MADSEN

Partners in Hearing Care

ORBITER 922-2
Clinical Audiometer

Operation Manual part 7 →

Version 2.x

CE
0301

Part No. 7-26-110/05

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Introduction 1-1
1.2 About This Manual 1-4
1.3 Test Conditions 1-5
1.4 Safety Precautions 1-5

2. INSTALLING ORBITER 922

2.1 Unpacking and Inspection 2-1
2.2 Storage and Shipment 2-1
2.3 Installation 2-3
2.4 Voltage Selection 2-4
2.5 Fuse Replacement 2-5
2.6 Care and Maintenance 2-6
2.7 Equipment Failure 2-7
2.8 Service and Repair 2-7

3. GENERAL DESCRIPTION

3.1 General 3-1
3.2 Front Panel Layout 3-2
3.3 Front Panel Controls 3-3
3.3.1 Operation Subpanel 3-3
3.3.2 Display Subpanel 3-6
3.3.3 Control Subpanel 3-6
3.3.4 Keypad 3-8
3.4 Softkeys 3-9
3.5 Liquid Crystal Display 3-9
3.6 Connection Panel Layout 3-10

4. GETTING STARTED

4.1 Start-Up 4-1
4.2 Patient Identity 4-2
4.2.1 Operator I.D. Data Entry 4-3
4.2.2 Patient I.D. Data Entry 4-4
4.2.3 Comments 4-5
4.3 Easy And Advanced Modes 4-5
4.4 Summary 4-6

5. TONE AUDIOMETRY

5.1 Tone 5-1
5.1.1 Input/Output Settings 5-3
5.1.2 Menu 5-5
5.1.3 Option 5-6
5.1.4 Display 5-6
5.1.5 Setup 5-9
5.1.6 Data Transfer 5-11
5.1.7 Print 5-11
5.2 Pure Tone Testing 5-12
5.2.1 AC Threshold Measurements 5-12
5.2.2 BC Threshold Measurements 5-13
5.2.3 Free-Field Pure Tone Testing 5-14

6. SPEECH AUDIOMETRY

6.1 General 6-1
6.2 Introduction to Speech Testing 6-2
6.2.1 Input/Output Settings 6-3
6.2.2 Menu 6-5
6.2.3 Option 6-6
6.2.4 Display 6-7
6.2.5 Setup 6-10
6.2.6 Data Transfer 6-12
6.2.7 Print 6-12
6.3 Speech Testing 6-13
6.3.1 Speech Testing with Live Voice Signal 6-13
6.3.2 Speech Testing with Tape Materials 6-14
6.3.3 Speech Testing with CD Player 6-15
6.3.4 Free-Field Speech Testing 6-18
6.4 Theory of Speech Audiometry 6-18
6.4.1 Speech Reception Threshold 6-19
6.4.2 Discrimination Testing 6-19
6.4.3 Speech Audiometry with Live Voice 6-20
6.4.4 Speech Audiometry with Tape or CD Input 6-22
6.4.5 Speech Audiometry and Masking 6-24
6.4.6 Free-Field Speech Audiometry 6-25

7. SPECIAL TESTS

7.1 Auto Threshold Test 7-2
7.1.1 Setup For Auto Threshold Test 7-3
7.2 Fowler's Test 7-5
7.2.1 Setup For Fowler's Test 7-7
7.3 Stenger Test 7-8

7.3.1 Setup For Stenger Test 7-10
7.4 SISI Test 7-11
7.4.1 Setup For SISI Test 7-13
7.5 DLI Test 7-16
7.5.1 Setup For DLI Test 7-17
7.6 Supra Threshold Test 7-19
7.6.1 Setup For Supra Threshold Test 7-20
7.7 Tone Decay Tests 7-21
7.7.1 Setup For Tone Decay Tests 7-23
7.8 Rainville Test 7-24
7.8.1 Setup For Rainville Test 7-26
7.9 High-Frequency Audiometry (HFA) 7-28
7.9.1 Setup for High-Frequency Audiometry 7-29
7.10 Two Tone Test 7-32
7.10.1 Setup For Two Tone Testing 7-33
7.11 Monaural Loudness Balancing (MLB) Test 7-35
7.11.1 Setup For MLB Test 7-37
7.12 Békésy Audiometry 7-39
7.12.1 Setup For Békésy Test 7-40
7.13 Data Transfer 7-43
7.14 Print 7-43

8. USER TESTS & DEFAULT SETTINGS

8.1 User Test Programming 8-1
8.2 Default Settings 8-4

9. PT. COMMUNICATION & MONITORING

9.1 Introduction 9-1
9.2 Talkover 9-2
9.3 Talkback 9-3
9.4 Monitoring 9-4
9.5 Level Adjustment 9-5
9.6 Patient Signal 9-6

10. SYSTEM SETUP

10.1 Power-On Options 10-1
10.2 Configuration Menu 10-1

11. CALIBRATION

11.1 Error Check 11-1
11.2 Calibration Reference 11-2

12. DATA INTERFACE

12.1 Data Transfer 12-1
12.2 Connections 12-1

13. PRINTOUT

13.1 Printout On Internal Printer 13-1
13.1.1 Paper Loading 13-3
13.2 Printout On External Printer 13-4

APPENDIX A: TECH. SPECIFICATIONS A-1

Standard Accessories A-3
Optional Accessories A-4

APPENDIX B: SELECTION TREES

Selection Tree: Tone B-1

APPENDIX C: ORBICON™ SOFTWARE

Specification Of Configuration Options C-1

SUBJECT INDEX

Subject Index S-1

Acknowledgement
The word lists used in figures in the chapter on speech audiometry in this manual originate from speech material found in the Q / MASS Speech Audiometry CD, vol. 3, and are quoted with the kind permission of the authors (Massachusetts Eye and Ear Infirmary) and distributors (Qualitone).

7. SPECIAL TESTS

The ORBITER 922 Clinical Audiometer features the following special tests:

- Auto Threshold Test
- Fowler's Alternate Binaural Loudness Balance Test (ABLB)
- Stenger Test
- Short Increment Sensitivity Index (SISI Test)
- Lüscher-Zwislocki Test (DLI – Difference Limen for Intensity)
- Supra Threshold Test (MCL/UCL)
- Threshold Tone Decay Test
- Rainville Test
- Extended high-frequency (EHF) testing
- Békésy testing
- Two Tone testing
- Monaural Loudness Balancing Test (MLB)

Please note that both Warble and Frequency Resolution for a Version 2 differs from that of the Version 1, and that the setup screens in this chapter for special tests which are common to both audiometers only show the warble and frequency resolution selections available in the Version 1. In addition, increment selections for the SISI and DLI tests are finer, i.e. they go down to 0.2 dB steps.

Typically, special tests are performed after obtaining pure-tone thresholds at each frequency. Consequently, each of the special tests found in ORBITER 922 includes the previously stored pure-tone audiograms of the patient on the display. In fact, a pure-tone audiogram can be made from each special test in the same way as in Tone. Threshold data may be stored and/or transferred to a PC or printed out as in Tone.

Select **Special** to access the first of the Special Test submenus. Pressing **Softkey 7**, Next, accesses the next menu, and so on. Select the desired Special Test by pressing the appropriate softkey.

7.1 AUTO THRESHOLD

Hughson & Westlake

This test enables automatic threshold testing either at a single frequency, or at multiple frequencies, which are selectable in Setup. The principle utilized is that first described by Hughson and Westlake (1944).

**The time window for a valid patient response is 1.7 seconds*

The first tone is presented at 50 dB, 1000 Hz in the ear selected. If the subject responds, the tone is attenuated in 10 dB steps until a level is reached when the subject does not respond*, and then the next presentation is at a level 5 dB higher in intensity. When the subject again responds, the intensity is decreased 10 dB and again increased in 5 dB steps until a response is given*. A threshold is accepted by the audiometer and stored after the same level has been found twice consecutively (approaching from a lower level).

If the subject does not respond* to the first tone at 50 dB, the intensity is increased in 20 dB steps until the first patient response occurs*. Thereafter follows the same 10 dB decrease described above until the threshold is found.

Beep Signals Threshold

If Pt. Response is set to Audible, see §9.5, a beep is emitted when the automatic program accepts a value as a threshold.

After finding the threshold at 1000 Hz, the next tone is presented at 20 dB above the last found threshold and at 1500 Hz until the threshold is found. The sequence of frequencies always starts at 1000 Hz and then goes up to 12000 Hz, whereupon the automatic program returns to 1000 Hz and continues downwards. Frequencies may be deselected in setup (see §7.1.1 below). Stimuli may be presented as constant or pulsed pure tones, or as warble tones. Tone and pulsing duration are specified in Setup.

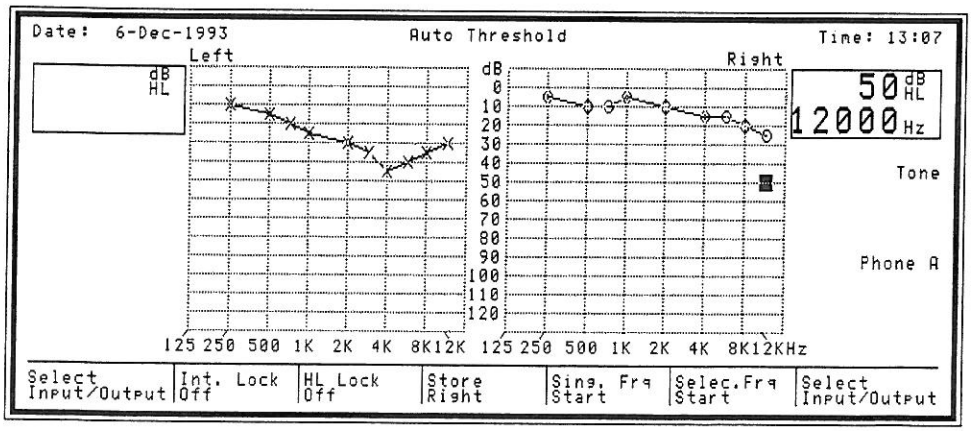


Fig. 7.1. The Auto Threshold Screen.

Testing at single frequencies follows the same principle, but only for the individual frequency selected, i.e. when a threshold has been accepted, the audiometer stops.

Single-Frequency Testing

Before starting the test, select intensity and frequency, as well as setup parameters (see §7.1.1 for setup details). Any standard frequency between 125 Hz and 12000 Hz may be selected. Intermediate frequencies may also be selected, but only after selecting multi-frequencies as frequency resolution in setup (Softkey 6).

Standard & Intermediate Frequencies

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

7.1.1 SETUP FOR AUTO THRESHOLD

Press **Setup** to access the following screen:

Setup

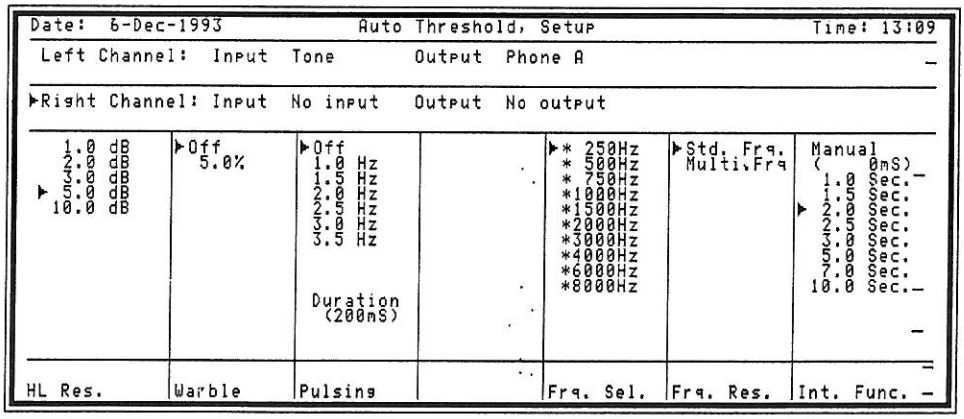


Fig. 7.2. The Auto Threshold Setup Screen.

Note that the 2nd and 3rd lines on the LCD specify the current setup for the two channels, while the ➤ cursor indicates which channel is active.

L/R SHIFT

Changes between left and right channel.

L/R Shift

HL RESOLUTION

This option is only available for regular pure-tone testing, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. This selection does not affect the increments used by the automatic program in the Auto Threshold test mode.

HL Resolution

Warble

WARBLE
Warble is default off.

Pulsing Rate

PULSING
Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

Frq. Sel.

FREQUENCY SELECTION
When testing at multiple frequencies, all standard frequencies between 250 Hz and 8000 Hz are selected as default and marked with an asterisk *. Use either Tone Switch (Interrupter) to deselect or select individual frequencies.

Frq. Res.

FREQUENCY RESOLUTION
Standard frequencies are default selected. If you wish to use other frequencies in connection with Single Frequency testing, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION
Note that this setup parameter is not used during Auto Threshold testing as presentation of stimulus is controlled by the audiometer's automatic program.

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.2 FOWLER'S TEST

ABLB Test

This test, also known as the Alternate Binaural Loudness Balance Test, was first described by Fowler (1928). Hearing levels at which a pure tone sounds equally loud to both ears of a subject are compared. The test is applicable when there is a difference in hearing loss of at least 20 dB between the two ears at the pure-tone test frequency.

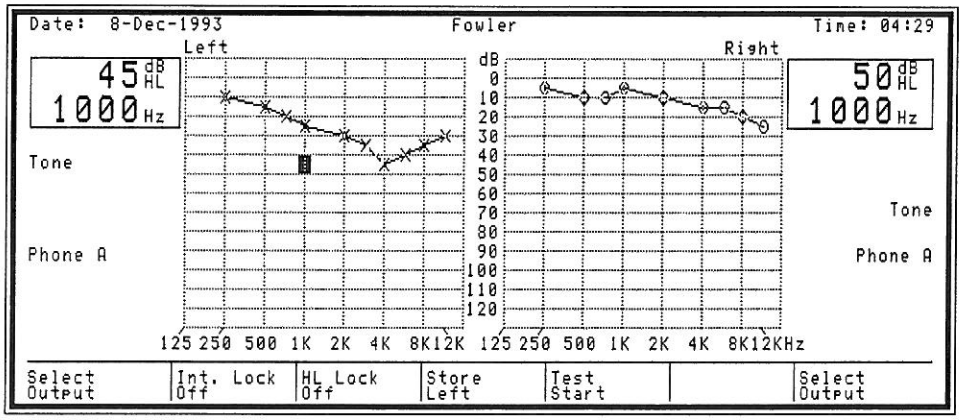


Fig. 7.3. The Fowler's Test Screen.

Softkey 5

The tone is presented automatically through the two ears by pressing **Softkey 5** to start the test. A tone is presented first in the left ear, then in the right ear, then again in the left ear and finally in the right ear. The patient is thus presented with the tone twice in each ear. If a tone has to be presented again, press **Softkey 5** and the same sequence will be repeated.

Level

The test can be performed on either of the two ears. If, for example, you wish to test the left ear for recruitment, one uses the right ear as the indicator ear. Choose the desired frequency. Adjust left channel **Level** to 10 dB above the actual threshold for that frequency for left ear. In the same way adjust right channel **Level** control to a value of 10 dB above the actual threshold for right ear.

Softkey 5

Press **Softkey 5** for automatic presentation of the tone sequence. Ask the patient if the tone was heard with the same sensation in both ears. If not, adjust **Level** so that the tone gives the same sensation level in both ears.

Level

When the exact balance has been found, record the intensities presented to the ears shown on the display. Thereafter, increase intensity in the right ear by 10 dB using the right channel **Level**

control and then find the intensity in the left ear at which the patient indicates that the tone was heard with the same sensation. Record again the values shown on the display. Continue in this way until maximum intensity on the audiometer has been reached, or until the patient indicates that the presentation of the tone has reached the pain threshold. Record the results from each test. In the absence of recruitment, the difference between the two hearing level readouts will be constant during the whole test. If the difference between the two readouts diminishes at increased intensities, it is an indication of recruitment.

A typical example of recruitment in the left ear is shown in the table below:

Recruitment

Read Out 1 – Left	Read Out 2 – Right
40	20 (Threshold +10 dB)
50	30
57	40
65	50
72	60
75	70
80	80

As shown, the difference between the two ears becomes smaller and smaller as the intensity is increased, and at 80 dB there is no difference at all. The degree of recruitment will vary in different cases and may be more marked than in the example given. In all cases, however, the recruitment reduces the hearing span, i.e. from threshold to the uncomfortable loudness level.

A normal ear has a wide hearing span and is able to perceive pure tones from the normal threshold of 0 dB to the upper limit of the audiometer without undue stress. The recruiting ear may only span 25 to 30 dB. Such a patient may find tones 25 to 30 dB above threshold unbearably loud. The pure tone test frequency to be used will depend upon the relative hearing losses of the two ears, and should always be chosen so that there is a difference in hearing loss of more than 20 dB.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

7.2.1 SETUP FOR FOWLER'S TEST

Press **Setup** to access the following screen:

Setup

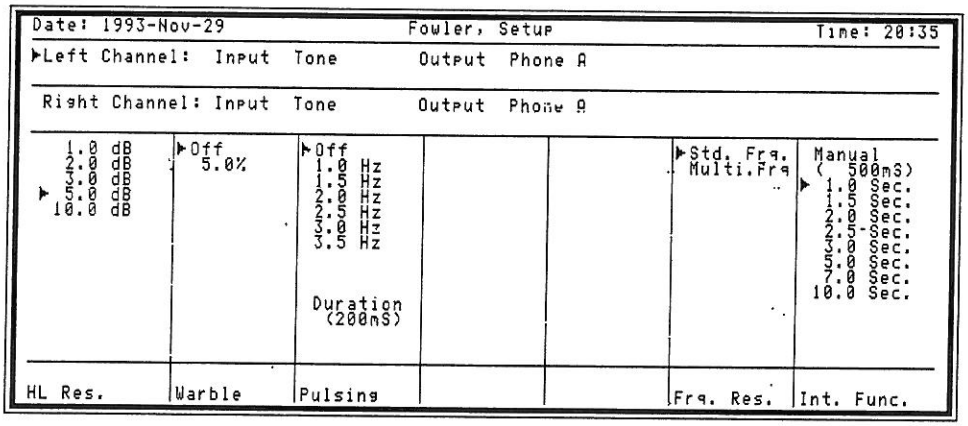


Fig. 7.4. The Fowler's Test Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel.

L/R Shift

HL RESOLUTION
This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. 5 dB is default.

HL Resolution

WARBLE
Warble is default off.

Warble

PULSING
Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Rate

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Pulsing Duration

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

Frq. Res.

FREQUENCY RESOLUTION

Standard frequencies are default selected. If you wish to use other frequencies in connection with Fowler's Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

Int. Funct.

