of the response of the subject in accordance with the Hughson Westlake procedure. Test completion is indicated on the Main window and the HTL is stored with an **M** to indicate that the test results were derived using the manual method.

Enter Data command	F3	Allows you to enter social security information for test subjects.
Print command		This command allows you to print a hearing test report. Use the Print Setup command to open the Print Setup dialog box so that you can set printing parameters.
Retrieve Status command		Allows you to display all data from all stations.
Check All Stations command		Allows you to verify that a station is installed in the module chassis.

2.3.4 Setup Menu

The Setup menu provides the following commands:

Command	Shortcut Key	Function
Group Testing Command		Allows you to conduct group test in a common sound room. If this command is enabled, a check mark appears to the left of the menu command. If this command is disabled, no check mark appears to the left of the menu command.
Pulsed / Continuous Command		Allows you to administer the hearing test with either pulsed or continuous tones sent to the earphones. This command is a toggle between the two modes of operation. The pulsed tone character is 0.2 second on and 0.2 second off, corresponding to a 50% duty cycle with three pulsed tone presentations. The continuous tone character is 1.0 seconds in duration. If pulsed is enabled, a check mark appears to the left of the menu command. If continuous is enabled, no check mark appears to the left of the menu command.
Delete 8K Command		Allows you to delete the 8,000 Hz (8K Hz) part of the hearing test. This effectively reduces the time required to administer the hearing test. If this command is enabled, a check mark appears to the left of the menu command.
Right Ear First command		This command results in a test subject's right ear being tested first, followed by testing of the left ear. This is the opposite of normal convention. If the Right Ear First is enabled, a check mark appears to the left of the menu command.
Enable / Disable Station Command		This command allows you to remove an enabled station from the testing group or to add a previously disabled station to the testing group. This ensures that no sounds are emitted from unused headphones during group testing. If the Stations are enabled, a check mark appears to the left of the menu command.

Set Lower HTL to 00 dB command		Sets the lower hearing threshold level tested to 00 dB, instead of –10 dB. If 00dB is the lowest level to test, a check mark appears to the left of the menu command.
Adaptive Mode Command		Automatically extends the length of the hearing test to accommodate slow responses. This mode increases the response acceptance window time. If Adaptive is enabled, a check mark appears to the left of the menu command.
Check and Retest on: Adjacent Frequencies command		Activates a switch that enables or disables the comparison of adjacent frequencies looking for a difference of 50 dB or greater. If the difference is greater than 50 dB, the frequency of the higher HTL of the adjacent frequencies is re-tested. An **EC Error** is displayed and the frequency in error is automatically re-tested.
HTL ≥ 90dB or 500 Hz ≥ 30 dB command		Allows you to automatically retest the subject in the event that the HTL was equal to or greater than 90 dB for any frequency. This result will generate a **ED Error** condition. This command allows you to also automatically retest the subject in the event that the HTL was greater than or equal to 30 dB at 500 Hz. This result will generate a **ED Error** condition.
Contralateral of 40 dB command		Activates a switch that compares the HTL for the same frequency of the opposite ear and, if greater or equal to 40 dB, then the higher level is re-tested. An **EA Error** is displayed and the frequency is re-tested automatically.
STS of 15 dB Command		Compares the levels of the current hearing test to the reference baseline hearing of the subject. If the baseline data is stored with the subject demographics, the baseline data is downloaded to the audiometer when you enter the subject's social security number. An **EB Error** is displayed if the difference between the current test and the baseline data is 15 dB or greater. If any of these commands is enabled, a check mark appears to the left of its menu command. If any of these commands is disabled, no check mark appears to the left of its menu command.
Multimedia: Play Instructions on Error command		Automatically plays an error-specific multimedia recording when an error occurs during a test. If this command is enabled, a check mark appears to the left of the menu command. If this command is disabled, no check mark appears to the left of the menu command.
Error Handling: Military Error Processing command		Allows you to enter the number of times that a prerecorded message will be played.

Process Errors in Manual Mode command		Activates multimedia announcements while operating in manual mode.
Reset Error Count on Error Test command		Allows you to specify the number of times that the system will automatically start after a station error.
Frequency Order command		Not used at this time.
RS232 Configuration command		Allows you to specify the Com Port that is being used.
Timing Parameters command		Not used at this time.
Station Summary command		Displays station diagnostic messages.

