

ILO96

OAE Research System



Installation & Calibration Manual

Otodynamics Ltd

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The ILO96

The ILO96 provides unique facilities for otoacoustic emission measurement, including advanced functions for auditory research. It includes all the OAE measurement functions provided by our other instruments. The special research functions not available on other Otodynamics products are provided by an extension to the Version 5.6 software and by the four-channel channel hardware of the ILO96. This software extension is under continued development and purchasers of the ILO96 will be provided with regular updates, free-of-charge.

Summary of specification

The ILO96 provides four stimulus channels and two input channels, each capable of operating at up to 40 KHz digitisation rate. The unit can run all existing ILO88, ILO92 and ILO-V5 software, providing comprehensive DPOAE and TEOAE measurements. All standard Otodynamics probes can be used with the ILO96. Adaptors are available for use with original 5-pin probes. A range of probes is supplied with the instrument, including easily disassembled and cleaned screening probes, dedicated clinical DPOAE probes and a special three-stimulus laboratory probe. Two probes can be used simultaneously with the device when binaural stimulation and/or recording is being undertaken. The amplifier modules of the ILO96 are self-testing, being fitted with a number of programmable 'loop-back' switches.

The ILO96 is intended to provide regular screening, clinical investigation and upgradable research facilities. It requires a full sized ISA expansion slot which is normally found only in desktop style PCs. The unit requires power to be supplied to the amplifier and so is not suitable for portable, battery operation.

The ILO96 promise

Otodynamics promises purchasers of the ILO96 regular updates of software (at least every six months for the three years following purchase), providing the latest research software and documentation available at that time. Otodynamics invests in a programme of OAE research in association with the Institute of Laryngology and Otology (University College London) and aims to give users of the ILO96 advantage of developments in technique arising from this research, at the same time as publication of scientific results of such research. Otodynamics promises that ILO96 users will be

able to perform all measurement functions available on currently existing Otodynamics hardware. In the event that Otodynamics finds it necessary to introduce a new product with facilities and OAE measurement functions not conceived of or provided in the ILO96 hardware, then ILO96 owners will be entitled to a discount on purchasing the new Otodynamics hardware in exchange for their ILO96, for a period of three years after purchase.

ILO96 purchasers are asked to note that they have purchased the right to use an evolving library of specialised OAE software. Functions which are experimental in nature will be clearly identified in literature provided with the software. Whilst Otodynamics will make every effort to ensure that the experimental software functions reliably and correctly, Otodynamics cannot accept responsibility for any inadequacy in the software and documentation provided. Users of research level experimental OAE functions should therefore take care to test and evaluate software provided to make certain that it fulfils their particular requirements. Otodynamics will make reasonable efforts to accommodate the particular needs of individual users in modifying its software, where this modification will be of use to some other ILO96 users. We therefore welcome comments and suggestions for software changes and new facilities.

Pre-installation checks

Please note:

This manual is for the use with the ILO96 system.

It includes information on upgrading the ILO92 to ILO96 specification. ILO96 is a research specification, requiring IRB approval for use in the US.

Before you begin setting-up or upgrading your ILO system, please take a moment to check that you have the appropriate items:

- ILO96 OAE system amplifier unit



- Amplifier power supply unit



- ILO 1-card interface with four-stimulus capacity

NB: This circuit card is sensitive to static and should be kept in its antistatic bag at all times. The normal precautions for handling electronic equipment should be taken. If you are unfamiliar with these procedures, please see a qualified person.



- Cross coupler plug (used to test distortion levels in the amplifier circuitry)



- Interface cables - two blue cables are supplied (marked ILO96 A and B respectively).



- Each cable is clearly marked A or B on both connectors. The 25-pin connector should be fitted to the amplifier and the 15-pin connector to the interface card.



- SNS-type newborn TEOAE serviceable probe (blue)



- SGS-type general purpose TEOAE serviceable probe (red) or SNS type newborn TEOAE serviceable probe (blue) (includes 20dB attenuator)



- SGD-type general purpose DP+TEOAE serviceable probe (grey)



- SND-type newborn DP+TEOAE serviceable probe (yellow)



- Probe service kits



- BP adult DPOAE probe



- BT1 laboratory research three-stimulus OAE probe



- Starter pack of replacement probe tips and also serviceable



- 1cc acoustic probe test cavity



- Optional 5-pin to 8-pin probe coupler (allows older style 5-pin connector to be fitted into the 8-pin socket)



- ILO OAE System Installation and User Manuals plus ILO Version5 software and Registration Disk enabling research functions of the ILO-V5 software



Computer system requirements

Recommended minimum system requirements when used with Version5 software:

- 486 33MHz PC
- 8MB RAM
- VGA or better

The higher the specification of your computer, the faster the system will operate. The ILO96 system will function on basic 386 machines with reduced speed.

ILO96 amplifier

The ILO96 amplifier contains two identical two-channel stimulus and response amplifiers, together with signal attenuators and logic control switches. The unit requires 12V AC to be applied.



Connectors

The ILO96 amplifier has two eight-pin probe sockets on the front panel. These are labelled Probe 1 and Probe 2. Probe socket 1 is used for Transient and regular DP measurements. Probe socket 2 provides the third stimulus channel for advanced three-tone DP measurements and contralateral suppression work. Probe socket 2 also includes the auxiliary signal input, allowing for dual channel recording of OAEs.

Standard TEOAE and DPOAE probes plug directly into probe socket 1. The special three-tone probe has two plugs, marked 1 and 2. For certain applications, two standard probes may be required, one fitted to each socket. All standard OAE measurements are made through probe socket 1. No recording is possible if the probe is accidentally fitted to socket 2.