INTERRUPTER FUNCTION

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Setup for this function is identical regardless of which channel is selected.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.3 STENGER TEST

The Stenger Test is based on the fact that when both ears are stimulated by a tone of the same frequency but of a differing sensation level in each ear, a normal-hearing subject is aware of hearing the tone only in the ear in which it is louder. This also applies to subjects with equal bilateral hearing loss. This phenomenon is useful in determining the genuineness of a patient's claim that his hearing in one ear is impaired, i.e. this is a test for exposing malingering.

The Stenger Test setup is similar to a normal pure tone test setup with tone selected as both stimulus and masking in both transducers (see Fig. 7.5).

The Stenger Principle

The Stenger principle states that when two tones of the same frequency are introduced simultaneously into both ears, only the louder tone will be perceived. The test is performed by introducing a tone of a particular frequency into the better ear at a level 10 dB above threshold. If the loss in the poorer ear is genuine, the patient will be unaware of any signal in his poor ear and will respond to the tone in his good ear, since it is 10 dB above threshold. This is a negative Stenger result. If the patient does not respond, it is a positive Stenger. If the tone is above true threshold in the bad ear it will preclude hearing the tone in the good ear. As the patient does not want to admit hearing in the bad ear, and is unaware of the tone in the good ear, he does not respond.

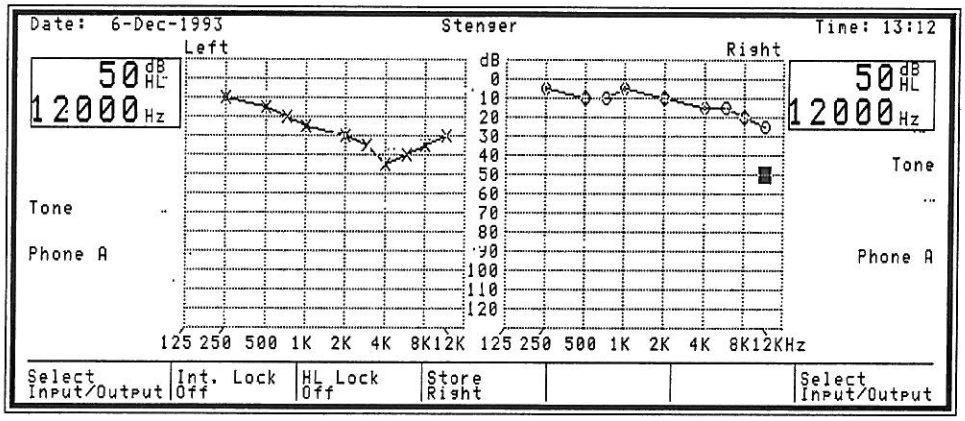


Fig. 7.5. The Stenger Test Screen.

The test is only valid if the difference between the ears is >20 dB.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

7.3.1 SETUP FOR STENGER TEST

Setup

Press **Setup** to access the following screen:

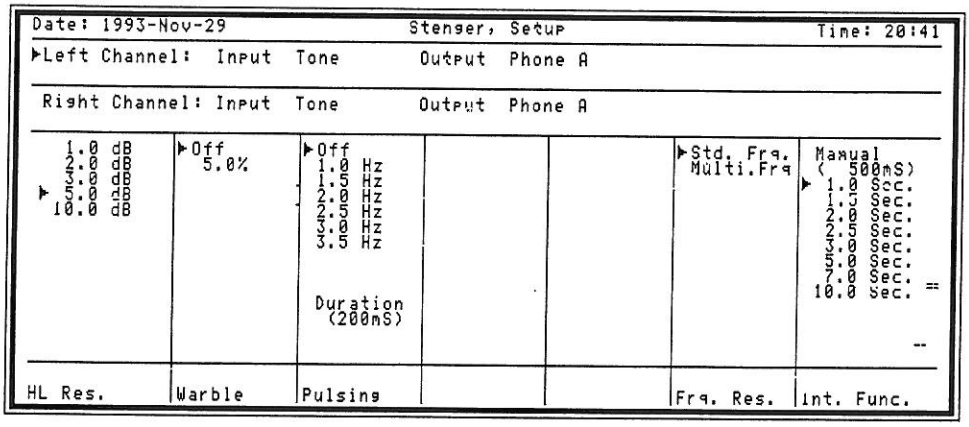


Fig. 7.6. The Stenger Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT

L/R Shift

Changes between left and right channel.

HL RESOLUTION

HL Resolution

This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. 5 dB is default.

WARBLE

Warble

Warble is default off.

PULSING

Pulsing Rate

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

FREQUENCY RESOLUTION

Frq. Res.

Standard frequencies are default selected. If you wish to use other frequencies for the Stenger Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.4 SHORT INCREMENT SENSITIVITY INDEX (SISI) TEST

ORBITER 922 features two separate test of difference limen (DL) for determining the presence or absence of loudness recruitment: the SISI Test and the DLI Test (difference limen for intensity). The ORBITER 922 is able to perform automatic SISI tests with the standardized specifications for this test.

SISI Test Described

The SISI Test was developed by Jerger and coworkers (Jerger, Shedd, and Harford, 1959) and was introduced as a procedure that was reliable and reasonably objective. The test consists of superimposing brief bursts of 1-dB intensity increments on a sustained tone presented monaurally through earphones at a sensation level of 20 dB at each tested frequency. The patient is instructed to report any jumps in loudness detected while listening to the sustained tone for a period of about two minutes. The audiometer produces an intensity increment every 5 seconds. Each increment has a rise time of 50 msec, a duration at full strength of 200 msec, and a decay time of 50 msec. The size of the increment can be varied via Setup from 0 to 5 dB in 1 dB steps (or

0.2, 0.4, 0.6, 0.8 dB), although the test is scored only on the percentage of 1 dB increments correctly identified by the patient. Twenty 1 dB increments are presented during the test. If the subject responds 10 times out of the 20, 1 dB increments, the sensitivity index is 50%. Before starting the test, present five 5 dB increments to give the subject a noticeably intense increment to respond to.

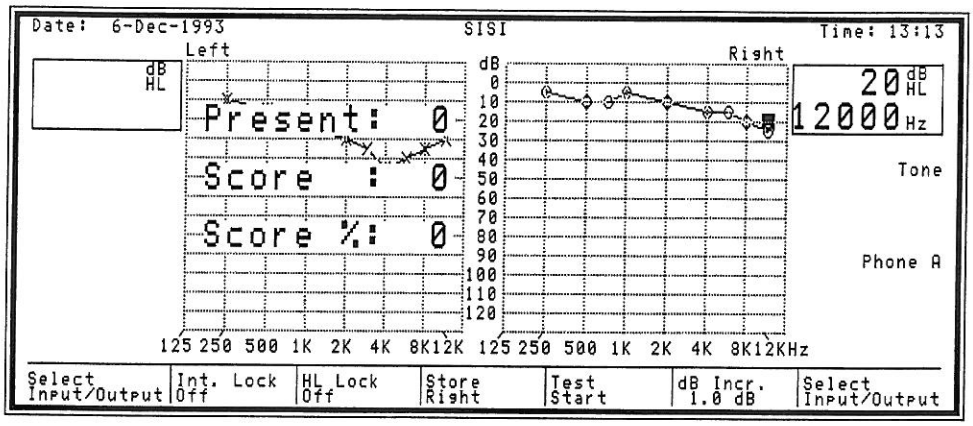


Fig. 7.7. The SISI Screen.

To perform this test with ORBITER 922, press **Special**, then **Softkey 4**, SISI, to access the following screen:

BEFORE STARTING SISI TEST PROPER

Explain to the patient that he will hear a continuous tone the intensity of which will be increased for a very short time (200 ms) every fifth second and that he should press the patient signal **immediately** each time he hears such a change. To demonstrate this, ensure that modulation is set at 5 dB (toggle **Softkey 6**) where it should be easy for the patient to hear the intensity changes and set HL at 40 dB or higher.

Reverse

Select **Reverse** and then press **Softkey 5** to start the test. The HL setting on the display will change each time the intensity is raised. Press **Softkey 5** again to stop the SISI test. Press **Softkey 7** to pause, and restart by pressing **Softkey 7** again.

The display will show the number of presentations, the patient's score and the score as a percentage of presentations.

Softkey 6

Pressing **Softkey 6** toggles between the intensity increments that have been selected in **Setup**.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

SISI TEST PROPER

When the patient has been instructed and is ready to begin the test proper, set modulation in position "1 dB", check that **Reverse** is on, and press **Softkey 5** to start the test. The presentation counter will now count the number of presentations to the patient and will automatically stop after 20 presentations. At the end of the test the score may be read off on the display.

Note That The Modulation Cannot Be Heard Via Monitor Headset Or Speaker!

To find out whether the patient really hears the intensity increments, one can pause the test and by this omit one or more presentations and at the same time see if the patient still indicates that he hears the intensity changes—press **Softkey 7** to pause the test and then choose whether to restart (**Softkey 5**) or continue the test (**Softkey 7**).

Patients with normal hearing, middle ear diseases or nerve hearing loss will be able to hear from 0 - 20% of the increments at all frequencies.

Patients with cochlear disorders will respond to 60 - 100% of the increments for frequencies above 1000 Hz, and in some cases even down to 250 Hz.

The SISI test is not a recruitment test. It shows whether a patient is able to detect small variations in intensity. If a patient indicates that he hears 60% or more of the increments, it indicates that there may be cochlear problems.

7.4.1 SETUP FOR SISI TEST

Press **Setup** to access the following screen:

Setup

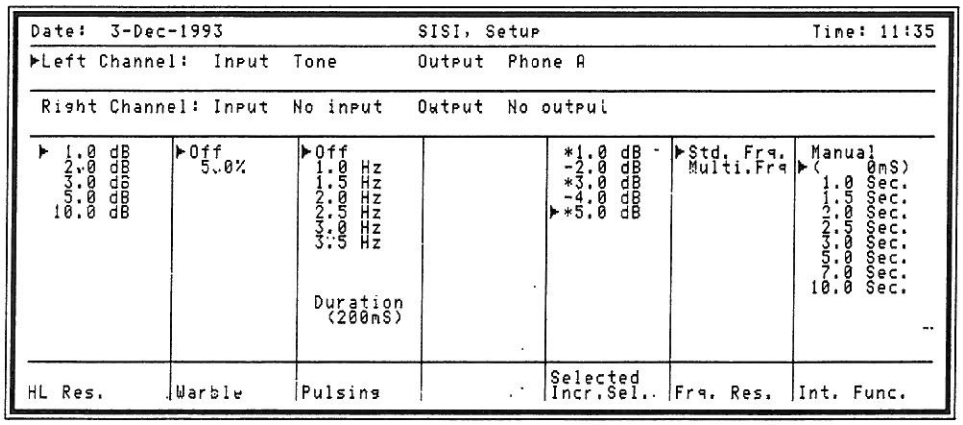


Fig. 7.8. The SISI Test Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R Shift

L/R SHIFT
Changes between left and right channel.

HL Resolution

HL RESOLUTION
This option is not available in SISI Test Mode—use **Softkey 5** instead to set intensity increment.

Warble

WARBLE
Warble is default off.

Pulsing Rate

PULSING
Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

Incr.Sel.

INCREMENT SELECTION
The following intensity increments are available: 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, and 5 dB. All increments are selected as default and marked with an asterisk *. Use either Tone Switch (Interrupter) to deselect or select individual intensities (deselection is indicated by a minus sign).

Frq. Res.

FREQUENCY RESOLUTION
Standard frequencies are default selected. If you wish to use other frequencies for the SISI Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down. In the SISI Test, the tone is normally presented via the **Reverse** function.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.5 DLI - DIFFERENCE LIMEN FOR INTENSITY

Difference Limen (DL)

Difference Limen (DL), sometimes called just noticeable difference or differential threshold, may be defined as the smallest change in frequency or intensity which can be recognized (James H. Delk). Tests of the DL are used for determining the presence or absence of loudness recruitment.

Lüscher and Zwislocki (1949) described a DLI test administered at a sensation level of 40 dB. It involved the presentation of a tone that varied in intensity so that the subject could hear intensity beats. The tone is reduced gradually until the subject reports that the tone is steady. The amount of intensity variation at the point at which the subject signals the tone is no longer fluctuating is the DL for intensity. An abnormal DL is one that is smaller than the minimum value within the range of the norms established by Lüscher and Zwislocki. In practice, subjects with normal hearing can hear a 5 dB intensity variation, while those with recruitment can hear one of just 1 dB, or less.

Difference Limen for Frequency (DLF)

A Difference Limen for Frequency (DLF Test) can also be performed, either from Tone or from the DLI screen, using the Orbiter 922 Version 2. Present the subject with a warble tone set at 5% modulation, and then reduce the modulation percentage until the subject can no longer detect frequency modulation. This indicates the smallest change in frequency which can be recognized.

Softkey 5

To perform the DLI test with ORBITER 922, press **Special**, then **Softkey 5**, DLI, to access the following screen:

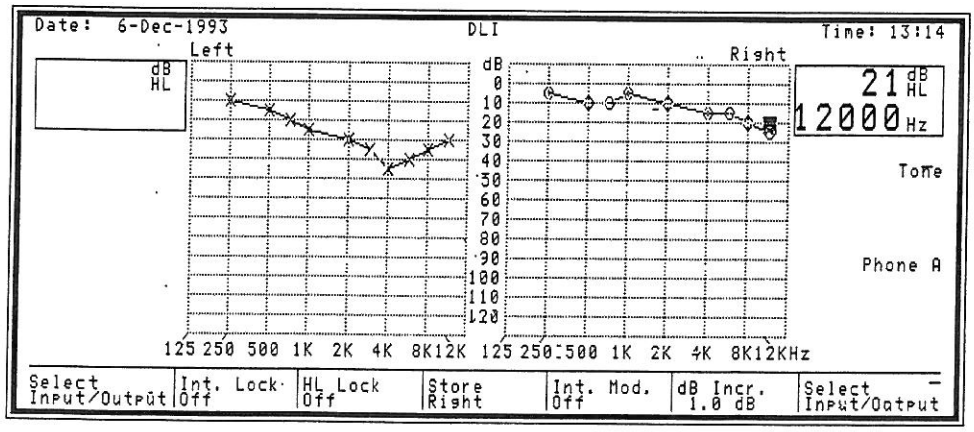


Fig. 7.9. The DLI Screen.

Tone in Phone A for the left channel (20 dB, 1000 Hz) is the default setting for Tone, which may be changed, see §8.2 Default Settings. You can also set this test up as a User Test (see §8.1, User Test Programming).

DLI Test Setup

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

Softkey 5, Int. Mod. (Intensity Modulation) starts and stops the test. **Softkey 6** toggles the intensity increment (which can be set in Setup). Use Reverse or Tone Switch to administer the tone.

7.5.1 SETUP FOR DLI TEST

Press **Setup** to access the following screen:

Setup

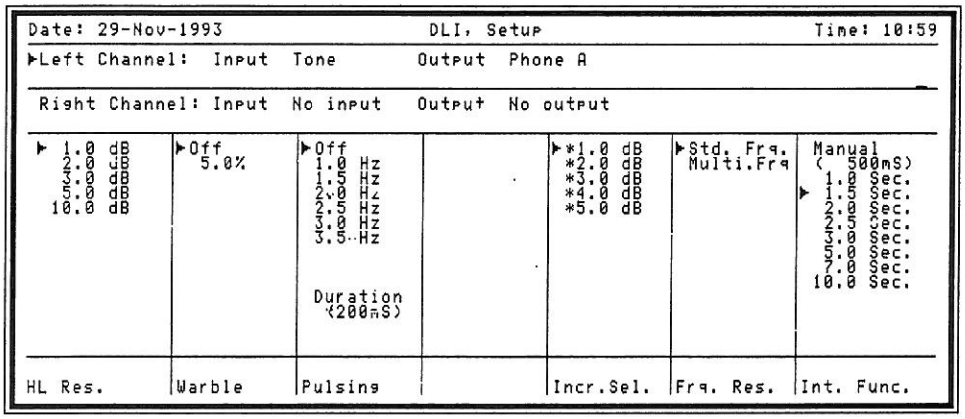


Fig. 7.10. The DLI Test Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel.

L/R Shift

HL RESOLUTION
This option is not available in DLI Test Mode—use **Softkey 5** instead to set intensity increment.

HL Resolution

Warble

WARBLE
Warble is default off.

PULSING
Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

Incr.Sel.

INCREMENT SELECTION
The following intensity increments are available: 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 4, and 5 dB. All increments are selected as default and marked with an asterisk *. Use either Tone Switch (Interrupter) to deselect or select individual intensities (deselection is indicated by a minus sign).

Frq. Res.

FREQUENCY RESOLUTION
Standard frequencies are default selected. If you wish to use other frequencies for the DLI Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

Int. Funct.

INTERRUPTER FUNCTION
The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down. In the SISI Test, the tone is normally presented via the **Reverse** function. Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.6 SUPRA THRESHOLD TEST (MCL/UCL)

MCL & UCL

In Supra Threshold Test Mode, thresholds for MCL (Most Comfortable Loudness) and UCL (Uncomfortable Loudness Level) may be displayed on the same screen as the previously stored audiograms. Up to 10 different curves can be entered, each with its own symbol—user-definable symbols can be downloaded via ORBICON™ in cooperation with your local Madsen distributor.

This test mode is useful for establishing the presence of loudness recruitment, which may be defined as the abnormal growth of loudness with signal intensity. A patient with sensorineural hearing loss can be asked to indicate at which point, as the intensity of a tone is increased, the tone is most comfortable to listen to, and again the point at which the tone becomes uncomfortably loud as the intensity is increased. For each frequency tested, these points may be compared with the patient's threshold. These points will tend to be relatively close together for the patient with loudness recruitment, whereas with the patient with no loudness recruitment, the points may be spread far apart.

Softkey 6

To perform this test with ORBITER 922, press **Special**, then **Softkey 6**, Suprathr., to access the following screen:

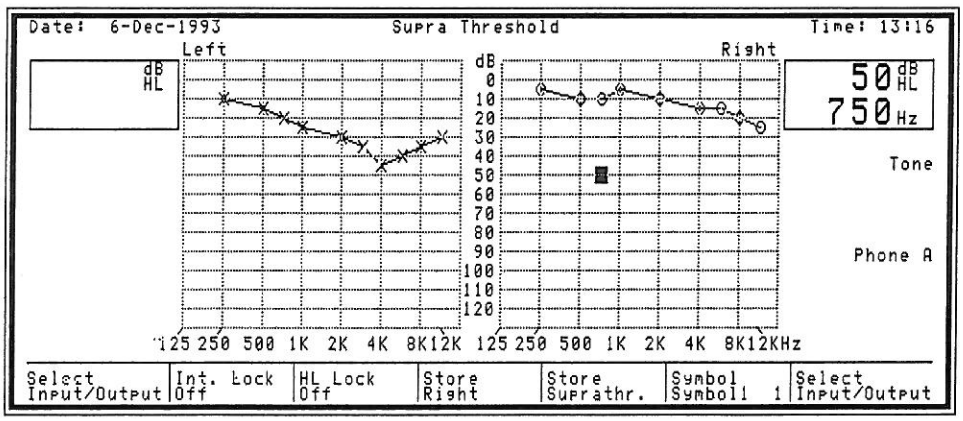


Fig. 7.11. The Supra Threshold Screen.