2.3.5 Calibrate Menu

The Calibrate menu provides the following commands:

Command	Shortcut Key	Function
Acoustic: Calibration command		Allows you to calibrate each audiometer module.
Verification command		Allows you to test the rise and fall times of each tone as it is turned on and off, the linearity of the audiometer attenuation from 100 dB to -10dB, check the total harmonic distortion signal (tone) on to off ratio, and check the crosstalk from one ear to the other ear.
Remote Verification command		Allows you to verify the operation of an audiometer channel from the sound room (remotely). The audiometer module will automatically step through a 70 dB test tone frequency sequence, starting at 500 Hz. Activation of the handswitch steps to the next tone of the verification sequence.
Daily Biological: Run Test		Disables the check for HTL over 30 dB. This is intended for the daily verification of the audiometer.
Functional command		Performs part of the daily check. The technician listens for unusual clicks or noises in the earphone at a listening station. Each time the handswitch is depressed, the frequency of the tone changes.
Memory command		Requests that the selected audiometer module station performs a RAM and ROM memory test. If the system is operating correctly, nothing is displayed. If a problem is detected, an **E8** message is displayed for the station with the memory problem.

2.3.6 Help Menu

The Help menu provides the following commands:

Command	Shortcut Key	Function
Contents command	F1	Opens RA650 Group Audiometer online Help at the Contents tab. You can then use the contents, index, or find functions to find the topic(s) of interest.
Search for Help On command		Opens RA650 Group Audiometer online Help at the Find tab. You can then use the find function to find topic(s) of interest by searching all online Help topics.
How to Use Help command		Opens a Help file that describes how to use the Online Help provided with your RA650 Group Audiometer System.
On Main Window		Opens a Help file that describes the main window functions and features.
About		Displays RA650 developed by Tremetrics, Version number, and copyright message.

2.4 Control Buttons

The following control buttons are provided in the RA650 operating software:

2.4.1 Start/Resume button

This button starts the audiometry test for all test subjects or resumes all paused audiometer tests. Alternatively, you can use the **Functions | Start/Resume** command, or the F2 key.

2.4.2 Pause button

This button temporarily stops the selected audiometry test(s). This command can be used if a problem occurs during the administration of one or more audiometry tests. Alternatively, you can use the **Functions | Pause** command, or the F6 key.

2.4.3 Reset button

This button clears all subject information and all audiometry test information so that you can start another group of subjects. Alternatively, you can use the **Functions | Reset** command, or the F8 key.

2.4.4 Restart button

This button resets audiometry test data for the selected test subjects, but does not change subject information that has been previously entered. Alternatively, you can use the **Functions | Restart** command, or the F7 key.

2.4.5 Talk-Over All button

This command allows you to talk over the microphone to all audiometry test subjects simultaneously. Alternatively, you can use the **Functions | Talk Over Group** command, or the Alt-F5 key combination.

2.4.6 Talk-Over Each button

This button allows you to talk over the microphone to a single audiometry test subject. Alternatively, you can use the **Functions | Talk Individual** command, or the F5 key.

2.5 Dialog Boxes

The following dialog boxes are provided in the RA650 operating software:

2.5.1 Calibrating Station #[ ] dialog box
2.5.2 Calibration dialog box
2.5.3 Enter Examiners SSN dialog box
2.5.4 Enter SSN for Station #[ ] dialog box
2.5.5 Select a Subject dialog box

2.5.1 Calibrating Station #[ ] dialog box

Refer to the RA650 Microprocessor Group Audiometer Service Manual.

2.5.2 Calibration dialog box

Refer to the RA650 Microprocessor Group Audiometer Service Manual.

2.5.3 Enter Examiners SSN dialog box

This dialog box allows you to enter the social security number of the current hearing test examiner into the database records.

The Enter Examiners SSN text box displays the social security of the current examiner. To change the current social security number, type the social security number using the format xxx-xx-xxxx into the text box. Alternatively, left-click the button beside the SSN dialog box to select an Examiner from the Examiner database. The Examiner must already be in the database to be selected in this way. Choose **OK** when you have completed your entry.

