

MADSEN

Partners in Hearing Care

ORBITER 922-2 Clinical Audiometer

Operation Manual
Version 2.x

Part 1 → C

CE
0301

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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).

1. GENERAL INFORMATION

1.1 INTRODUCTION

The ORBITER 922 Clinical Audiometer follows in Madsen's proud tradition of designing user-friendly audiological instrumentation of high quality. Attention has been given not only to a high standard of technological excellence, but also to ergonomics, reliability and ease of use.

The ORBITER 922 supersedes the renowned OB 822 clinical "workhorse", the world's most widely used clinical audiometer, and is a two-channel desktop instrument of similar dimensions. However, all parallels stop here: the ORBITER 922 is one of Madsen's new generation of intelligent multilingual software-driven instruments, equipped with its own display and keyboard, and capable of two-way communication with a PC (which also allows remote control of the audiometer from a PC).

ORBITER 922 Versions 1 and 2

ORBITER 922 has previously been available in two versions, where Version 2 provided the additional features and performance of DSP (Digital Signal Processing). Version 1 was discontinued in December 1997, and Version 2 of the Orbiter is designated Orbiter 922-2.

Among the many features of the instrument are the following:

- Audiogram plotted in real time on large, clear graphics display
- 2 separate and identical channels (left/right or channel 1/channel 2)
- Optional built-in thermal printer or printout to external printer
- Built-in free-field amplifier, gooseneck boom microphone and monitoring loudspeaker
- Multiple transducer calibrations stored in non-volatile memory
- Individual calibration of earphones, insert earphones*, bone conductor, masking insert phone, and free field

* E-A-RTONE® 3A Insert Earphones

- Word lists can be stored in internal memory
- Direct control of optional CD player (CD's word list displayed simultaneously on LCD together with word counter and score in percent)
- Totally clickfree operation over entire attenuator range

Orbiter 922 (with DSP) is equipped with two separate oscillators and offers the following high performance features:

- Extended High-Frequency (EHF) testing up to 20,000 Hz
- Complete Békésy audiometry
- Monaural Loudness Balancing Test (MLB)
- Frequency accuracy of $\pm 0.03\%$
- High resolution multiple frequencies in increments of 6/12/24/48 points per octave, or as low as 1 Hz resolution

Easy to learn, fast to use

*Easy and
Advanced Modes*

Madsen Electronics has made it extremely easy for you to learn and operate ORBITER 922 so that you can devote more time to your patient and less to your audiometer. The instrument features two operating modes, Easy and Advanced, which are selectable from the startup screen.

Multilingual graphics display

ORBITER 922's multilingual display-based user interface facilitates learning and accelerates operation. Test status and options, date and time of test, and all test data are constantly visible on ORBITER's large, clear liquid crystal display.

Thresholds can be plotted directly on the screen audiogram matrix during the test—all symbols for ear, test conditions, and masking being recorded automatically and correctly—thereby saving time and eliminating a source of common error.

Save time with your own memorized test protocols

You do not need to be an equipment expert to operate the 922—test setup is quick and simple, or you can select memorized settings for your own customized test setups with a single keystroke.

Emphasis on speech audiometry

In acknowledgement that speech audiometry is being applied more and more in hearing diagnostics, Madsen Electronics has designed ORBITER 922 to make speech tests easier to perform and to score than ever before.

Word lists can be stored in internal memory and displayed on the LCD display or delivered from a compact disk player and controlled directly from ORBITER 922. Scoring is facilitated by the on-screen word counter, which automatically tracks score.

Patient monitoring

Sophisticated patient communication and monitoring systems enhance and simplify interaction with your patient: ORBITER 922 features built-in boom microphone and monitoring speaker.

Optional accessories

The following additional features are available as options: print-out on built-in or external printer, connection of external PC keyboard, remote control from PC, VERA 103 Visual Reinforcement Accessory, CD player, external interrupters, and Koss or Sennheiser headphones for high-frequency audiometry.

Expanding and customizing your configuration

ORBITER 922 has been designed to meet your evolving requirements, not just now but in the future, and has therefore been equipped with a large number of communication ports as standard. Besides the regular connectors for earphones, bone conductor, insert phone, loudspeakers, CD or tape deck, etc., the audiometer may be connected to a PC and other optional peripherals, e.g. parallel printer, PC keyboard, extra earphones, VERA 103 Visual Reinforcement Accessory. Outlets have also been provided for controlling and supplying power to a CD player.

Moreover, ORBITER 922 can be customized by means of ORBICON™, Madsen's own customer configuration software.

ORBICON™ Configuration Software

This PC program lets your local Madsen distributor configure the instrument to satisfy your own specific needs—fashion your own personal audiometer!

In addition to entering your preferred default settings, audiogram symbols, clinic's name for printout, printer driver, alternative language, etc., ORBICON™ can be used to download your favorite speech materials and store them in the audiometer's memory. Furthermore, the default left/right configuration can be changed to channel 1/channel 2, i.e. the left channel is always the stimulus, and the right channel is always masking. And, for those countries which prefer that the operator's left side corresponds with the subject's right ear (i.e. with the subject facing the operator), ORBITER 922 can be configured to meet those demands.

Default Left/Right Configuration

1.2 ABOUT THIS MANUAL

Manual's Structure

The ORBITER 922 Operation Manual consists of 13 chapters and 3 appendices, which give technical specifications, a schematic overview of the audiometer's procedures, and a detailed list of configuration options via ORBICON™. Chapter 4, Getting Started, enables the operator to rapidly acquaint himself with the instrument. Chapters 5 and 6 contain short-form "cookbook" instructions for tone and speech audiometry, respectively, giving the first-time user a quick and easy-to-read guide. Being a menu-driven system where a number of user instructions appear on the instrument's display, the ORBITER 922 is easy to operate and easy to learn to use.

Manual Conventions

All screen instructions and menu choices are reproduced as far as possible as they appear on the screen, or are shown as "screen dumps" from the ORBITER 922 and are printed in a box to resemble the actual display:

Key Words in Margins

The margins contain corresponding "key words" to help you to quickly find what you are looking for, and they are listed under a subject index at the end of this manual.

Pushbuttons on the instrument's front panel are printed in the text in bold script, and shown in the margins inside a box. For example:

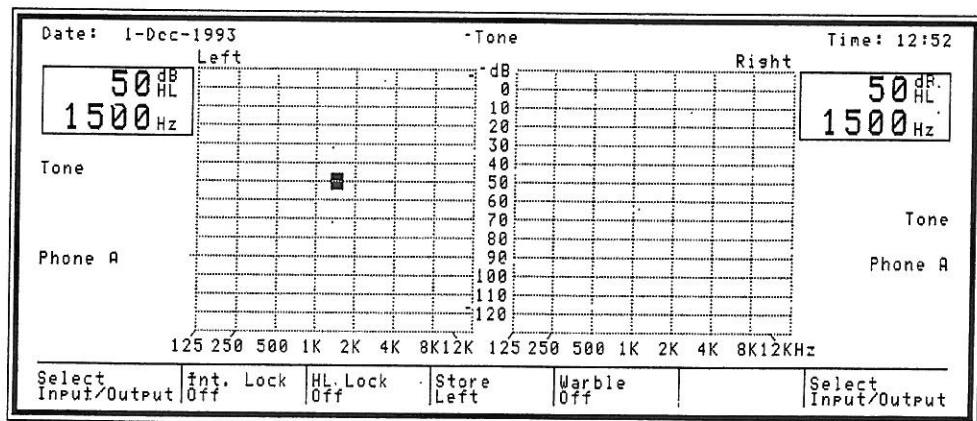


Fig. 1.1

Menu

Press **Menu** to select Test Mode.

Default Settings Modified by ORBICON™

Note that default settings of various setup parameters, etc., specified in this manual, refer to those set at the factory—if your ORBITER 922 differs, this is because the default settings have been changed by your local distributor using ORBICON™.

Another feature of ORBITER 922 is that test parameters for all tests may be changed at any time, except when a test is actually in progress.

If you have any questions or suggestions with regard to the ORBITER 922 or this manual, please do not hesitate to contact us directly at the following address:

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2630 Taastrup, Denmark.
Telefax: +45 4371 6240
E-mail: madsen@madsen-electronics.dk

1.3 TEST CONDITIONS

The ambient noise conditions for audiometric tests should be less than 30 to 40 dBA SPL. In most cases an audiometric silent booth (sound cabin) is recommended (especially for speech audiometry), but may not always be necessary.

Silent Booth

If the patient to be tested is to be located next to the audiometer, ensure that the display and control panel are not visible to the patient.

NOTE: If the audiometer is to be connected to a PC, and if the examination is to be undertaken in a silent booth, then please ensure that the PC is not inside the booth. Most PC's produce noise from ventilator and hard disk!

*Keep PC's Outside
Sound Booth!*

1.4 SAFETY PRECAUTIONS

This Operation Manual contains information and warnings which must be followed to ensure the safe performance of the ORBITER 922 Clinical Audiometer. Local government rules and regulations, if applicable, should also be followed at all times.

ORBITER 922 is marked with this symbol when it is important that the user refers to associated warnings given in this manual.



ORBITER 922 complies with the following standards for audiometers:

EN 60645-1, -2
ANSI S3.6



The ORBITER 922 and this manual are CE-marked according to the Medical Devices Directive 93/42/EEC.



ORBITER 922 is marked with this symbol to indicate compliance with Class 1, Type B requirements of EN 60601-1.

To ensure safe performance, ORBITER 922 must be correctly installed and the following safety requirements must be complied with.

Any PC connected to the ORBITER 922 must comply with the requirements of IEC 950 "Safety of information technology equipment, including electrical business equipment".

Only the original power cable supplied with ORBITER 922 should be used. This must be fitted with an approved 3-pole mains (line) plug, which has a protective earth conductor in compliance with IEC requirements.

CAUTION!

Grounding continuity should be checked periodically.

Avoid using extension cables. The increased length of the cable may increase the resistance of the protective earth conductor beyond an acceptable level.

2. INSTALLING ORBITER 922

2.1 UNPACKING AND INSPECTION

The ORBITER 922 is shipped in its own custom-made carton together with this Operation Manual, a Packing Specification and standard accessories. Please do **NOT** dispose of this carton, in case the instrument needs to be returned to your Madsen Electronics distributor for service or repair.

Unpacking

If the shipping carton is visibly damaged, ask the carrier's agent to be present when the instrument is unpacked. If the instrument is damaged or fails to operate, please notify the carrier and your Madsen Electronics distributor immediately. The Madsen Electronics distributor will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

Inspection

Please check that all accessories are complete and intact (referring to the enclosed **Packing Specification**).

2.2 STORAGE AND SHIPMENT

To protect the instrument and accessories during storage or shipment always use the best packing available. If it is necessary to return the instrument to the Madsen Electronics distributor or to the factory for repair, use the original shipping cartons.

*Storage &
Shipment*

Always store ORBITER 922 in a clean, dry environment and never leave the power on when the instrument is in an enclosed container!

When shipping the ORBITER 922, please remember the following:

1. Seal shipping container securely.
2. Mark container **FRAGILE** to ensure careful handling.
3. In any correspondence, please refer to the instrument by model and serial number.

2.3 INSTALLATION

KEEP AWAY FROM LIQUIDS!

Site the instrument in a well-ventilated location away from all liquids and sources of heat.

Connections

Connect the headset, insert phone(s), patient response hand-switch(es), speakers, bone conductor and, if required, the optional PC keyboard, CD player and personal computer (PC) to their respective connectors in the Connection Panel located on the rear of the instrument (see Figs. 2.1 and 2.2 as well as the fold-out diagram at the back of this manual).

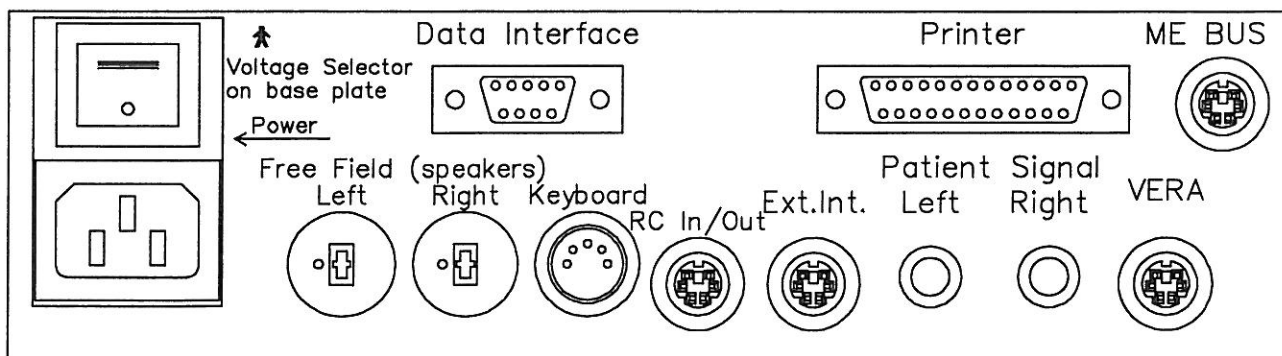


Fig. 2.1 ORBITER 922 Connection Panel (left).

Note that the headphone jacks are color-coded: blue is for left, and red for right. The plugs on the Connection Panel for both headphones (Phones), insert earphones, patient responses (signal) and Free Field are clearly marked Left and Right.

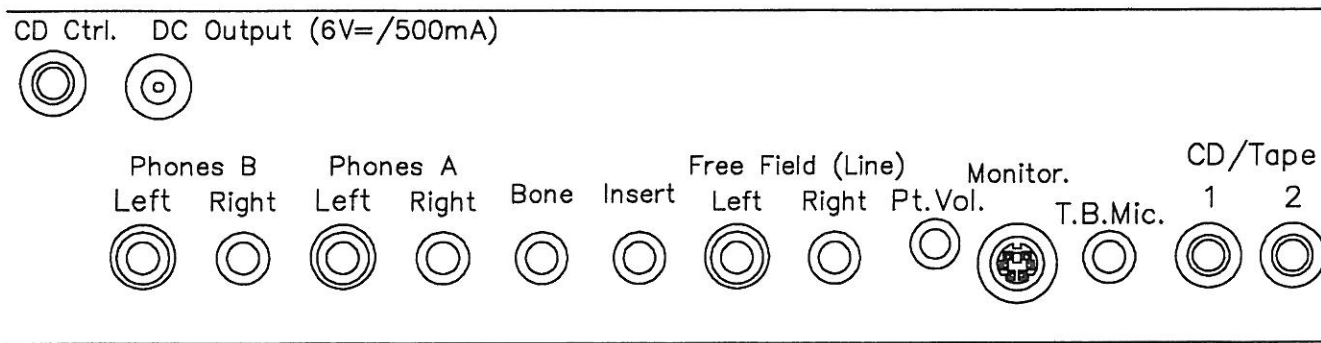


Fig. 2.2 ORBITER 922 Connection Panel (right).

The boom microphone (standard accessory for talkover) should be fitted into the 3-pin socket on the back left of the top cabinet. Align the 3 pins in the base of the microphone with the socket and press firmly into place—you should hear a click as it snaps into place. The microphone is now also electrically connected.

*Fitting Boom
Microphone*

The microphone may be removed by pulling forward the little lever at the back of the socket, and simultaneously lifting out the base of the microphone with the other hand.

*Removing Boom
Microphone*

Before connecting the power cord, ensure that the mains (line) voltage from the electrical outlet matches the voltage shown on the identification label stuck over the power inlet as well as the voltage visible on the Voltage Selector (see §2.4).

**PLEASE READ
BEFORE
SWITCHING ON!**

CAUTION!

Operating at the wrong voltage may blow the fuses!

Check the Voltage!

Plug one end of the power cord supplied into the power inlet on the back of the ORBITER 922 and plug the other end directly into a three-wire, protective ground, AC power outlet. If an extension cord is required, only use a cord with a three-prong connector.

*Mains/Line
Connection*

Fig. 2.3 below shows the on/off switch and the power inlet on the extreme left of the rear panel of the audiometer (seen from the rear).

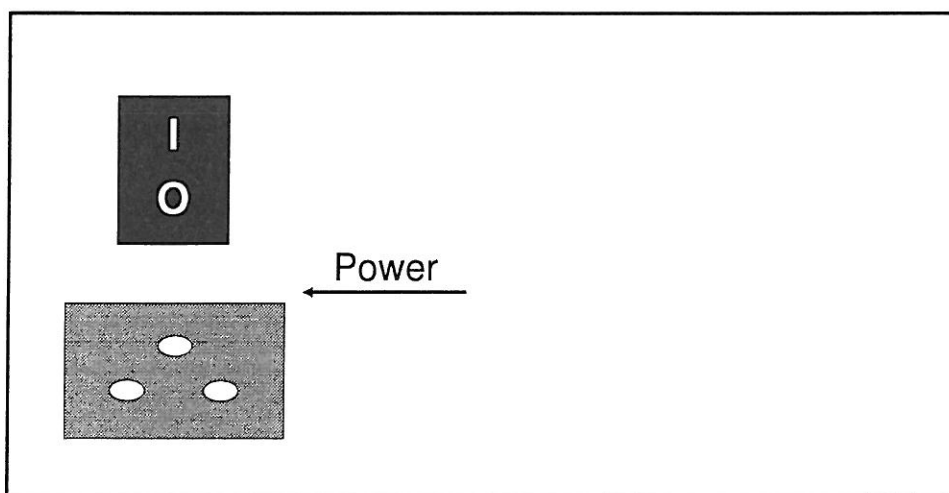


Fig. 2.3 Power Inlet on Rear Panel.

2.4 VOLTAGE SELECTION

Voltage Selector

The Voltage Selector is located on the bottom plate of the audio-meter, at the corner near the power inlet (see Fig. 2.4).



WARNING! Before changing voltage, first switch off instrument and disconnect from mains power supply!