Tone settings will be the same as those which obtained for your last Tone test mode—they may also be set up as a User Test (see §8.1 User Test Programming). These settings may be altered as per Tone, i.e. by means of the Select Input/Output softkeys.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Symbols

Softkey 5, Store Suprathreshold, may be used for storing MCL/UCL thresholds, while **Softkey 6**, Symbol, may be used to toggle through the 10 available symbols. Where no special symbols have been stored in the audiometer's internal memory, numbers 0 to 9 appear instead.

7.6.1 SETUP FOR SUPRATHRESHOLD TEST

Setup

Press **Setup** to access the following screen:

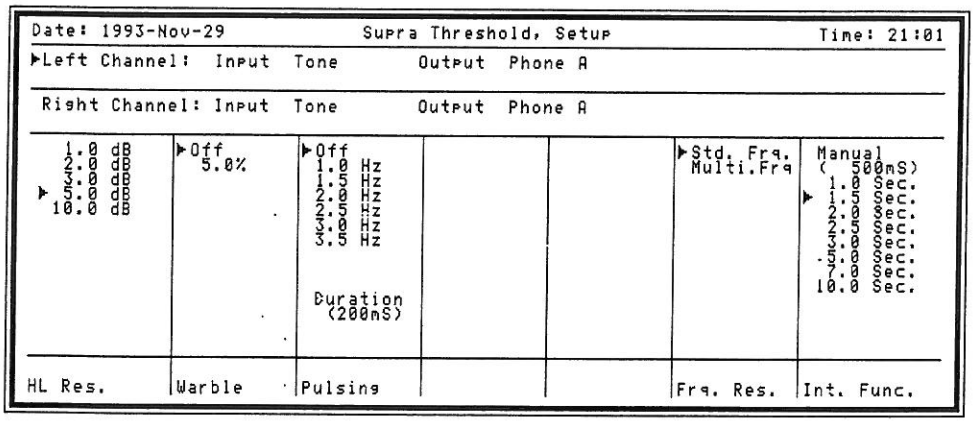


Fig. 7.12. The Suprathreshold Test Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT

L/R Shift

Changes between left and right channel.

HL RESOLUTION

HL Resolution

This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected.

WARBLE

Warble

Warble is default off.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

FREQUENCY RESOLUTION

Frq. Res.

Standard frequencies are default selected. If you wish to use other frequencies for the Supra Threshold Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down. In the SISI Test, the tone is normally presented via the **Reverse** function.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.7. TONE DECAY TESTS

Carhart (1957) proposed a tone decay test and reported that patients with Ménière's disease or other sensori-neural disorders demonstrated tone decay in this test.

"Carhart's procedure involved presenting a continuous tone at a patient's previously determined hearing-threshold level and checking the patient's response with a stopwatch. If the patient is able to hear the tone for 60 seconds, the test result is negative: there is no tone decay. If the patient "loses" the tone short of 60 seconds, the examiner increases the intensity in 5-dB steps until the patient again signals that the tone is heard. The stopwatch is

then restarted. Additional increases in intensity are made if necessary until a hearing level is reached at which the patient can respond to the tone for a full 60 seconds. The amount of tone decay is expressed as the dB change from original threshold to the final hearing level required to meet the sixty-second criterion" (Newby and Popelka).

MTDT

A Modified Tone Decay Test (MTDT) specifies that a pure tone is presented 5 dB above threshold. If and when the tone disappears, the intensity is increased by 5 dB. The number of times this increase must be repeated (the shift) in one minute is noted as an index of the degree of tone decay at that frequency.

STAT

"Jerger and Jerger (1975) hypothesized that VIIIth-nerve pathology is predicted best—and earliest—by tests at the highest testable intensities. Accordingly, they proposed a test for tone decay that involved presenting a sustained tone at an SPL of 110 dB for 60 seconds. If the patient hears the tone for the full 60 seconds, the test result is negative for retrocochlear involvement. If the tone is heard for less than 60 seconds, the result is positive. Jerger and Jerger called this test the Suprathreshold Adaptation Test, or STAT" (Newby and Popelka).

Built-In Stopwatch

ORBITER 922 features a built-in stopwatch function on the Tone Decay test screen.

Special

To perform any of these tests with ORBITER 922, press **Special**, then **Softkey 7**, Next, then **Softkey 1**, Tone Decay, to access the following screen:

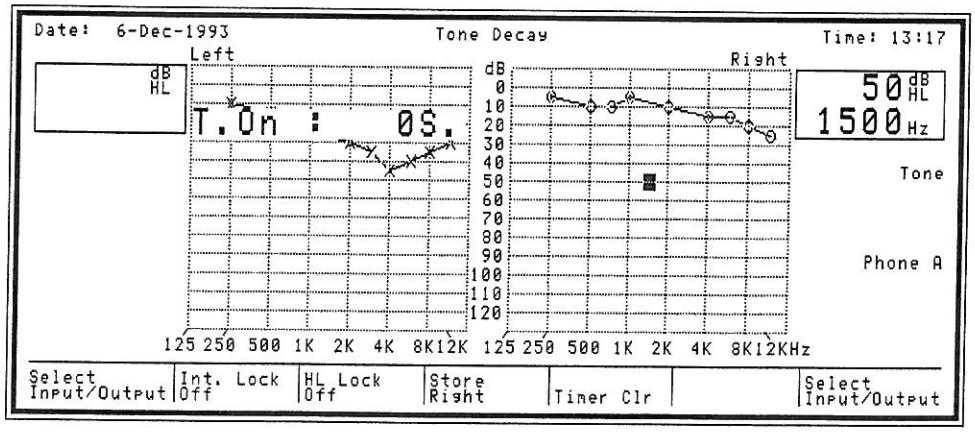


Fig. 7.13. The Tone Decay Screen.

Tone settings will be the same as those which obtained for your last Tone test mode—they may also be set up as a User Test (see §8.1 User Test Programming). These settings may be altered as per Tone, i.e. by means of the Select Input/Output softkeys.

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

Softkey 5, Timer Clr, resets the built-in stopwatch.

Softkey 5

7.7.1 SETUP FOR TONE DECAY TESTS

Press **Setup** to access the following screen:

Setup

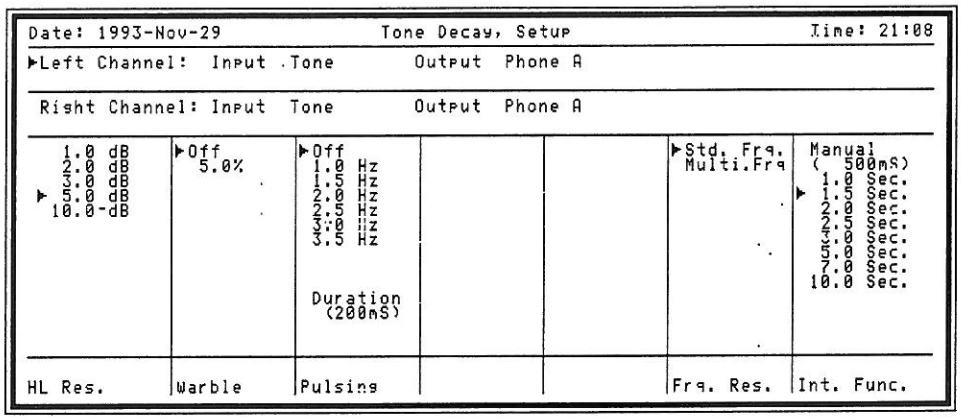


Fig. 7.14. The Tone Decay Setup Screen.

Note that the second and third lines on the LCD specify the setup for each channel, while the ➤cursor indicates the active channel. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel.

L/R Shift

HL RESOLUTION
This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected.

HL Resolution

WARBLE
Warble is default off.

Warble

PULSING
Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7. Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit.**

FREQUENCY RESOLUTION

Frq. Res.

Standard frequencies are default selected. If you wish to use other frequencies for the Tone Decay Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down. In the SISI Test, the tone is normally presented via the **Reverse** function.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.8 RAINVILLE TEST

The Rainville Test is used to determine the bone conduction threshold without testing the other ear. The test consists basically of masking ipsilaterally by means of the bone vibrator.

If "Ma" is the masking level just necessary to mask the air tone threshold (Ta) on the same ear, and if "Mb" is the bone masking level just necessary to mask the pure tone bone conduction threshold (Tb), then Ta = Ma – X and Tb = Mb – X, where "X" equals the difference in intensity level in order to obtain effective masking. This difference is usually 3 dB.

It is known that, for threshold, the cochlea receives the same energy in both cases of air threshold and bone threshold, so Ta may be masked by Ma or Mb.

We can then obtain Mb versus Ta, because Mb is the quantity of masking necessary to mask Ta. Tb is then equal to Mb – X.

To perform the Rainville Test with ORBITER 922, press **Special**, then **Softkey 7**, Next, then **Softkey 2**, Rainville, to access the following screen:

Special

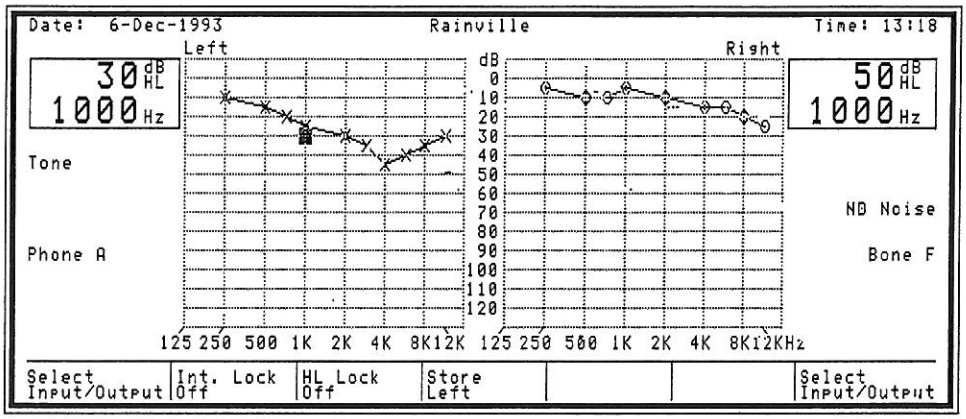


Fig. 7.15. The Rainville Test Screen.

Intensity and frequency settings will be the same as those which obtained for your last Tone test mode, but with Tone to Phone A for the left channel, and NB Noise to Bone F (forehead) for the right channel. Note that masking should be ipsilateral.

Settings may be altered as per Tone, i.e. by means of the Select Input/Output softkeys and they may also be set up as a User Test (see §8.1 User Test Programming).

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

Present a pure tone in the earphone and adjust to approx. 5 dB above threshold (pulsed tone may also be used).

Increase masking in bone vibrator until effective masking is obtained. The bone threshold may now be evaluated by subtracting 3 dB (or X depending on calibration) from the masking attenuator setting.

7.8.1 SETUP FOR RAINVILLE TEST

Setup

Press **Setup** to access the following screen:

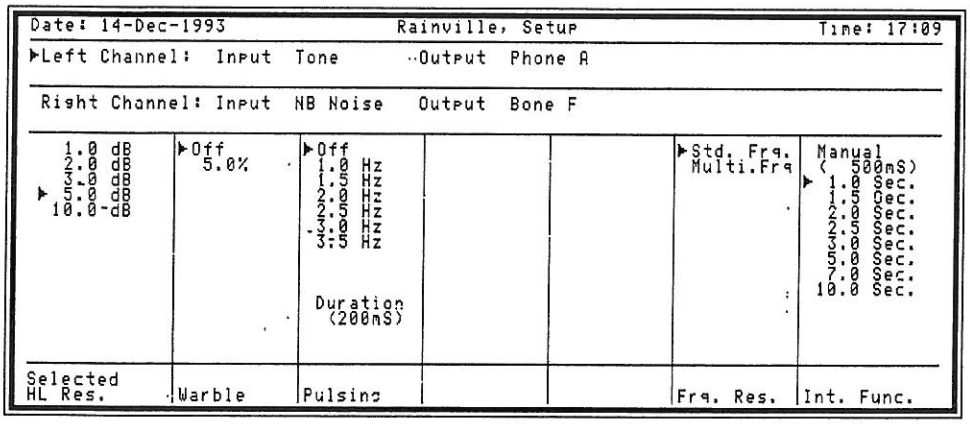


Fig. 7.16. The Rainville Setup Screen.

Note that the second and third lines on the LCD specify the setup for each channel, while the ➤cursor indicates the active channel. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT

L/R Shift

Changes between left and right channel.

HL RESOLUTION

HL Resolution

This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected.

WARBLE

Warble

Warble is default off.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, press Option, and the Keypad is activated while a cursor appears on the 5-digit numeric field above Softkey 7.

Alternative values are 140, 160, 180, 220 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

FREQUENCY RESOLUTION

Frq. Res.

Standard frequencies are default selected. If you wish to use other frequencies for the Rainville Test, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution.

Standard frequencies are:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000 and 12500 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down. In the SISI Test, the tone is normally presented via the **Reverse** function.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration entered by means of the Numeric Keypad and **Softkey 7** (range 0 to 65,535 milliseconds).

7.9 HIGH-FREQUENCY AUDIOMETRY

At the time of writing, interest in measuring air-conduction thresholds in the extended high frequencies (up to 20 kHz) is increasing, and a number of studies have been published indicating that such testing may have both diagnostic and rehabilitative value. However, as yet no standard has been established, and no calibration norms exist for frequencies over 16,000 Hz.

Supra-aural Earphones

A major consideration when testing at high frequencies is that neither the TDH series earphones nor insert earphones can produce sufficient intensity levels. Special supra-aural earphones are required. At present, only Sennheiser HDA 2000 earphones are available for use together with the ORBITER 922 (optional accessories).

Special

To perform this type of testing with ORBITER 922, press **Special**, then **Softkey 7**, Next, the **Softkey 3**, HighFreq, to access the following screen:

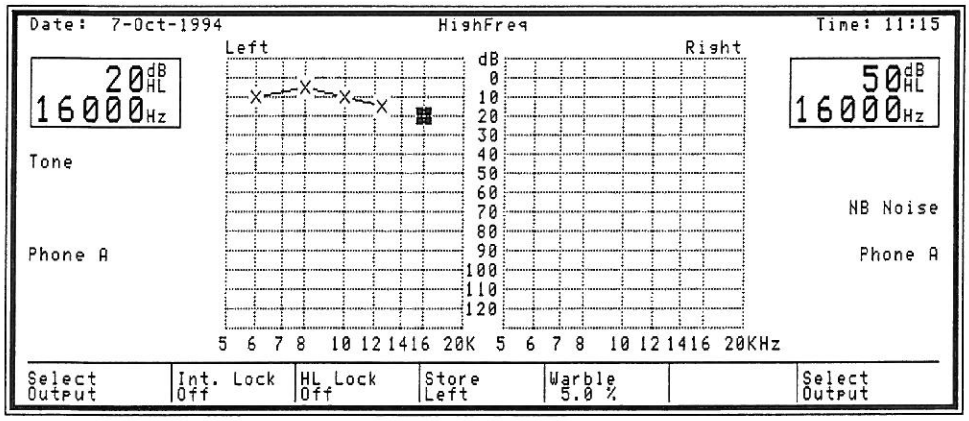


Fig. 7.17. The High-Frequency Screen.

Tone settings and setup will be the same as those which obtained for your last Tone test mode—they may also be set up as a User Test (see §8.1 User Test Programming). Settings may be altered as per Tone, via **Setup** and Select Input/Output.

Testing procedure for the higher frequencies is the same as for the conventional frequency range with the exception of the requirement for different earphones–see §5.1, Tone.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

7.9.1 SETUP FOR HIGH-FREQUENCY AUDIOMETRY

Press **Setup** to access the following screen (Advanced Mode only): **Setup**

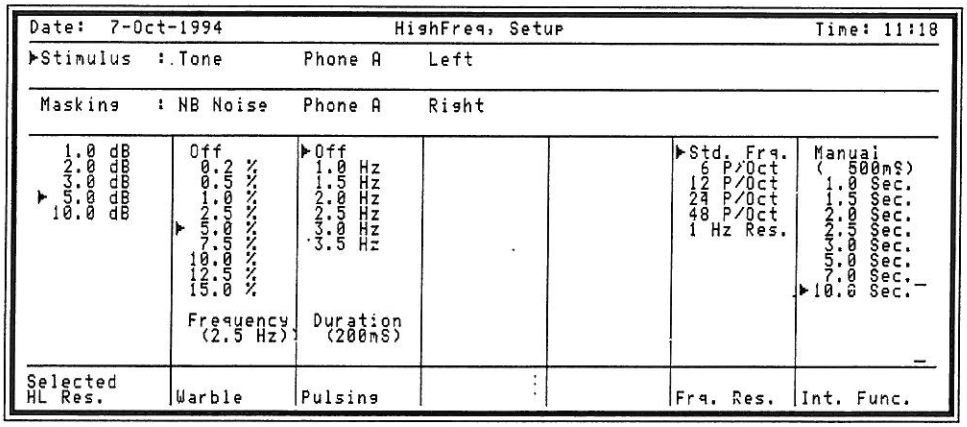


Fig. 7-18. The High-Frequency Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel. *L/R Shift*

HL RESOLUTION
This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. *HL Resolution*

WARBLE
Warble is default off. *Warble*

The following frequency modulations (in %) may be selected: Off, 0.2, 0.5, 1.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0. Press **Softkey 2** to select Warble, and turn either Level knob to select the desired modulation percentage (as indicated by the ➤ cursor). These settings may also be selected directly from the High-Frequency screen by toggling **Softkey 5**. *To Select Warble Modulation Settings*

The actual frequency in Hz of the modulation can be altered by entering value via the Keypad (range 1.0 to 15.0 in 0.5 Hz steps). *To Select Warble Frequency*

KEYPAD ENTRY

After pressing any digit on the Keypad, a 5-digit field appears on the bottom right of the display, and the softkey fields display the parameters that may be altered from the Keypad: Warble Frequency, Pulsing Duration and Interrupter Duration.