2.5.4 Enter SSN for Station #[ ] dialog box

This dialog box allows you to enter the social security number of the hearing test subject assigned to a specific testing station and to enter the purpose of the hearing test examination into the subject's records.

The Enter SSN for Station #[ ] text box displays the social security of the subject assigned to the selected testing station. To change the current social security number, type the social security number using the format xxx-xx-xxxx into the text box. Alternatively, click on the text box to open the Select a Subject dialog box so that you can select a previously entered subject by Last Name, First Name, or Social Security Number. To be a valid entry, the subject SSN must already be in the database. Choose **OK** when you have completed your entry.

The Enter SSN for Station #[ ] dialog box also includes a section which allows you to enter the purpose of the exam. The following Purpose of Exam selection option buttons are offered:

Symbol	Name	Purpose of Exam
A	Annual option button	To complete an annual hearing test.
B	Reference Baseline option button	To complete a hearing baseline test in which future hearing tests will be compared.
1	Follow-Up No. 1 option button	To complete a hearing test as a follow up to a previous incident or test.
2	Follow-Up No. 2 option button	To complete a hearing test as a second follow up to a previous incident or test.
9	90 Day option button	To complete a hearing test every 90 days.
R	Re-established Baseline option button	To complete a new hearing baseline test in which future hearing tests will be compared.
E	Reference Following Exposure option button	To complete a new hearing baseline reference test in which future hearing tests will be compared.
T	Termination option button	To complete a final hearing test upon the completion of an assignment and subsequent termination of a position.
O	Other option button	To complete a hearing test for a reason not covered by the other options in this list of option buttons.
	OK option button	Select the OK button to store the selected options and close the current dialog box.
	Cancel option button	Select the Cancel button to ignore all entries and to return to the previous dialog box or window.

2.5.5 Select a Subject dialog box

This dialog box allows you to select the Last Name, First Name, and Social Security Number of a test subject who has been entered into the hearing test database. The alternative entry method is to enter the social security number using the Enter SSN for Station #[ ] dialog box. Scroll to select a subject and choose the **Select** button.

2.6 Procedures

This section describes the procedures for the following audiometer tests:

2.6.1 Standard Audiometry Test
2.6.2 Automatic Retest
2.6.3 Daily and Yearly Calibrations

It also includes a description of the Fault Codes that may arise during audiometer testing, and the appropriate operator responses.

2.6.1 Standard Audiometry Test Procedure

1. **Prepare for next test subjects:**
   SAVE THE CURRENT TEST. Then, click on the Reset button to clear all previous data and get ready for the next hearing tests. Tests can be started at this time.
2. **Enter operator's social security number:**
   Left-click the mouse button on the Examiners SSN number displayed in the Main window to open the Enter Examiners SSN dialog box. Enter your social security number in the Examiner SSN text box.
   Choose **OK** to save your entry.
   The new examiner's social security number is displayed in the Main window.
3. **Enter subject's social security number and purpose of exam:**
   Left-click the mouse button on **000-00-0000** to the right of the subject's assigned station number to open the Enter SSN for Station [ ] dialog box. Enter the subject's social security number in the Station SSN text box (The SSN must already be entered in the database.) and select the appropriate Purpose of Exam option button. Repeat as required for other subjects.
   Alternatively, you can select the number from the database. Left-click the mouse button on the Station SSN text box to open the Select a Subject dialog box. Scroll to the appropriate row and click to select the subject's Last Name, First Name, and Social Security Number. Choose the **Select** button to save the selection and return to the Enter SSN for Station [ ] dialog box.
   Choose **OK** to save entries and return to the Main window.
   The new subject's social security number is displayed. Repeat as required for other subjects at other stations.
4. **Talk to test subjects:**
   Click the Talk-over all button, or select **Functions | Play and Start**, to provide instructions to all testing subjects.
5. **Start hearing test:**
   Click the Start button to start all hearing tests.
6. **Monitor test:**
   Monitor the progress of all tests.
7. **Respond to problems:**
   Respond to error codes and problems.
8. **Retest as required:**
   Provide special additional testing, as required.
9. **Save test data:**
   Select **Functions | Save** to save all data for the testing group.
10. **Store data in Hears database:**
    Select **Functions | Print** to save all data to the Hears Database.