The rear of the ILO96 amplifier carries two 25-pin D-type female connectors, labelled A and B. Sockets A and B each receive a cable from the ILO96 expansion card fitted to the computer. The most common cause of apparent malfunction of the ILO expandable system is crossing over of the A and B cables at the rear of the amplifier. (A must go to A and B must go to B). Connector A provides the F1 signal to and receives the microphone signal from probe socket 1. Connector B provides the F2 signal to probe socket 1. Connectors A and B carry additional signals, including the digital controls for the amplifier routing relays and attenuators. Cables must be fitted to Connectors A and B for the unit to work correctly. A second microphone input channel is provided for probe socket 2, together with an additional stimulus channel (F3). The F3 signal appears on the socket pin number which carries the F1 stimulus to facilitate stimulation with F3 via a standard Otodynamics single or DP probe in probe socket 2.

Also on the rear of the amplifier is the two-pin power connector, which is connected to the external power adaptor. A green LED is illuminated on the front panel when power is applied (compact format only). Additionally, the green 'power on' indicator on the power supply will be illuminated whenever the PSU is connected to a power outlet, regardless of whether the ILO96 amplifier is connected or not. The metal case, rear panel and probe socket trims are electrically connected to each other but are isolated

from all wiring within the amplifier. When in use and all connectors are fitted, it is not possible to make electrical connection with any of the ILO96 circuit elements.

There are two physical formats for the amplifier; all functions and connectors are identical to both, with the exception that the flat format does not include an LED power indicator.



Probe socket 1



Probe socket 2



Cable socket A



Cable socket B



12v Power cable socket

Installing your ILO96 system

Having successfully checked and identified your ILO system installation set, you are now ready to connect the system to your computer.

Any PC compatible computer having a processor equivalent or superior to the 386 and having a free full-length ISA expansion slot is suitable. The ILO96 cannot be fitted to a laptop PC as they usually do not contain a suitable ISA slot. However, many portables can be fitted into a proprietary docking station, which may contain a suitable ISA slot. Please note, the ILO96 amplifier requires 12V external power and is not intended for portable operation.

NB: Before undertaking this installation, you should ensure that you are familiar with the precautions required when handling sensitive electronic circuits and also with the safety measures necessary when disassembling electronic equipment.

The instructions given here are for installation into a tower system; users with desktop PCs should refer to their PC handbooks for variations.

The only tools you will need are a cross-head screwdriver and a flat-blade screwdriver.



1. Switch off and unplug your computer.



2. Remove the screws from the PC cover (consult your PC manual).



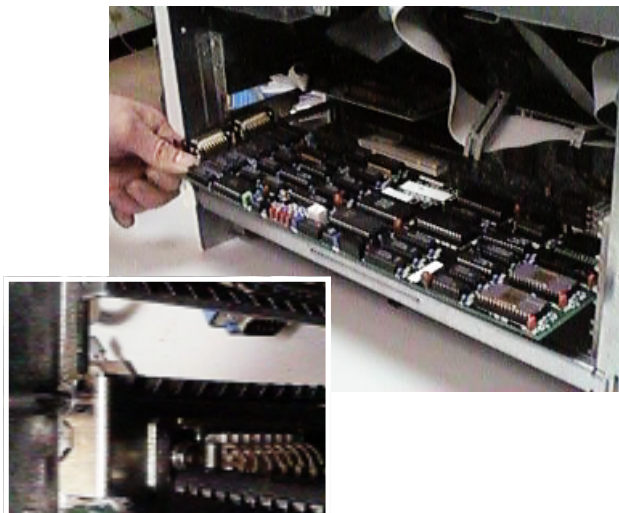
3. Remove the cover itself.



4. Find a free full-length ISA (AT) expansion slot in your computer and remove the adjacent blanking plate from the back of the computer.



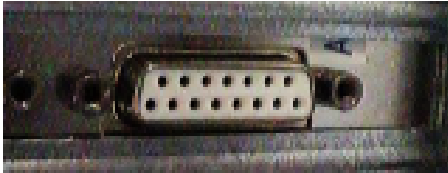
5. Insert the ILO card, press firmly into the socket and replace the single retaining screw.



6. Replace the computer cover and screws.



7. Identify socket A on the rear of the interface card and connect the blue interface cable A, as shown.



8. Fit the 25-pin D-type connector of the cable marked A to the matching rear socket of the ILO amplifier marked A. Tighten the two retaining screws on the computer and amplifier connections. Connect the interface cable B to the socket B of the interface card in the computer and the socket B on the rear of the amplifier. Tighten all retaining screws.



9. Attach the power supply unit to the ILO96.



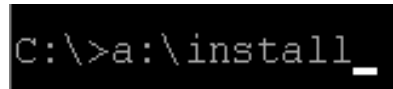
10. Reconnect the VDU, keyboard, mouse etc. to your computer. Attach the power cable and switch on your PC. Now install the software, as described in the next section, and run full engineering tests as described in **Test and calibration**.

Version5 software installation

The installation software comprises five disks or one CD plus one additional registration floppy disk. It may be installed under DOS or Windows 95/98/ME. We do not recommend installation under Windows 3.1 as this version of Windows has not proved a totally reliable means of operating the ILO high performance data acquisition hardware.

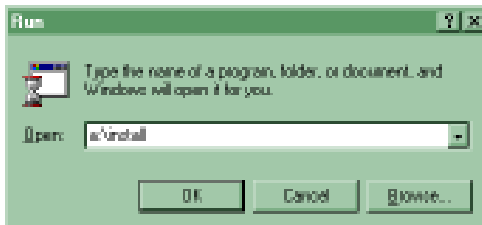
Installation under DOS

1. Insert V5 installation diskette 1 into the A drive of your computer.
2. To start the installation process, from the C prompt, type **a:\install** and press Enter. Then follow steps 3-7 below.