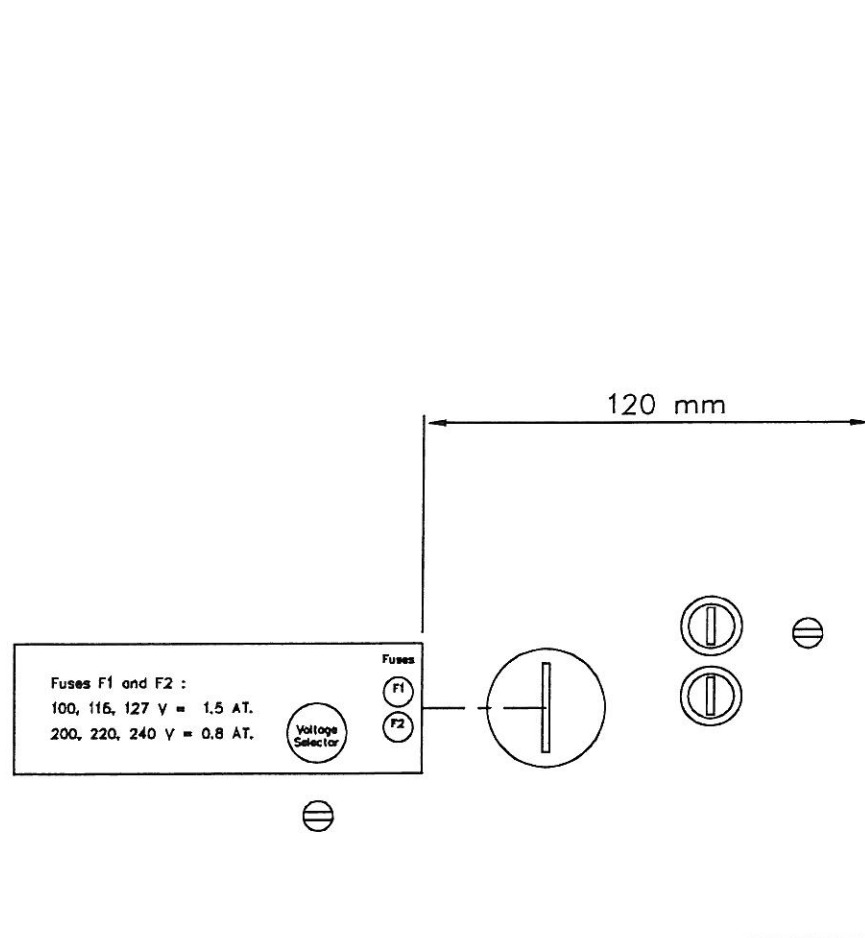


Fig. 2.4 Voltage Selector & Fuses.

Turn Voltage Selector to Desired Setting

To change voltage, use a large screwdriver or a suitable coin, and turn the selector to the desired voltage (or to the nearest available selection, i.e. for 130 V, select 127 V).

Ranges available are: 100 to 130 V, and 200 to 240 V, $\pm 10\%$.

2.5 FUSE REPLACEMENT

Two fuses are located on the bottom plate of the instrument, next to the Voltage Selector. **When fuses need to be replaced, both fuses must be changed.** To replace fuses, please proceed as follows (ref. Fig. 2.4).

WARNING!

Before replacing fuses or changing voltage, first switch off instrument and disconnect from mains power supply!



TO REPLACE FUSES:

Fuse Replacement

1. Switch off the instrument and disconnect from mains.
2. Tilt the audiometer to access the right-hand corner of the instrument's bottom plate.
3. The fuses are located next to the Voltage Selector (see Fig. 2.4).
4. Using a screwdriver, release each fuse in turn from its bayonet mount (1/4 turn anti-clockwise).
5. Replace fuses according to the voltage selected, see below:

Component	Voltage	Fuses	Type	Dimensions
F1/F2	100,115,127V	1.6 A	Slow Blow	5 x 20 mm
F1/F2	200,220,240V	0.8 A	Slow Blow	5 x 20 mm

6. Insert the new fuses and fasten by means of a 1/4 turn clockwise.

2.6 CARE AND MAINTENANCE

Cleaning

The ORBITER 922 requires no preventive maintenance. However, it is recommended that the following guidelines be observed.

The instrument should be kept clean and as free of dust as possible:

- Clean the display periodically with an anti-static non-solvent solution using a lint-free cloth.
- Remove dust using a soft brush and take special care to dislodge any accumulations of dirt on or around the push-buttons on the front panel.

KEEP AWAY FROM LIQUIDS!

- To clean the cabinet and the front panel, use a soft, slightly damp cloth with a small amount of mild detergent on it. Do not allow any moisture inside the instrument!

Display

- To clean the display, use a dry cloth or soft brush. Note that the display is laminated for maximum readability and must therefore be treated with care.

ATTENTION!

WARNING!

Chemical cleaning agents containing ammonia or alcohol will damage the cabinet and display.

Dust Cover

If your ORBITER 922 has been supplied with the optional plastic dust cover, you should keep the instrument covered at all times when it is not in operational use.

CAUTION!

However, the instrument should **NOT** be left switched on with the dust cover in place, as this may cause severe overheating and damage to the instrument. Avoid exposing the instrument to direct sunlight, and keep it well-ventilated at all times to prevent overheating.

The earphones are in constant contact with your patients so care should be taken to ensure that they are kept clean. Just wipe them regularly with a moist cloth. Likewise, the eartip of the masking insert phone should be wiped regularly, and replaced at frequent intervals. There are no special requirements for disposal of the rubber eartip. The bone vibrator (conductor) should also be wiped clean periodically.

If you use the E-A-RTONE 3A insert earphones, note that the standard yellow foam insert tips are disposable, and therefore should not be cleaned and reused. There are no special requirements for disposal of the insert tips.

Disposal

2.7 EQUIPMENT FAILURE

If you believe the correct function or operating safety of ORBITER 922 is impaired in any way, disconnect it from the power supply and secure it against further use before contacting your local Madsen representative.

WARNING!
**Under no circumstances remove the front or top cover
of the instrument!**



2.8 SERVICE AND REPAIR

Service and repair of electromedical equipment should only be carried out by the equipment manufacturer or by authorized representatives.

The manufacturer reserves the right to disclaim all responsibility for the operating safety, reliability and performance of equipment serviced or repaired by other parties.

3. GENERAL DESCRIPTION

3.1 GENERAL

Unlike most other audiometers, the ORBITER 922 has no switches for selecting fundamental parameters nor potentiometers for calibration of inputs and patient communication/monitoring functions (with the exception of the audible patient response level, which has its own potentiometer on the rear panel). Instead these parameters are selected using the control panel together with the display while the conventional potentiometers on the rear panel are largely replaced by electronic level controls.

Test parameters are either preprogrammed and stored in non-volatile memory (where stored information is retained when the power supply is cut off) to be subsequently accessed as User Tests, or are selected by means of the pushbuttons on the front panel.

*Test Setup and
Preprogrammed
Tests*

The instrument features two operating modes, Easy and Advanced, which are selectable from the I.D. screen. Please refer to the next chapter for further details (§4.3).

ORBITER 922 offers two different ways for setting up tests. Either select **Tone**, **Speech** or **Special** from the front panel and specify test parameters from that test screen (Select Input/Output, Softkeys 1 and 7), or press **Menu**, and use softkeys 1 to 7. As you press these "softkeys", the audiometer responds by displaying options for your selection. The resulting test setup is erased by pressing **Menu**. This latter method will be familiar to all who have ever used Madsen's MIDIMATE 602 or 622 audiometers.

Menu

It is easier to understand how the menu selection method for test setup functions if you visualize it as a series of different levels like a mathematical tree. You can use the softkeys to move down through the different levels of the setup process and the **Menu** button to jump back to the top of the selection tree and then switch from one branch of the tree to the other.

*The Selection
Tree*

The Connection Panel is located on the rear of the instrument (please refer to §2.3 as well as to the fold-out diagram at the back of the manual for a detailed description of connections). In addition to the On/Off switch and all connections, there is a white potentiometer marked Pt.Vol. for controlling the level of the audible patient response.

Connection Panel

3.2 FRONT PANEL LAYOUT

Front Panel

The front panel layout has been designed for maximum ergonomic efficiency irrespective of whether the operator is left- or right-handed. It is constructed around a large display, which has a row of softkeys underneath it referring to choices at the bottom of the display. Parameters on the display also correspond with the LED's on either side indicating which transducers are in use.

The front panel has been subdivided into 4 parts (please refer to diagram below): the lower center is for the manual controls used during testing and is called the OPERATION subpanel, the central part underneath and on either side of the display is the DISPLAY subpanel. The CONTROL subpanel is located on the left of the panel and consists of 10 keys. The KEYPAD is located on the right, and functions like the numeric keypad on a PC keyboard, complete with **Enter** key and arrow keys (left/right, up/down) for moving a cursor on the LCD and for changing intensity and frequency.

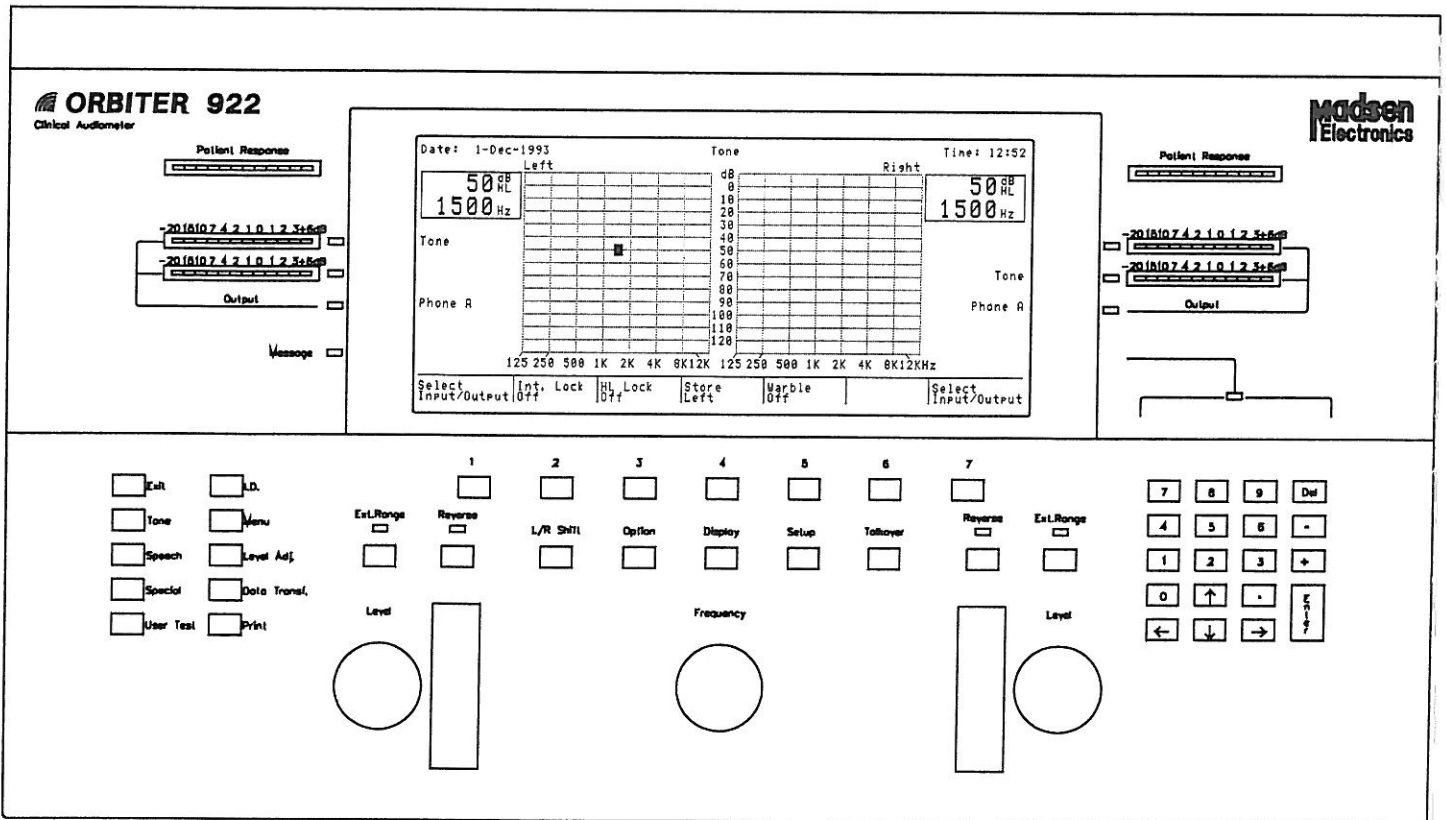


Fig. 3.1 ORBITER 922 Front Panel and Display.

The individual controls for each subpanel will be described in detail in the following sections.

3.3 FRONT PANEL CONTROLS

Please refer to the diagrams for each individual subpanel when reading the description of each individual control and indicator below.

3.3.1 OPERATION SUBPANEL

The OPERATION subpanel comprises three rotary control knobs for controlling Frequency, Hearing Level and Masking Level, two Tone Switches/Interrupters and 9 pushbuttons for Extended Range, Reverse, L/R Shift, Option, Display, Setup and Talkover.

The Operation Subpanel

There is one Ext. Range and Reverse pushbutton for each channel; each of these pushbuttons has an LED above it to indicate status.

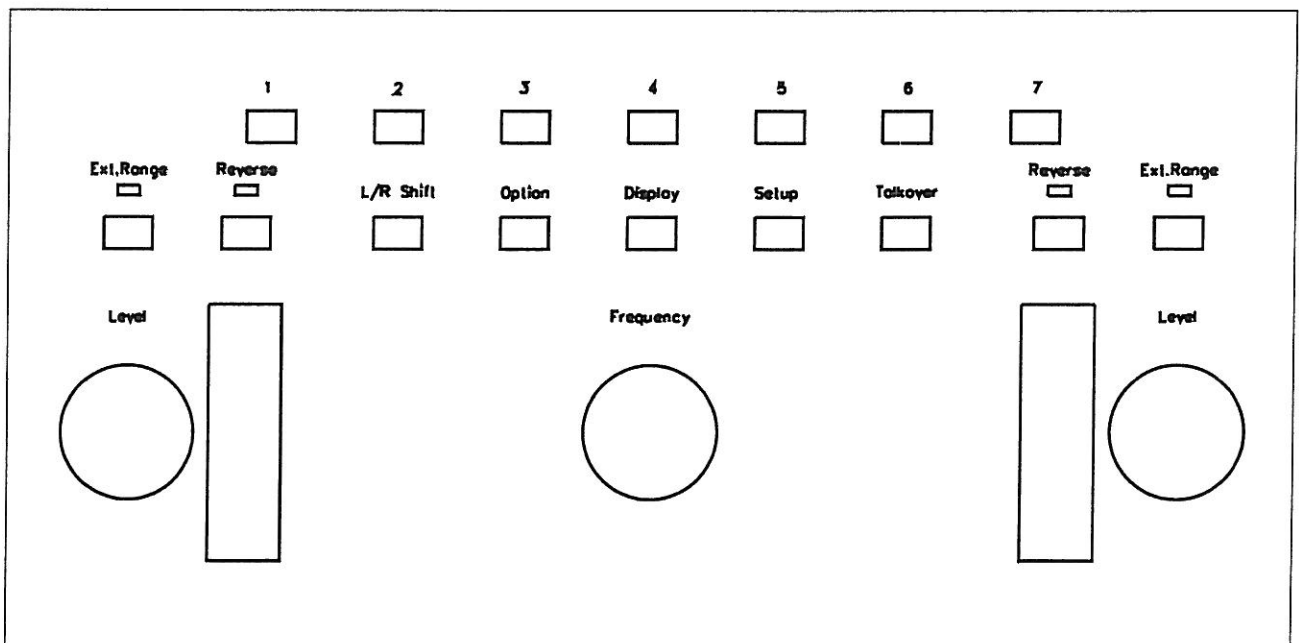


Fig. 3.2 The Operation Subpanel.

<i>Level (Left)</i>	<p>LEVEL (LEFT) Rotary control knob for setting transducer level of stimulus or masking during testing. The stimulus intensity is increased or decreased in 1, 2, 3, 5 or 10 dB steps within the permitted range at any given frequency. This knob may also be used as a potentiometer control when adjusting levels of input sources and patient communication functions.</p>
<i>Ext. Range (Left)</i>	<p>EXT. RANGE (LEFT) This function is primarily for safety purposes. When Level for the left channel is at its maximum output intensity, pressing this pushbutton will extend the range, maximum level being dependent on transducer. The LED above this pushbutton lights up to indicate that the function is active.</p> <p>Please note that this function is automatically disabled whenever Frequency is changed or Input/Output is selected.</p>
<i>Tone Switch / Interrupter</i>	<p>TONE SWITCH/ INTERRUPTER (LEFT) Presents stimulus or masking via left channel using preselected transducer, or interrupts tone if in Reverse mode. Is also used for entering characters in the I.D. screen.</p>
<i>Reverse (Left)</i>	<p>REVERSE (LEFT) Reverses the function of the Tone Switch for this channel changing it to an Interrupter. Used mainly in speech audiometry to interrupt tape/CD input. Pressing Reverse cancels this mode. The LED above this pushbutton lights up to indicate that the function is active.</p>
<i>L/R Shift</i>	<p>L/R SHIFT This pushbutton automatically switches all selected parameters from the left to the right channel and vice versa.</p>
<i>Option</i>	<p>OPTION This pushbutton accesses the Options Menu for erasing stored thresholds for left, right or both ears. In addition, Option is used for entering a user-defined duration for the Interrupter Function.</p>
Option	<p>Option is also used when storing User Tests or default settings for Tone and Speech.</p>
<i>Display</i>	<p>DISPLAY This pushbutton accesses the Display Menu, enabling audiogram data to be displayed in different modes, and LCD contrast to be adjusted.</p>

SETUP

This pushbutton accesses setup parameters, which vary according to whether one is in Tone, Speech or Special Test Mode. Typical setup options in Tone Mode include warble on/off, frequency resolution, intensity resolution (1, 2, 3, 5 or 10 dB), and timing of internal functions.

*Setup***FREQUENCY**

Rotary control knob for setting frequency during testing. May also be used as an alternative to cursor keys and softkeys when selecting from display submenus. This knob may also be used for scrolling through display options.

*Frequency***TALKOVER**

This pushbutton accesses the Talkover function and interrupts the presentation of stimulus permitting communication with the patient.

Talkover

Pressing and holding down **Talkover** also accesses a submenu for adjusting the level of the various microphone transducers.

STONE SWITCH/ INTERRUPTER (RIGHT)

Presents stimulus tone via right channel and using preselected transducer or interrupts tone if in Reverse mode.

*Tone Switch /
Interrupter***REVERSE (RIGHT)**

Reverses the function of the Tone Switch for this channel changing it to an Interrupter. Used mainly in speech audiometry to interrupt tape/CD input. Pressing **Reverse** cancels this mode. The LED above this pushbutton lights up to indicate that the function is active.

*Reverse (Right)***LEVEL (RIGHT)**

Rotary control knob for setting transducer level of stimulus or masking during testing. The stimulus intensity is increased or decreased within the permitted range at any given frequency. **Level** may also be used as a potentiometer control when adjusting levels of input sources and patient communication functions.