2.7 Automatic Retest Procedure

2.7.1 Automatic Retest Criteria

The RA650 Group Audiometer automatically performs a retest of the subject under the following circumstances (if Check and Retest has been selected):

- **Error EB** - A threshold change of ± 15 dB HTL or greater occurs at any frequency, during testing, relative to the reference.
- **Error ED** - Any frequency has an HTL of 90 dB or greater.
- **Error ED** - The HTL at 500 Hz is greater than 30 dB.
- **Error EA** - There is an HTL difference of 40 dB or more between ears at the same frequency.
- **Error EC** - There is a difference of 50 dB or greater for an adjacent frequency.

2.8 Fault Code Instructions and Responses

A fault code is an immediate warning, including both an on screen visual and auditory signal. The intensity of the auditory signal is controlled by the RA650 Group Audiometer.

A fault code is generated under the following conditions:

- **Error E1 -** A listener response is not obtained for the first ear tested at 1000Hz.
- **Error E2 -** There is no validation for the first test ear response at 1000 Hz. This can occur if too much time has elapsed without achieving threshold validation.
- **Error E3 -** The first ear fails the 1000 Hz re-test. A validity check is performed by testing each ear twice at 1000 Hz. The threshold values must be within ± 5 dB. If this is achieved, the lower of the two threshold levels is retained. If this is not achieved, the test is stopped, the technician is summoned, and the entire test is repeated.
- **Error E4 -** There is no release of the hand switch button.
- **Error E5 -** More than one response per frequency is given without additional tone presentations.
- **Error E6 -** The retest did not validate the HTLs at the required one or two frequencies. A maximum of 20 tone presentations or 60 seconds are allowed at each test frequency.
- **Error E7 -** There is no validation of HTLs at three frequencies.

For each of the above errors, the appropriate operator responses, either through Talk-over or the multimedia function provides additional instructions to the test subject, as follows:

Error E1: No Response at 1000 Hz. Test

Instructions: "You are not pushing the handswitch when you hear the tone. I will restart the test, remember to push and release the handswitch as soon as you hear the tone."

Error E2: No validation of 1000 Hz. Test

Instructions: "Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

Error E3: Failed 1000 Hz. Retest.

Instructions: (Single Test; First Time, First Ear) "Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

Response: Start the test over.

(Single Test; First Time, Second Ear) "Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

(Single Test; Second Time, Second Ear) "Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

Response: Start the test over.

(Group Test; First Time, First Ear) "Sit quietly and I will retest you when the group finishes. Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

Response: Start the test over.

(Group Test; Second Time, Second Ear) "Sit quietly and I will retest you when the group finishes. Press and release the handswitch button as soon as you hear a tone, even if the tone is very soft."

Response: Start the test over.

Error E4: No release of handswitch button.

Instructions: "You are not releasing the handswitch quickly enough. Remember to press and release the handswitch quickly, as soon as you hear the tone."

Error E5: Responding when no tone is present.

Instructions: "You are pushing the handswitch when no tone is present. Be sure you hear the tone and press and release your handswitch quickly."

Error E6: No validation on one or two frequencies.

Instructions: None.

Response: Switch to manual mode and administer a manual test at the missed frequencies.

Error E7: Failed to validate at three frequencies.

Individual Instructions: None.

Response: Re-instruct the individual on the entire test procedure. Press the Reset button, then press Start. You will need to reassign the individual to a station.

Group Instructions: "Sit quietly and I will retest you when the group finishes."

Response: Re-instruct the individual on the entire test procedure. Press the Reset button, then press Start. You will need to reassign the individual to a station.

Error EA: Contralateral of 40 dB recorded.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error EB: Difference between the current test and baseline data is ≥ 15 dB.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error EC: Difference between adjacent frequencies is ≥ 50 dB.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error ED: HTL ≥ 90 dB. or 500 Hz ≥ 30 dB.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error EE: No responses at frequencies other than 1000 Hz. Test.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error EF: No validation at frequencies other than 1000 Hz. Test.