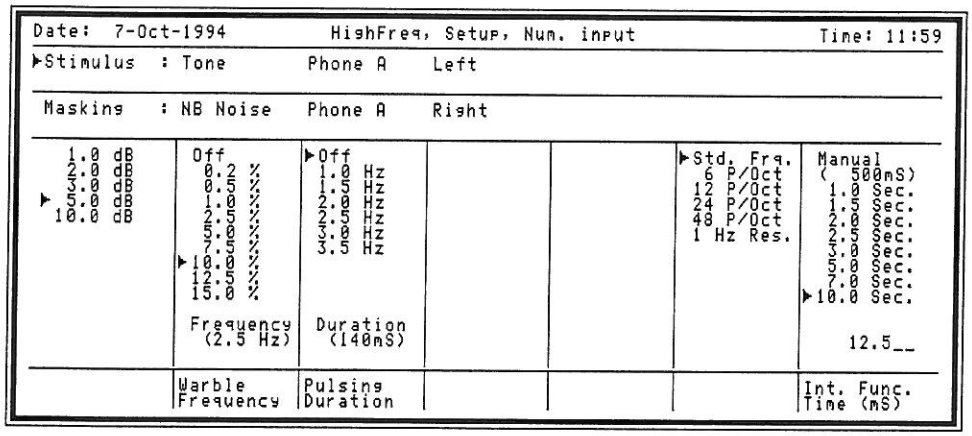


Fig. 7.19. Example of Screen for Numeric Input from Keypad.

Enter desired value (max. 5 digits including decimal point), and then press the softkey that corresponds to the desired parameter– it is not necessary to select the parameter first. Only values within the permitted range can be entered, e.g. if you enter 1.3 Hz for Warble Modulation Frequency and press **Softkey 2**, 1.5 Hz will be selected as the nearest valid value.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, activate the Keypad as described above and enter a valid value: 140, 160, 180, 220 or 240 mS.

FREQUENCY RESOLUTION

Std. Frq.

Standard Frequencies are default selected, but these intermediate frequencies are not to be confused with those available in conventional pure-tone testing.

The following standard intermediate frequencies are available in HFA:

6000, 8000, 10000, 12500, 16000, 18000, 19000, and 20000 Hz

Multiple Frequencies

In addition to standard frequencies, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution. These selections give you finer steps all the way down to 1 Hz in the range between 5000 and 20000 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration in mS (milliseconds) that is entered by means of the Numeric Keypad as described on the previous page under Keypad Entry. Range 0 to 65,535 milliseconds.

7.10 TWO TONE TEST

TwoTone

The two separate DSP oscillators of the Orbiter 922 permit a number of routing combinations where pure tones of different frequencies may be routed to both ears or the same ear and presented separately or simultaneously.

Special

To perform this type of testing with ORBITER 922, press **Special**, then **Softkey 7**, Next, the **Softkey 4**, TwoTone, to access the following screen:

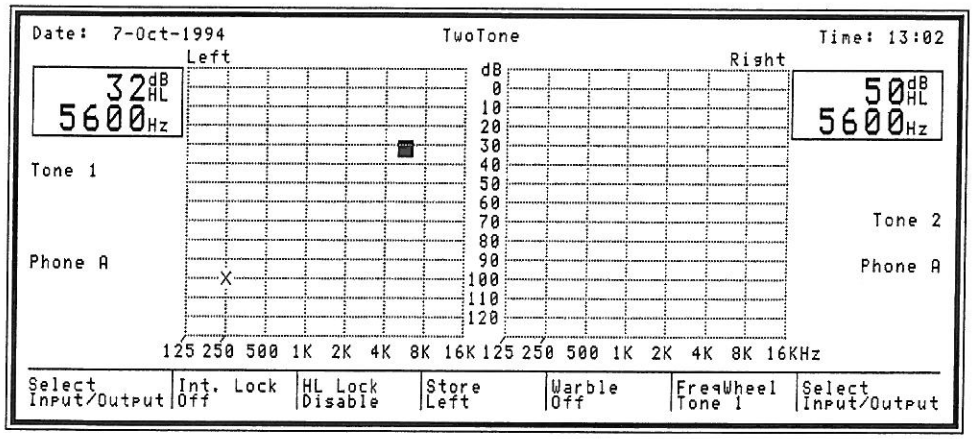


Fig. 7.20. The TwoTone Test Screen.

Tone settings and setup will be the same as those which obtained for your last Tone test mode—they may also be set up as a User Test (see §8.1 User Test Programming). Settings may be altered as per Tone, via **Setup** and Select Input/Output. For example, selecting Tone 2 for the left channel gives the following screen:

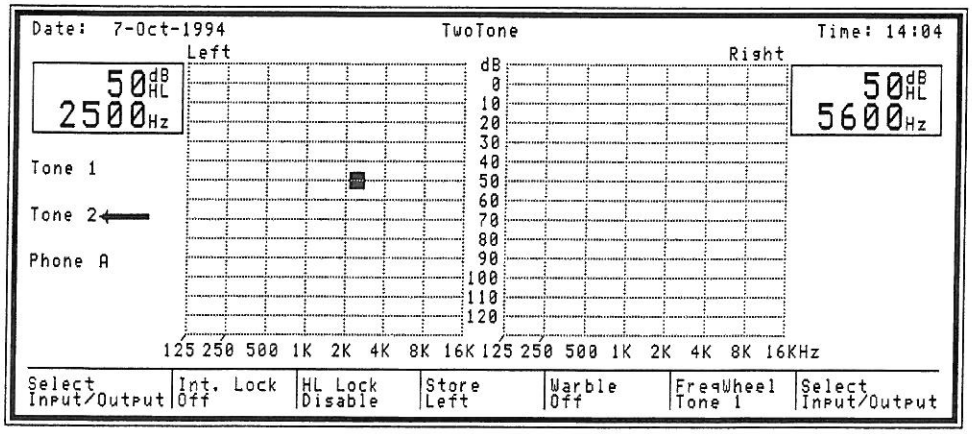


Fig. 7.21. Example of TwoTone Test.

In this example, two pure tones at 50 dB HL are presented to the same ear simultaneously, one at 2500 Hz and one at 5600 Hz.

Testing procedure for Two Tone is the same as for conventional pure-tone testing with the exception of the function of **Softkey 6**, FrqWheel. Toggling this softkey selects between Tone 1, Tone 2 or locked, with the result that turning **Frequency** changes frequency for either Tone, or for both. Please refer to §5.1, Tone, for further details re input/output settings, etc.

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

7.10.1 SETUP FOR TWO TONE TESTING

Press **Setup** to access the following screen (Advanced Mode only):

Setup

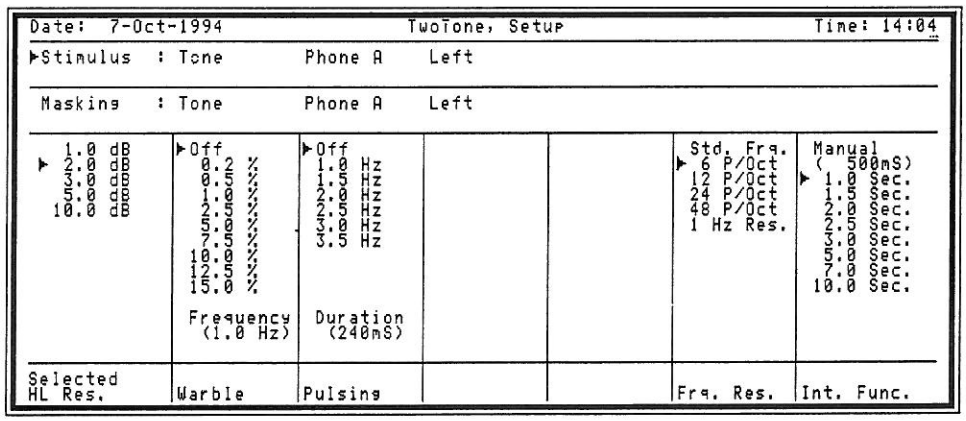


Fig. 7-22. The Two Tone Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, in the case of our example from the previous figure, both tones are being routed to the left channel. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT

Changes between left and right channel.

L/R Shift

HL RESOLUTION

This option is available at any time in Test Mode, and enables setting of intensity increment: 1, 2, 3, 5 and 10 dB may be selected.

HL Resolution

WARBLE

Warble

Warble is default off.

To Select Warble Modulation Settings

The following frequency modulations (in %) may be selected: Off, 0.2, 0.5, 1.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0. Press **Softkey 2** to select Warble, and turn either Level knob to select the desired modulation percentage (as indicated by the ➤ cursor). These settings may also be selected directly from the High-Frequency screen by toggling **Softkey 5**.

To Select Warble Frequency

The actual frequency in Hz of the modulation can be altered by entering value via the Keypad (range 1.0 to 15.0 in 0.5 Hz steps).

KEYPAD ENTRY

After pressing any digit on the Keypad, a 5-digit field appears on the bottom right of the display, and the softkey fields display the parameters that may be altered from the Keypad: Warble Frequency, Pulsing Duration and Interrupter Duration (see Fig. 7-19).

Enter desired value (max. 5 digits including decimal point), and then press the softkey that corresponds to the desired parameter– it is not necessary to select the parameter first. Only values within the permitted range can be entered, e.g. if you enter 1.3 Hz for Warble Modulation Frequency and press **Softkey 2**, 1.5 Hz will be selected as the nearest valid value.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, activate the Keypad as described above and enter a valid value: 140, 160, 180, 220 or 240 mS.

FREQUENCY RESOLUTION

Std. Frq.

Standard Frequencies are default selected, and these intermediate frequencies are the same as those available in conventional pure-tone testing:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000, 12500, and 16000 Hz

Multiple Frequencies

In addition to standard frequencies, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution. These selections give you finer steps down to 1 Hz in the range between 125 and 16000 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration in mS (milliseconds) that is entered by means of the Numeric Keypad as described on the previous page under Keypad Entry. Range 0 to 65,535 milliseconds.

7.11 MLB - MONAURAL LOUDNESS BALANCING TEST

MLB Test

The two separate DSP oscillators of the Orbiter 922 permit a number of special routing combinations as in the Monaural Loudness Balance Test, which is similar to the Alternate Binaural Loudness Balance Test of Fowler. Fowler's Test, however, cannot be used in cases of bilateral sensorineural impairment where hearing sensitivity is about the same in each ear. If one frequency region has normal or nearly normal hearing sensitivity and another region has a hearing loss, the monaural loudness balancing procedure may be employed: the loudness of tones in the impaired frequency region is compared to the loudness in a normal region in the same ear.

MLB Procedure

The procedure is the same in principle as for Fowler's Test: a test frequency in the normal region is increased in intensity in 20-dB steps above threshold. The patient is instructed to balance the loudness of the test frequency to the loudness of a tone in the impaired region at each step. The points of equal loudness are then connected. The loudness at each frequency to be evaluated is then compared to the loudness of the frequency selected as the standard. The usefulness of the MLB test is that it is not necessary for the patient to have one good ear with which to compare a poor ear to obtain a measure of loudness recruitment. The test can be performed in either ear in the case of bilateral impairment. However, the patient must have normal or nearly normal hearing sensitivity for at least one frequency, which can then be used as a "standard" frequency for comparing the sensation of loudness at other frequencies.

The main disadvantage of the MLB test is the difficulty most patients experience in matching the loudness of two tones of different frequency. And the greater the difference in frequency, the harder it becomes. Considerable practice may be required before you can rely on the results.

Special

To perform this test with ORBITER 922, press **Special**, then **Softkey 7**, Next, the **Softkey 5**, MLB, to access the following screen:

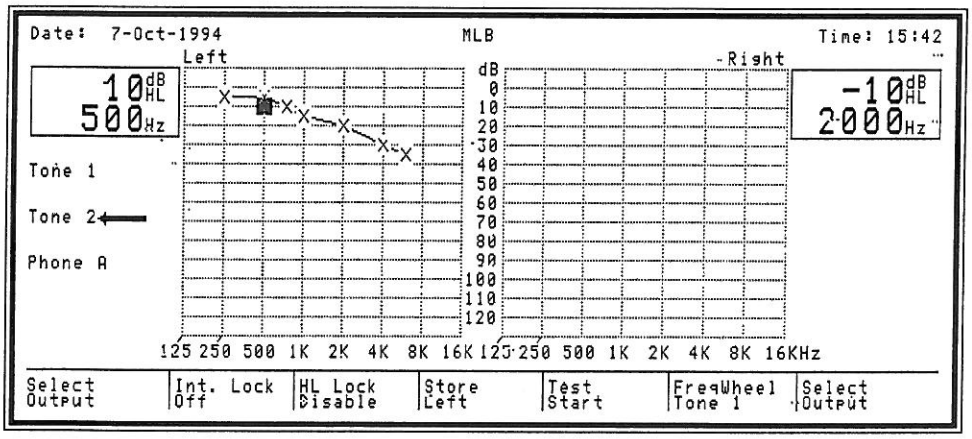


Fig. 7.23. The MLB Test Screen.

Softkey 5

Tone settings and setup will be the same as those which obtained for your last Tone test mode—they may also be set up as a User Test (see §8.1 User Test Programming). Settings may be altered as per Tone, and via **Setup**. In this test, Softkeys 1 and 7 only let you select output.

The test can be performed on either of the two ears. If, for example, you wish to test the left ear for recruitment, two tones will be presented alternately to that ear twice. First select ear by means of **L/R Shift** and then choose the desired frequency. Adjust intensity via **Level** for both Tone 1 and Tone 2.

Softkey 5

Press **Softkey 5** for automatic presentation of the tone sequence. Ask the patient if the tone was heard with the same sensation in both ears. If not, adjust **Level** so that the tone gives the same sensation level in both ears. If a tone has to be presented again, press **Softkey 5** and the same sequence will be repeated. The test can be interrupted at any time by pressing **Softkey 5** again.

Easy Mode

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

7.11.1 SETUP FOR MLB TEST

Press **Setup** to access the following screen:

Setup

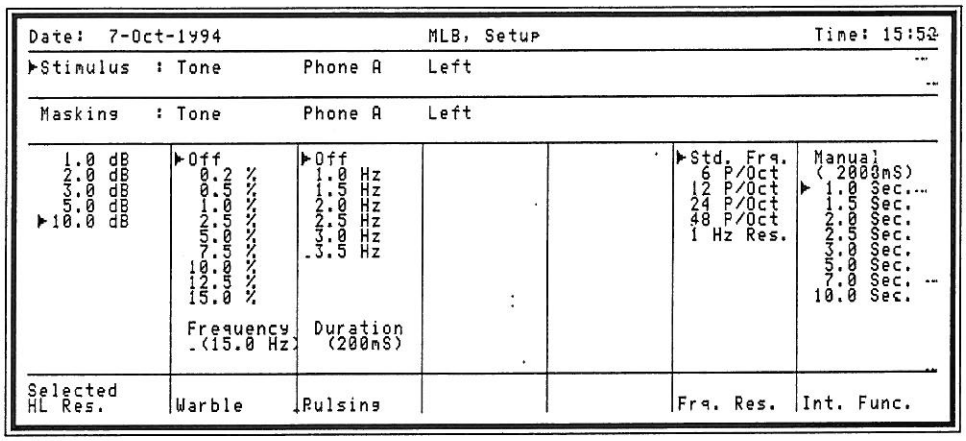


Fig. 7.24. The MLB Setup Screen.

Note that the second and third lines on the LCD specify the setup for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel.

L/R Shift

HL RESOLUTION
This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. 5 dB is default.

HL Resolution

WARBLE
Warble is default off.

Warble

The following frequency modulations (in %) may be selected: Off, 0.2, 0.5, 1.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0. Press **Softkey 2** to select Warble, and turn either Level knob to select the desired modulation percentage (as indicated by the ➤ cursor). These settings may also be selected directly from the High-Frequency screen by toggling **Softkey 5**.

To Select Warble Modulation Settings

To Select Warble Frequency

The actual frequency in Hz of the modulation can be altered by entering value via the Keypad (range 1.0 to 15.0 in 0.5 Hz steps).

KEYPAD ENTRY

After pressing any digit on the Keypad, a 5-digit field appears on the bottom right of the display, and the softkey fields display the parameters that may be altered from the Keypad: Warble Frequency, Pulsing Duration and Interrupter Duration (see Fig. 7-19).

Enter desired value (max. 5 digits including decimal point), and then press the softkey that corresponds to the desired parameter– it is not necessary to select the parameter first. Only values within the permitted range can be entered, e.g. if you enter 1.3 Hz for Warble Modulation Frequency and press **Softkey 2**, 1.5 Hz will be selected as the nearest valid value.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, activate the Keypad as described above and enter a valid value: 140, 160, 180, 220 or 240 mS.

FREQUENCY RESOLUTION

Std. Frq.

Standard Frequencies are default selected, and these intermediate frequencies are the same as those available in conventional pure-tone testing:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000, 12500, and 16000 Hz

Multiple Frequencies

In addition to standard frequencies, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution. These selections give you finer steps all the way down to 1 Hz in the range between 125 and 16000 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

Note that the field in parentheses is a user-defined duration in mS (milliseconds) that is entered by means of the Numeric Keypad as described on the previous page under Keypad Entry. Range 0 to 65,535 milliseconds.

User-Defined Duration

7.12 BÉKÉSY AUDIOMETRY

The ORBITER 922 provides conventional Békésy testing as a special test. A variation designated Quebec is also available under Special Tests (for the Canadian market only).

The Békésy Test in Orbiter 922 is performed with the following rates:

Change of level (attenuator speed):	2.5 dB per sec.
Change of frequency (sweep speed):	1 Octave per min.

To perform this type of testing with ORBITER 922, press **Special**, then **Softkey 7**, Next, the **Softkey 6**, Bekesy, to access the following screen:

Special

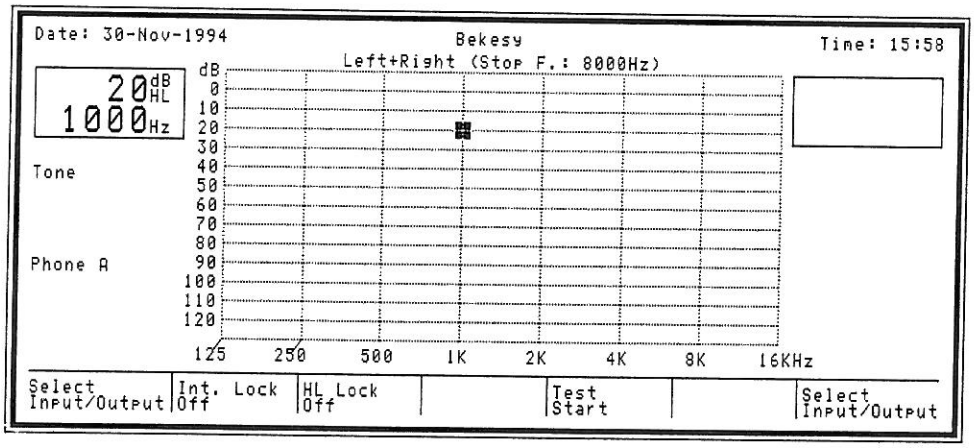


Fig. 7.25. The Békésy Test Screen.