*Level (Right)***EXT. RANGE (RIGHT)**

This function is primarily for safety purposes. When Level for the left channel is at its maximum output intensity, pressing this pushbutton will extend the range, maximum level being dependent on transducer. The LED above this pushbutton lights up to indicate that the function is active.

*Ext. Range
(Right)*

Please note that this function is automatically disabled whenever Frequency is changed or Input/Output is selected.

3.3.2 DISPLAY SUBPANEL

The Display Subpanel

The Display subpanel consists of 7 softkeys and 6 LED's. With the exception of the Patient Response LED's, which simply indicate patient response left or right, all these pushbuttons and indicators interact with the display. The softkeys are used for selecting options and interfacing with the instrument.

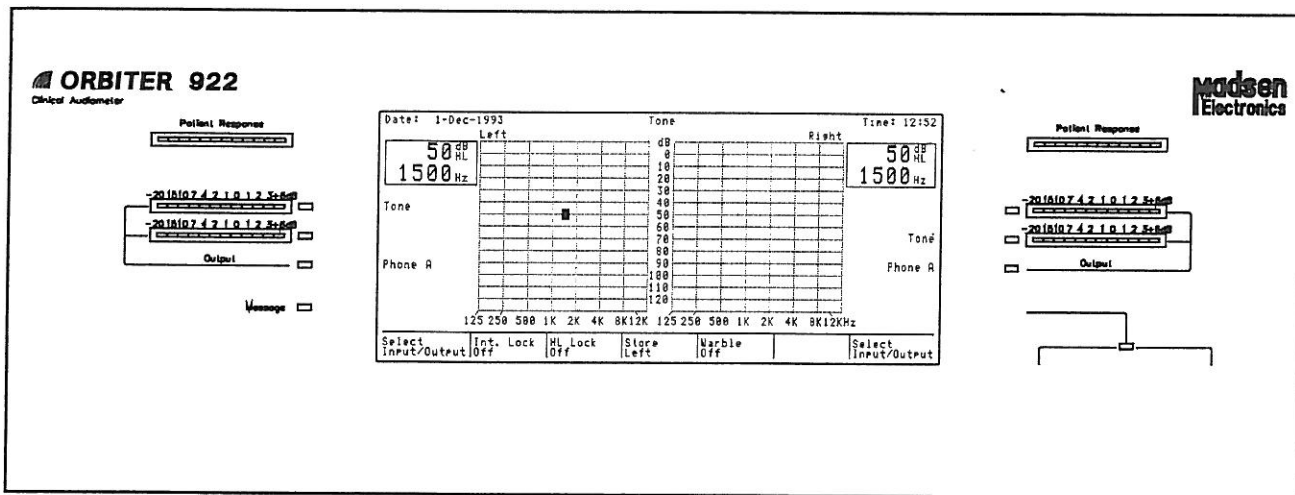


Fig. 3.3 The Display Subpanel.

MESSAGE

The Message LED lights up when there is a message to the operator or when there has been a hardware/software error, e.g. "Printer is out of paper", or "Invalid I/O Setting". The LED also lights up when storing thresholds, displaying "Data stored".

3.3.3 CONTROL SUBPANEL

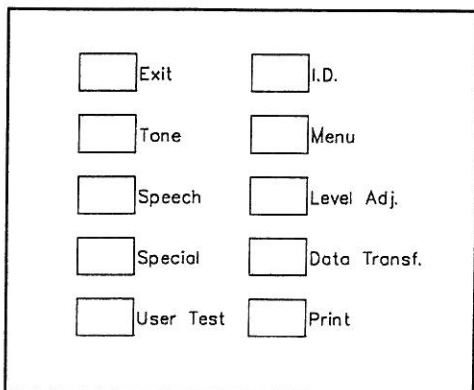


Fig. 3.4 The Control Subpanel.

The Control subpanel is used for selecting the primary operating modes and functions of the instrument.

EXIT

Pressing this pushbutton returns you to the previous test mode with all parameters and setup left as shown on the display. If you are already in test mode, you will return to the I.D. screen (or whichever screen has been configured as the start-up screen).

EXIT has no function immediately after power-on, i.e. from the I.D. screen before any test mode is selected.

TONE

Pressing this pushbutton accesses the Tone Audiometry screen, and you are ready to begin testing.

*Tone Audiometry
Screen*

Input/output sources and transducers are preselected (default settings may be changed as a power-on option), but may be reselected from this screen using the softkey options (**Softkeys 1** and **7**), in Advanced Mode. In Easy Mode, select the desired settings via **Menu** (see next page).

SPEECH

Pressing this pushbutton accesses the Speech Audiometry screen, and you are ready to begin speech testing.

*Speech Audio-
metry Screen*

Input/output sources and transducers are preselected (default settings may be changed as a power-on option), but may be reselected from this screen using the softkey options (**Softkeys 1** and **7**), in Advanced Mode. In Easy Mode, select the desired settings via **Menu** (see previous page).

SPECIAL

Pressing this pushbutton accesses the Special Test Menu, and you may select which special test you require by using the softkey options.

Special Tests

Special tests include: Auto Threshold (Hughson & Westlake), Fowler (ABLB), Stenger, SISI, DLI (Difference Limen for Intensity), Supra Threshold, Tone Decay, Rainville, DLF (Difference Limen for Frequency), MLB (Monaural Loudness Balance), Békésy, high-frequency audiometry.

USER TEST

The ORBITER 922 enables up to 7 "User Tests" to be stored for instant one-key retrieval of your most frequently used test setups.

User Tests

When pressing the User Test pushbutton, a screen is displayed which enables selection of User Test by means of a softkey, and which contains a short user description of each test, specification of input/output settings, etc.

I.D.

Pressing this pushbutton accesses the Patient Identification mode, permitting entry of patient/operator I.D., comments, etc.

Patient I.D.

The audiometer automatically enters this mode after power-on (or whichever screen has been configured via ORBICON™ as the start-up screen).

<i>Menu</i>	<p>MENU</p> <p>This pushbutton accesses the Select Function Menu on the display, automatically exiting any other mode. The Select Function Menu (Tone and Speech) is the top of the Selection Tree, and enables manual selection of test parameters from a submenu located above the softkeys, and subsequent access to a Test Mode.</p>
Menu	<p>The resulting test setup is erased by pressing Menu again.</p>
<i>Level</i>	<p>LEVEL ADJ.</p> <p>Level Adj. accesses electronic level controls for the various speech test inputs and patient-operator communication with the levels shown on the display. These electronic controls replace the old potentiometers and are used in conjunction with the rotary control knobs thus preventing accidental alteration of preselected levels.</p>
<i>Data Transfer</i>	<p>DATA TRANSF.</p> <p>This pushbutton is reserved for future advanced applications. In ORBITER 922, measurement data is stored in internal buffer memory, and retrieved by a PC on demand.</p>
<i>Print</i>	<p>PRINT</p> <p>This pushbutton accesses the Print Menu, and enables printout of measurement data on optional built-in printer or to an external parallel printer.</p>

3.3.4 KEYPAD

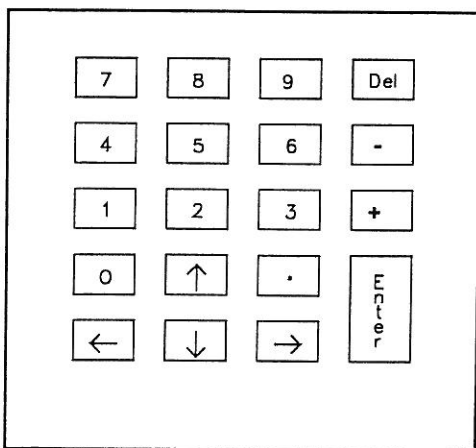


Fig. 3.5 The Keypad.

The Keypad resembles that to be found on the right of a standard PC keyboard, and is used for entering numeric I.D. and other data, as well as for moving the screen cursor and deleting data. The arrow keys may also be used for changing intensity and frequency.

The keypad also permits direct numeric entry of frequency and intensity when in test mode, as well as controlling speech material presentation from a CD player.

Additionally, the **Delete** key can be used for erasing stored thresholds—just move the cursor to the threshold you wish to delete and press **Delete**.

3.4 SOFTKEYS

A softkey may be defined as a key whose function changes depending on context as opposed to a so-called "dedicated" key whose function is always the same. The ORBITER 922 has 7 softkeys located under the display in the center of the front panel.

Softkey Defined

The 7 softkeys interact with the options shown in the bottom two lines of the display, enabling you to execute functions or make selections (see §3.5 below), e.g. individual threshold data is stored via Softkey 4.

3.5 LIQUID CRYSTAL DISPLAY

The Liquid Crystal Display (LCD) can show both textual and graphical information about the functions of the ORBITER 922 and the results of tests. It can display audiograms, intensity level and frequency during measurement. Each test mode and supplementary function has its own screen display layout, which has been optimized to convey information relevant to the function.

Liquid Crystal Display

Every display layout contains a lower sector consisting of a submenu with 7 panels. Each panel shows the function of the **Softkey** immediately below it. At the top of each display layout in the center is a descriptive title such as "Tone" which identifies the current operating mode. The operating modes are: Identification, Tone, Speech, Special (and each of the Special Tests), User Tests, Menu. Pressing **Level Adj.**, **Print**, **Option**, **Display** and **Setup** accesses a new submenu with the relevant options for each operating mode.

Submenus

The contrast of the LCD may be altered using **Display** or in System Setup (Chapter 10). This value is saved to NOVRAM, i.e. the LCD will have the new value next time the instrument is powered on.

Contrast

At all times, the current date is displayed in the top left corner and the current time in the top right of the display. The built-in clock/calendar can be reset and display format changed as a power-on option (see System Setup).

Date and Time Displayed

3.6 CONNECTION PANEL LAYOUT

Connection Panel

As previously described in chapter 2, §2.3 Installation, all peripherals and accessories are connected to the audiometer via the Connection Panel located at the rear of the instrument (with the exception of the boom microphone, which is fitted into the 3-pin socket in the top cabinet).

In this section, the individual connectors will be described in detail, starting at the top left. For convenience, the Connection Panel is divided into two figures (Figs. 3.6 and 3.7) and designated left and right, respectively. Connections are also illustrated in the fold-out diagram at the back of this manual.

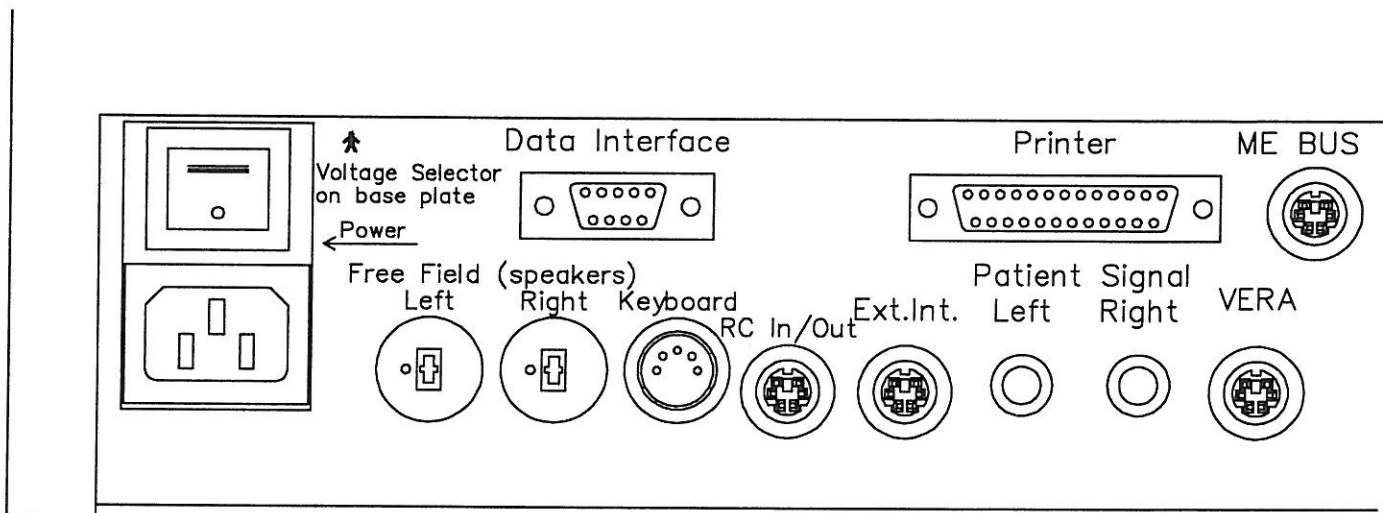


Fig. 3.6 ORBITER 922 Connection Panel (left).

On / Off Switch

Power

On the extreme left is located the on/off switch and 3-pole AC power inlet. When the lower part of the on/off switch (with the "O") is depressed, the audiometer is off. Pressing the top part of the switch down, powers on the instrument.

Power Cord and Appropriate Plug

A power cord fitted with the specific type of plug ordered together with the audiometer is supplied as standard. Please refer to §1.4 for safety information and to §2.3 for details on connecting the power cord.

Data Interface

The 9-pole data interface port for ORBITER 922 is a standard RS232C serial interface, and may be used for connecting the audiometer to a PC's COM port. Please use a 9-pin zero-modem serial interface cable for this purpose (M.E. part no. 8-71-340). See chapter 12 for further details re connections via this port.

*Serial Data
Interface*

Please note that the serial data interface of ORBITER 922 is connected via a high speed, fully insulated optocoupler.

Optocoupler

Printer

This port is a standard Centronics parallel printer port, and is used for connecting the audiometer to an external printer. See chapter 13 for details re printing out on an external printer.

*Centronics
Parallel Interface*

You may use a standard 25-pin parallel printer cable for connecting your printer, or order M.E. part no. 8-71-360.

ME Bus

Reserved for future applications.

Free Field Speakers (Left & Right)

This pair of DIN loudspeaker sockets is for direct connection of a pair of free-field loudspeakers to the audiometer's own built-in free-field amplifier. The output is in parallel with the Free Field Line output, and calibration for both outputs is the same, i.e. only one set of speakers may be used at a time.

*Connection To
Built-in Amplifier*

Keyboard

A standard IBM PC AT® computer keyboard may be connected to this DIN socket.

PC Keyboard

RC In/Out

Reserved for future applications.

Ext. Int.

A pair of Madsen footswitches may be connected to this mini-DIN socket and used as external interrupters (M.E. part no. 8-31-960). Remember to activate the connection in the audiometer's software, see §10.2, under Power-On Options.

Footswitches

Patient Signal

One set of patient response handswitches with standard jack plugs is supplied together with ORBITER 922. Plug the blue one into the left connector, and the red one into the right connector.

*Patient Response
Handswitches*

*Connection to
VERA 103*

VERA

This mini-DIN socket is reserved for connecting Madsen's visual reinforcement accessory, VERA 103. Remember to activate the connection in the audiometer's software, see §10.2, under Power-On Options. M.E. part no. 8-02-060, cable for VERA 103, is required for connecting VERA 103 to this socket.

NOTE: *Production of VERA 103 has been discontinued!*

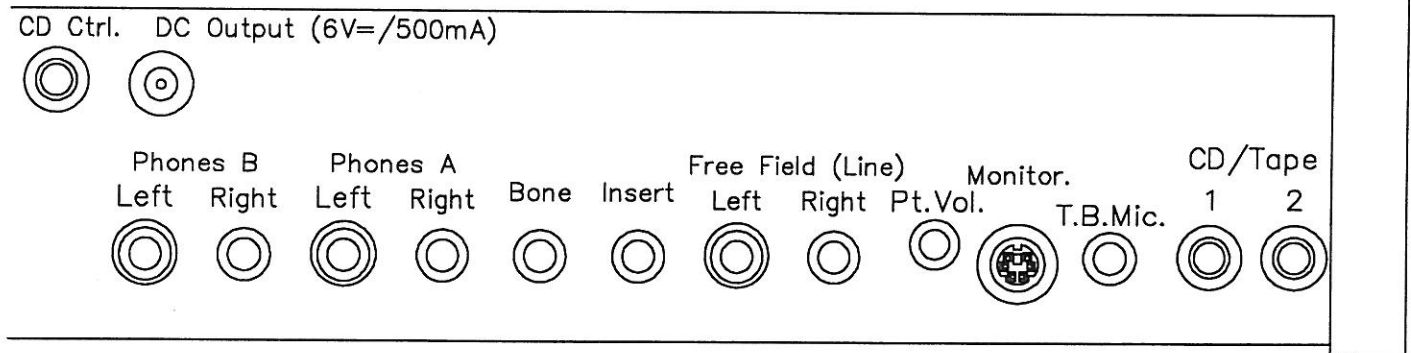


Fig. 3.7 ORBITER 922 Connection Panel (right).

CD Control

CD Ctrl.

This phono plug may be used for connecting a CD player via an interface cable, e.g. the standard Madsen infrared transmitter cable or a Philips RC5 cable, enabling direct control of CD from the keyboard of your ORBITER 922.

*DC Power Source
For CD Player*

DC Output

This 6 volt, 500 mA DC output is reserved for powering portable CD players, thus conserving the CD player's battery or eliminating the need for an AC/DC adaptor.

*Transducer
Calibration*

NOTE: All transducers are calibrated! Do not swap transducers without also swapping calibration data!

*Extra Connectors
for EHF
Headphones or
Insert Phones*

Phones B (Left & Right)

This pair of standard jack connectors (10Ω transducer) is a calibrated alternative to Phones A (standard headphones). EHF Headphones or E-A-RTONE® 3A Insert Earphones, for example, may be installed via these connectors (one to each ear), or any other transducer with an impedance of ≥ 10 Ω.

Phones A (Left & Right)

This pair of standard jack connectors (10 Ω transducer) is calibrated for use with a pair of standard headphones, TDH39 supplied with the audiometer and fitted on an ME70 noise-excluding headset or on a TC89E headband. Any other transducer with an impedance of $\geq 10 \Omega$ may also be connected, including EHF headphones.

*TDH39
Earphones*

Connect the blue jack plug to the left socket and the red one to the right socket.

Please note that, although it is possible to connect two sets of calibrated transducers to Phones A and B, it is NOT possible to route signals to both simultaneously!

Bone

Connect the supplied B-71 bone conductor to this socket.

Insert

Connect the supplied insert phone to this socket. This insert phone is used for masking, and is supplied with an earmould.

*Insert Phone For
Masking*

Free Field Line (Left & Right)

This pair of jack sockets is for connecting an external free-field amplifier, to which is connected a pair of free-field speakers.