Response: Will not stop the test. Automatically re-tested at the end of the test. No operator intervention required.

Error NR: No response at any level of frequency presented.

3. Calibration Procedures

Two different types of calibration procedures should be performed on the RA650 Audiometer, Biological Calibration and Acoustical Calibration.

3.1 Biological Calibration

Biological Calibration provides an electronic calibration monitor that tests the acoustic output of each test station for 500 to 8000 Hz, inclusive. Calibration is provided with the Tremetrics Oscar™ instrument. See the section in this document, which describes the operation of the Electro-acoustic ear Oscar. Also the operator, to verify pure tones without odd or distorted sounds should perform a daily functional check.

3.2 Acoustical Calibration

Acoustical Calibration is a password protected calibration mode in which the earphones are controlled using a 70 dB continuous tone beginning at 500 Hz.

The calibration date in YYMMDD format is required before the calibration is completed. Y=year, M=month, and D=day.

Certified calibration should be performed approximately once per year or as required. This procedure requires the use of a calibrated sound level meter.

Note: Only qualified personnel should perform this calibration procedure.

See the RA650 Microprocessor Group Audiometer Service Manual for this procedure.

4. Hardware and Software Installation

Introduction

This installation manual provides a qualified technician with sufficient information for the installation of both the hardware and the software components of the RA650 Microprocessor Group Audiometer. If major problems are encountered, it is recommended that the technician contact Customer Service at TREMETRICS, giving complete and accurate details; such as serial number, date of purchase, description of part, and TREMETRICS part number. The reader should refer to the illustrations of this manual to aid in the installation process.

4.1 Hardware Installation

The RA650 Group Audiometer System should be installed in a well-lighted, well-ventilated area near the audiometric sound room. The table space required for a 4-station installation is five feet by three feet. The table space required for an 8-station installation is six feet by three feet.

The RA650 requires power connection to 90-264 VAC at 47 to 63 Hz with a 500 VA (voltage/ampere) rating. The power receptacle should be marked “Hospital Grade” or “Hospital Only” to comply with safety regulations. Outside the continental United States, usage must comply with European standards.

Hardware requirements for the RA650 Group Audiometer System are as follows:

Computer:

IBM compatible PC (486 or higher)
8 MB RAM
340 MB hard drive
3.5” floppy drive
EGA/VGA monitor
Keyboard
Mouse
Windows Office Professional
An available communication port (to communicate with the RA650)

Printer:

A parallel printer is required to print reports.

To install the RA650 hardware, use the following procedure:

1. **Locate sound room jack panels:**

   Locate the exterior jack panels for each subject location. If necessary, label the jack panel with the provided labels.

2. **Position RA650 components:**

   Locate the RA650 chassis(s) and computer near the sound room jack panel. A 30-ft. cable is provided for connecting the RA650 to the Sound Room.

3. **Confirm module installation:**

   Verify that all modules are installed properly in the chassis(s).

4. **Connect audiometer modules to jack panel:**

   Connect each audiometry module to the corresponding sound room earphone and handswitch jack panel location.

5. **RA650 Chassis Installation:**

   See Figure 4, which displays an RA650 Audiometer Chassis with installed controller and four audiometer modules.

Note that your installation may have from 1 to 8 audiometers. The first chassis contains audiometers for up to 4 stations (Stations 1 through 4). An optional second chassis contains audiometers for additional stations (Stations 5 through 8). Also note that the station number is defined by the location of the audiometer in the RA650 chassis, as shown in the figure 4.

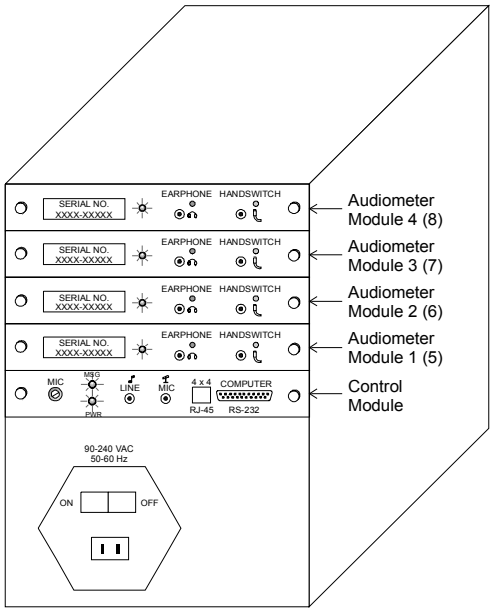

Figure 4

RA650 Audiometer Chassis with Installed Controller and Four Audiometer Modules

4.1.1 Configuration and Power Connections

1. Configure the computer, printer, and RA650 hardware, as shown in the following figures.
2. Plug in each component, but do not turn them on at this time.