This screen shows the default settings, i.e. those which obtain after each power up. If you have changed the Békésy setup earlier in the same session, for example activated masking, that setup will obtain until changed or the instument is powered off. Settings may be altered as per Tone, via **Setup** and Select Input/Output. Set the sweep's start frequency using **Frequency** and continue up to the default 8000 Hz Stop Frequency, which can be set via **Setup** (see §7.12.1).

NOTE: In Easy Mode, Select Input/Output Settings, Setup and Display are all disabled.

Easy Mode

Testing procedure for Békésy testing is as follows: ensure that the patient has a response handswitch and instruct him to press and hold down the handswitch button as long as he can hear a tone, and to release the button when he no longer can hear the tone.

Softkey 5

Press **Softkey 5** to start the test sweep. The test can be interrupted, and restarted, at any time by pressing **Softkey 5** again.

A typical Békésy test screen will look like this:

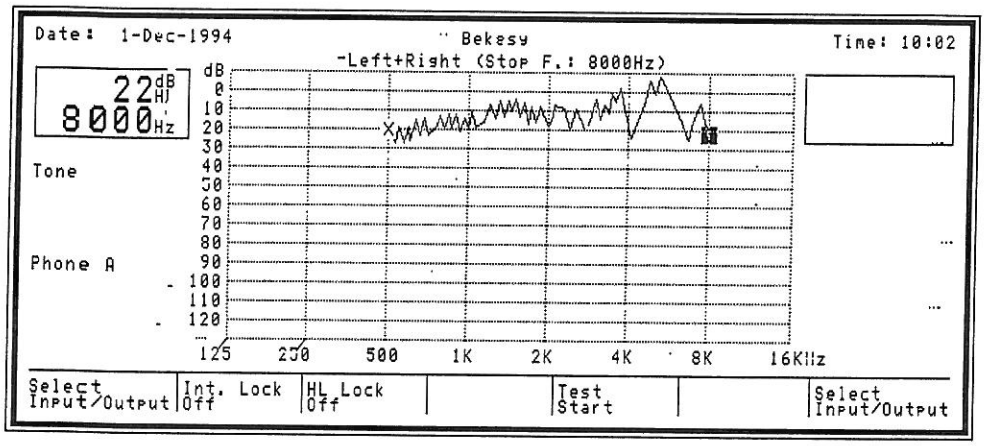


Fig. 7.26. An Example Of The Békésy Test.

7.12.1 SETUP FOR BÉKÉSY TEST

Setup

Press **Setup** to access the following screen:

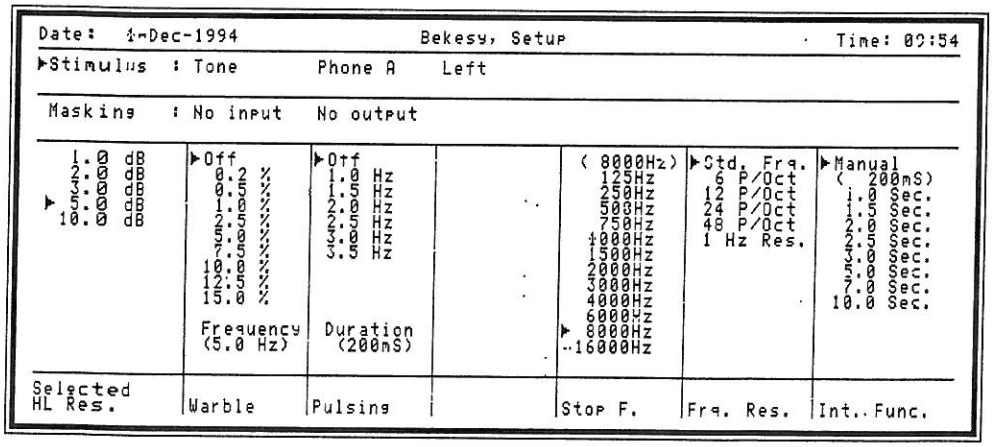


Fig. 7.27. The Békésy Setup Screen.

Note that the second and third lines on the LCD specify the setup

for the two channels, while the ➤ cursor indicates which channel is active. Different setup parameters can be stored for each individual channel—with the exception of the Interrupter Function, which is the same regardless of which channel is selected.

L/R SHIFT
Changes between left and right channel.

L/R Shift

HL RESOLUTION
This option is available at any time in Test Mode, and enables setting of intensity increment. Increments of 1, 2, 3, 5 and 10 dB may be selected. 5 dB is default.

HL Resolution

WARBLE
Warble is default off.

Warble

The following frequency modulations (in %) may be selected: Off, 0.2, 0.5, 1.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0. Press **Softkey 2** to select Warble, and turn either Level knob to select the desired modulation percentage (as indicated by the ➤ cursor). These settings may also be selected directly from the High-Frequency screen by toggling **Softkey 5**.

To Select Warble Modulation Settings

The actual frequency in Hz of the modulation can be altered by entering value via the Keypad (range 1.0 to 15.0 in 0.5 Hz steps).

To Select Warble Frequency

KEYPAD ENTRY
After pressing any digit on the Keypad, a 5-digit field appears on the bottom right of the display, and the softkey fields display the parameters that may be altered from the Keypad: Warble Frequency, Pulsing Duration and Interrupter Duration (see Fig. 7-19).

Enter desired value (max. 5 digits including decimal point), and then press the softkey that corresponds to the desired parameter–it is not necessary to select the parameter first. Only values within the permitted range can be entered, e.g. if you enter 1.3 Hz for Warble Modulation Frequency and press **Softkey 2**, 1.5 Hz will be selected as the nearest valid value.

STOP FREQUENCY
Select Stop F. by pressing **Softkey 5**, and then use either the same softkey or the up/down arrows to select desired stop frequency for your Békésy sweep.

PULSING

Select Pulsing by pressing **Softkey 3**, and then use either the same softkey or the up/down arrows to select desired pulsing rate.

Pulsing Duration

To change the pulsing duration from the default 200 mS, activate the Keypad as described above and enter a valid value: 140, 160, 180, 220 or 240 mS.

FREQUENCY RESOLUTION

Std. Frq.

Standard Frequencies are default selected, and these intermediate frequencies are the same as those available in conventional pure-tone testing:

125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000, 12500, and 16000 Hz

Multiple Frequencies

In addition to standard frequencies, you can select 6, 12, 24, or 48 points per octave, or 1 Hz resolution. These selections give you finer steps all the way down to 1 Hz in the range between 125 and 16000 Hz.

INTERRUPTER FUNCTION

Int. Funct.

The audiometer is set at manual as default, i.e. the duration of tone presentation or interrupt is determined by how long the operator holds the **Tone Switch** down.

Selecting any one of these time options gives a minimum of that time stimulus or interrupt when pressing the Tone Switch.

User-Defined Duration

Note that the field in parentheses is a user-defined duration in mS (milliseconds) that is entered by means of the Numeric Keypad as described on the previous page under Keypad Entry. Range 0 to 65,535 milliseconds.

7.13 DATA TRANSFER

Softkey 4

Pressing **Softkey 4**, Store, while in any Special Test Mode saves the current threshold in a local buffer memory. The buffer's contents may be transferred to a PC via the data interface. In practice, test data will be retrieved from the buffer memory by the PC.

Please refer to chapter 12 for further details.

7.14 PRINT

Print

Pressing **Print** accesses the Print submenu, and enables printout of data on optional built-in printer or to an external printer.

Identification data, time and date are also included on the print-out, except when making a screen dump.

The Print function for internal printer has the following options:

Softkey 1: Screen Dump

Softkey 2: Print Data*

Softkey 3: Print All/Continue

Softkey 4: Print All/Single

Softkey 5: Paper Feed

Softkey 7: Internal/External Printer

* This option appears only if there is any data stored in the buffer memory.

The Print function for external printer has the following options:

Softkey 3: Print

Softkey 5: Paper Feed

Softkey 7: External/Internal Printer

Please refer to chapter 13 for further details.

8. USER TESTS AND DEFAULT SETTINGS

Two of the function keys, **User Test** and **Setup**, may be used to initiate extra facilities. This is achieved by holding down the chosen function key while powering the instrument on. These facilities are used, if required, not during patient testing, but in the course of preparations for testing, and this method of access protects the user against their accidental alteration or misuse.

User Test Programming Enabled

NOTE: Your ORBITER 922 can be modified via ORBICON™ so that it is always in User Test Programming mode. If so, this will be indicated on the power-on screen.

User Tests

The ORBITER 922 enables up to 12 "User Tests" to be stored for instant one-key retrieval of your most frequently used test setups. The first 5 User Tests are preprogrammed at the factory, and provide you with the most common setups, e.g. for Tone, Bone, Speech, Békésy.

When pressing the **User Test** pushbutton, a screen is displayed which enables selection of user test by means of a softkey, (Fig. 8.1), and which contains a user description of each test and specification of input/output settings, etc. If no test has been stored, "No User Test stored" is displayed.

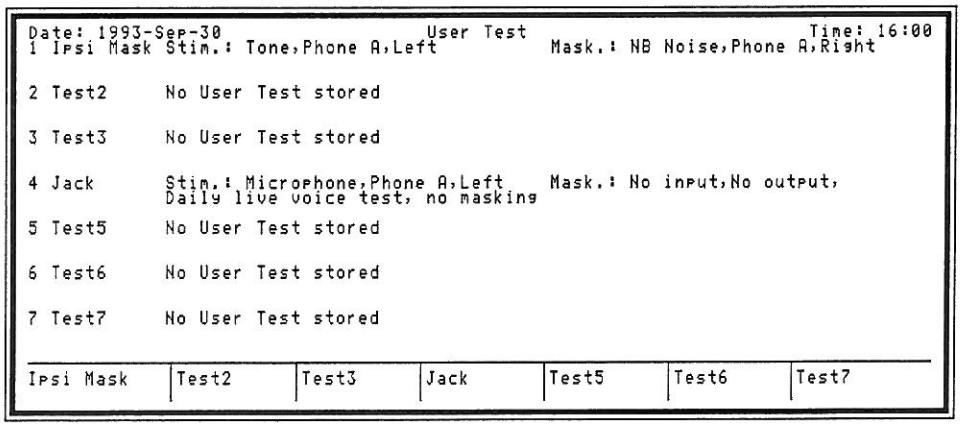


Fig. 8.1 User Test Screen.

8.1 USER TEST PROGRAMMING

User Tests Defined

The purpose of the User Test Programming Mode is to permit the user to program his own tests (Tests 1–7 in the User Test Menu accessed from **User Test**). By user tests, we mean that the user can select the default parameters of a particular test. Clearly, only valid test parameters can be set up, e.g. you cannot set up a Rainville Test without ipsilateral bone masking.

User Test

To enter User Test Programming Mode, switch off the instrument and power it on again with **User Test** held down. Keep it held down during the normal self-test procedure until the start-up screen appears on the display; then release it.

To continue with user programming, press **User Test** again. The User Test Menu screen appears.

User Test

Exit this screen by selecting the function mode you wish to program, i.e. **Tone**, **Speech** or **Special**.

Set up your test as if you were going to begin testing. Use input/output settings or **Menu,** and set up start intensity and frequency, make any selections required from **Display** and **Setup**, and then press **User Test** again. You are now ready to store your test.

If any tests have previously been stored, the screen might look like that in Fig. 8.3.

Option

Now press **Option**, and the screen illustrated in Fig. 8.2 appears:

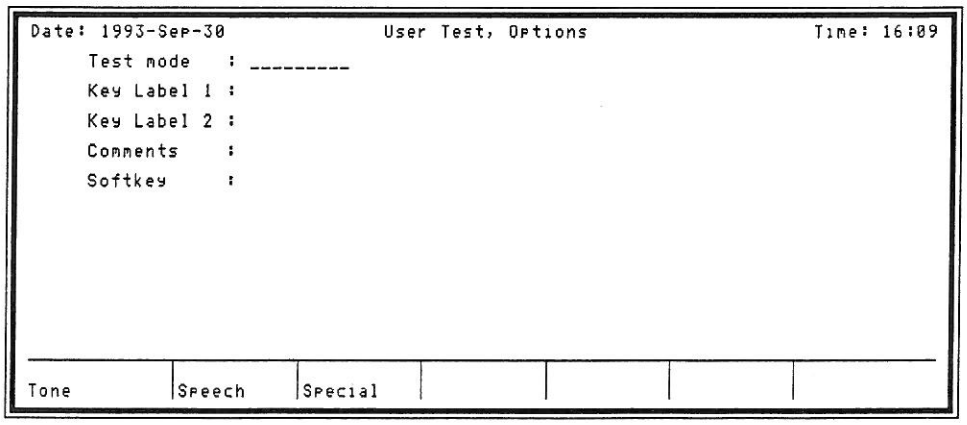


Fig. 8.2 User Test Options.

Select **Tone**, **Speech** or **Special**, as appropriate and note that the alphabet familiar from the Identity screen appears to permit data entry. At this point obviously, a PC keyboard is very useful for facilitating data entry. The data entered here will be displayed on the screen as in Fig. 8.3 below, 2 lines per test and including a specification of input/output settings, etc.

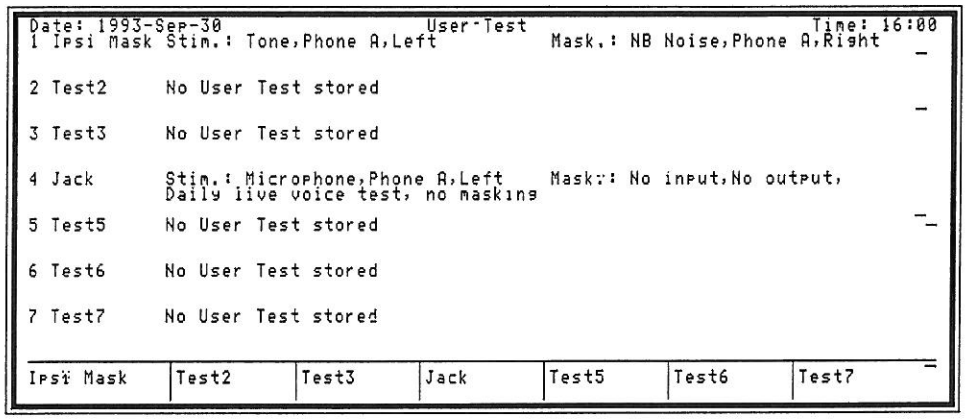


Fig. 8.3 User Test Screen.

The last line asks you to specify under which softkey you wish to store the test. If a test has already been stored under the selected softkey, you will be prompted before the test is saved.

Exit this screen by pressing one of the function pushbuttons, or **Exit**.

Exit

Note that the audiometer is still in User Test Programming Mode, and you can store another test at any time by repeating the sequence **User Test**, then **Option**.

To exit the User Test Programming Mode, switch off the audiometer.

To Exit

Please note that, in the case of some special tests, some routing parameters cannot be changed!

Special Tests

8.2 DEFAULT SETTINGS

As previously mentioned in this manual, the default settings for Tone and Speech may be modified as power-on options.

The procedure to follow is exactly the same as that for entering the User Test Programming Mode (see §8.1), up to and including the step where you press the **Option** key:

User Test/Option When in User Test Programming Mode, press **Tone** and change Tone settings as required, press **User Test** and then **Option**.

Tone Instead of selecting one of softkeys 1, 2, or 3 as for user test programming, press **Tone** to change default settings for Tone, and the Message LED lights up with the message: "Store new Tone default?"

Select "Yes", and the new settings will be saved as default. You are then returned to the User Test screen.

Speech The same procedure as for Tone is used for changing Speech default settings.

To Exit To exit this mode, switch off the audiometer.

9. PT. COMMUNICATION & MONITORING

9.1 INTRODUCTION

Built-in Amplifiers & Monitoring Loudspeaker

The ORBITER 922 Clinical Audiometer has a high-quality patient communication and monitoring system. The instrument features built-in talkover and talkback amplifiers with individually adjustable monitoring, as well as a built-in monitoring loudspeaker.

As previously mentioned in connection with speech audiometry (§6.4.4), it is essential that the Talkback system be of excellent quality in order to avoid distortion increasing discrimination loss. However, it should be emphasized that it is equally essential the system used for delivering the live voice signal to the patient's ears be of equally high quality. Obviously one cannot make an objective measurement of a patient's ability to hear and understand words in speech audiometry if there is distortion in the presentation system!

The ORBITER 922 is supplied as standard with a complete patient communication and monitoring system. This system consists of:

- built-in talkover and talkback amplifiers
- built-in monitoring loudspeaker
- removable talkover boom (gooseneck) microphone mounted on top cover
- patient response handswitches
- TDH 39 earphones fitted onto either ME 70 Noise-Excluding Headset or TC 89 E headband
- talkback microphone with table stand

In addition, the following optional accessories are available to supplement the system:

- electret Stetomike® monitoring headset with built-in pilot-style microphone
- lapel microphone

It is essential that whatever microphones, etc., are used should be of high quality. The Madsen Stetomike® monitoring headset is strongly recommended, however, not only for its high quality specifications but also for its convenience and comfort. The microphone itself is located at an ideal distance from the mouth and it must be emphasized that no communication/ monitoring system can adequately satisfy the requirements of speech audiometry if the operator or patient is too far away from the microphone!

9.2 TALKOVER

OPERATOR TO PATIENT

The Talkover function enables the patient to receive verbal information from the operator via the output transducer in use, e.g. the headset or loudspeakers, but not the masking insert phone which is only intended for masking purposes. Consequently, the operator may communicate with the patient.

This capability is not only needed when using a sound cabin, but also when the ME 70 Noise-Excluding headset is used as otherwise the patient would have great difficulty hearing the operator.

Talkover & Live Voice Microphone

In the ORBITER 922, the Talkover microphone is also the microphone used for live voice presentations and the Hearing Level presented may be precisely calibrated in dB HL (see §9.5).

Speech

To present live voice, **Speech** must be selected and the audiometer will always start the test in Reverse–the stimulus is continuously presented and the Tone Switch becomes an interrupter.

To Access Talkover Mode

Press and hold down **Talkover** to access the Talkover Mode and interrupt the presentation of stimulus thus permitting communication with the patient, see Fig. 9.1 below.