*External Free-
Field Amplifier*

The output is in parallel with the Free Field Speaker output, and calibration for both outputs is the same, i.e. only one set of speakers may be used at a time.

Pt. Vol.

ORBITER 922 features an audible patient response signal which may be routed through the audiometer's own built-in speaker, or the optional Stetomike® monitoring headset. This potentiometer controls the volume of the audible patient response.

*Audible Patient
Response Signal*

This function may be activated from the **Level Adj.** screen, see §9.5.

Monitor.

This mini-DIN socket is reserved for connecting the optional Stetomike® monitoring headset (M.E. part no. 8-75-690).

*Monitoring
Headset*

Please note that the plug on this headset is not the same as that on the Stetomike® monitoring headset for the MIDIMATE 602 or 622, and therefore not interchangeable.

Stetomike®

<i>Talkback Microphone</i>	T.B. Mic. Connect your talkback microphone to this jack socket, and adjust level using Softkey 6 in the Level Adj. screen—see §9.5 for further details (or press Talkover and use the right Level control).
<i>CD Player Or Tape Deck</i>	CD/Tape 1 and 2 Speech materials from a stereo CD player or tape deck may be routed to your patient via these standard hi-fi phono plugs, providing you with two high quality channels.

4. GETTING STARTED

This chapter takes you through powering on the audiometer, entry of operator and patient I.D., to the point where you are ready to start audiometric testing.

4.1 START-UP

- | | |
|---|--|
| 1. Plug the AC cable into the power inlet on the rear panel and then connect the audiometer to a power source. | <i>Connect AC Cable</i> |
| 2. Switch on the ORBITER 922 by depressing the power switch (located on the right of the rear panel when seen from the front). | <i>Power-On</i> |
| 3. The screen illuminates and displays "Boot Program" for a couple of seconds, and then a second screen displays the following (see Fig. 4.1 below): which version of the Orbiter software is installed, the date and time of the software release, which EPROM version is installed on the analog PCB, whether or not an external keyboard is connected, and whether or not programming of User Tests has been enabled. At the same time the audiometer runs an automatic self-test and displays the version number of the hardware controller and whether or not a PC keyboard or CD Player is connected. | <i>Software Version</i>

<i>No Warm-up Time Required</i>

<i>Self-test</i> |

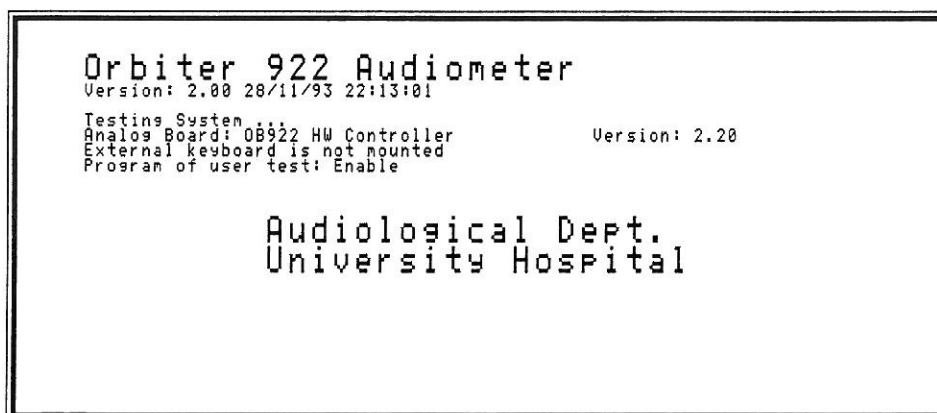


Fig. 4.1. The Power-On Screen.

NOTE: The second screen, which normally only displays for about 4 seconds, can be frozen by holding down the Display pushbutton.

Display

*Institution's
Name And
Address*

4. In Fig. 4.1, the two lines which display "Audiological Dept., University Hospital" may be configured by your local distributor by means of ORBICON™ to read your own institution's name and address.

*Automatic
Self-Test*

5. During the self-test, the system memory and the calibration memory are checked. In addition, analog and electrical circuits are checked and optimized. Should the self-test fail, an error message will be displayed. In case of a "fatal error", note down the error message, switch off and contact your local Madsen representative.

Note that calibration memory errors do not prevent operation—error will be shown on display whenever that location is accessed!

I.D.

6. When this process has been completed, the Identity Menu is loaded (or whichever screen has been configured as the start-up screen) and you are ready to enter your I.D. together with the I.D. of your first patient of the day (see §4.2).

4.2 PATIENT IDENTITY

I.D.

Following power-on, or after selecting **I.D.**, the screen shown in Fig. 4.1 below is displayed:

Date: 27-Nov-1993	Identity	Time: 14:45
Operator :	-----	
Patient :	-----	
Address :	-----	
I.D. No. :	-----	
Reference :	-----	
Comments :	-----	
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz		
Erase Line	NewPatient	Overwrite
Select Operator	User mode	Advanced

Fig. 4.2. The Identity Screen.

A blinking square and a stippled line indicate the cursor and the active line, defaulting at "Patient:" The active line and cursor may be moved by means of the **Level** knobs or arrow keys. The format

of both date and time may differ from that shown here if they have been modified using System Setup (see chapter 10).

Data for each line may be easily entered by means of a PC keyboard, if available, or by entering letters one at a time from either the Numeric Keypad or the alphabet in the lower part of the screen. The Frequency knob moves the cursor (▲) under the alphabet and the Tone Switches (Interrupters) select the character. Note that there is a space immediately in front of "A" for entering spaces, e.g. between names and words.

Data entered may be transferred to a PC together with measurement data.

The following supplementary functions may be accessed from the Identity Menu:

- Pressing **Softkey 1** erases any data on the active line. Softkey 1
- Data from last patient tested may be erased by pressing **Softkey 2** to select New Patient. Softkey 2
- Pressing **Softkey 3** toggles between Insert and Overwrite just like the "Insert" key on a PC keyboard. Softkey 3
- **Softkey 4** invokes a pop-up menu containing any previously stored operator names so that you can store or select names. Softkey 4

4.2.1 OPERATOR I.D. DATA ENTRY

- Select "Operator" line by using the **Level** knob or Cursor keys and enter data directly from external keyboard, or manually from the Keypad or on-screen alphabet: turn the **Frequency** knob until you find the desired character, and press either **Tone Switch** (Interrupter) to enter the character.

Operator Entry

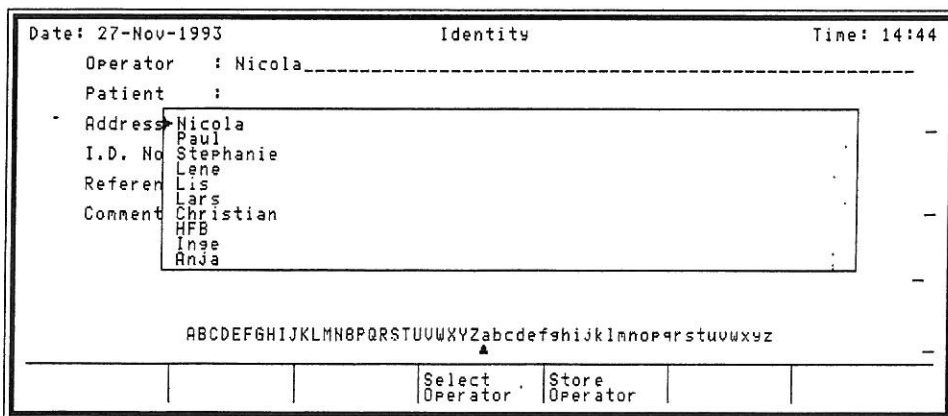


Fig. 4.3 Select Operator.

Select Operator

- Press **Softkey 4**, Select Operator, and a pop-up box appears (see Fig. 4.3). If any operator names have previously been stored, they will be listed in this pop-up box (maximum 10 names). **Softkey 5** now becomes active permitting new operator names to be stored in memory.

Store Operator

- The arrow keys on the keypad or the **Level** knobs move the cursor up or down the list of operators enabling selection of operator by means of Softkey 4. Softkey 5, Store Operator, replaces selected Operator with the name previously entered on the Identity screen, if any. A new name may be entered at the same time as the pop-up box is displayed.

4.2.2 PATIENT I.D. DATA ENTRY

- Select line and enter data directly from external keyboard, or manually from the Keypad or on-screen alphabet: turn the **Frequency** knob until you find the desired character, and press either **Tone Switch** (Interrupter) to enter the character.
- The following characters are available in both upper and lower case: space, A-Z.
- Pressing the Cursor arrow keys (Numeric Keypad) moves the cursor to the right or left on each line (max. 60 characters per line) or up and down. If you make a mistake, return to the incorrect character(s) by means of the Cursor arrow buttons and overwrite the incorrect character(s), or delete backwards using the **Delete** key. Press **Softkey 1**, Erase Line, to clear any previous data on selected line.

*Overwrite Data or Delete**New Patient*

Each time you finish testing a patient and wish to start a new patient, press **I.D.** to enter the Identity Menu, press **Softkey 2**, New Patient, and press **Softkey 1** again to confirm your choice.

WARNING!

**NOTE! Selecting New Patient
erases all data on previous patient!**

Previous Patient Data Erased!

The selection of New Patient must be confirmed because all the data concerning the last patient is automatically erased from the instrument's memory whenever you confirm selection! If a mistake has been made, press **Softkey 2** when asked to confirm thus preventing the data from being erased.

4.2.3 COMMENTS

Eight lines of 60 characters is available for comments—you can enter data as for the other fields on this screen, but note that you can use the **Enter** key as a <CR> key, i.e. to go down to the next line.

Enter

When filled in, your Identity screen could look something like this:

Date: 27-Nov-1993	Identity	Time: 14:42
Operator : HFB		
Patient : Jane Chichester	-----	
Address : 277 Bracken Path Epson Surrey		
I.D. No. : 120562-5987		
Reference : PGR		
Comments : Acoustic trauma in left ear Referred by her GP		
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz ▲		
Erase Line..	NewPatient	Overwrite
	Select Operator	User mode Advanced

Fig. 4.4 Patient I.D. Data.

4.3 EASY AND ADVANCED MODES

As in other Madsen instruments, ORBITER 922 has two user modes, easy and advanced, selectable from the I.D. screen. ORBITER 922 always starts up after power-on in Advanced Mode.

Powers On In Advanced Mode

In Advanced Mode, which is the factory default, all the functions of the instrument are available.

Advanced Mode Defined

In Easy Mode, ORBITER 922 functions more like a MIDIMATE 602 or 622, i.e. test parameters are primarily set up via **Menu** (as explained in §3.1, §5.1.2 and §6.2.2), and the **Display** and **Setup** functions are disabled. Output settings, however, may be changed by toggling Softkeys 1 and 7.

Easy Mode Defined

Note that Select Input/Output Settings, Softkeys 1 and 7, are no longer available in Tone, Speech and Special Tests—only outputs can be changed. Input/output settings should be made via the Menu Selection Tree.

Input/Output Settings Disabled

4.4 SUMMARY

After installing your ORBITER 922, connecting the various accessories and peripherals, powering on and entering I.D. data, you are now ready to begin testing!

The next chapters take you through the main functions of the instrument in more or less the same order as presented in the Control Subpanel: Tone Audiometry, Speech Audiometry, Special Tests, User-programmable Tests—supplementary functions such as Setup, Option, Display, Data Transfer and Print are described under each of these main functions—followed by chapters on Patient Communication and Monitoring, System Setup, Calibration, Data Interface, and Printout.

5. TONE AUDIOMETRY

This chapter describes how to operate the ORBITER 922 Clinical Audiometer for both air and bone conduction and free-field threshold measurements using pure tones. §5.2 gives short-form “cookbook” instruction. The ORBITER 922 described is the factory default version, which is configured as a left/right audiometer. Please refer to chapter 10 for details on how to configure your ORBITER 922 as a channel 1/channel 2 audiometer.

*Factory Default
Left/Right
Configuration*

Note that default settings of various parameters, etc., specified in this manual, refer to those set at the factory—if your ORBITER 922 differs, the default settings have been changed by your local distributor using ORBICON™.

*Default Settings
Modified by
ORBICON™*

5.1 TONE

Pressing **Tone** on the Control Subpanel directly accesses the pure tone measurement screen (see Fig. 5.1 below), displaying audiograms for both ears, input/output sources/transducers, intensity and frequency, as well as a submenu for selecting test parameters and options by means of the softkeys. Beside each audiogram, the input for each channel is displayed while the output to the ear(s) is displayed on the extreme left and right of the screen corresponding to the LED's outside the display.

Tone

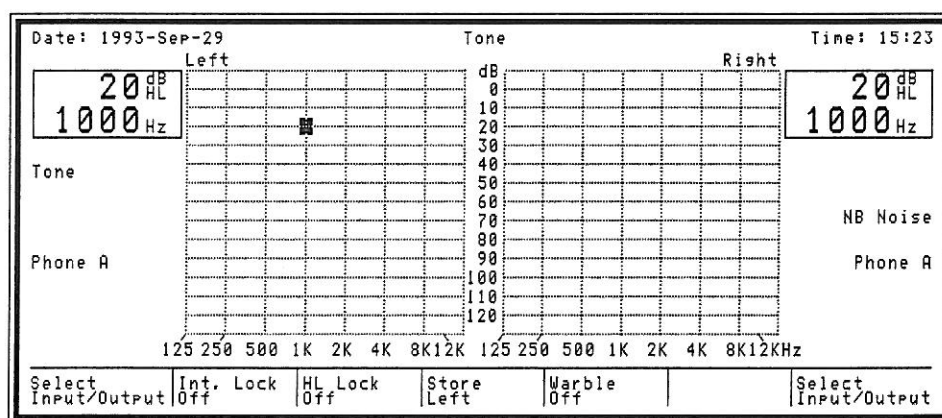


Fig. 5.1 Tone Audiometry Screen.

Note that the input/output sources and transducers for both channels are those that were last selected. See §5.1.1 to change these settings. See chapter 8 to change default settings.

L/R Shift

Select ear by means of **L/R Shift**, and turn the hearing level knob for that channel to set intensity—intensity is displayed in dB in the box at the side of the screen.

Frequency

Turn the frequency knob to alter frequency, which is displayed in Hz on each side of the screen.

Softkey 2

Softkey 2 toggles the Interrupter Lock off and on. When on, pressing one Interrupter (Tone Switch) also activates the other.

Softkey 3

Softkey 3 toggles the Hearing Level Lock off and on. When on, turning the HL knob for the stimulus channel will change the Hearing Level in both channels maintaining the preset interval between stimulus and masking levels, i.e. the interval set before activation of the HL Lock. Note that the masking channel's intensity can be changed independently. Hearing levels will continue to change in this way until one of the channels reaches the upper or lower limit, whichever is relevant.

Softkey 4

Softkey 4 stores the current threshold, i.e. the combination of intensity and frequency for the channel selected, which is indicated by the cursor on the audiogram matrix. A threshold symbol is now displayed. To store masking symbols, masking must be enabled. Threshold data is stored temporarily in a buffer memory, and can be subsequently transferred to a PC.

No Threshold

Shortly after pressing **Store**, the Message LED lights up and the following is displayed: "Data stored". If **Softkey 4** is held down for longer than 2 seconds, a different symbol is displayed indicating "No Threshold".

Softkey 5

Warble can be toggled off and on with this softkey.

Additionally, you can toggle through the following frequency modulations (in %): Off, 0.2, 0.5, 1.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0. The actual frequency in Hz of the modulation can be altered in Setup—see §5.1.5.

Numeric Level & Frequency Entry

Stimulus and masking intensity levels and frequencies can not only be changed by means of the arrow keys and the Rotary Knobs, but also entered directly from the Numeric Keypad.

Keypad

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 levels that may be entered, i.e. Intensity (Softkey 1), Frequency (Softkey 2) and masking levels (if selected). Pressing any of these softkeys changes the level directly. Use the **Delete** key to edit numbers before entering them.

Delete can also be used to erase a stored threshold.

Delete

Erase data functions, display options and test parameters may be selected from **Option**, **Display** and **Setup** (see §5.1.3, §5.1.4, and §5.1.5 for further details).

Supplementary Functions

Note that default settings, i.e. input/output settings, audiogram display, intensity, frequency, HL resolution, Frequency Resolution, Interrupter Function, Interrupter Lock, HL Lock, left or right channel, can all be changed—and these settings are memorized until the next time they are changed. See §8.2, for details.

Default Settings

5.1.1 INPUT/OUTPUT SETTINGS

In Easy Mode, these settings are primarily made via **Menu**, and the fields over Softkeys 1 and 7 display "Select Output" only—you can toggle through the available transducers, which are displayed on the sides of the LCD, and select them in this way. In Advanced Mode, the Tone screen illustrated in Fig. 5.1 is displayed. Press **Softkey 1** to change settings for left channel and **Softkey 7** to change settings for right channel (for audiometer configured as left/right).

Select via Softkeys 1 and 7

In either case, a box pops up consisting of 3 columns with options for stimulus input, masking input and output, respectively:

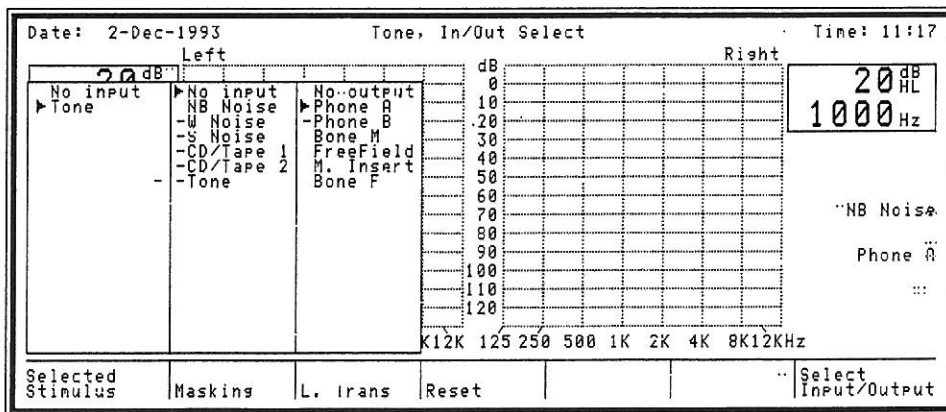


Fig. 5.2 Input / Output Settings (Tone).

If you now press **Softkey 7**, a similar box will pop up on the right side of the display.

NOTE: Input/Output Settings for an instrument configured as a channel 1/channel 2 audiometer will present inputs and outputs differently, i.e. with stimulus on the left side and masking on the right.