Figure 5 shows the power connections of a typical RA650 Group Audiometer installation with one chassis, one controller, and four audiometer modules to accommodate four testing stations.

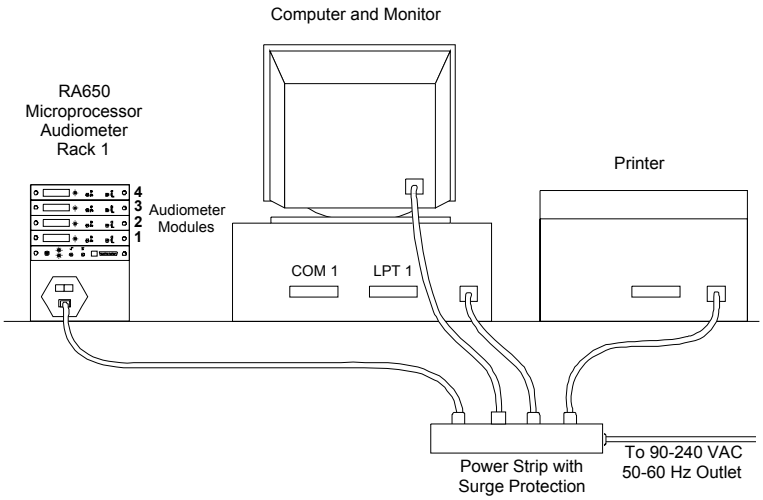

Figure 5

Power Connections of One RA650 Group Audiometer Chassis with Installed Controller and Four Audiometer Modules

Figure 6 shows the power connections of a typical RA650 Group Audiometer installation with two chassis, two controllers (one for each chassis), and eight audiometer modules to accommodate eight testing stations.

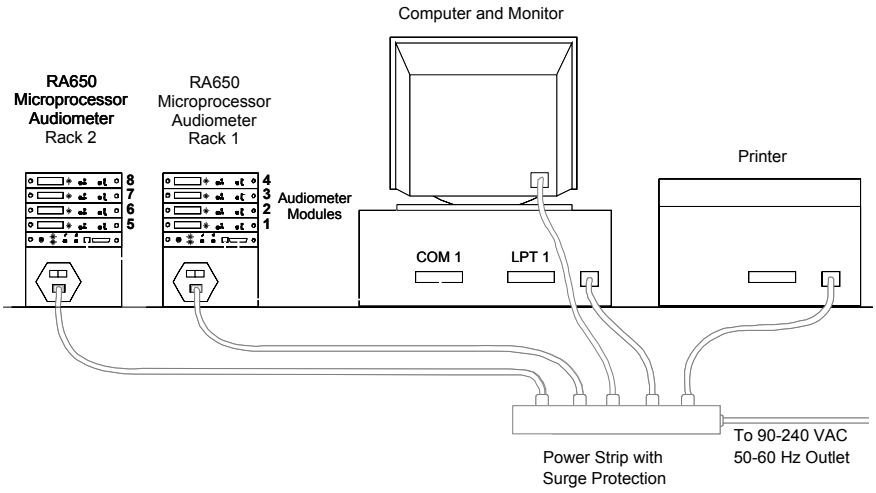

Figure 6

Power Connections of Two RA650 Group Audiometer Chassis with Installed Controllers and Eight Audiometer Modules

4.1.2 Control Module Connections

Figure 7 presents an illustration of the RA650 Audiometer Control Module.

1. Connect the 9-pin RS-232 cable from the Control Module on RA650 Chassis 1 to the available communication port on the computer.
2. Connect the stereo multimedia cable from the RA650 Control Module Line jack to the sound card on the computer, if the sound card is available.