Installation under Windows 95/98/ME

1. Click on the **Start** button and select **Run**.



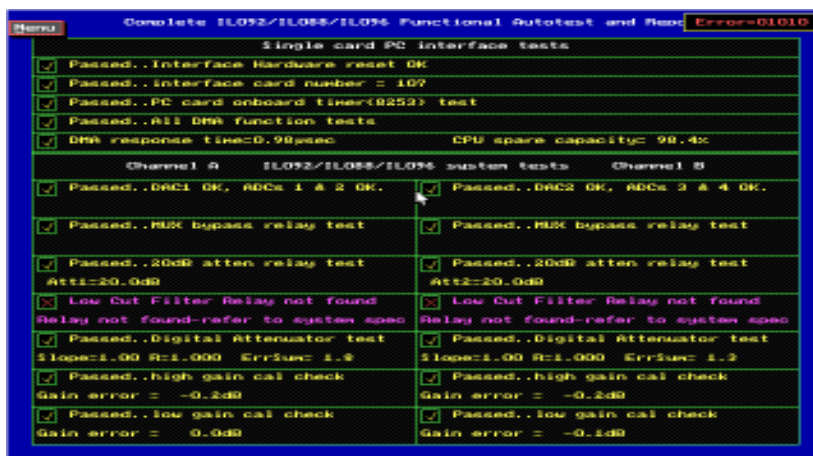
2. If you are installing from **diskette**, insert disk 1 in the A drive, type **a:\install** in the window and press Enter, or click on **OK**.

If you are installing from **CD**, place the CD in your CD-ROM drive and click on the **Browse** button. Select your CD-ROM drive, followed by **Install**.

3. You will see an information screen describing the software version. When you have read this and if you agree to the conditions, press Enter. Otherwise, press ESC.
4. You will be able to select the disk drive on which the ILO software will be installed. The sub-directory is automatically named. To continue the installation, press Enter.

5. A number of files will now be copied to your hard disk which will take a couple of minutes. If you are installing from diskette, insert disks 2, 3, 4 and 5 when requested and press Enter.
6. Installation is now completed.

In the case of a **PURCHASED PROGRAM**, when you start the program for the first time, it will ask you to insert the Registration Disk provided with the software. This will fully register the system. The Configuration program will then be automatically run. You will probably be informed that automatic configuration is necessary. Accept this option by pressing the Enter key. Automatic configuration reads your registration file and sets the system configuration to look for and recognise your particular ILO system. It also enters the global site name which has been issued to you into the system. Configuration is also used to select the display screen and printer you will be using. After automatic configuration is complete, you will see the following screen:



In the case of an **EVALUATION COPY** of the program, when you start the program for the first time you will be given the following options:

1. To load your registration file from a disk in drive A:
2. To enter your new registration details manually
3. To restore the previous registration stored in register.ilo
4. To continue using software and register later
5. To Exit the program now

When new registration details have been entered or loaded, the **ILOCFG** screen will then be presented, as shown above. If registration details are not loaded, an option to load will be presented each time the ILOV5 program is run.

After registration and automatic configuration, the **ILOCFG** configuration program can be recalled from within the ILOV5 program or externally by calling **ILOCFG** from within the ILO-V5 directory. The operation of ILOV5 can be customised using this program.

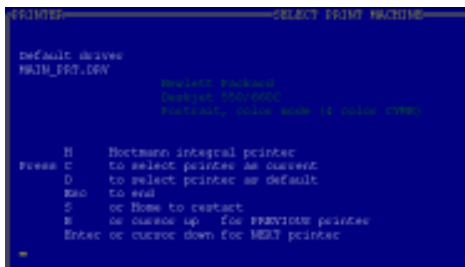
- 6.1 Select **G** to identify the graphics display; select option 3 for standard VGA graphics displays. If your system normally runs in SVGA mode, you may select option 5. If problems arise with this option on your machine, revert to option 3. The remaining options are included for compatibility with older software and will not normally be required. Option 1 (CGA) provides monochrome, low resolution graphics suitable for very old PCs.
- 6.2 When you have made your selection, you will be offered choices of screen colours. We recommend that you accept the standard option (0) and explore the other options at your leisure once you have become familiar with the ILO software.

Please note that the graphics choice becomes effective on starting the ILO program.

- 6.3 Check the printer type shown:

e.g. P printer PRT=MAIN_PRT.DRV;0;0

To ensure that the ILO is configured for your printer, select the **P** Printer Type option. You will see the Select Print Machine screen. The properties of the current printer driver will be shown.



To change the printer, use the up/down cursors to find your printer or a related printer. Press **D** to select this printer. Select Standard print content

(0). You will then be offered the Printer Port selection; enter **0** if you are using the standard printer port. The program will return to the opening screen.

6.4 Note the level of function, which will be:

Level of Function (menu facilities) .. LEV=ILO88+DUALCH

This entry is set automatically from the Registration Disk. It controls the level of menus and options provided by the software. It can be changed to reduce the number of options, if convenient.

6.5 To exit the **ILOCFG** program, press **Q** followed by Enter.

6.6 Other information about your registration is shown on the ILOCFG configuration screen. The Global Site Name is incorporated in all data files and identifies your testing site. The serial number should be as marked on your ILO hardware. If your system is not working and the registration details do not match your installation, please consult your dealer.

The line **H** identifies the Otodynamics hardware you will be using. If the software has been correctly registered for your system, then this will have been pre-selected as **1 ILO96**. Please check the entry.