Inputs/Outputs For Channel 1/Channel 2

ATTENTION!

When changing input/output settings, select in the following sequence:

1. Output
2. Stimulus
3. Masking

In the upper line of the submenu, the word "Selected" indicates which column is active, e.g. in Fig. 5.2, "Stim Input" is selected. Use the Frequency knob, left/right arrow keys or the appropriate softkey to select column. The > cursor may be moved by means of the up/down arrow keys or the appropriate Level knob. Options marked with a minus sign (-) are not available because of the other options selected.

Options available for the left side are as follows (the available options for the right side are the same but in the opposite sequence, i.e. output, masking and stimulus):

<u>Stimulus Input</u>	<u>Masking Input</u>	<u>Output</u>
No input	No input	No output
>Tone	>NB Noise	>Phone A
	W Noise	Phone B
	S Noise	Bone M
	CD/Tape 1	FreeField
	CD/Tape 2	M. Insert
	Tone	Bone F

In this example, the instrument is set to route both stimulus and Narrow-Band Noise masking through the headphone into the same ear (ipsilateral masking).

*Factory Default
Input/Output
Settings*

The default settings, which are the settings in which the instrument leaves the factory in Denmark, are: Tone in left phone, NB Noise masking in the right phone (i.e. contralateral masking). These settings are also those which apply after power-on (unless changed as a power-on option, see §8.2, Default Settings).

NOTE!

Please note that illegal combinations of inputs and outputs, e.g. ones requiring more than 2 channels, cannot be selected. If you select such a condition and try to exit, the Message LED lights and displays "Invalid I/O Setting".

SOFTKEY 4*Reset Function*

Press **Softkey 4** to reset all settings to no input or output.

*To Exit Input/
Output Settings*

Press **Exit** or **Tone** to exit and revert to the Tone screen. The selected input/output sources/transducers are now displayed.

5.1.2 MENU

It is also possible to enter this same pure tone testing mode by going through the selection tree from **Menu**. In fact, if you have selected Easy Mode, this is the only way to change test parameters without changing the Default Settings (see §8.2 for details). Setting up a specific test is performed by means of selections from a series of menus. During menu selection, you are asked to select Test Mode, Stimulus Output, Stimulus Side, and Masking, while the submenu at the bottom of the display shows which possible functions may be selected.

Menu

The choices available in each step are always restricted so as to comprise only relevant items. For example, in pure tone audiometry, speech noise will not appear as a valid masking source.

The selection sequence is condensed whenever possible, e.g. if Left+Right is selected, questions about masking will be omitted.

In each step of the setup sequence, the previously selected parameters are displayed on the upper line of the display—cancellation of an entry can be accomplished by simply pressing **Softkey 7**, Previous, which returns you to the previous line (see Fig. 5.3).

Softkey 7

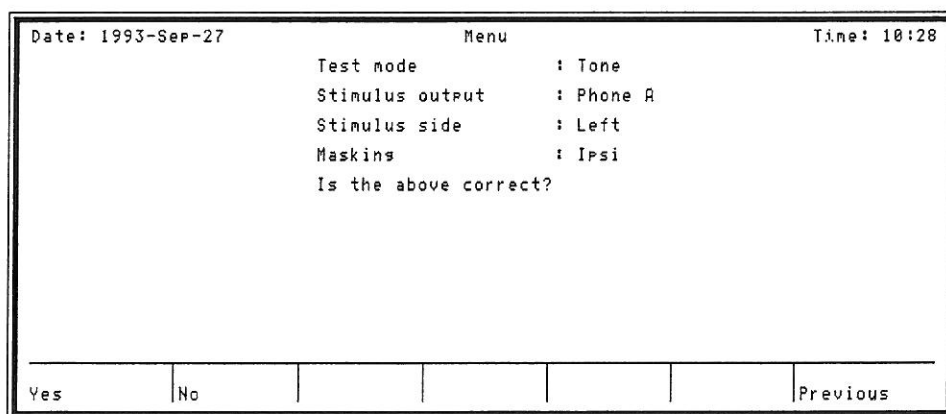


Fig. 5.3 Example of Menu Selection (Tone).

Pressing **Softkey 1** to accept the setup accesses the Tone Audiometry screen (Fig. 5.1), while pressing **Softkey 2** takes you back to the first menu selection, Test Mode.

Softkeys 1/2

You can exit at any point in the setup sequence, by pressing **Exit**, which returns you to the Identity screen (start-up screen), or by accessing any of the other Functions on the Control subpanel.

Exit

5.1.3 OPTION

Option

Pressing **Option** accesses the same submenu in all test modes:

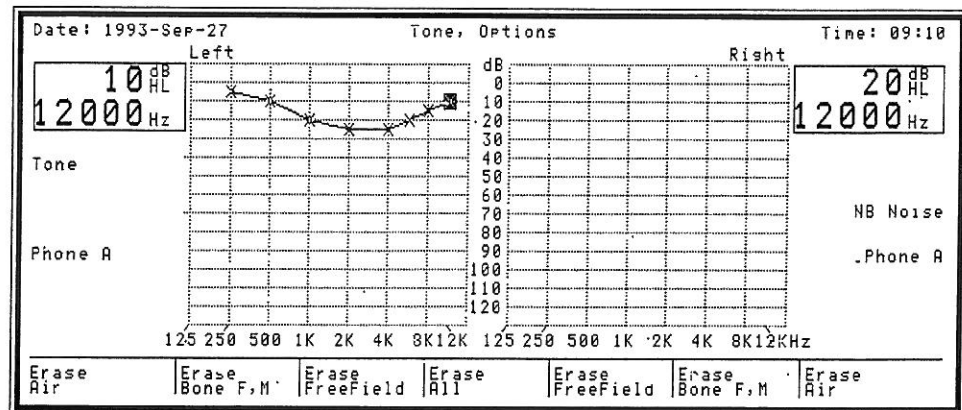


Fig. 5.4 Option Submenu (Tone).

This function is primarily an “Erase” or “Delete” function and is used for erasing stored threshold data for air, bone, free field, for each ear, or all at once. Individual stored thresholds may be erased by moving the cursor to them, and pressing **Delete**.

Option

Option is also used when programming user tests or changing default settings (see chapter 8), and from Setup when entering a user-defined duration for Pulsing or the Interrupter Function.

Softkeys 1,2,3 erase data for the left channel, **Softkeys 5,6,7** for the right channel.

In setup mode, when either Pulsing or Int. Func. (Interrupter Function) are selected, pressing **Option** permits direct numeric entry of duration (in mS and sec., respectively) from the Keypad.

EXIT

Press **Exit** or **Option** to exit the Option submenu and return to the previous screen.

5.1.4 DISPLAY

Display

Pressing this pushbutton accesses different screens depending on current test mode. In Tone Audiometry, test data may be displayed graphically, i.e. as audiograms, or as in conventional audiometers where intensity and frequency values are displayed numerically. Audiogram configuration may be changed from the default left and right, and LCD contrast may be adjusted.

**Please note that the Display pushbutton is inactive in Easy Mode!
Return to I.D. screen and select Advanced Mode.**

Inactive in Easy Mode

The tone audiometry submenu may appear as follows:

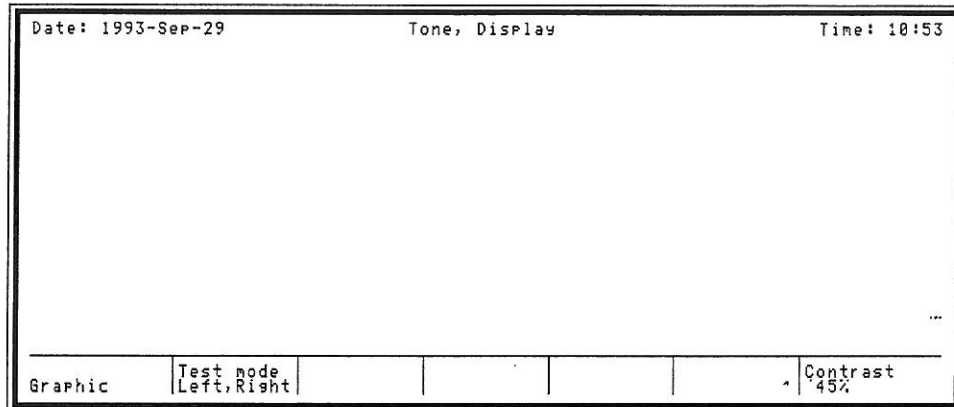


Fig. 5.5 The Display Submenu (Tone).

Pressing **Softkey 1** toggles between the two modes of showing test data: graphic audiograms or the conventional digital readouts for intensity and frequency (see Fig. 5.6 below). It is also possible to store thresholds in "Big Value" mode, but thresholds are only plotted on-screen in "Graphic" mode. However, the Message LED lights up and a message is displayed to inform you that threshold data has been stored in memory.

Graphic & Big Value Modes

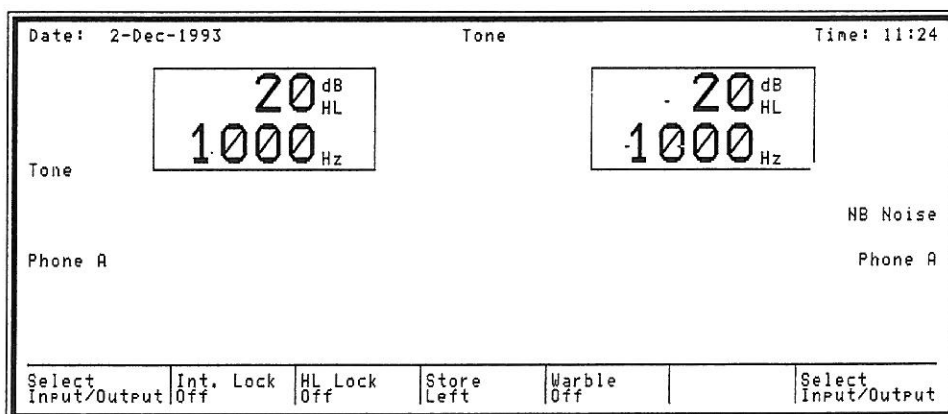


Fig. 5.6 Big Value Display (Tone).

Pressing **Softkey 2** enables selection of the different graphic audiogram configurations: left and right, left only, right only, and left and right superimposed.

Audiogram Configuration

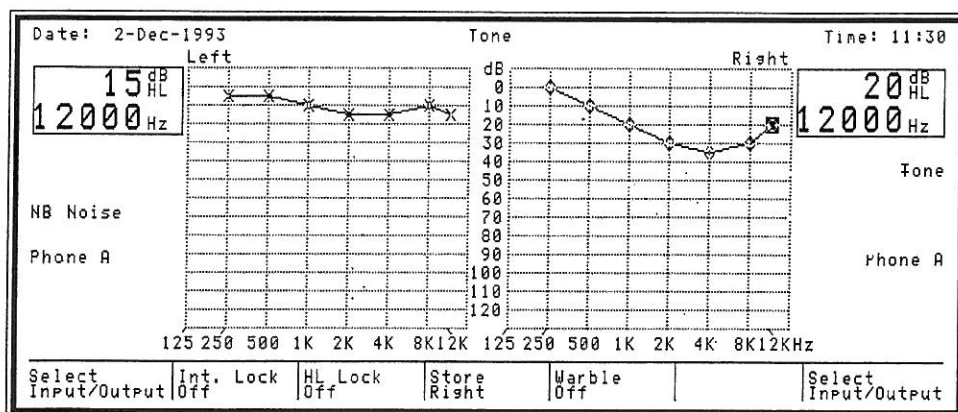


Fig. 5.7 Left, Right Audiogram Display.

Fig. 5.7 above shows audiograms configured in the default Left, Right manner—compare this display to Fig. 5.8 which has the same test data, but displayed after selecting Left + Right, i.e. with the two audiogram matrices superimposed.

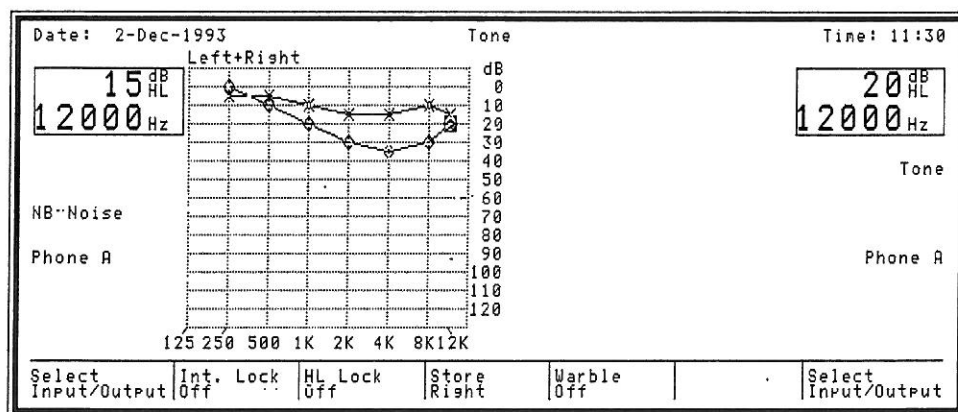


Fig. 5.8 Left+Right Audiogram Display.

LCD Contrast Adjustment

Contrast may be adjusted from the Display submenu by pressing and holding down **Softkey 7** while at the same time turning any of the Rotary Knobs. Note that as screen contrast is changed, the setting displayed as a percentage in the submenu changes. This enables you to note which settings are suitable for which lighting conditions.

Exit

Press **Exit** to exit the Display submenu and return to the previous screen. Note that the display has now been updated according to the changes made in the Display submenu.

5.1.5 SETUP

Pressing this pushbutton accesses different screens depending on current test mode, i.e. setup options for pure tone audiometry differ from those for speech audiometry. Setup allows you to alter test parameters for each particular test mode, i.e. it is context-sensitive. This mode is not to be confused with System Setup, which is used for basic instrument functions such as language and clock, and which may be accessed by pressing **Setup** when powering on (please refer to chapter 10, System Setup).

Setup

Please note that this pushbutton is inactive in Easy Mode! Return to I.D. screen and select Advanced Mode.

Inactive in Easy Mode

Setup settings are stored temporarily (i.e. they are not memorized after power-off). To store setup settings in the audiometer's non-volatile memory, the User Test function must be employed.

The setup screens for tone and speech audiometry include display of date and time at the top, and display of current input/output status for each channel.

5.1.5.1 SETUP FOR TONE AUDIOMETRY

The tone audiometry setup screen and submenu is as follows:

Date: 30-Nov-1993		Tone, Setup		Time: 11:21	
▶Left Channel: Input Tone			Output Phone A		
Right Channel: Input NB Noise			Output Phone A		
1.0 dB 2.0 dB 3.0 dB 4.0 dB 5.0 dB	▶Off 5.0%	▶Off 1.0 HZ 2.0 HZ 3.0 HZ 4.0 HZ 5.0 HZ		▶Std. Freq. Multi.Freq	▶Manual (300ms) 1.0 Sec. 1.5 Sec. 2.0 Sec. 3.0 Sec. 5.0 Sec. 7.0 Sec. 10.0 Sec.
		Duration (200ms)			
HL Res.	Warble	Pulsing		Freq. Res.	Int. Func.

Fig. 5.9 Setup For Tone Audiometry.

The cursor "Selected" indicates which column of parameters is active. The Frequency knob as well as the left/right cursor keys and softkeys may be used for selecting column, while the Level knobs and the up/down cursor keys move the >cursor from parameter to parameter.

5.1.5.2 NOTES ON TONE SETUP**L/R SHIFT***L/R Shift*

Changes between left and right channel. Note that the ► cursor at the top left of the screen moves as you change channel. Different setup parameters can be stored for each individual channel—with the exception of Interrupter Function, i.e. whether the Interrupter (Tone Switch) functions manually or with a preset duration is the same regardless of which channel is selected.

HL RESOLUTION*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.

WARBLE*Warble*

This column is only active if Tone has been selected.

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. 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).

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 and 240 mS. Key in desired value on the Keypad and exit by pressing **Enter** or **Exit**.

FREQUENCY RESOLUTION*Frq. Res.*

This column is only active if Tone has been selected.

Select Std. Frq. if you wish to use standard frequencies in pure-tone testing. Alternatively, you can select 6, 12, 24 or 48 points per octave, or 1 Hz resolution.

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.

Tone Switch

Note that the field in parentheses is a user-defined duration that is entered by means of **Option** and the Numeric Keypad.

*User-Defined
Duration*

5.1.6 DATA TRANSFER

Pressing **Softkey 4**, Store, while in 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 by the PC. Please refer to chapter 12 for further details on data transfer.

Softkey 4

5.1.7 PRINT

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

Print

Identification data, time and date are also included on the printout (with the exception of 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

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.

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

5.2 PURE TONE TESTING

This section gives a short cookbook description of how to operate the ORBITER 922 Clinical Audiometer for air conduction (AC), bone conduction (BC) and free-field threshold measurements using pure tones.

5.2.1 AC THRESHOLD MEASUREMENTS

1. Plug the headphones, patient microphone, patient response handswitches and monitor headset (or Talkover microphone) into their respective connectors (see §2.3).
2. Connect the ORBITER 922 to an AC power outlet (see §2.3).
3. Switch on the instrument by pressing the power switch on the back right of the rear panel.
4. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or whichever screen has been configured as the start-up screen). Enter I.D. data and press **Tone**.
5. Place the patient in sound cabin, if available. If not, ensure that the patient is facing away from the audiometer.
6. Instruct the patient in usage of Patient Response Handswitches and/or microphone and fit headphones ensuring that the red phone is on the right ear.
7. Press Input/Output for required channel(s) and select Tone for input and Phone A for output. The default intensity is 20 dB and default frequency is 1000 Hz. Change these settings, if desired, select the better ear and continue with the higher frequencies.
8. If the difference between the two ears is greater than 40–60 dB, repeat the test using masking. Press Input/Output, or **Menu**, to select masking input for whichever channel desired.

Tone

*Air (Phone A)
Output*

5.2.2 BC THRESHOLD MEASUREMENTS

1. Plug the headphones, patient microphone, patient response handswitches, bone conductor, insert phone and monitor headset (or Talkover microphone) into their respective connectors (see §2.3).

WARNING! The bone conductor cable is not to be removed or tampered with while it is connected to the audiometer. Either disconnect the bone conductor entirely from the Connection Panel, or ensure that the instrument itself is disconnected from the power source.