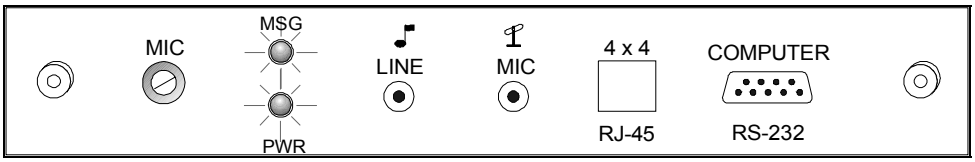

Figure 7

RA650 Control Module

3. Connect the microphone cable to the MIC jack on the RA650 control module.
4. Optional. If you are installing two RA650 chassis to accommodate more than four testing stations, connect the RJ-45 cable from the 4+4 RJ-45 port on the control module of Chassis 1 to the 4+4 RJ-45 port on the control module of Chassis 2.

4.1.3 Audiometer Module Connections

Figure 8 displays the RA650 Audiometer Module.

1. Connect the Earphones and Handswitches to their respective jacks in each of the sound rooms. Ensure that the station number tag on each handswitch (**HS #X**) and earphone (**EAR #X**) wire (from Step 3) correlates with the audiometer module station number, as defined by the placement in the RA650 chassis(s).

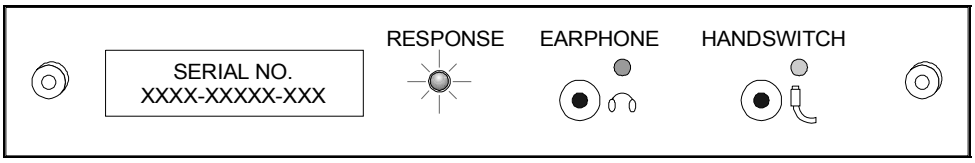

Figure 8

RA650 Audiometer Module

Note: Each set of earphones must be matched to its respective audiometer. Match the Serial Number tag on each audiometer to the Serial Number tag on each earphone package. Assign each earphone to the corresponding testing station.

4.1.4 Completed Wiring

Figures 9 and 10, below, illustrate all connections of a typical RA650 Group Audiometer. Installation with one chassis, one controller, and four audiometer modules to accommodate four testing stations, and all connections of a typical RA650 Group Audiometer installation with two chassis, two controllers, and eight audiometer modules to accommodate eight testing stations.

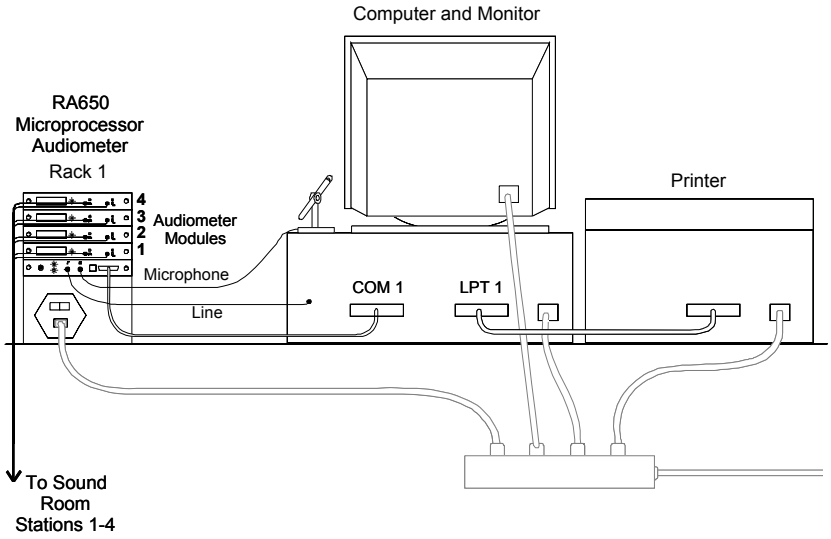

Figure 9

Complete Connections of One RA650 Group Audiometer Chassis with Installed Controller and Four Audiometer Modules