If your software is not fully registered and configured, an alternative hardware type may be seen. An explanation of the types follows:

- 1-Card** Identifies the ILO88 XP, ILO92
- 2-Card** Identifies the original ILO88 system, comprising two full-length expansion cards with desktop amplifier unit
- E-Port** Identifies the ILO88 and ILO288 parallel port interfaced products (Echoports)
- CODECi** Identifies the internally mounted ILO systems - ILO88i, DPi, TEi and 88DPi
- 1-88DP** Identifies the ILO88 DP clinical desktop ILO system employing one full-length expansion card
- D-Port** Identifies the ILO292 DP Echoport battery portable TEOAE and DPOAE system
- 1DPT96** Identifies the ILO96 research OAE system with DPT desktop amplifier

NoCard This option will not search for ILO hardware but will allow data to be examined and simulated recordings made for training purposes. This is useful if running the ILO software on a second computer for analysis purposes.

7. Customising the ILOV5

There are a number of other options available on this screen which you do not need to change until you begin to use the system. You can run the program ILOCFG at any time from within the ILOV5 program. The options available are listed below.

- 7.1 **R Raw data spooling directory.** This identifies the directory where raw data from a test may be saved. If left blank, raw data will be saved on ECHOSPOO, with the file extension .MEG. See Customise for how to enable raw data recording.
- 7.2 **D Data Directory.** This sets the directory where standard ILO data files are stored. If left blank, the directory ECHODATA is used.
- 7.3 **S Stimulus Directory.** This determines the directory from which custom stimuli are read. If blank, the directory EHOSTIM is used. It is not usually necessary to make an entry here.
- 7.4 **E Expert Interpretation Directory.** This defines the directory where normative data profile are stored. If blank, the directory EHOSTAT is used. Refer to Use of the ILO Statistical Analyser.
- 7.5 **I Interpretation statistics filename.** Enter the name of the statistical database file created by ILOSTATS for use with the OEG function of the analysis menu.
- 7.6 **M Macroprogram preload name.** Enter the name of the macro program library file to be automatically loaded with the ILOV5. Files beginning with the letters AUTO will automatically result in program 1 being run (included for compatibility with earlier versions).
- 7.7 **A Automatic Stop Protocol filename.** Enter the name of the protocol file you wish to use to control the test. The file may be created and edited within the ILOV5 program. A control is enabled using the Customise T option and if no name is entered, the file MANUAL is used.
- 7.8 **F Function Level (menu facilities).** Controls the menu complexity and options available. Not every level can be used with all installations.
- 7.9 **L Language options.** Selects the language used on the main menus.

7.10 **N Navigation options (mouse/keys).** We strongly recommend drop down menu option, which requires a mouse. The original 'keystroke' operation mode of the ILO88 can be selected for compatibility with earlier versions. The mouse can be used to navigate around the ILO program. The recommended mode is DROPDOWN MENUS. The current mode is indicated on the N Navigation Options line. Selecting this option will allow the choice of the original ILO88 hot key system (0), hot key control with the choice of mouse operation (1) and mouse operation with dropdown menus (2). The ILO software recognises the computer mouse, if one is installed on your PC. Its use in controlling the ILO292 functions is optional. The software may be completely controlled using keystrokes. These are identified in the User Manual and also by operating Help keys on important screens. The DPOAE section of the program accepts both keystroke and mouse operation, by default. The TEOAE section of the program offers two modes of operation, vis a vis the classic keystroke operated ILO88 mode or the V5 dropdown menu mouse operated mode. To change modes on the TEOAE program, you need to call **ILOCFG** from the DOS prompt.

7.11 **C** This allows various switches to be set for customised options of the ILO. Not all the options are available to all installations. On selecting **C**, the customising menu is seen. Options of general use are as follows:

- A Turns on or off the ILO beep sounds.
- H Enables measurements up to 8kHz on certain systems only. The function must be additionally enabled in the set-up options of the DP program.
- I Performs a more rapid start-up by by-passing the opening screens, if the software has been recently accessed.
- L Activates the interface with compatible databases such as Hi-Screen. In addition, it is necessary to select ILO+DATABASE. Access to HiScreen requires registration with NCHAM.
- M Allows or inhibits mouse operation.
- N Enables additional low frequency rejection during recording. This is useful when screening in noisy conditions.
- O Automatically opens the ILO spool file which allows raw data from a test to be saved. This option requires substantial memory - only use it if advanced statistical processing is required.

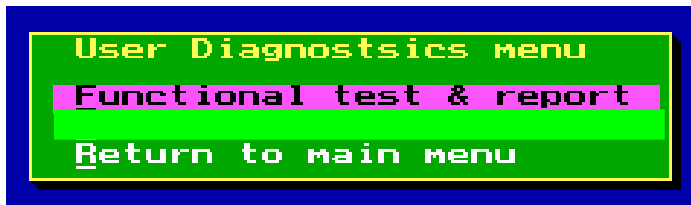
- P This controls the probe usage tracking system, which records the workload of each probe for warranty and service purposes. The ILO96 cannot automatically detect probe identification. This must be entered manually.
- X Works in conjunction with P and sets the time between reminders to test the probe condition.
- R This controls the automatic display of processed data during the test.
- S Allows the original ILO file naming protocol to be used if required. The new protocol identifies the site in the name so that every test record is globally unique.
- T Enables automatic test termination according to the conditions set out in the protocol file. The specific file should be named at the main ILO CFG screen, see A, Automatic Stop Protocol filename. The default protocol file MANUAL is used if no selection is made.