2. Connect the ORBITER 922 to an AC power outlet (see §2.3).
3. Switch on the instrument by pressing the power switch on the back right of the rear panel.
4. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or whichever screen has been configured as the start-up screen). Enter I.D. data and press **Tone**.
5. Place the patient in sound cabin, if available. If not, ensure that the patient is facing away from the audiometer.
6. Instruct the patient in usage of Patient Response Handswitches and/or microphone and fit headphones ensuring that the red phone (right) covers the ear to be masked. The other earphone is placed on the temple region to leave the test ear uncovered.
7. Fit the bone conductor to the mastoid arranging the headband so that it does not come into contact with the headset.
8. Press Input/Output for channel(s) required and select Tone for input, N.B. Noise for masking input, and Bone M for output. It is essential that masking be used in bone conduction tests. The default intensity is 20 dB and default frequency is 1000 Hz. Change these settings, if desired, select the better ear and continue with the higher frequencies.

Tone

Bone Output

*Masking
Required*

Insert Phone

NOTE: In cases where the masking intensity required in one ear is very high and, therefore, it is impossible to make an accurate threshold measurement for bone conduction in the other ear, an insert phone is recommended. An insert phone produces less bone conduction than a normal TDH 39 or Holmco headphone.

5.2.3 FREE-FIELD PURE TONE TESTING

Free-field pure tone audiometry is primarily used when testing children owing to their dislike of wearing headphones.

1. To perform a threshold test in free field, connect the optional speakers to the left and right channel connectors on the rear panel of the instrument. Set up the loudspeakers in the sound cabin with the left and right channels facing correctly.
2. Connect the ORBITER 922 to an AC power outlet (see §2.3).
3. Switch on the instrument by pressing the power switch on the back right of the rear panel.
4. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or whichever screen has been configured as the start-up screen). Enter I.D. data and press **Tone**.
5. Place the patient in the sound cabin facing away from the audiometer and ensure that the left and right speakers are facing the corresponding ears. If no sound cabin is available, ensure that there is a minimum of ambient noise otherwise this form of testing is of no value.
6. Instruct the patient in usage of Patient Response Hand-switches and/or microphone.
7. Press Input/Output for required channel(s) and select Tone for input, N.B. Noise for masking input (if desired), and Free Field for output. Select Warble from Setup if required. The default intensity is 20 dB and default frequency is 1000 Hz.

Tone

6. SPEECH AUDIOMETRY

This chapter describes how to operate the ORBITER 922 Clinical Audiometer for speech testing. §6.3 gives short-form “cookbook” instructions, while §6.4 gives a detailed description of speech audiometry. The ORBITER 922 described is the factory default version, which is configured as a left/right audiometer. Please refer to chapter 10 for details on how to configure your ORBITER 922 as a channel 1/channel 2 audiometer.

*Factory Default
Left / Right
Configuration*

Note that default settings of various parameters, etc., specified in this manual, refer to those set at the factory—if your ORBITER 922 differs, the default settings have been changed by your local distributor using ORBICON™.

*Default Settings
Modified by
ORBICON™*

6.1 GENERAL

Either live voice or prerecorded speech from a tape recorder or CD player may be employed for speech audiometry using one or both channels. A total of 2 line inputs is available. The audiometer has connections for both microphone or tape/CD enabling you to read out loud or play back word lists for threshold and discrimination determination.

*Live Voice or
Tape / CD Input*

Note that only recorded speech materials with a stated relationship with a calibration signal should be used.

Live voice investigations should only be carried out with the patient in a sound cabin since the patient must not hear the Audiologist’s voice directly.

*Sound Cabin
Required*

Word lists may be read into the instrument’s memory by means of ORBICON™ and then shown on the LCD display. In addition, ORBITER 922 is equipped with a unique interface for directly controlling an external CD player, as well as a 6-volt DC power outlet for compact portable CD players. These features may be combined so that the word list on your display corresponds with that on the CD, and so that the CD is directly controlled from your ORBITER 922!

*Word Lists in
Memory*

CD Control

In other words, by selecting a word on your display, that word can be transmitted from your CD player to your patient’s earphone at a given intensity, and his reply scored in % on the speech matrix!

6.2 INTRODUCTION TO SPEECH TESTING

A great many combinations of test parameters are available in speech audiometry as the following outputs are available:

Air, Bone, Free Field and Insert

and the following inputs:

CD/Tape 1, CD/Tape 2, Microphone

together with ipsilateral or contralateral masking with White Noise, Speech Noise or external noise (2 line inputs). If Bone or F.F. is selected, then masking via insert phone is also available.

Speech

Pressing this pushbutton directly accesses the speech measurement screen, displaying an audiogram, input/output sources and transducers, intensity and frequency, as well as a submenu for selecting test parameters and options by means of the softkeys. The input for each channel is displayed at each side of the screen above the output to each ear, which correspond to the LED's outside the display. If your speech screen differs, either the default settings have been changed (see chapter 8), or the ORBITER 922 has been configured as an ANSI version (see §6.2.4). This "graphic" screen is not used in the U.S.A., and is replaced in ANSI versions with a "numeric" screen where speech threshold data may be entered numerically into predefined fields.

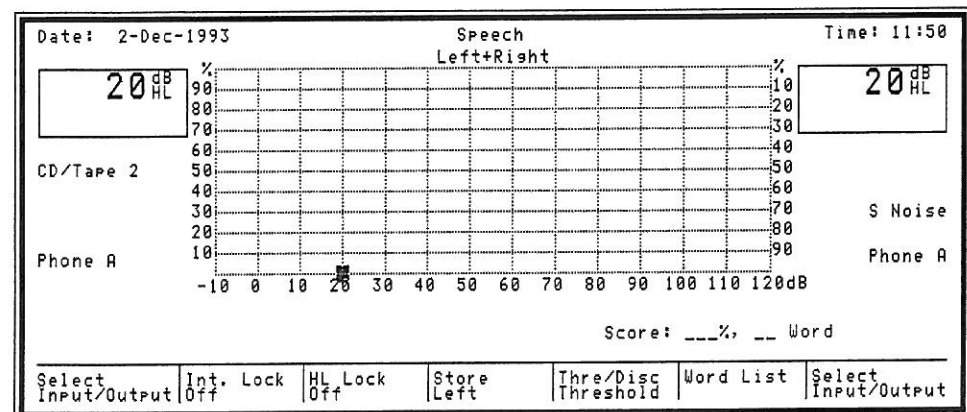


Fig. 6.1 Speech Audiometry Screen.

Input/Output Settings

Note that the input/output sources and transducers for both channels are those that were last selected (see §6.2.1 for details). Note too that this screen will only be presented if "Graphic" is selected in **Display** (refer to §6.2.4). Default settings may be changed—refer to chapter 8.

Select ear by means of **L/R Shift**, and turn the hearing level knob for that channel to set intensity—intensity is displayed in dB in the box in the relevant corner of the screen.

L/R Shift

The Speech submenu permits selection of input/output settings for both sides (**Softkeys 1 and 7**), Interrupter and Hearing Level Locks (**Softkeys 2 and 3**), as well as selection of Threshold, Discrimination or Word List (**Softkeys 5 and 6**). Note that the field above **Softkey 5**, for selecting threshold or discrimination, is only displayed in “Graphic” mode. The submenu may then be as follows:

The Speech Submenu

Select Input/Output	Int. Lock Off	HL Lock Off	Store Left	Thre/Disc Discrimin	Word List	Select Input/Output
1	2	3	4	5	6	7

Softkey 4 permits the storage of thresholds for subsequent print-out or data transfer. Shortly after pressing **Store**, the Message LED lights up and the following is displayed: “Data stored”.

Store Function

Erase data functions, display options and test parameters may be selected from **Option**, **Display** and **Setup** (see §6.2.3, §6.2.4, and §6.2.5 for further details).

Supplementary Functions

Note that default settings, i.e. left or right channel, input/output settings, display, intensity, frequency, HL resolution, Interrupter Function, Interrupter Lock, HL Lock, can all be changed—and these settings are stored in memory. See §8.2, for details.

Default Settings

Note that Softkey 6, which selects Word List from the Speech Audiometry submenu, is only activated if either Sp. Mat 1 or Sp. Mat 2 has been selected in Setup.

NOTE!

6.2.1 INPUT/OUTPUT SETTINGS

In Easy Mode, these settings are made via **Menu**, and the fields over Softkeys 1 and 7 display “Select Output” only—you can toggle through the available transducers, which are displayed on the sides of the LCD, and select them in this way. In Advanced Mode, the submenu illustrate in Fig. 6.1 is displayed. Press **Softkey 1** to change settings for left channel and **Softkey 7** to change settings for right channel.

Select via Softkeys 1 and 7

In either case, a box pops up consisting of 3 columns with options for stimulus input, masking input and output, respectively:

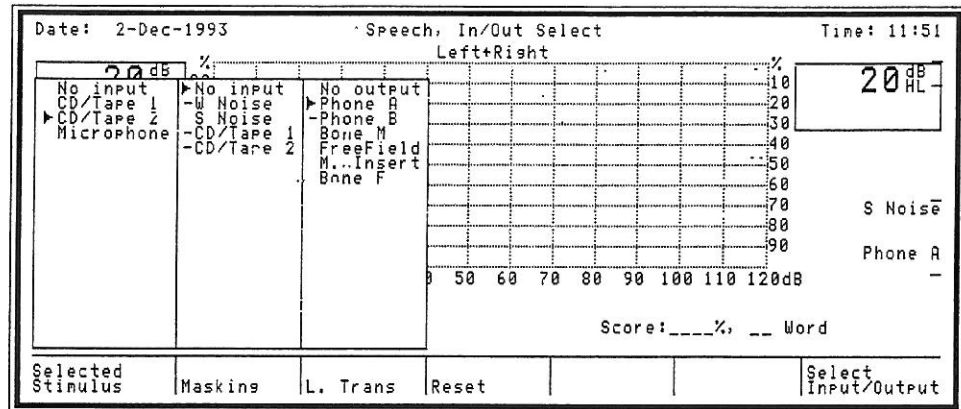


Fig. 6.2 Input / Output Settings (Speech).

If you now press **Softkey 7**, a similar box will pop up on the right side of the display.

Inputs / Outputs For Channel 1 / Channel 2

NOTE: Input/Output Settings for an instrument configured as a channel 1/channel 2 audiometer will present inputs and outputs differently, i.e. with stimulus on the left side and masking on the right.

ATTENTION!

When changing I/O settings, select in the following sequence:

1. Output
2. Stimulus
3. Masking

In the upper line of the submenu, the word "Selected" indicates which of the 3 columns is active, e.g. in Fig. 6.2, "Stim Input" is selected. Use the Frequency knob, left/right arrow keys or the appropriate softkey to select column. The > cursor may be moved by means of the up/down arrow keys or the appropriate Level knob. Options marked with a minus sign (-) are not available because of the combination of other options selected.

Options available for the left side are as follows (the available options for the right side are the same but in the opposite sequence, i.e. output, masking and stimulus):

Stimulus Input	Masking Input	Output
No input	>No input	No output
>CD/Tape 1	W Noise	>Phone A
CD/Tape 2	S Noise	Phone B
Microphone	CD/Tape 1	Bone M
	CD/Tape 2	FreeField
		M. Insert
		Bone F

In this example, the instrument is set to route stimulus from CD/Tape 1 without any masking through the headphone—which is the factory default setting. These settings are also those which apply after power-on (unless changed as a power-on option, see §8.2, Default Settings).

*Factory Default
Input/Output
Settings*

Please note that illegal combinations of inputs and outputs, i.e. ones requiring more than 2 channels, cannot be selected. If you should select such a condition and try to exit, the Message LED lights up and displays “Invalid I/O Setting”.

NOTE!

SOFTKEY 4

Press **Softkey 4** to reset all settings to no input or output.

Reset Function

Press **Exit** or **Speech** to exit and revert to the Speech screen. Note that the last selected input/output sources/transducers are now displayed.

*To Exit Input/
Output Settings*

It is also possible to enter this same speech testing mode by going through the selection tree from **Menu** (please refer to the next section §6.2.2).

Menu

6.2.2 MENU

In addition to pressing **Speech**, speech test mode can be accessed by going through the selection tree from **Menu**. If you have already selected Easy Mode, this is the only way to change test parameters without changing the Default Settings (see §8.2 for details). Instead of changing Input/Output settings, setting up a specific test is performed by means of selections from a series of menus. During menu selection, you are asked to select Test Mode, Stimulus Output, Stimulus Side, Stimulus Input, Masking, and Masking Input while the submenu at the bottom of the display shows which possible functions may be selected.

Menu

The choices available in each step are context-sensitive, i.e. they comprise only relevant items. For example, in speech audiometry, selecting CD/Tape 1 as stimulus input source limits masking line input to CD/Tape 2.

The selection sequence is condensed whenever possible, e.g. if Left+Right is selected, questions about masking will be omitted.

Softkey 7

In each step of the setup sequence, the previously selected parameters are displayed on the upper line of the display—cancellation of an entry can be accomplished by simply pressing **Softkey 7**, Previous, which returns you to the previous line (see Fig. 6.3).

Date: 28-Sep-1993	Menu	Time: 16:23
Test mode	: Speech	
Stimulus output	: Phone A	
Stimulus side	: Left	
Stimulus input	: CD/Tape 1	
Masking	: Ipsi	
Masking input	:	
..		
W Noise	S Noise	CD/Tape 2
		Previous

Fig. 6.3 Menu Selection (Speech).

Confirm Selections

After selecting the last parameter, the prompt “Is the above correct?” appears. Pressing **Softkey 1** to accept the setup accesses the Speech Audiometry screen (Fig. 6.1, with modifications), while pressing **Softkey 2** takes you back to the first menu selection, Test Mode.

Exit

You can exit at any point in the setup sequence, by pressing **Exit**, which returns you to the Identity screen, or by accessing any of the other Functions on the Control subpanel.

6.2.3 OPTION

Option

Pressing **Option** accesses the same submenu in all test modes:

Erase Air	Erase Bone F,M	Erase FreeField	Erase All	Erase FreeField	Erase Bone F,M	Erase Air
1	2	3	4	5	6	7

This function is primarily an “Erase” or “Delete” function and is used for erasing stored threshold data for air, bone, free field, for each ear, or all at once. Individual stored thresholds may be erased by moving the cursor to them, and pressing **Delete**.

Option

Option is also used when programming user tests or changing default settings (see chapter 8), and from Setup when entering a user-defined duration for the Interrupter Function.

Softkeys 1,2,3 erase data for the left channel, **Softkeys 5,6,7** for the right channel.

In setup mode, when Int. Func. (Interrupter Function) is selected, pressing **Option** permits direct numeric entry of duration (in seconds) from the Keypad.

*Numeric
Function In
Setup*

Option is also used when programming user tests or changing default settings (see chapter 8).

Option

Press **Exit** or **Option** to exit the Option submenu and return to the previous screen.

EXIT

6.2.4 DISPLAY

Pressing **Display** from Speech accesses one of several different screens depending on configuration or default settings. If your ORBITER 922 has been configured as an ANSI version, the “graphic” speech screen illustrated in Fig. 6.1 will have been replaced by the “numeric” speech screen shown in Fig. 6.5. Intensity and frequency values may also be displayed numerically as in conventional audiometers (“Big Values”). In addition, a special screen with word lists is available (if no word list has been selected or loaded in memory, three columns of blank fields will be displayed). LCD contrast may also be adjusted from this submenu.

Display

The Display submenu may appear as follows:

Graphic	Test mode Left+Right			Std curve Off		Contrast 45%
1	2	3	4	5	6	7

Pressing **Softkey 1** toggles between the different modes of showing test data: graphic audiogram (see Fig. 6.1) or numeric depending on configuration, word list display and the conventional digital readouts for intensity and frequency (see “Big Value” mode, Fig. 6.4).

*Graphic or
Numeric, Big
Value and Word
List Modes*

Thresholds may be stored in “Big Value” mode, but they are only plotted on-screen in “Graphic” mode. However, storing is confirmed by the Message LED lighting up and displaying a message that threshold data has been stored in memory.

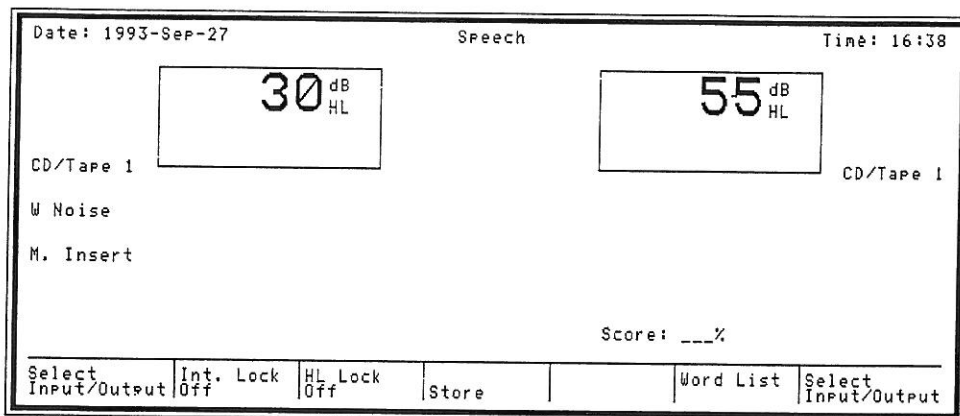


Fig. 6.4 Big Value Display Mode (Speech).

Fig. 6.5 below shows the display for entering numeric test results:

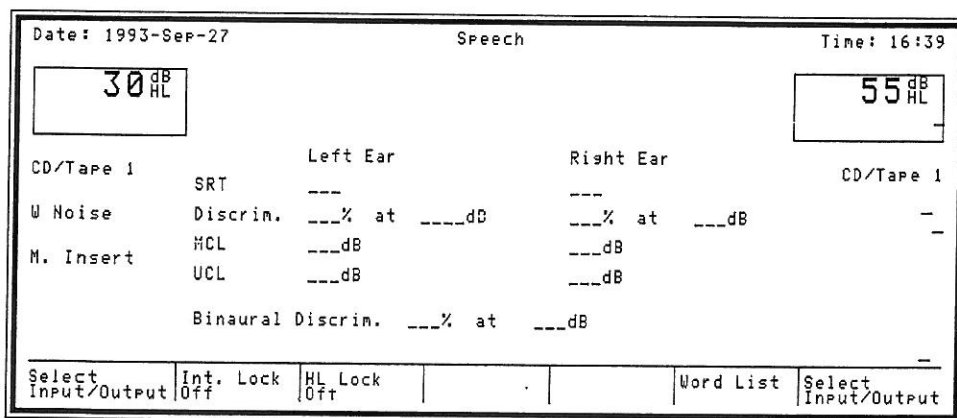


Fig. 6.5 Numeric Speech Display.