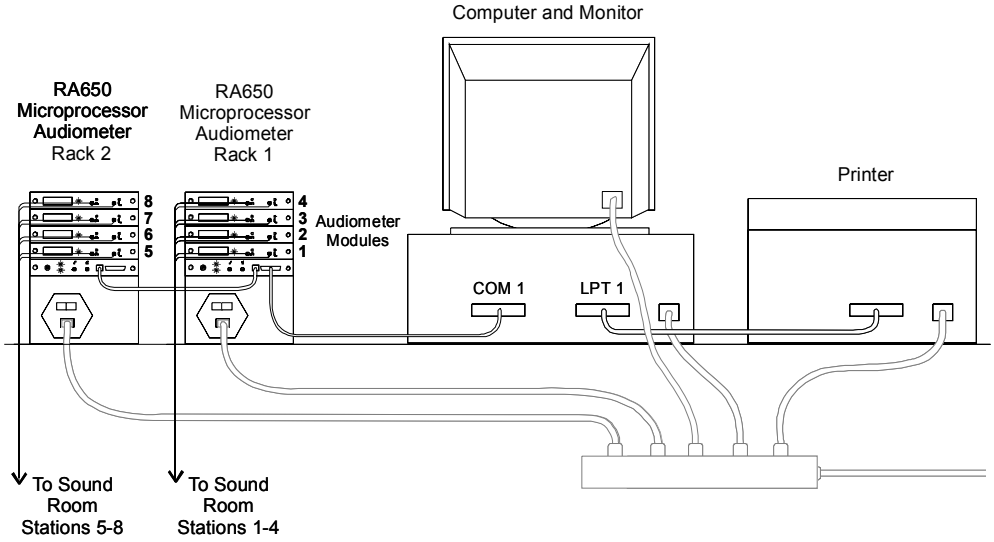

Figure 10

Complete Connections of Two RA650 Group Audiometer Chassis with Installed Controllers and Eight Audiometer Modules

4.1.5 Software Installation

Install the RA650 operating software as directed in the Software Installation section of this manual.

4.1.6 RA650 Chassis Power On

Turn on power to the RA650 Chassis(s) using the power switch in the back. Confirm that the PWR light on the Control Module(s) comes on.

4.1.7 Computer Power On and Boot

1. Turn on power to the computer, monitor, and printer. The computer should boot and the Windows 95/98/ME/XT starting screen should appear.
2. Because the RA650 is Plug-and-Play compatible, the computer should recognize that the RA650 is on line and ask that the driver be loaded. (This should happen only once.)
3. Use the Start button to navigate to the RA650 program, and double-click to start the RA650 software program. Alternatively, double-click on the earphone icon. The RA650 main control window will appear.
4. The RA650 software will locate all installed audiometers and display each installed station on the screen. Note that the assigned station number is defined by the placement of each RA650 audiometer in its RA650 chassis.

4.1.8 Microphone Volume Adjustment

1. Turn on Talk-Over using the RA650 software.
2. Plug in the matching earphone to a station and speak into the microphone. Use a screwdriver to adjust the volume using the MIC adjustment.
3. Turn clockwise to turn volume up and counter-clockwise to turn volume down.
4. Repeat to confirm volume level for all stations.
5. Use Operation instructions to perform audiometer testing.

4.2 Software Installation

Note: The diskettes that are used with the computer warrant special considerations. The disks are covered in a flexible housing for protection. Nevertheless, they can vary in quality so the prudent user will always use the very highest quality diskettes. Do not store the diskettes in an area near magnets or large motors. Always store them in their proper containers. Even with these precautions, data on the disks can be destroyed, so be sure to use your computer to make backup copies (copy to another disk) of the installation disks. These limited precautions, if followed, will help to ensure good results with your computer system.

Completion of the RA650 Group Audiometer system installation requires one of the following operating systems:

Windows 95/98/ME/XT

or Windows NT 4.0 / Windows 2000

To install the RA650 software, use the following procedure:

1. Insert the RA650 software disk.
2. From the Windows Start Menu, click **Run**.
3. Type into the window **D:\SETUP**. (where "D" is the letter of your CD ROM drive.)
4. The Setup program will automatically start and prompt you through the remainder of the installation process.

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