Test and system calibration

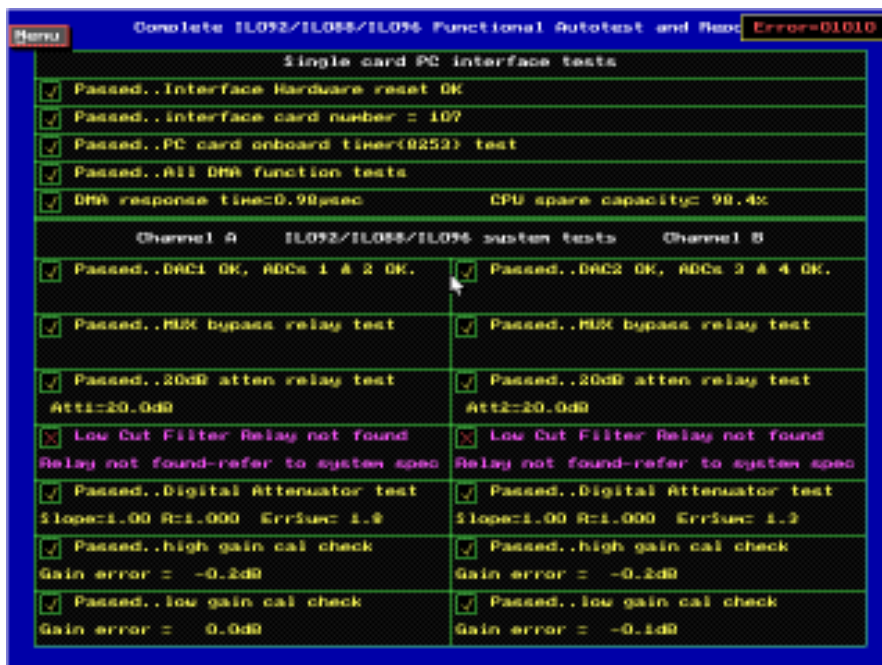
Running the test program

We strongly recommend that the ILO test program is run immediately following installation, to check that the hardware is correctly installed and calibrated.

1. Call the program **Test 96**, which is on the ILO-V5\ECHOPROG directory. Alternatively, the program can be called from within the ILOV5 software. On starting up ILOV5, a screen appears with a number of option boxes. This follows the screen indicating the product name (if the customisation option **I** has been set to **Instant Start**, then the options box screen may not be seen until the measurement screen has been exited). From the options box screen, select **Utilities**. Double-click on the **Equipment** box, or press **E** on the highlighted Equipment box. This runs the program **Test 96**.
2. You will see the opening screen of the hardware specific test program. This will show the 'ILO96' product name. Follow the instructions.
3. Remove all probes before conducting the ILO96 hardware test. The ILO96 has a built-in self-test facility, which automatically connects loops around circuit elements during the test. A Test Plug is therefore NOT required with the ILO96, unlike previous ILO systems.



4. Select the **Menu** button and then **User Tests**, followed by **Functional Test & Report**.
5. The test is automatically performed on your hardware and the following report screen is shown:



6. This may take several minutes. Each function of the equipment is listed and ticked if correct.
7. It is normal for 'Low Cut Filter Relay' to be 'not found' for the ILO96, as it does not include the low cut filter fitted to the ILO92. This particular test therefore fails on the ILO96. All other test items should be passed. On the top right of the screen, a code is shown. The normal code for the ILO96 is 01010. Any other number indicates an error and should be reported. If a cross is seen in any other box, please obtain advice from your **Otdynamics** distributor. You may be asked to examine an error log file or run additional tests.

On termination of the test program, you may have to restart the ILO program.

Using Version5 software

Starting and setting up the ILO program

1. To run the program in DOS

- Change directory by typing: **cd\ilo-v5** or the alternative you have selected during installation.
- Type **ILOV5** to start the program.

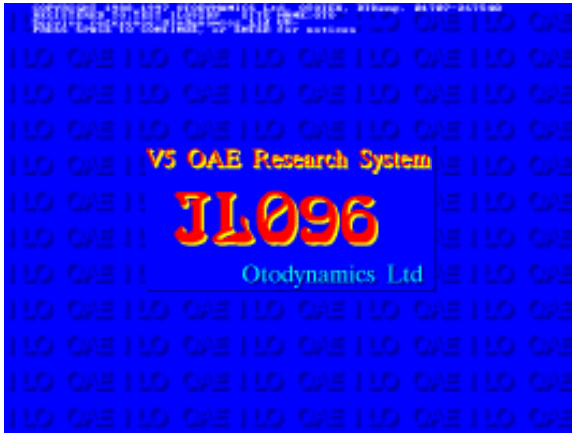
To run the program from Windows 95/98//ME

- Double-click on the ILO OAE icon.
- Windows will automatically open an MS-DOS application area which will close automatically when the program is terminated. Windows cut-and-paste utilities will not be available. You will be able to switch windows between the ILO and other programs, but we strongly recommend you do not do this while the ILO is actually collecting data as your computer may not have sufficient speed to service both applications.
- An alternative way to run the ILO program from Windows is to open an MS-DOS application area by selecting the MS-DOS prompt option from the Program list after pressing Start. Once in the MS-DOS area, proceed as for running under DOS.