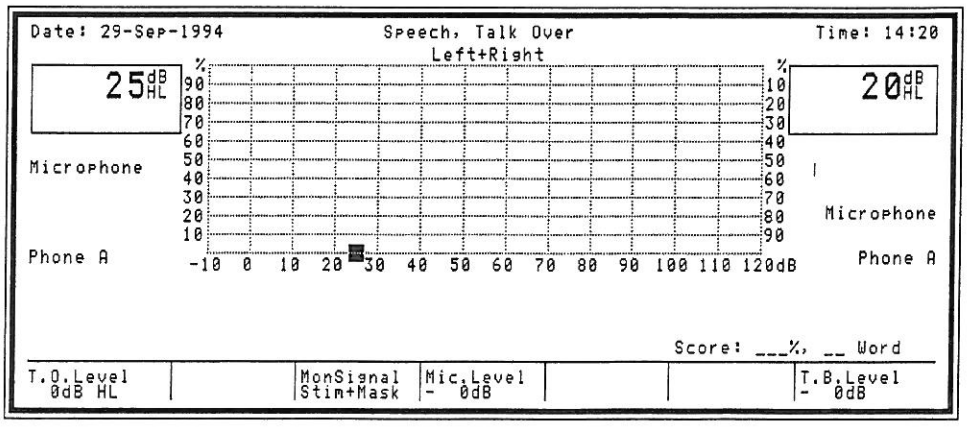


Fig. 9.1 Talkover Screen.

The lower part of the display indicates the levels in dB for Talkover, Mic. and Talkback, as well as which monitoring signal has been preselected in **Level Adj.**

To Adjust the Talkover Level

To adjust the Talkover level, press and hold down **Talkover** and turn the left-hand **Level** knob until the desired level is displayed. This is the level presented to the patient in dB.

To Change Monitoring Signal

To alter the preselected monitoring signal, press and hold down **Talkover** and press Softkey 3 to toggle between "Off", "Stimulus", "Masking", "Stim+Mask".

To Adjust the Mic. Level

To adjust the Mic. level, press and hold down **Talkover** and turn the **Frequency** knob until the desired level is displayed. This is the level presented to the patient in dB.

To Adjust the Talkback Level

To adjust the Talkback level, press and hold down **Talkover** and turn the right-hand **Level** knob until the desired level is displayed. This is the level presented to the patient in dB.

Setup Mode

NOTE: Levels may also be changed in exactly the same way while in Setup mode.

When using the Talkover microphone instead of the stetomike, ensure that the microphone is no more than 20–25 cm from your mouth while speaking into it. Adjust the Talkover Level so that it is comfortably audible for the patient.

The selected level will be stored, even after the audiometer has been powered off.

NOTE: The ORBITER 922 is supplied with the internal microphone selector set for electret. If you wish to connect a dynamic Talkover microphone, call your local Madsen service representative!

9.3 TALKBACK

PATIENT TO OPERATOR

The Talkback function enables the operator to receive verbal response from the patient via a monitor phone or the built-in loudspeaker. The patient communicates via a Talkback microphone installed in the sound cabin.

NOTE: Please instruct the patient to ensure that his mouth is 20 to 25 cm from the microphone for satisfactory sound quality.

Level Adj.

You will be able to hear the patient's response via the built-in monitoring loudspeaker (located on the left side panel of the audiometer). If you have the optional Stetomike® monitoring headset, you will be able to hear the patient respond via this headset. Adjust monitoring levels by means of **Level Adj.** (§9.5), or by pressing **Talkover** as described in §9.2.

To Adjust Talkback Level

Press **Level Adj.** to enable sensitivity adjustment of the Talkback microphone amplifier.

A bar-graph on the display shows the actual setting as a percentage of range. Level may be adjusted by turning any of the rotary control knobs—level is set electronically thus preventing accidental alteration.

Adjust the Talkback Level so that the monitor phone level is comfortable.

The selected level will be stored, even after the audiometer has been powered off.

9.4 MONITORING

Via the stetomike monitoring headset or built-in loudspeaker, the operator has full monitoring facilities of all signals presented to the patient. The Talkback signal is also heard via the monitoring medium.

Select which signal is monitored: none, Stimulus, Masking, Stimulus and Masking (see §9.5).

Adjust the level so that the monitor phone/speaker level is comfortable (see §9.5).

9.5 LEVEL ADJUSTMENT

Level Adj.

This function permits not only the electronic adjustment of a number of transducers, but also the selection of related functions, e.g. the audible patient response feature. When **Level Adj.** is depressed, the following screen is displayed (Fig. 9.2):

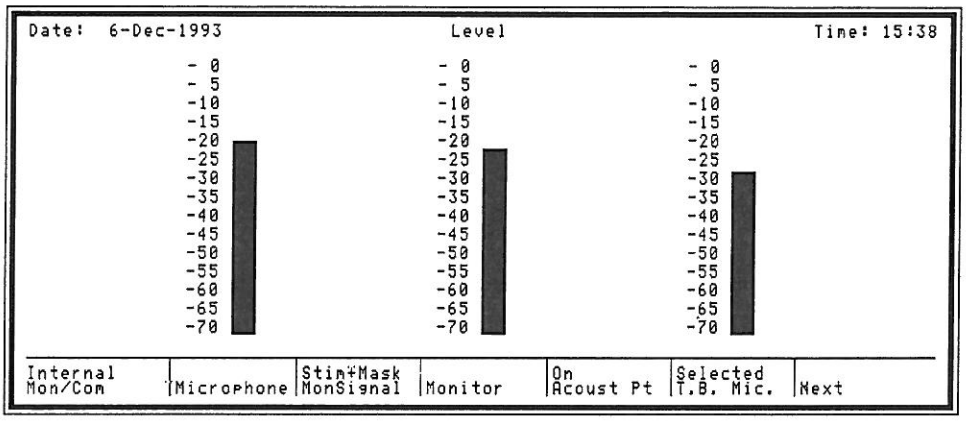


Fig. 9.2 Level Adjustment (Screen 1).

Press **Softkey 7**, Next, and a second screen is displayed (Fig. 9.3):

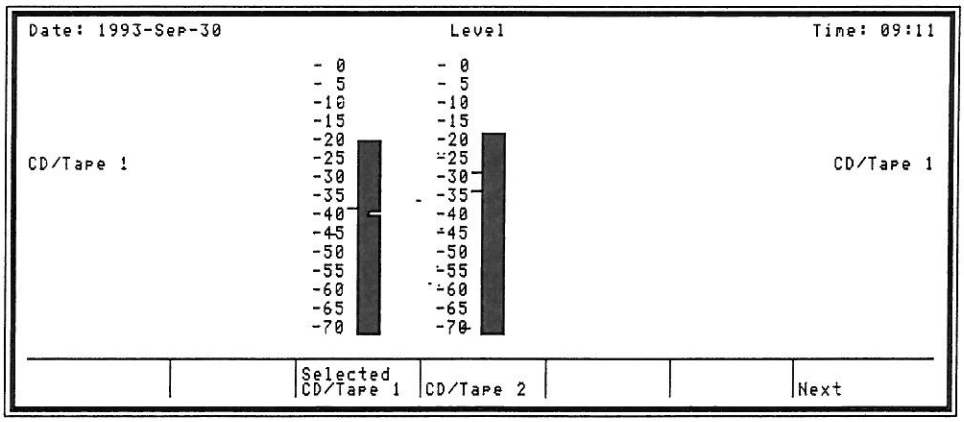


Fig. 9.3 Level Adjustment (Screen 2).

Levels may be adjusted for the following:

- external microphone
- monitoring loudspeaker (Stimulus or Masking signal, or both)
- talkback microphone
- CD/Tape 1
- CD/Tape 2

The position of the "potentiometer" is shown as a bar-graph on the display as a percentage of range. Level may be adjusted by turning any of the rotary control knobs—level is set electronically thus preventing accidental alteration.

The selected level will be stored, even after the audiometer has been powered off.

Other selections which may be made from this screen are as follows:

Softkey 1

Softkey 1 selects whether the monitoring medium is internal or external, i.e. the built-in loudspeaker or the monitoring headset. In Fig. 9.2, external monitoring is selected.

Softkey 3

Softkey 3 selects which signal is monitored: none, Stimulus, Masking, Stimulus and Masking. In Fig. 9.2, Stimulus and Masking is selected.

Softkey 5

Softkey 5, Acoustic Pt, selects whether the patient response is audible as well as visible, or not.

Adjust Pt. Response Volume

When selecting Acoustic Pt. On, remember to adjust the volume using the white potentiometer on the rear of the audiometer—otherwise the patient response may not be audible!

Exit

To exit, press **Exit**, or any of the other pushbuttons on the Control Subpanel (except **Level Adj.**, **Data Transf.** and **Print**).

9.6 PATIENT SIGNAL

Patient Response Handswitches

Two Patient Response Handswitches are supplied with the instrument as standard accessories. These are to be connected to the jacks on the rear panel of the instrument (refer to §2.3).

Audible Patient Response

Patient response is visible on the red LED's on either side of the LCD, one for left and one for right. In addition, an audible signal may be enabled via the **Level Adj.** screen (please refer to §9.5). The signals are different in tone permitting easy recognition of left and right.

Adjust Pt. Response Volume

When selecting Acoustic Pt. On, remember to adjust the volume using the white potentiometer on the rear panel — otherwise the patient response may not be audible!

10. SYSTEM SETUP

10.1 POWER-ON OPTIONS

Two of the function keys, **User Test** and **Setup**, may be used to initiate extra facilities. This is achieved by holding down the chosen function key while powering the instrument on. These facilities are used, if required, not during patient testing, but in the course of preparations for testing, and this method of access protects the user against their accidental alteration or misuse.

There are two different facilities that may be accessed in this way—User Test Programming (see §8.1), and ORBITER 922 System Setup. User Test Programs and changes made to parameters using System Setup will be preserved in the non-volatile memory of the ORBITER 922 when the power is switched off, and will remain in effect unless altered again subsequently using the System Setup facility.

10.2 CONFIGURATION MENU

To enter this mode, switch off the instrument, and power it on again with **Setup** held down. Keep it held down until the screen shown in Fig. 10.1, Configuration, appears:

Setup

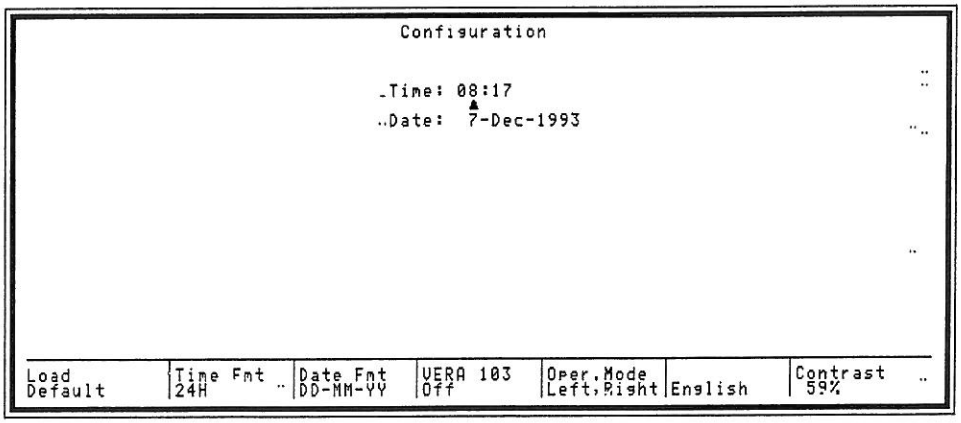


Fig. 10.1 The Configuration Menu.

Pressing **Softkey 1** enables you to select default configuration—note that you are prompted to confirm this step before it is effected! If selected, this function resets the clock/calendar, reverts the display language to English, and resets the LCD contrast at 45%.

Softkey 1

Softkey 2

Softkey 2 toggles the Time Format for the internal clock from 24 hour to 12 hour format, AM or PM. The displayed time changes format as you press the pushbutton.

Softkey 3

Softkey 3 toggles the Date Format for the internal calendar, and the new date format can be seen on the display as you press the pushbutton. The options available are as follows:

Date Format	Example	
MM-DD-YY	Nov-29-1993	
MM-YY-DD	Nov-1993-29	
YY-MM-DD	1993-Nov-29	
YY-DD-MM	1993-29-Nov	
DD-MM-YY	29-Nov-1993	(default selected)
DD-YY-MM	29-1993-Nov	

To Set The Clock

The internal clock/calendar may be set from this screen: Note the ▲ cursor located under the hour—this may be moved to select hour, minute, day, month, and year by turning the **Frequency** knob, and then **Level** until the correct time or date is displayed.

Softkey 4

Softkey 4 toggles the connection to VERA 103 (the Madsen Visual Reinforcement Accessory) on and off. In addition, this softkey toggles the connection to external footswitches on and off.

Softkey 5

Softkey 5, Oper.Mode, toggles between the default left/right configuration and channel 1/channel 2 configuration.

Softkey 6

Softkey 6 toggles the audiometer's display language from the factory default English to the alternative language. The alternative language, if present, will have been downloaded into ORBITER 922 by your local Madsen Electronics' representative.

If no alternative language has been downloaded, English texts will appear instead. Please contact your local Madsen representative if you require another language.

Softkey 7

Softkey 7 allows you to adjust the LCD's contrast in the same way as the **Display** pushbutton in test mode: hold down softkey and turn any of the rotary knobs until you find the best contrast for the current lighting conditions. The displayed % allows you to make notes of specific settings for varying conditions.

LCD Contrast Setting Memorized

NOTE! The contrast setting for the LCD is stored in memory, i.e. ORBITER 922 will "wake up" with the same setting after being powered off and on again.

Exit

To exit System Setup, press **Exit** and you will enter the start-up screen.

11. CALIBRATION

Calibration Stored in Memory

The calibration of the ORBITER 922 is stored in a non-volatile memory EEPROM type, which requires no battery backup. In order to prevent unintentional alteration of calibration this function must be enabled separately before any changes can be made to calibration (please refer to Service Manual).

Calibration should be performed annually by suitably qualified personnel, using the appropriate equipment.

Your ORBITER 922 is dispatched from the factory in Denmark together with a Test Report (Calibration Certificate). The Test Report specifies which transducers have been calibrated (i.e. those which have been supplied together with the instrument), according to which standards, and what equipment was used for calibration. Results are listed for each transducer at all standard frequencies.

In general, the instrument is calibrated in dB HL using the stated reference equivalent thresholds, which are related to sound pressure levels (db SPL = dB re 20 μPA), and force levels (dB re 1 μN).

Note that calibration has only been performed on the supplied transducers! If you wish to use any other transducer for testing with the ORBITER 922, please contact your local Madsen distributor first.

11.1 ERROR CHECK

Calibration Check

To ensure accurate measurements, all calibration locations are checked at power-on time and whenever a new location is accessed, i.e. when changing frequency or input/output routing.

11.2 CALIBRATION REFERENCE

Please refer to the accompanying Test Report (Calibration Certificate) for details.

Free Field

FREE FIELD

Fixed output level for all signal sources (must be calibrated on site).

12. DATA INTERFACE

ORBITER 922 is supplied with an RS232C data interface as standard. However, it should be noted that data transfer, in fact any form of communication with a PC, is possible only if your PC has been installed with suitable software. The optional Audi-Link software, for example, lets you transfer data to NOAH's audiometry screen, and save data to NOAH's patient database.

ORBITER 922 is prepared for communication of raw measurement data from the audiometer to a PC for processing and storage in a custom-designed database—whenever a threshold is stored by means of **Softkey 4**, the data is transferred to a local buffer where it can be retrieved by a PC.

Softkey 4, Store

In addition to data transfer of measurement data to a PC, ORBITER 922 is prepared for remote control from a PC, i.e. the audiometer may be controlled from a PC.

Remote Control From PC

The **Data Transf.** key is reserved for future advanced data transfer applications.

Data Transf.

Please refer to the Data Interface Operation Manual (7-26-121) for a detailed description of the interface functions.

Data Interface Manual

12.1 DATA TRANSFER

Pressing **Softkey 4**, Store, in Test Mode not only stores threshold data in a local buffer (memory), but also implements an internal flag which can be read by an external application program and data transfer can then be executed.

Softkey 4

12.2 CONNECTIONS

Fig. 12.1 on the next page indicates which Madsen Electronics' cables should be used for connecting ORBITER 922 to a PC or to an external printer. Please refer to §3.6 for further details re installation).

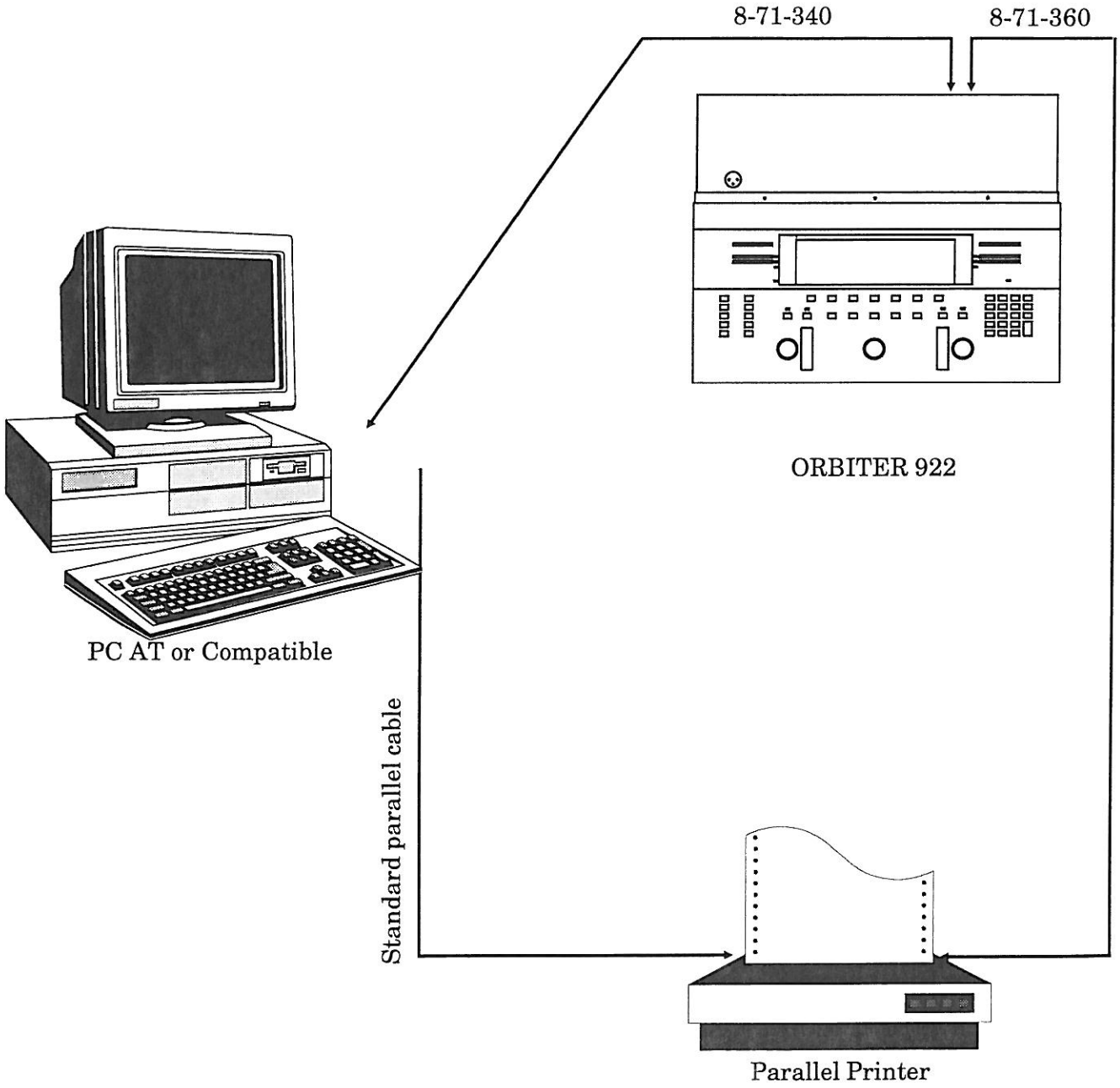


Fig 12.1 Printer / PC Connections & Cables for ORBITER 922.