Fig. 6.6 below shows the display when "Word List" has been selected (and a word list has been downloaded into the audiometer's memory from a PC via ORBICON™). In this case, a number of words have been presented from a CD player, and scored. Please compare this screen with Fig. 6.7 on the next page

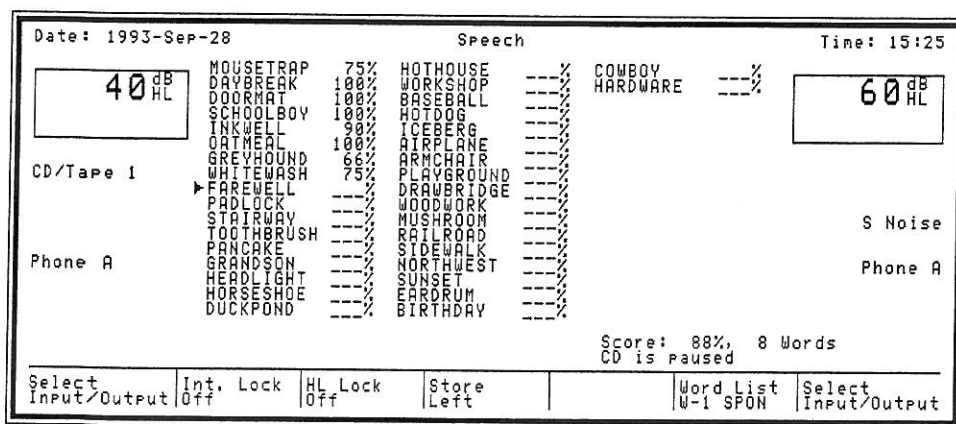


Fig. 6.6. Word List Display Mode.

showing exactly the same test (with a number of speech thresholds entered), but displayed as “Graphic”.

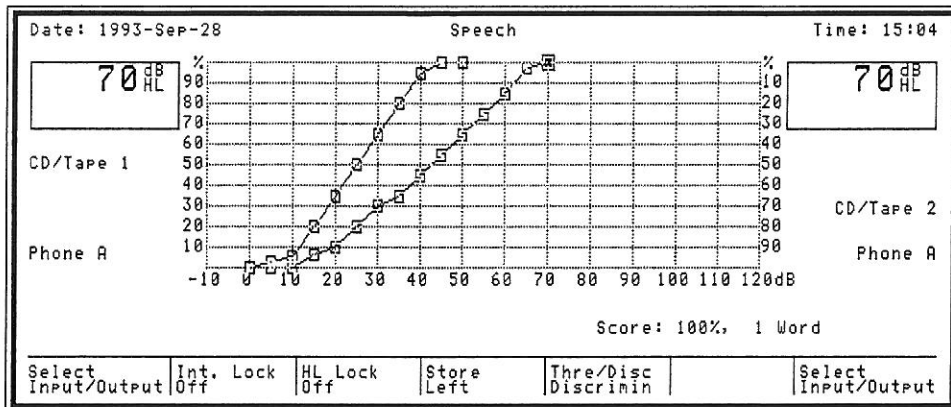


Fig. 6.7 Graphic Display Mode.

The submenus vary according to which form of speech display has been selected. Note that the field above **Softkey 5**, for selecting threshold or discrimination, is only displayed in “Graphic” mode.

To Select Threshold or Discrimination

Selection of Graphic Mode via **Softkey 1** also determines whether further options are displayed in the fields above Softkeys 2 and 5. If any other display mode is selected, these fields will be empty. If Graphic Display Mode is selected, the choices displayed in the Display submenu shown on page 6-7 will be available.

Graphic Display Mode

Softkey 2, Test mode, permits the selection of speech audiogram data displayed for left and right channels (default), left only or right only, as in Tone.

Softkey 2

Softkey 5, Std curve, is active only if any standard curves have been downloaded to the audiometer’s memory via ORBICON™.

Softkey 5

Standard curves may be memorized for Threshold, Discrimination, and Threshold + Discrimination. This function allows you to compare speech results with a “standard” set of results for a normal-hearing person. Standard curves may also be downloaded for individual Speech Materials (see §6.2.5.2 on Setup).

Contrast may be adjusted from the Display submenu by pressing and holding down **Softkey 7** while at the same time turning any of the Rotary Knobs. As screen contrast is changed, the setting displayed as a percentage in the submenu changes enabling you to note which settings are suitable for which lighting conditions.

LCD Contrast Adjustment

NOTE: LCD contrast setting is saved in NOVRAM, and will apply when the instrument is next powered on.

Contrast Setting Saved

Exit

Press **Exit** to exit the Display submenu and return to the previous screen. Note that the display has now been updated according to the changes made in the Display submenu.

6.2.5 SETUP

Setup

Pressing this pushbutton accesses different screens depending on current test mode, i.e. setup options for pure tone audiometry differ from those for speech audiometry. Setup allows you to alter test parameters for each particular test mode, i.e. it is context-sensitive. This mode is not to be confused with System Setup, which is used for basic instrument functions such as language and clock, and which may be accessed by pressing **Setup** when powering on (please refer to chapter 10).

Setup Inactive in Easy Mode

Please note that this pushbutton is inactive in Easy Mode! Return to I.D. screen and select Advanced Mode.

Setup settings are stored temporarily (i.e. they are not memorized after the power supply is cut off). To store setup settings in the audiometer's non-volatile memory, the User Test function must be employed.

The setup screens for tone and speech audiometry include display of date and time at the top, and display of current input/output status for each channel.

6.2.5.1 SETUP FOR SPEECH AUDIOMETRY

The speech audiometry setup screen and submenu are displayed below:

Date: 30-Nov-1993		Speech, Setup		Time: 14:42	
▶Left Channel: Input CD/Tape 1 Output Phone A					
Right Channel: Input S Noise Output Phone A					
1.0 dB 2.0 dB 3.0 dB 5.0 dB 10.0 dB				Off ▶On	Off ▶Sp.Mat 1
				CD Player: Philips AZ	▶Manual (0ms) 1.0 Sec. 1.5 Sec. 2.0 Sec. 2.5 Sec. 3.0 Sec. 5.0 Sec. 7.0 Sec. 10.0 Sec.
HL Res.				CD Mode	Speech mat Int. Func.

Fig. 6.8 Setup For Speech Audiometry.

The cursor "Selected" indicates which column of parameters is active. The Frequency knob as well as the left/right cursor keys and softkeys may be used for selecting column, while the Level knobs and the up/down cursor keys move the >cursor from parameter to parameter.

6.2.5.2 NOTES ON SPEECH SETUP

L/R SHIFT

Changes between left and right channel. Note that the ► cursor at the top left of the screen moves as you change channel. Different setup parameters can be stored for each individual channel—with the exception of Interrupter Function, i.e. whether the Interrupter (Tone Switch) functions manually or with a preset duration is the same regardless of which channel is selected.

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

CD MODE

This function is only relevant if an external CD player has been connected. To control a CD player from your ORBITER 922, select "On". In Fig. 6.8, a Philips AZ series portable CD player has been selected (please contact your local Madsen representative re drivers for different CD players).

CD Mode

SPEECH MATERIALS

This function is only relevant if any speech materials have been downloaded by means of ORBICON™.

Speech Materials

Select Sp.Mat 1 or Sp.Mat 2 to activate the word list function in speech audiometry.

Softkey 6

Note that Softkey 6, which selects Word List from the Speech Audiometry submenu, is only activated if Sp. Mat 1 or Sp. Mat 2 has been selected in Setup.

NOTE!

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** (Interrupter) down.

Int. Funct.

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 that is entered by means of **Option** and the Numeric Keypad.

6.2.6 DATA TRANSFER

Softkey 4

Pressing **Softkey 4**, Store, while in 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 by the PC.

Please refer to chapter 12 for further details on data transfer to a PC.

6.2.7 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 printout (with the exception of 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

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.

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

6.3 SPEECH TESTING

This section gives a short cookbook description of how to operate the ORBITER 922 Clinical Audiometer for air conduction (AC), bone conduction (BC) and free-field speech measurements.

6.3.1 SPEECH TESTING WITH LIVE VOICE SIGNAL

With a live voice signal it is possible to perform either threshold measurements or discrimination tests and to present the stimuli via Air, Bone or Free Field.

1. Plug the headphones, patient microphone, patient response handswitches, bone conductor and monitor headset (or Talkover microphone) into their respective connectors (see §2.3).
2. Connect the ORBITER 922 to an AC power outlet (see §2.3).
3. Switch on the instrument by pressing the power switch on the back right of the rear panel.
4. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or which ever screen has been configured as the start-up screen). Enter I.D. data and press **Speech**.
5. Press **Display** and, using **Softkey 1**, select which kind of screen should be displayed for your speech test.
6. Use Select Input/Output (or **Menu**) to set up live voice test. Output may be Air, Bone or even Free Field but **Microphone** must always be selected as input. If you have a suitable word list installed in your ORBITER 922, press **Softkey 6** and select desired word list using up/down arrows and **Enter**.
7. To adjust microphone level, press and hold down **Talkover**, and read from a word list while turning the **Frequency** knob so that the stimulus level on the Output LED deflects up to O VU. See §9.5 for further details. Talkback and Talkover may also be adjusted by turning the corresponding **Level** knob.
8. Place patient in sound cabin facing away from the audiometer.
9. Instruct the patient to repeat the words he hears and test each ear in turn (using **L/R Shift**).

Refer to §6.4.3 for further details on live voice testing.

6.3.2 SPEECH TESTING WITH TAPE MATERIALS

With prerecorded speech materials on tape, it is possible to perform either threshold measurements or discrimination tests and to present the stimuli via Air, Bone or Free Field. Please refer to §6.4.4.1 and §6.4.4.2 for details concerning threshold measurements and discrimination testing in speech audiometry.

Note that only recorded speech materials with a stated relationship with a calibration signal should be used.

1. Plug the headphones, patient microphone, patient response handswitches, bone conductor and monitor headset (or Talkover microphone) into their respective connectors (see §2.3).
2. Connect the tape recorder to the socket marked CD/Tape 1 on the rear panel. If masking with a prerecorded signal is to be used, connect the signal to the socket marked CD/Tape 2.
3. Connect the ORBITER 922 to an AC power outlet (see §2.3).
4. Switch on the instrument by pressing the power switch on the back right of the rear panel.
5. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or which ever screen has been configured as the start-up screen). Enter I.D. data and press **Speech**.

Speech

5. Press **Display** and, using **Softkey 1**, select which kind of screen should be displayed for your speech test.
6. Use Select Input/Output (or **Menu**) to set up tape test. Output may be Air, Bone or even Free Field but **CD/Tape** must always be selected as input.

Display

6. Start playback unit with calibration signal and adjust input level by pressing **Level Adj.**, select Next, and then the appropriate **CD/Tape** pushbutton and turn one of the **Level** rotary knobs so that the stimulus level on the Output LED deflects to 0 VU. See §9.5 for a more detailed description of Level Adjustment.
7. Place the patient in sound cabin facing away from the audiometer.

Level Adj.

8. Instruct the patient to repeat the words he hears and test each ear in turn (using **L/R Shift**).

L/R Shift

Refer to §6.4.4 for further details on testing with prerecorded signals.

6.3.3 SPEECH TESTING WITH CD PLAYER

With prerecorded speech materials on CD, it is possible to perform either threshold measurements or discrimination tests and to present the stimuli via Air, Bone or Free Field. Please refer to §6.4.4.1 and §6.4.4.2 for details concerning threshold measurements and discrimination testing in speech audiometry.

Note that only recorded speech materials with a stated relationship with a calibration signal should be used.

A CD player may be used in exactly the same way as a tape deck (§6.3.2), or you can utilize ORBITER 922's sophisticated CD Control feature. In the latter case, it is recommended that your local Madsen distributor configures your ORBITER 922 to match your CD player.

1. Plug the headphones, patient microphone, patient response handswitches, bone conductor and monitor headset (or Talkover microphone) into their respective connectors (see §2.3).
2. Connect the CD player's line output to the socket marked CD/Tape 1 on the rear panel. If masking with a prerecorded signal is to be used, connect the signal to the socket marked CD/Tape 2.
3. For direct CD Control, connect either the optional infrared transmitter cable (part no. 8-71-510) or the optional RC5 interface cable (part no. 8-71-480) to your CD player, and to the socket marked CD Ctrl. on the rear panel.

CD Connections

If you are using a compact portable CD player, you can also connect the DC input to the audiometer's 6V DC output, also located on the rear panel.

Portable CD Player

4. Connect the ORBITER 922 to an AC power outlet (see §2.3).
5. Switch on the instrument by pressing the power switch on the back right of the rear panel.
6. After the power-up test has been completed, the audiometer will automatically access the Identity screen (or which ever screen has been configured as the start-up screen). Enter I.D. data and press **Speech**.
7. Press **Display** and, using **Softkey 1**, select which kind of screen should be displayed for your speech test.

Speech

Display

8. Use Select Input/Output (or Menu) to set up tape test. Output may be Air, Bone or even Free Field but **CD/Tape** must always be selected as input.

Level Adj.

9. Insert the appropriate CD into your CD player and start the calibration signal on the CD. Adjust input level by pressing **Level Adj.**, select Next, then the appropriate **CD/Tape** push-button and turn one of the **Level** rotary knobs so that the stimulus level on the Stimulus LED deflects to 0 VU. See §9.5 for a more detailed description of Level Adjustment.

Setup

10. Press **Setup**, select CD Mode on with **Softkey 5**, and speech materials with **Softkey 6**. Press **Speech** or **Exit**, to exit.
11. Select Word List from **Softkey 6**, use arrow keys to select a word list, and press **Enter**—your CD player is now on standby. See 6.3.3.1, CD Control, below for further instructions.
12. Place the patient in sound cabin facing away from the audiometer.

L/R Shift

13. Instruct the patient to repeat the words he hears and test each ear in turn (using **L/R Shift**).

Refer to §6.4.4 for further details on testing with prerecorded signals.

NOTE!

Note that Softkey 6, which selects Word List from the Speech Audiometry submenu, is only activated if either Sp. Mat 1 or Sp. Mat 2 has been selected in Setup.

6.3.3.1 CD CONTROL

To control a CD player from your ORBITER 922, first ensure that the two instruments are compatible (check with your Madsen Electronics' representative). The procedure for testing with CD Control varies according to whether a duration in seconds has been specified for each word via ORBICON™, or not.

Next, connect the two instruments as described in §6.3.3 #2, #3 on the previous page.

Calibrate CD signal (§6.3.3 #9), set up audiometer for speech testing (§6.3.3), and check that a CD player is selected in **Setup**, CD Mode—ensure that the speech materials in ORBITER 922 match the CD in your CD player!

Select Word List from **Softkey 6**, use arrow keys to select a word list, and press **Enter**—your CD player is now on standby. On the audiometer's display, just above the submenu, can be seen the message "CD is paused" (see Fig. 6.9 below).

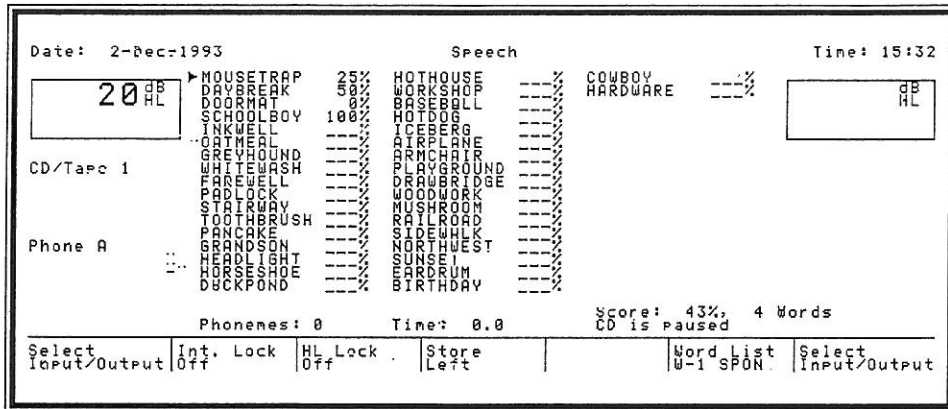


Fig. 6.9 Word List Display Mode With CD Control.

Press **Enter** and the first word will be presented. How the test now proceeds depends on whether a duration (Time) has been specified for your word list (underneath the word list in Word List Display Mode, duration is specified in seconds, or you can see "Time: 0.0" - see Fig. 6.9).

Enter

If a duration in seconds for each word has been specified, the word will be presented and the CD player will pause after that duration. You can proceed either by scoring the word or by skipping it by means of the down arrow key. The CD player will then continue with the next word, and stop.

With Duration Specified

To score a word, you must use the Keypad. Score 100% by pressing + (plus), and 0% by pressing - (minus). You can also select any number between 0 and 100 by keying it in directly on the Keypad and then pressing **Enter**. If you press the down arrow key, that word will be skipped and the test will continue with no score entered.

Scoring

If you have specified phonemes (also via ORBICON™ and also displayed in Word List Display Mode, see Fig. 6.9), you can not only score as specified above, but also by entering a number corresponding to the number of phonemes the subject scored. For example, if a word has 4 phonemes, and you enter 3 from the Keypad, the score 75% will appear on the LCD: 3 out of 4 = 75%.

Phonemes

If no duration for each word has been specified, the CD player will have to be paused manually by pressing **Enter**; otherwise, it will continue to present one word at a time, relatively quickly, until you pause it with **Enter**. Scoring is done in exactly the same way as described above.

Without Duration Specified

The display shows each word presented while tracking the number of words presented and the score in %. The cursor on the speech matrix moves up and down reflecting the score.

Automatic Tracking of Score

<i>To Restart Word List</i>	To go back to the beginning of the word list, pause the CD player by pressing Enter , press Softkey 6 , Word List, and reselect word list.
<i>To Stop CD Player</i>	To stop CD player, pause by pressing Enter , then press Softkey 6 , Word List, and either select the empty space at the top of the index of speech materials, or simply press Exit and leave the Speech Audiometry screen.

6.3.4 FREE-FIELD SPEECH TESTING

Free-field testing is often employed in speech audiometry when testing children because many children dislike wearing headphones. Testing for threshold or speech discrimination is as described above for live voice and tape/CD except for the following:

- A pair of (optional) loudspeakers may be connected to the sockets marked Speaker Left and Right on the rear panel and set up in the sound cabin so that the stimulus channel faces the left ear and the masking channel faces the right. Alternatively, an external power amplifier and a pair of loudspeakers can be connected to the sockets marked Free Field Left and Right
- F.F. must be selected as output when setting up test (Select Input/Output or **Menu**).