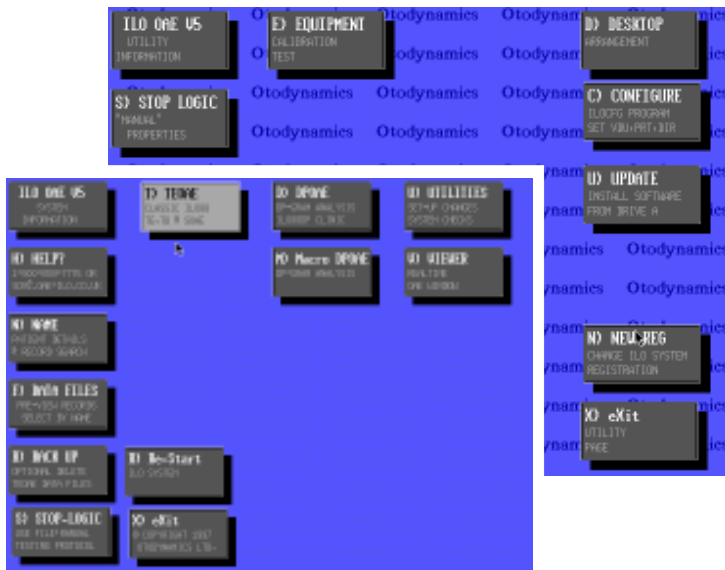


If the program fails to recognise the requested hardware, a message will be issued (see Appendix I: Error Messages). The first time you run the ILO program, it may request you to insert your registration floppy disk, which identifies your hardware to the ILO software.

- You will now be presented with your opening screen. The centre panel will indicate the ILO hardware you have installed, as shown below:



- Press Enter and you will be presented with the Options screen; selecting **Utilities** will show a second screen containing various set-up options.



- To commence OAE measurement, choose either **T** (TEOAE) or **D** (DPOAE) to enter the measurement program. Transfer between TEOAE and DPOAE measurements can be made from within the measurement programs. Please see the Version5 User Manual for more details. Test functions unique to the ILO96 will be provided in the Otodynamics otoacoustic emission research manual.

Probe calibration

Internal circuit self-test

The **Test 96** test program should first be run and, if completed satisfactorily, this confirms that the internal circuit is working correctly. This test automatically confirms that the correct amplification is present in each section of the system.

The test program does not perform tests on the OAE probe. This is performed using the ILO96 OAE measurement program.

Probe condition self-test

The probe to be tested is fitted into the probe socket and the TEOAE program started. The probe is fitted into the 1cc acoustic calibration cavity. There are two ways to access the probe calibration test option. Firstly, from the **Test menu, Calibration** option, or via the **TE full menu** option provided after Checkfit. If the **TE full menu** is selected, a Checkfit is performed as if beginning a patient measurement. The Transient stimulus waveform will be seen. On closing the Checkfit process, select the **Probe Cavity Test** option from the **Collection** menu. Confirm the type of probe being tested and continue with the test. The probe test injects an artificial OAE which is recorded on the screen as a series of three oscillatory tone bursts at 700, 2,000 and 4,000 Hz respectively.

A typical probe response is shown on the right.



The result of a probe condition test can be saved and recalled just like any OAE measurement. A copy of the probe test performed at the time of manufacture accompanies every probe. We recommend that you perform and print a probe test on your equipment on first receiving the probe and retain this for later comparison. Changes of 3dB or more on any tone burst may indicate contamination of the sound tubes, deterioration of the probe transducers or incorrect fitting into the test cavity. If, on servicing the probe and properly fitting it into the cavity, changes of 3dB or more are still seen, the probe should be replaced. Contamination typically reduces the higher frequencies first, loose coupling to the test cavity can reduce the low frequency response and may artificially enhance the middle frequency response.

While the above test is adequate to ensure that the probe has maintained its condition, it is unable to distinguish between changes in the performance of the probe and the loudspeaker. The microphone sensitivity can be independently tested by applying a known external sound field (see below). An independent external probe calibration should be performed at least annually when your ILO equipment is serviced, or at any time.

Test for artefactual distortion generation

Distortion products can be generated in any system which exhibits 'non-linearity'. This includes the probe and amplifiers. Instrumental distortion such as this is distinguishable from auditory distortion because it lacks the characteristic delay (latency) of DPOAEs. However, the presence of instrumental distortion can lead to errors in judgement and so you should periodically test your system to ensure that no significant artefactual distortion is generated.

To test for distortion in the probe, a normal DP-gram is performed with the probe inserted in the Otodynamics 1cc cavity. Distortion should be at or below the -10dBspl level. The probability of distortion increases with stimulus level. We recommend regular testing of the probe at $F1=F2=70\text{dBspl}$. Probes are tested at the factory to be free of distortion up to 75dBspl. All probes will produce some distortion at higher levels.

To test for distortion in the instrumentation, the probe is removed and the cross coupler plug is inserted in probe socket 1. A DP-gram is performed as above.

Microphone sensitivity calibration

The ILO OAE system acts as a sound level meter and sound analyser for OAEs. This facility can also be used to check the probe microphone sensitivity. Signals from this microphone are amplified by the ILO equipment and digitised. The ILO software extracts information from the signal. This consists of measurements of the stimulus present in the ear canal and also the response. Both stimulus and response measurements are made using the same probe microphone so that it is only necessary to calibrate the microphone and ILO once against a known sound level.

Simple method

The ILO OAE probe is placed in a known sound field consisting of 84dBspl 1kHz. This sound is monitored by a previously calibrated sound level meter and the OAE probe is held immediately adjacent to the sound level meter microphone (fig 1). The ILO system is set to the **Calibration** option in the menu **Tests>Calibration>84dBspl Calibration**. The sound wave representing the applied sound is seen in the stimulus window as in the Checkfit mode of operation. The level of 84dBspl will produce a wave just reaching the calibration marks on the side



Fig 1

of the stimulus panel. The sound field, as registered by the ILO microphone and sound level measuring equipment, will be shown on the ILO screen. The message may be, for example: REGISTERED LEVEL = 83db spl - P TYPE. Subtract the probe type dB correction 'P- TYPE' as supplied with the probe. The correction for standard BS and BP adult probes is usually close to zero. The correction for SNS and SGS serviceable probes is normally around +6dB. For example, a typical new SNS probe may register 90dB spl - 6dB = 84dB. SNS and SGS probes are therefore 6dB more sensitive than the standard probes at 1kHz. Please note that the peak of a sound wave is necessarily 3dB higher than the RMS value normally used to express the level of sound.