13. PRINTOUT

Printout On External Printer

ORBITER 922 is supplied with a Centronics parallel printer port fitted on the Connection Panel as standard. An HP Deskjet generic printer driver is installed permitting printout on most HP Deskjet parallel printers.

Available Printer Drivers

Other printer drivers available are: generic Epson, IBM Proprinter, HP Laserjet —please contact your local Madsen distributor for further information. Alternative printer drivers may be defined and downloaded by means of ORBICON™.

Built-in Thermal Printer Option

ORBITER 922 can also be supplied with a built-in thermal printer as an optional accessory. Selection of internal or external printer is made from the audiometer's Print submenu (see below).

Print

Press the **Print** key from the I.D. screen or from any Test Mode to access the following submenu:

Screen Dump	Print Data*	Print All Continue	Print All Single	Paper Feed		Internal Printer
1	2	3	4	5	6	7

ORBITER 922 is default set to print out on an internal printer.

13.1 PRINTOUT ON INTERNAL PRINTER

Print

Pressing **Print** in I.D. or Test Mode accesses the Print submenu (see screen illustrated on the next page):

Softkey 1: Screen Dump

Softkey 2: Print Data*

Softkey 3: Print All/Continue

Softkey 4: Print All/Single

Softkey 5: Paper Feed

Softkey 7: Internal/External Printer

* This option only appears if there is data stored in the audiometer's buffer.

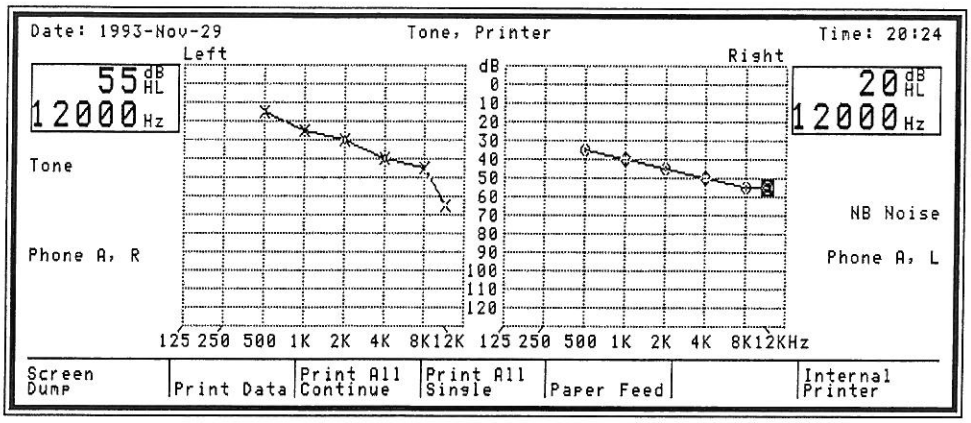


Fig. 13.1 The Internal Printer Submenu.

Softkey 1

Pressing **Softkey 1**, Screen Dump, prints out everything on the screen including the submenu.

Printer Busy

NOTE! While busy printing out, the Print submenu is replaced by the previous one. The audiometer cannot be used while it is busy.

Softkey 2

Pressing **Softkey 2**, Print Data, which is only available if there is any measurement data in the audiometer's buffer memory, displays the data stored and a new submenu:

Print		Cancel	Hide Softkeys	Paper Feed		
1	2	3	4	5	6	7

Press **Softkey 1**, Print, to print out this data together with submenu. Return to previous screen by pressing **Softkey 3**, Cancel. Pressing **Softkey 4**, Hide Softkeys, lets you view all data on the screen before printing out. Press **Softkey 5** for paper feed.

To Stop Printout

Printout may be interrupted by holding down **Print** key until printout stops.

Identification data, time and date are also included on the printout.

Softkey 3

Pressing **Softkey 3**, Print All, Continue, prints out all I.D. and test data, for both ears, for the current patient.

To Stop Printout

Printout may be interrupted by holding down **Print** key until printout stops.

I.D. data, time and date are also included on the printout.

Softkey 4

Pressing **Softkey 4**, Print All, Single, displays the current data and a new submenu:

Print	Skip	Cancel	Hide Softkeys	Paper Feed		
1	2	3	4	5	6	7

Press **Softkey 1**, Print, to print out this data together with submenu. Skip the current screen by pressing **Softkey 2**, and the next screen where data has been stored will be displayed. Return to previous screen by pressing **Softkey 3**, Cancel. Pressing **Softkey 4**, Hide Softkeys, lets you view all data on the screen before printing out. Press **Softkey 5** for paper feed.

To Stop Printout

Printout may be interrupted by holding down **Print** key until printout stops.

Identification data, time and date are included on the printout.

Softkey 5

Press **Softkey 5**, Paper Feed, to advance the paper.

Softkey 7

Pressing **Softkey 7** toggles between internal and external printer.

Paper Cutter

The built-in printer is fitted with a sharp, serrated-edge paper cutter. Remove your printout by tearing the paper towards you.

13.1.1 PAPER LOADING

When the paper roll is exhausted, a message appears informing that the printer is out of paper.

Print

Access the Print Menu by pressing **Print**. Ensure that internal printer is selected (Internal is displayed over Softkey 7).

13.1.1.1 REMOVING THE OLD PAPER ROLL

Raise the printer cover, and pull the remaining paper straight out of the printer and remove the old paper roll core from the spindle.

If the paper is stuck on the paper roll core, separate the paper from the core before pulling out the paper.

13.1.1.2 INSERTING A NEW PAPER ROLL

Lift up the head-up lever on the right of the printer to raise the thermal head above the platen.

Insert the spindle into the new paper roll, and fit the spindle into the printer recess with the leading edge of the paper roll underneath.

Insert the leading edge of the paper straight through the paper slot, and feed it through manually.

When the paper comes out from between the thermal head and platen, pull the paper ensuring that the paper is aligned properly, and then press the head-up lever down again to lower the thermal head to its normal position.

Finally, pressing **Softkey 5**, feed the paper through the slot in the printer cover, and close the cover.

13.2 PRINTOUT ON EXTERNAL PRINTER

Installation Of Ext. Printer

Ensure that an external printer is connected via the parallel port on the Connection Panel at the rear of ORBITER 922 (please refer to §3.6 and to the fold-out drawing at the back of this manual).

Print

Access the Print Menu by pressing **Print**. Ensure that external printer is selected by toggling **Softkey 7**. A different submenu will now be displayed:

		Print		Paper Feed		External Printer
1	2	3	4	5	6	7

When pressing **Softkey 3**, Print, your measurement data will be printed out with all tone data on two audiograms, one for each ear, and all speech data on a speech matrix. Special Test data will also be printed out.

Troubleshooting

If nothing is printed out, check connections and printer selection. If garbage is printed out, contact your local Madsen distributor and ask for the correct printer driver to be downloaded to your ORBITER 922.

APPENDIX A: TECHNICAL SPECIFICATIONS

Channels	2 separate and identical channels (2 oscillators)
Standard Frequencies	Air, F.F.: 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000, 12500 Hz Bone: 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, 8000 Hz
Multi-Frequencies	Air, F.F.: 125 to 20000 Hz Bone: 250 to 8000 Hz Frequency resolution: Standard Frequencies, 6/12/24/48 points per octave, or down to 1 Hz
Masking	Contralateral, Ipsilateral or Binaural; White Noise, Speech Noise, Narrow Band Noise or External (CD/Tape)
Attenuator	1 dB step resolution; fully clickfree operation over entire range
Hearing Level Range	Maximum output is limited by transducer capability. Air: Typically -10 to 120-125 dB HL at 500-6000 Hz Bone: Typically -10 to 70-80 dB HL at 500-4000 Hz
External Inputs	Microphone T.O.: Dynamic or electret; Ext. Mic., Int. Boom Mic. or Stetomike Microphone T.B.: Dynamic or electret CD/Tape 1-2: Sensitivity 0.1 to 3.0 Vrms, 47 kOhm
Outputs	Phones: Air Conduction Bone: Bone Conduction Insert: Insert Phone for masking F.F.: Free Field Loudspeaker via external amplifier L.S. Free Field Loudspeaker via internal amplifier (2 x 10 W)
Standard Functions	Speech Aud.: Stimulus via Microphone or CD/Tape 1-2 Word counter and automatic calculation of score/failure % Tone Switch: Normal or reverse operation Pure Tone: Manual or programmable Tone Duration (1 to 10 sec) Pulsing Rate: 1, 2, 2.5, 3 or 3.5 Hz Warble: Frequency Modulation: ±0.5 - ±15 % 0.5 - 15 Hz Modulation waveform: triangular Modulation range: 5% L/R Shift: Automatic switching of all selected parameters from left to right channel, and vice versa HL Lock: Locking of masking level to stimulus level at any preselected interval Tone Lock: On/Off, Internal tone switch synchronization
Special Functions	SISI Test, Fowler Test (ABLB), Stenger Test, Rainville Test, Difference Limen for Intensity (DLI), Supra Threshold (MCL/UCL), Auto Threshold (Hughson & Westlake), Threshold Tone Decay, Difference Limen for Frequency (DLF), Monaural Loudness Balance (MLB), Békésy, High-Frequency Audiometry (HFA)

User Functions	12 user-programmable tests can be stored in non-volatile memory for quick test retrieval.
Communication and Monitoring	Built-in talkover and talkback amplifiers with individually adjustable monitoring. Visible Patient Response (LED indicator) supplemented by Audible Patient Response with a separate level control; removable talkover boom microphone and built-in loudspeaker; monitor headset, or external loudspeaker. The monitoring signal is mixed with the talkback signal. LED bar-graph V.U. Meter provides visual indication of stimulus level as well as displaying level for sensitivity adjustment of Microphone and CD/Tape input signals.
Distortion	Speech: Less than 2.5% at 9 dB above 0 VU at 250, 500 and 1000 Hz Tone: Less than 1% (T.H.D.)
Accuracy	Frequency: Better than ± 0.03% Hearing Level: Electrical: Within ± 1 dB of indication Acoustical: Within ± 3 dB of indication
Approvals	Demko, FDA and PTB
Standards	Safety: Instrument safety according to EN 60601-1 class 1, type B. Opto-insulation of printer and RS232C interfaces. Audiometer: EN 60645-1, -2 Calibration: ISO 389, -3, -4, ANSI S3.6 Individual calibration of earphones, bone conductor, EAR phone, insert phone, and free field. Calibration data stored in non-volatile memory.
Static Force of Transducer Headbands	TDH 39: 4.5 N ± 0.5 N Bone: 5.4 N ± 0.5 N
Display	640 x 200 monochrome LCD display with cold cathode fluorescent (CFL) backlighting. Anti-reflex, scratch-resistant coating. 80 characters x 25 lines; viewing area: 224 mm x 98 mm
Printer	All data is printed in graphic mode. Built-in: Optional thermal printer. Paper width: 112mm, 4,5" Weight: 500 g, 1 lb External: Built-in Centronics Interface for optional parallel printer
Languages	Multilingual: English and one user-defined language (any Roman characters).
Power Supply	AC 50/60 Hz, 100-127V ± 10%, or 200-240V ± 10% (please specify with order).
Power Consumption	Maximum 120 VA

Operating Environment	Temperature: 15° – 35°C, 59° – 95°F Relative Humidity: 30 - 90% (Operation in temperatures exceeding -20°C or + 60°C may cause permanent damage!)
Construction	Plastic cabinet and aluminium chassis
Dimensions	522 x 418 x 155 mm, 20.5" x 16.5" x 6.1" (W x D x H)
Weight	Net weight: approximately 9 kg, 20 lbs Shipping weight: approximately 14 kg, 31 lbs Standard Accessories: approximately 2 kg, 4.5 lbs
Miscellaneous	Built-in loudspeaker for monitoring, software adjustment of display contrast, RC5 interface, DC output, RC in/out, ME Bus

Specifications are subject to change without notice.

STANDARD ACCESSORIES

TDH39 fitted with Noise-Excluding Headset ME70 or TC89E Headband

Bone Conductor B-71 with headband

Two Patient Response Handswitches, blue and red

Talkover Boom Microphone

Patient Talkback Microphone

Power Cord

2 Roller Pens (blue & red)

Audiogram Pad

Operation Manual

Interface for CD Player

DC Output for Portable CD Player (6 V, 0.5 A)

Infrared Transmitter Cable to CD Player

RS232C Serial Data Interface

Centronics Parallel Printer Interface

MECS II Communication Software for PC

OPTIONAL ACCESSORIES

Holmco Headset Type 95-01

For High-Frequency Audiometry:

Sennheiser Headphones Type HDA 200

Free Field Loudspeakers

Dust Cover

CD Player

Monitor Headset with pilot-style boom microphone for talk-over facility

Desktop Talkback Microphone

Lapel Talkback Microphone

Insert Phone with eartip

External Interrupters (footswitches)

Built-in Printer, and 110 mm thermal sensitive paper rolls

External Printer and Cable (Centronics)

External PC Keyboard

Free Field equalizing of Phones (Holmco)

ORBICON™ Configuration Software

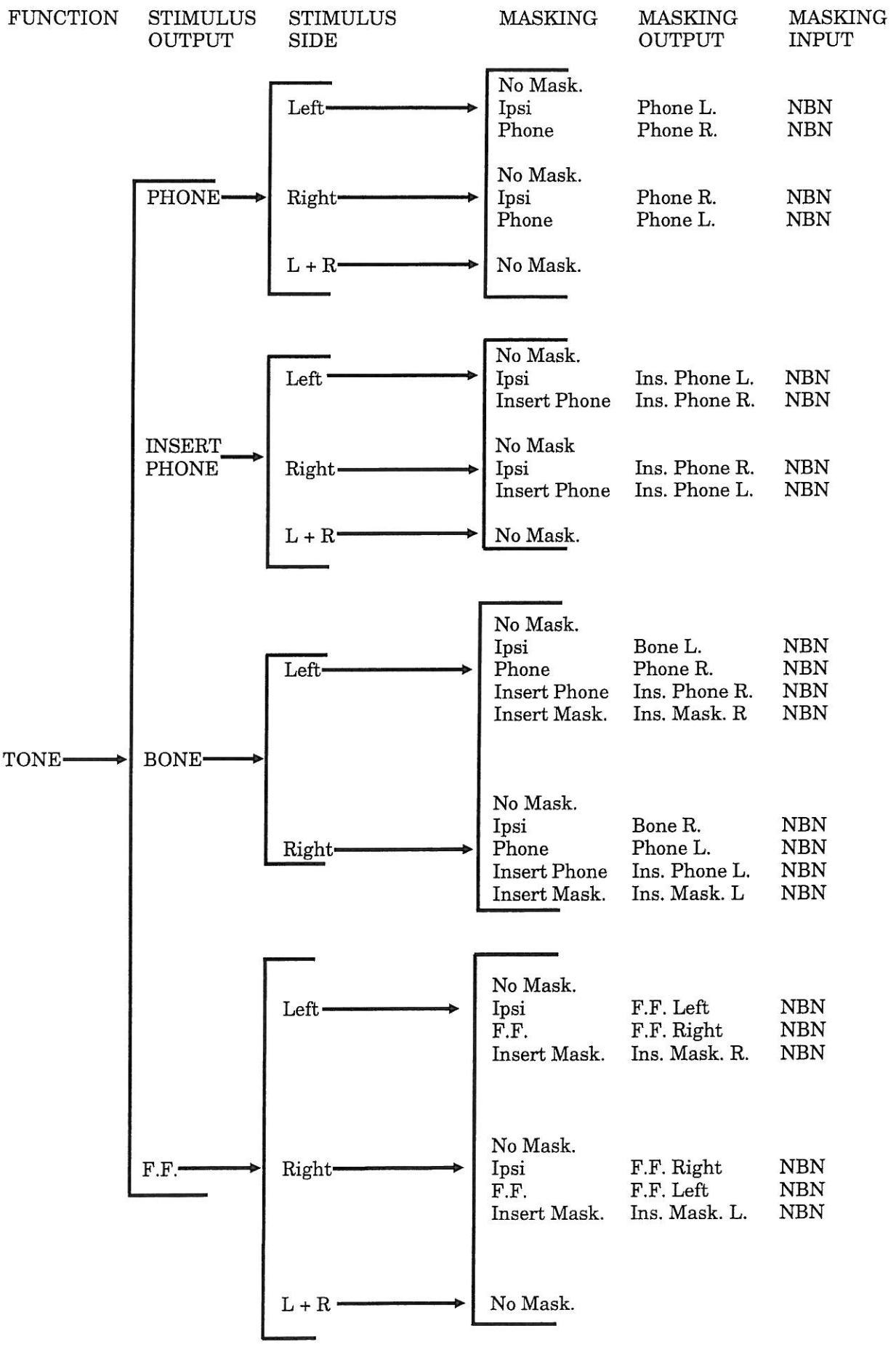
Data Interface Manual

Service Manual

Stetomike-to-ext.loudspeaker/ext.mic. adapter

RC5 Interface Cable to CD Player

Audi-Link software for NOAH


FUNCTION
STIMULUS OUTPUT
STIMULUS SIDE
MASKING
MASKING OUTPUT
MASKING INPUT
TONE
PHONE
Left
No Mask.
Ipsi
Phone
Phone L.
Phone R.
NBN
NBN
Right
No Mask.
Ipsi
Phone
Phone R.
Phone L.
NBN
NBN
L + R
No Mask.
INSERT PHONE
Left
No Mask.
Ipsi
Insert Phone
Ins. Phone L.
Ins. Phone R.
NBN
NBN
Right
No Mask
Ipsi
Insert Phone
Ins. Phone R.
Ins. Phone L.
NBN
NBN
L + R
No Mask.
BONE
Left
No Mask.
Ipsi
Phone
Insert Phone
Insert Mask.
Bone L.
Phone R.
Ins. Phone R.
Ins. Mask. R
NBN
NBN
NBN
NBN
Right
No Mask.
Ipsi
Phone
Insert Phone
Insert Mask.
Bone R.
Phone L.
Ins. Phone L.
Ins. Mask. L
NBN
NBN
NBN
NBN
F.F.
Left
No Mask.
Ipsi
F.F.
Insert Mask.
F.F. Left
F.F. Right
Ins. Mask. R.
NBN
NBN
NBN
Right
No Mask.
Ipsi
F.F.
Insert Mask.
F.F. Right
F.F. Left
Ins. Mask. L.
NBN
NBN
NBN
L + R
No Mask.