Please refer to §6.4.6 for further details on free-field testing in speech audiometry.

6.4 THEORY OF SPEECH AUDIOMETRY

Either live voice or speech from tape or CD can be used for speech audiometry and both measurements can be performed using the ORBITER 922. The audiometer has connections for microphone for live voice or tape recorder (or CD player), from which you can play back word lists for threshold and discrimination determination. The auxiliary CD/Tape channel (CD/Tape 2) may be used for recorded masking.

6.4.1 SPEECH RECEPTION THRESHOLD

The definition of the speech reception threshold (SRT, and also known as the speech recognition threshold) varies from country to country. The American National Standard (ANSI, 1969) specifies that 0 dB hearing level for speech is an SPL of 19 dB when normal threshold is based on 50% correct responses to two-syllable words (spondees). This threshold may also be expressed as the lowest SPL at which 50% or more of the spondaic test words are repeated correctly. Spondees are words of two syllables having equal stress, e.g. shotgun, airplane, workshop, etc.

*ANSI Definition
of SRT*

Threshold word lists are used for this test. Each ear is tested separately and the patient is requested to repeat the word he hears one at a time.

*Threshold
Word Lists*

It is recommended to begin with the better ear, at 1000 Hz and with the hearing level set at approximately 20 dB above the threshold. The audiologist then begins to repeat the words reducing the intensity in 5 dB steps until the patient is only able to repeat about half the words.

In order to obtain an exact result, a complete word list must be presented to the patient (approximately 20 words). Under normal circumstances, it is possible after the presentation of only a few words to find the threshold and the rest of the list is used for verifying the result. A descending, ascending and then descending again technique has been recommended for both recorded and live voice procedures (Norma T. Hopkinson).

This test may be performed using either live voice or recorded speech. However, live voice presentation may be recommended both for its effectiveness and flexibility enabling the clinician to fit the test to the patient's particular needs. In any case, it is of utmost importance that the patient be adequately instructed.

6.4.2 DISCRIMINATION TESTING

For this test, use word lists with phonetically balanced words. Each ear is tested separately and the patient is requested to repeat the words he hears. Using the discrimination test you investigate the patient's ability to discriminate speech at different intensities. In normal ears, the perception is 100% if the words are presented at a proper intensity. For certain types of hearing

loss, the patient only perceives about 40 to 50% of the presented words, no matter what intensity is used.

*Discrimination
Percentage*

Furthermore, you will find certain cases where the discrimination percentage is less when a certain intensity is exceeded. The discrimination percentages at different intensities are normally entered on a special speech audiogram which graphically shows the ratio between the intensity and the discrimination percentage.

Set hearing level so that the patient just hears the words above threshold level, thereafter present the complete word lists and observe the discrimination percentage. Increase the intensity 10 dB and present the new word lists and observe again the discrimination percentage. Continue in this way until the maximum intensity of the audiometer is reached. If the patient feels uncomfortable when presented with the higher intensity, the measurements will probably have to stop at an intensity lower than the maximum. By entering the results in the audiogram form you can read which intensities give the greatest discrimination percentage. The discrimination percentage can also be expressed as discrimination loss. This is simply the difference between maximum possible discrimination percentage of 100 and the discrimination found. For example, if the patient has discrimination percentage of about 75, he is said to have a discrimination loss of $100-75 = 25\%$.

6.4.3 SPEECH AUDIOMETRY WITH LIVE VOICE

Live voice examinations can only be carried out when the audiometer is used in connection with a sound room, so that the patient cannot hear the Audiologist's voice directly. With Audiologist and patient in the same room, especially in examinations of patients with normal or almost normal hearing, false results would be obtained.

Using a tape recorder to present word lists gives the advantage of always presenting the same program for the patient, even if there is a short or longer interval of time between the examinations. If live voice is used, there is the risk that it is not the same investigator each time and this can influence the results. However, the standardization of recorded tests has the disadvantage of lacking the flexibility of live voice testing, which enables the Audiologist to better fit the test to the patient's individual needs.

If a sound room is not used, varying background noise levels can also influence the results greatly. Speech audiometry, however, can be carried out if you have a comparatively quiet room and the

audiometer is equipped with ME 70 noise-excluding headset. Either one or both channels can be used for speech audiometry.

6.4.3.1 LIVE VOICE THRESHOLD MEASUREMENTS

Select the following setup: Speech, Phone A, Left, Micr., No Mask.

This gives the following display:

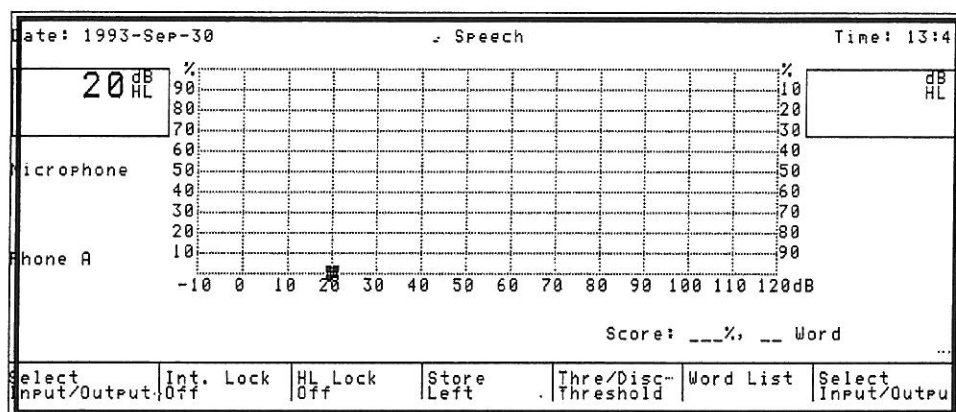


Fig. 6.10 Speech Audiometry Screen For Live Voice.

Before commencing the test, adjust Microphone Level. Put on the monitor headset or place the gooseneck microphone approximately 20 cm from your mouth, and read from the word list. The channel 1 VU meter should give peak deflection at 0 VU. If not, adjust the Microphone Level by pressing **Level Adj.** to display the Level Adjustment bar-graphs, selecting **Microphone** and simultaneously turning one of the **Level** rotary knobs. Alternatively, press **Talkover** and adjust the level by turning the **Frequency** rotary knob.

Level Adj.

The intensity of the speech presented to the patient can now be read on the Output LED. The intensities shown are dB re normal threshold. During the test the operator should speak with the same intensity and keep the same distance from the microphone in order to maintain deflections on the VU meter at zero.

Use a word list intended for threshold measurements. Test each ear in turn (use the L/R Shift pushbutton) and ask the patient to repeat the words he hears. Set stimulus Hearing Level so that the patient can just repeat the words with certainty. Then reduce intensity in 5 dB steps using Hearing Level until the patient can only repeat 50% of the presented words. Then read the hearing loss on the digital read out. In order to assure as valid a measurement as possible, 20 words should be presented to the patient. Under normal conditions the threshold can be found by using a few words and the rest are only used to confirm the test.

6.4.3.2 LIVE VOICE DISCRIMINATION TEST

Select the following setup: Speech, Phone A, Left, Micr., No Mask (see Fig. 6.10).

Adjust Microphone Level

Before commencing the test, adjust Microphone Level. Put on the monitor headset or place the gooseneck microphone approximately 20 cm from your mouth, and read from the word list. The channel 1 VU meter should give peak deflection at 0 VU. If not, adjust the Microphone Level by pressing **Level Adj.** to display the Level Adjustment bar-graphs, selecting **Microphone** and simultaneously turning one of the **Level** rotary knobs. Alternatively, press **Talkover** and adjust the level by turning the **Frequency** rotary knob.

The intensity of the speech presented to the patient can now be read on the stimulus LED. The intensities shown are dB re normal threshold. During the test the operator should speak with the same intensity and keep the same distance from the microphone in order to maintain deflections on VU meter at zero.

For this test, use word lists with phonetically balanced words. Each ear is tested in turn (use the L/R Shift pushbutton) and the patient is asked to repeat the words he hears.

The intensity is normally set at a level of 40 dB above the patient's threshold. Patients with normal hearing will be able to repeat 100% of the presented words. In some cases of hearing loss, the discrimination is only 40-50% or less, independent of intensity. There are cases where increase in intensity above a certain level gives a poorer discrimination.

6.4.4 SPEECH AUDIOMETRY WITH TAPE OR CD INPUT

The procedure for speech audiometry with tapes or CD's is the same as that described above for live voice examinations. For these examinations, recorded word lists for threshold determination as well as for discrimination determinations are available. Note that only recorded speech materials with a stated relationship with a calibration signal should be used.

The tape recorder or CD player is connected to the socket marked "CD/Tape 1". For thorough examinations, special noise, theatre noise, cocktail party noise, etc., may be required. The stereo recording can be played back correctly with the correct intensities, as the intensity can be controlled for each ear separately.

It is very essential that the talkback system is one of really good quality with little distortion, or the patient may show discrimina-

tion loss just because the repetition of the word lists cannot be heard clearly. The patient's microphone should also be of a really good quality and uni-directional. It should be placed very close to the patient. This is especially true when working with great intensities in free field.

6.4.4.1 RECORDED WORD LISTS (THRESHOLD)

Select the following setup sequence:

Speech, Phone A, Left, CD/Tape 1, No Mask.

The following display appears:

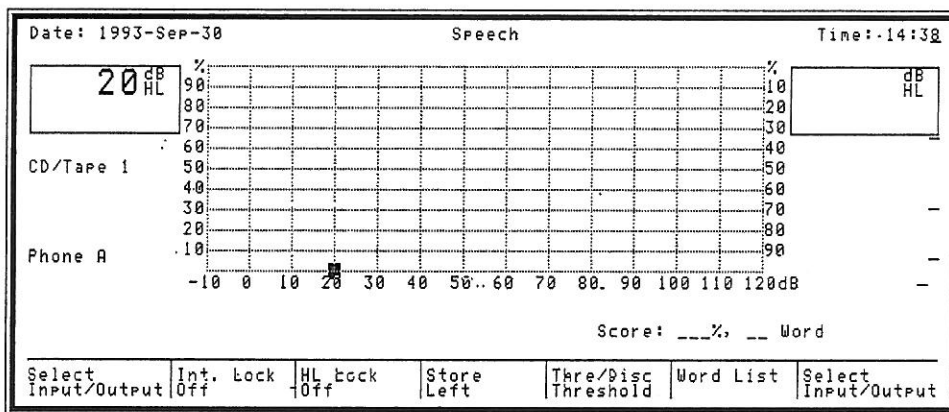


Fig. 6.11 Speech Audiometry Screen For Thresholds.

Start playback unit and check that the VU meter gives deflection to 0 VU. If necessary, adjust CD/Tape 1 level by pressing **Level Adj.**, **Softkey 7**, Next, and then CD/Tape 1 to select the bargraph: turn one of the **Level** rotary knobs. The HL level can then be read directly on the display.

Level Adj.

Use a word list intended for threshold measurements. Test each ear in turn and ask the patient to repeat the words he hears. Set stimulus HL so that the patient can just repeat the words with certainty.

Next, reduce intensity in 5 dB steps using Hearing Level until the patient can only repeat 50% of the presented words. Then read the hearing loss on the display. In order to assure as valid a measurement as possible, 20 words should be presented to the patient. Under normal conditions the threshold can be found by using a few words and the rest are only used to confirm the test.

6.4.4.2 RECORDED WORD LISTS (DISCRIMINATION)

Select the following setup sequence:

Speech, Phone A, Left, CD/Tape 1, No Mask (Fig. 6.10).

Level Adj.

Start playback unit and make sure the VU meter gives deflection to 0 VU. If necessary, adjust CD/Tape 1 level by pressing **Level Adj.**, **Softkey 7**, **Next**, and then CD/Tape 1 to select the bargraph: turn one of the **Level** rotary knobs. The HL level can then be read directly on the display.

For this test use word lists with phonetically balanced words. Each ear is tested in turn and the patient is asked to repeat the words he hears. The intensity is normally set at a level of 40 dB above the patient's threshold. Patients with normal hearing will be able to repeat 100% of the presented words. In some cases of hearing loss, the discrimination is only 40-50% or less, independent of intensity. There are cases where increase in intensity above a certain level gives a poorer discrimination.

6.4.5 SPEECH AUDIOMETRY AND MASKING

Masking is very important in speech audiometry as there is still the risk of response from the ear not being tested. In word discrimination testing, this danger is greater than in pure tone audiometry since the signal is presented to the test ear at a suprathreshold level. "Masking must be used whenever the presentation level for this suprathreshold task, minus the interaural attenuation, exceeds the bone conduction thresholds of the non-test ear" (Jean H. Lovrinic, in *Audiology for the Physician*, 1980).

Speech noise is generally recommended as the masking noise of choice but white noise is also favored by many—narrow-band noise, while used extensively in pure tone audiometry, is too narrow in frequency response for use in speech audiometry. Speech noise is actually white noise filtered to a low and middle frequency spectrum.

For speech audiometry, the ORBITER 922 enables masking to be employed together with Air, Bone and F.F. outputs. Contralateral, ipsilateral and binaural routings are available just as in pure tone audiometry, and white noise, speech noise or CD/Tape (1 or 2) may be selected. Any type of prerecorded masking may be used via the CD/Tape input.

To select masking for speech audiometry, select the following setup: Speech, Phone A, Left, Micr., Phone A. The screen illustrated in Fig. 6.12 appears on the display.

From the submenu, you can select the required masking noise: White Noise, Speech Noise, CD/Tape 1, or CD/Tape 2.

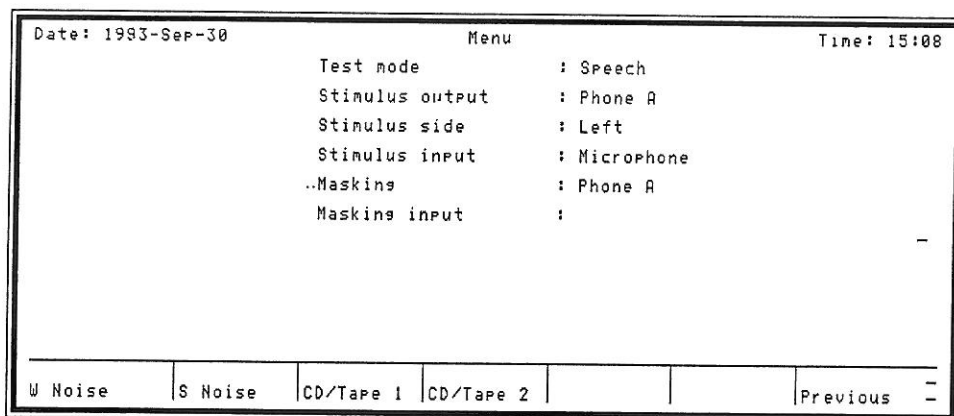


Fig. 6.12 Test Setup For Masking (Speech).

If speech noise is chosen, the following is displayed:

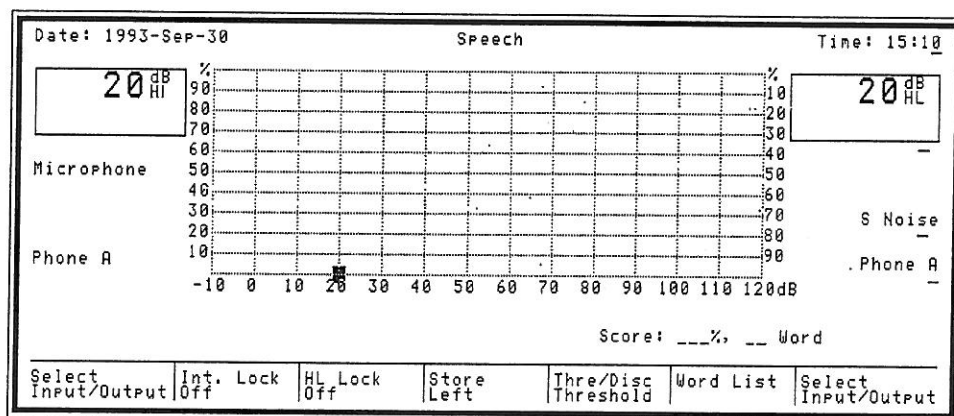


Fig. 6.13 Speech Audiometry Screen For Masking.

Note that “S Noise” is displayed on the right of the screen as output to Phone A.

6.4.6 FREE-FIELD SPEECH AUDIOMETRY

The ORBITER 922 is designed so that it can be used for free-field speech audiometry utilizing its built-in power amplifier and a pair of external loudspeakers. It can also be used in combination with suitable external power amplifiers and loudspeakers. Different types of amplifiers may be used depending on the maximum intensity level required in the free field. These intensities can vary from 80–100 dB above threshold, corresponding to 100–120 dB sound pressure level.

Both distance from the loudspeaker to the patient and the degree of absorption of the sound room are very critical factors. Power

free-field amplifier/loudspeaker units are specially designed to meet these requirements.

Menu

To select speech audiometry for free field, select the following setup sequence via **Menu**:

Speech, F.F., Left, CD/Tape 1, No Masking

The screen illustrated in Fig. 6.13 appears on the display.

This setup selects Tape signal as input to the Left amplifier and disables the masking channel. Alternatively, masking may be selected—the signal may be either white noise or speech noise or CD/Tape (1 or 2). Any type of prerecorded masking may be used via the CD/Tape input.

L/R Shift

Pressing **L/R Shift** interchanges the signal to the loudspeakers in the same way as it shifts the signal between the earphones.

Level Adj.

The CD/Tape 2 signal may be adjusted by pressing **Level Adj.**, **Softkey 7**, **Next**, and then **CD/Tape 2** to select the bar-graph: turn one of the **Level** rotary knobs for adjustment. In this case, the Stimulus LED functions as a VU meter for the *masking* signal and the sensitivity of the CD/Tape 2 signal may be adjusted until it deflects to zero. The HL level can then be read directly on the display.

Free-field speech audiometry is especially used for fitting hearing aids, particularly for the perceptive type hearing loss where the hearing aid's frequency response, and setting of the AVC, is of great importance in order to obtain as good a discrimination percentage as possible (as little discrimination loss as possible).

Free field speech audiometry is also very useful in connection with examining children seeing as how many children dislike wearing headphones. By examining children with narrow-band noise masking in free field, a very good idea of their hearing ability is obtainable.