Use of a sound calibrator with the ILO

Version5 software includes a utility for assisting with calibration. From the Test menu, select Calibration. From here, select Calibration (**Calibration > spl 114dB Calibration**). If using the calibrator which generates 114dBspl, it will be necessary to fit an Otodynamics 30dB attenuator (supplied separately) adaptor to the probe before applying this to the ILO input socket (fig 2). This attenuator is necessary because the highly sensitive amplifiers of the ILO will not accept the high level of 114dBspl. This adaptor should *not* be used if a 84dBspl calibrated sound field is used.

Fit the probe into the sound calibrator, as shown below, applying slight pressure with the finger. Ensure that the position of the probe in the calibrator coupling is exactly as shown. Note that the two types of probe, serviceable screening probe (fig 3) and adult probe (fig 4), are different in their form and position in the coupler. Switch on the calibrator unit.



Fig 2



Fig 3



Fig 4

The sound field, as registered by the ILO microphone and sound level measuring equipment, will be shown on the ILO screen. The message may be, for example: REGISTERED LEVEL = 115db spl - P TYPE. Subtract the probe type dB correction 'P- TYPE' as supplied with the probe. The correction for standard BS and BP adult probes is usually close to zero. The correction for SNS and SGS serviceable probes is normally around +6dB. For example, a typical new SNS probe may register 120db spl - 6dB = 114dB. SNS and SGS probes are therefore 6dB more sensitive than the standard probes at 1kHz.

Comment on probe calibration

OAE clinical testing utilises the presence or absence of the OAE response as an indicator of cochlear function. The absolute levels of sound developed in the ear canal are not of critical importance. It is therefore satisfactory for clinical purposes if the probe registers within +6dB to -3dB of the applied sound pressure.

The above procedure provides information on the calibration of the ILO system with that particular probe at 1kHz. It is also advisable to check the relative sensitivity of the microphone system at other frequencies. This can be performed satisfactorily in free-field testing against a sound level meter or within a calibrated test system.

Once the microphone sensitivity of the ILO is confirmed to be within acceptable limits, the stimulus developed by the probe in the ILO test cavity should then be observed using the default preset mode of the ILO. The peak stimulus developed in the Otodynamics 1cc cavity should be 84dB, as shown on the ILO readout. After allowing for any minor correction in the microphone sensitivity found with the above procedure, the actual peak sound pressure level may be obtained. This should be within +/- 2dB of the stated level. Some earlier Otodynamics probes may differ by more than 2dB due to aging. Correction for deficient sound output of a probe up to 3dB is permissible using the stimulus gain setting of the ILO. However, excessive corrections should be avoided and the probe replaced.

Unique features of the ILO96 research OAE system

The ILO96 is a unique OAE system based on laboratory research at the Institute of Laryngology and Otology, UCL. Unlike other clinical OAE systems, the ILO96 includes four fully programmable stimulus channels in its hardware, in addition to two input channels. This allows the ILO96 to make complex measurements of auditory function involving the controlled suppression of DP or TEOAE generation with a third stimulus tone and binaural recording of OAEs. These measurements and many other interesting features of OAEs are currently the subject of much scientific research aimed at enhancing the clinical value of OAEs in the future and also at providing answers to basic questions about cochlear function and physiology. This capability is not available in other standard clinical OAE systems at this time.

Because the capabilities of the ILO96 exceed those needed for routine clinical work and depend upon ongoing laboratory research, software for the ILO96 will evolve over the next few years to keep you up-to-date with the latest developments in OAE research (see **The ILO96 promise**). It is essential for you to return your registration form fully completed directly to Otodynamics Ltd., UK, in order to ensure that you are mailed with the latest software upgrades. Upgrades for research systems are not normally provided through commercial dealers, but is a special service of Otodynamics Audio-logical Equipment Services, UK.

Three-tone stimulation

The healthy cochlear generates otoacoustic emissions in response to any stimulus, however complex. Transient evoked OAEs are often thought of as 'echoes'. The standard ILO88 TEOAE measurement is, in fact, a complex derived response exploiting the non-linear characteristics of OAEs. It is therefore in itself a kind of 'distortion product'. Distortion products in response to two-tonal stimuli have become popular for clinical investigation of cochlear function. Typically, the two tones F1 and F2 are placed within one-third of an octave apart and the intermodulation distortion product 2F1-F2 is recorded as a general indicator of cochlear function.