APPENDIX C: ORBICON™ SOFTWARE

ORBICON™ Configuration Software runs on an IBM PC AT or compatible computer, connected to the audiometer via the RS232C serial data interface on the Connection Panel, and can configure a number of special functions. This software is normally used by your local Madsen Electronics' distributor to customize your ORBITER 922 into your own personal clinical audiometer.

This software allows the configuration of the following:

- Interface Setup: selection of Baud Rate and COM port for ORBICON to ORBITER communication
- General Parameters: name of institution (2 lines)
  audiogram display mode (i.e. switching of left to right, and right to left)
  audiometer operation mode*
  start-up screen
  activate CD player on/off
  activate VERA 103 mode
  default printer selection, internal or external
  programming of User Tests enabled
- Speech Materials: downloading of word lists and storage in memory, maximum 2, Roman characters only
- Language Setup: English and one alternative (Roman characters only)
- Symbol Setup: any audiometric symbol used on the audiometer's display and printout can be edited and defined
- User Test Setup: User Tests are programmed on the audiometer, but can be uploaded, erased, saved and downloaded by means of this feature
- Printer Setup other printer drivers can be selected or edited
- CD Player Setup drivers for different CD players can be selected or edited
- Update Firmware: this software can also be used for subsequent software updates of your audiometer

* Left/Right configuration or Channel 1/Channel 2

Subject Index

A

ABLB Test, 7-1, 7-5, 7-35
AC cable, 4-1
Accessories, Optional, 1-3
Advanced Mode, 1-3, 3-1, 4-5, 6-3, 6-10
Air Conduction Thresholds, 5-12
Air Output, 5-12
Alternative Language, 10-2
ANSI S3.43-1992, 11-1
ANSI S3.6-1969 (R 1973), 11-1
ANSI Version, 6-2
Audible Patient Response Signal, 3-13
Audiogram
    Liquid Crystal Display, 3-9
Audiometric Symbols, C-1
Auto Threshold Test, 7-1

B

B-71 Bone Conductor, 3-13
Baud Rate, C-1
Békésy Audiometry, 7-39
Békésy Testing, 7-39
Binaural Masking, 6-24
Bone Conduction Thresholds, 5-13
Bone Conductor, 3-13, 5-13
Bone Output, 5-13
Boom Microphone, Installing, 2-3
Boom Microphone, Removing, 2-3

C

Calendar, 10-2
Calibration, 11-1
Calibration Check, 11-1
Calibration of Headphones, 11-1
Calibration Reference, 11-1
Calibration Settings, 11-2
Calibration, Bone Conduction, 11-1
Calibration, Free Field, 11-2
Calibration, NBN Masking, 11-1
Care & Maintenance, 2-6
CD Control, 3-8, 6-16
CD Ctrl., 3-12
CD Mode, 6-11
CD Player, 3-12, 3-14, 6-1, 6-15, 6-18, 6-22
CD Player Setup, C-1
CD Player, Portable, 6-15
CD, Connections, 6-15
CD/Tape 2, 6-18, 6-26
Centronics Parallel Printer Port, 3-11
Channel 1/Channel 2, 1-4
Channel 1/Channel 2 Config., 10-2
Channel 1/Channel 2 Configuration, 5-3, 6-4
Cleaning of ORBITER 922, 2-6
Clock, 10-2
Clock, To Set, 10-2
COM Ports, C-1
Comments, 4-5
Computer
    See also Personal Computer
Configuration Menu, 10-1
Configuration Software, 1-4
Connection Panel, 2-2, 3-1, 3-10
Connections For PC & Printer, 12-1
Connections, ORBITER 922, 2-2
Contralateral Masking, 6-2, 6-24
Contrast Adjustment, 3-4, 3-9, 5-8, 6-9, 10-2
Control Subpanel, 3-6
Cursor, 4-4

D

Data Interface, 3-11, 12-1
Data Transfer, 3-8, 5-11, 6-12, 7-43, 12-1
Date Format, 10-2
Date, To Set, 10-2
DC Output, 3-12
DC Power For CD Player, 3-12
Default, 10-1
Default Settings, 6-3, 8-1
Default Settings for Tone, 5-3
Default Settings, To Change, 8-4
Delete Key, 3-8, 5-2
Difference Limen, 7-16
Difference Limen for Frequency, 7-16
Difference Limen for Intensity, 7-16
Discrimination, 6-23
Discrimination Percentage, 6-20
Discrimination Test, Live Voice, 6-22
Discrimination Test, Recorded Word Lists, 6-23
Discrimination Testing, 6-19
Display, 3-4, 5-6, 6-7, 10-2
Display Subpanel, 3-6
Display, Contrast Adjustment, 3-4
DL, 7-16
DLF Test, 7-16
DLI Test, 7-1
DLI, Test Setup, 7-17
Dust Cover, 2-6
Dynamic Microphone, 9-3

E

E-A-RTONE 3A Insert Earphones, 3-12
Earphones, For HFA/EHF, 7-28
Earth Conductor, 1-6
Easy Mode, 1-3, 3-1, 4-5, 5-3, 6-3, 6-5, 6-10, 7-3, 7-6, 7-9, 7-12, 7-17, 7-19, 7-23, 7-25, 7-28, 7-33,

7-39
EHF, 7-28
Electret Microphone, 9-3
English Language, 10-2
Equipment Failure, 2-7
Erase Line, 4-4
Erase, To Erase Thresholds, 5-6, 6-6
Error Check, 11-1
Exit, 3-6
Ext. Range HL, 3-4, 3-5
Extension Cables, 1-6
External Interrupter, 3-11
External Noise, 6-2
External Printer, Troubleshooting, 13-4

F

F.F. Output, 5-14
Failure, 2-7
Firmware, Updating Of, C-1
Footswitches, 3-11, 10-2
Fowler's Test, 7-1, 7-5, 7-35
Free-Field Line Connectors, 3-13
Free-Field Pure Tone Testing, 5-14
Free-Field Speakers, 3-11, 3-13
Free-Field Speech Audiometry, 6-25
Free-Field Speech Testing, 6-18
Frequency, 3-5
Front Panel, 3-2
Frq. Res., 5-10, 7-4, 7-8, 7-11, 7-14, 7-18, 7-21, 7-24, 7-27
Frq. Sel., 7-4
Fuse Replacement, 2-5
Fuses, 2-5

G

General Description, 3-1
General Information, 1-1
Getting Started, 4-1
Grounding, 1-6

H

Headphone Calibration, 11-1
Headphones, For HFA/EHF, 7-28
Hearing Level Lock, 5-2
HFA, 7-28
High-Frequency Audiometry, 7-28
HL Lock, 5-2
HL Res., 5-10, 6-11, 7-3, 7-7, 7-10, 7-14, 7-17, 7-20, 7-23, 7-26, 7-29, 7-33, 7-37, 7-40
HP Deskjet Printer Driver, 13-1
Hughson & Westlake Method, 7-2

I

I.D., 3-7
Identification details, 4-2, 4-3, 4-4
Identity Menu, 4-3
IEC 601-1, 1-6
IEC 645-1/1979, 11-1
Incr.Sel., 7-14, 7-18
Increment Selection, DLI, 7-14, 7-18
Input/Output Settings (Speech), 6-3
Input/Output Settings (Tone), 5-3
Input/Output, To Select, 5-3, 6-3
Insert, 4-3
Insert Phone, 5-13
Insert Phone, For Masking, 3-13, 6-2
Inspection, 2-1
Inspection, ORBITER 922, on delivery, 2-1
Installation, 2-1
Installation of ORBITER 922, 2-2
Institution's Name, C-1
Institution's Name & Address, 4-2
Int. Funct., 5-10, 6-11, 7-4, 7-8, 7-11, 7-15, 7-18, 7-21, 7-24, 7-27, 7-31, 7-35, 7-38, 7-42
Intermediate Frequencies, 5-10, 7-4, 7-8, 7-11, 7-14, 7-18, 7-21, 7-24, 7-27, 7-30, 7-34, 7-38, 7-42
Internal Calendar, To Set, 10-2
Internal Clock, To Set, 10-2
Interrupter, 3-4, 3-5
Interrupter Function, User-Defined, 3-4, 5-11, 7-5, 7-8, 7-11, 7-15, 7-18, 7-21, 7-24, 7-27, 7-31, 7-35, 7-39, 7-42
Interrupter Lock, 5-2
Interrupters, External, 3-11
Introduction, 1-1
Ipsilateral Masking, 6-2, 6-24
ISO 389-1975 (E), 11-1
ISO 7566-1987, 11-1
ISO 8798-1987, 11-1

K

Key Words, 1-5
Keyboard, 3-11, 4-3
Keypad, 3-8, 5-2
Keypad Entry, 7-30, 7-34, 7-38, 7-41

L

L/R Shift, 3-4, 5-10, 6-11, 7-3, 7-7, 7-10, 7-14, 7-17, 7-20, 7-23, 7-26, 7-29, 7-33, 7-37, 7-40
Language, 10-2
Language Setup, C-1
LCD, 10-2
    See Liquid Crystal Display
LCD Contrast Adjustment, 3-9, 5-8, 6-9
LCD, Contrast Adjustment, 3-4
Left/Right Config., 10-2
Left/Right Configuration, 1-4
Left/Right Shift, 6-13, 6-21, 6-22, 6-26
Level (Left), 3-4
Level (Right), 3-5
Level Adj., 3-8, 9-5
Level Adjustment, 9-5
Line Connection, 2-3

Liquid Crystal Display, 3-9
cleaning, 2-6
Live Voice, 6-18, 6-19, 6-20
Live Voice Discrimination Test, 6-22
Live Voice Input, 6-1
Live Voice Speech Audiometry, 6-13, 6-20
Live Voice Speech Testing, 6-13
Live Voice Thresholds, 6-21
Loudspeaker, Built-In, 9-1
Lüscher-Zwislocki Test, 7-1

M

Mains Connection, 2-3
Manual Conventions, 1-4
Masking, 5-13, 6-26, 7-25
Masking: Speech Audiometry, 6-24
Mastoid, 5-13
MCL, 7-1, 7-19
ME70 Noise-Excluding Headset, 3-13
Menu, 3-8, 6-5
Message, 6-7
Mic. Level Adjustment, 9-3
Microphone Level, 6-21, 6-22
MLB Test, 7-35
Modified Tone Decay Test, 7-22
Monaural Loudness Balancing Test, 7-35
Monitor Headset, 5-13
Monitor Level Adjustment, 9-5
Monitoring, 9-1, 9-4
Monitoring Headset, 3-13, 9-1, 9-4
Monitoring Loudspeaker, 9-1
Monitoring Signal, To Change, 9-3
Multiple Frequencies, 7-31, 7-35, 7-38, 7-42

N

Narrow-Band Masking, Calibration, 11-1
Narrow-Band Noise Masking, 6-26
NBN Noise, 6-24
New Patient, 4-3, 4-4
Noise-Excluding Headset, 6-21, 9-1
Numeric Keypad, 5-2
Numeric Level Entry, 5-2
Numeric Speech Display, 6-7

O

On/Off Switch, 3-10
Oper. Mode, 10-2
Operation Subpanel, 3-3
Operator Entry, 4-3
Operator I.D. Entry, 4-3
Option, 5-6, 6-6
Option Pushbutton, 3-4
Optional Accessories, 1-3
Optocoupler, 3-11
ORBICON, 1-4, 5-1, 6-1, 6-8
ORBICON™ Configuration Software, C-1
ORBITER 922 Setup
See System Setup
Overwrite, 4-3

P

Packing Specification, 2-1
Paper Cutter, 13-3
Paper Feed, 13-3
Paper Loading, 13-3
Paper Rolls, A-4
Patient Communication, 9-1
Patient I.D., 3-7
Patient I.D. Entry, 4-4
Patient Response Handswitches, 3-11, 9-1, 9-6
Patient Response Signal, 3-11, 9-6
Patient Response Signal, Audible, 3-13, 9-6
PC, 5-11, 6-12, 7-43, 12-1, C-1
See Personal Computer
PC Keyboard, 3-11, 4-3
Personal Computer, 2-2
Phonemes, 6-17
Plug, 3-10
Portable CD Player, 3-12, 6-15
Power Cord, 3-10
See AC cable
Power-On, 4-1
Power-On Option, 3-7
Power-On Options, 8-1, 10-1
Print, 3-8, 5-11, 6-12, 7-43, 13-1
Print Data Option, 13-1
Printer, 3-11
Printer Busy, 13-2
Printer Drivers, 13-1
Printer Setup, C-1
Printer, Internal, 13-1
Printers, External, 13-1
Printout, 13-1
Printout On External Printer, 13-4
Printout On Internal Printer, 13-1
Programming User Tests, 8-1
Pulsed Tone, 7-25
Pulsing, 5-10, 7-4, 7-7, 7-10, 7-14
Pulsing Duration, 5-10, 7-4, 7-7, 7-10, 7-14, 7-18, 7-21, 7-24, 7-26, 7-30, 7-34, 7-38, 7-41
Pulsing Rate, 5-10, 7-4, 7-7, 7-10, 7-14
Pure Tone Testing, 5-1, 5-12

R

Rainville Test, 7-1, 7-24
Recruitment, 7-6
Reference Thresholds, 11-2
Repair, 2-7
Reset, 5-4, 6-5
Reverse, 3-4, 3-5
RS232C Serial Data Interface, 3-11, 12-1

S

S.I.S.I. Test, 7-1, 7-11
Safety Precautions, 1-6

Scoring in Speech Audiometry, 6-17
Select Operator, 4-4
Selection Tree, 3-1
Selection Tree (Tone), B-1
Self-Test, 4-2
Service, 2-7
Setup, 3-5, 5-9
Setup (Speech), 6-10
Setup Settings, 5-9, 6-10
Setup, System
See System Setup
Shipment of ORBITER 922, 2-1
Silent Booth, 1-6
Siting of ORBITER 922, 2-2
Softkeys, 3-9
Softkeys 1 to 5, 3-9
Software Release, 4-1
Software Version, 4-1
Special Tests, 3-7, 7-1
Speech, 6-2
Speech Audiometry, 3-7, 6-1, 6-20, 6-22
Speech Audiometry (Tape), 6-14
Speech Audiometry and Masking, 6-24
Speech Audiometry Theory, 6-18
Speech Audiometry, Tape/CD, 6-22
Speech Materials, 6-11, C-1
Speech Materials on CD, 6-15
Speech Noise, 6-2, 6-24
Speech Options, 5-6, 6-6
Speech Reception Threshold, 6-19
Speech Setup, 6-10
Speech Submenu, 6-3
Speech Testing, 6-1, 6-2, 6-13
Spondees, 6-19
Spra-aural Earphones, 7-28
SRT, 6-19
Standard Curves, 6-9
Start-Up, 4-1
Start-Up Screen, C-1
Std curve, 6-9
Std. Frq., 7-30, 7-34, 7-38, 7-42
Stenger Principle, 7-9
Stenger Test, 7-1, 7-8
Stetomike, 3-13
Stetomike Monitoring Headset, 3-13
Stop F., 7-41
Stopwatch, Built-In, 7-22
Storage of ORBITER 922, 2-1
Store, 5-7, 6-7
Store Function, 6-3
Store Operator, 4-4
Submenus, 3-9
Supra Threshold Test, 7-1
Suprathr., 7-19
Suprathreshold Adaptation Test, 7-22
Symbols, 7-20
Symbols, Configuration Of, C-1
System Setup, 3-9, 4-3, 10-1

T

Talkback, 6-13, 9-3
Talkback Level Adjustment, 9-3
Talkback Microphone, 3-14, 9-3
Talkback Microphone Adjustment, 9-4
Talkback Microphone, Dynamic, 9-1
Talkback Microphone, Electret, 9-1
Talkover, 3-5, 6-13, 9-2
Talkover Level Adjustment, 9-3
Tape Deck, 3-14
Tape Recorder, 3-14, 6-1, 6-18, 6-22
Tape-Recorded Speech Materials, 6-14
Tape/CD Input, 6-14, 6-15
TC89E Headband, 3-13
TDH 39, 5-13
TDH39 Earphones, 3-13
Test Conditions, 1-6
Threshold, 6-23
Threshold Tone Decay Test, 7-1
Time Format, 10-2
Timer Clr, 7-23
Tone Audiometry, 3-7, 5-1
Tone Display, 5-7
Tone Setup, 5-9
Tone Switch, 3-4, 3-5, 4-3, 4-4
Two Tone Test, 7-32
TwoTone, 7-32

U

UCL, 7-1, 7-19
Unpacking, 2-1
Unpacking the ORBITER 922, 2-1
User Test Programming
Programming, 8-1
User Test Setup, C-1
User Tests, 3-7, 8-1
User-Defined Duration, 6-12
User-Programmable Tests, Defined, 8-1

V

Version, Software, 4-1
Visual Reinforcement, 3-12
Voltage
Operating, 2-3
Voltage Selection, 2-4
Voltage Selector, 2-4

W

Warble, 5-2, 5-10, 7-4, 7-7, 7-10, 7-14, 7-18, 7-20, 7-23, 7-26, 7-29, 7-34, 7-37, 7-40
Warble Tone, 5-14
White Noise, 6-2, 6-24
Word List, 6-3, 6-11, 6-16, 6-21
Word List, Phonetic, 6-22
Word Lists, 6-1, 6-11, 6-19
Word Lists, Recorded, 6-23