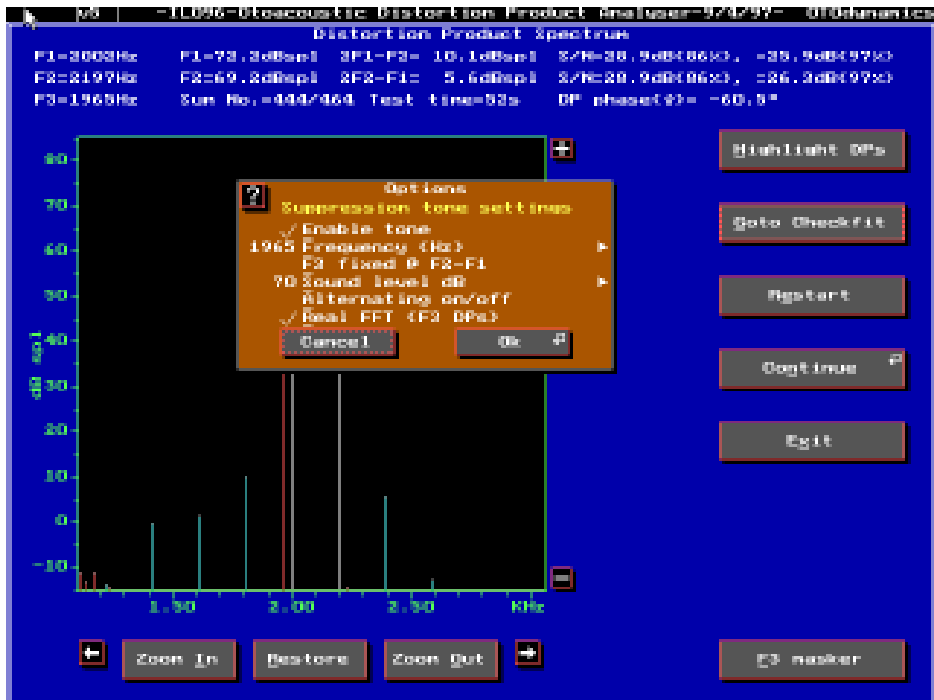


Fig 1

Fig 1 above shows a 'DP Spectrum' obtained with the ILO96, showing the two primary stimuli, F1 and F2, at approximately 2000 and 2200 Hz, surrounded by intermodulation distortion products. On the left, these are 4F1-3F2, 3F1-2F2, 2F1-F2. On the right-hand side you see 2F2-F1 distortion product. The latter is usually the only strongly produced higher frequency distortion product when two tones are presented.

The figure also shows the control panel, which allows the F3 masker tone to be set. In the figure this is placed at 1965 Hz (slightly lower in frequency than F1) and at a level of 70dBspl. In this position, the third tone slightly reduces the level of 2F1-F2 production. More intense levels of F3 result in the insubstantial suppression of distortion product activity as normally recorded. However, the presence of a suppressor tone (F3) does not actually suppress distortion product generation in the cochlear. Rather, it diverts the distortion production to alternative frequencies. This is shown most clearly when F3 is moved away from F1 to a lower frequency.

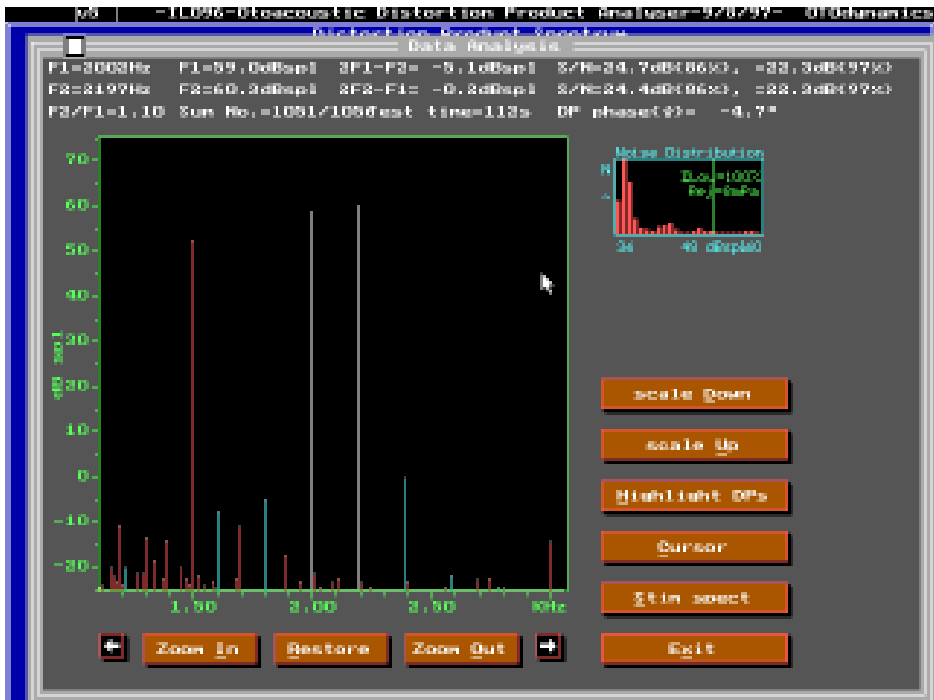


Fig 2

A new family of intermodulation distortion products, $F3 \pm N(F2-F1)$ (fig 2) is produced. In this figure, $F3$ is set to 1500 Hz. The new distortion products interleave with those from $F1$ and $F2$ (e.g. at 1680 Hz). These triple intermodulation distortion products have significant interest that the process of suppression itself reveals a major feature of auditory function. This is the auditory tuning curve, which may be obtained by measuring the level of $F3$ required to suppress the distortion product $2F1-F2$ as $F3$ itself is placed at a range of frequencies both above and below the primary tones.

In order to map the auditory filter response of particular cochlear, the $2F1-F2$ distortion product is monitored under a range of different $F3$ parameters. Fig 3 shows the 'spectral history' mode of the ILO96. The display takes the form of a chart recorder which records the amplitudes of the primaries together with their phases and also the level of the selected distortion product at predetermined intervals selected by the user. This display can be used to monitor changes in the distortion product level and phase with time. The suppressor tone $F3$ is under manual control and can be introduced step-by-step to determine the threshold for suppression of the $2F1-F2$. A real-time history is therefore obtained of the effects of the suppressor tone on cochlear function.

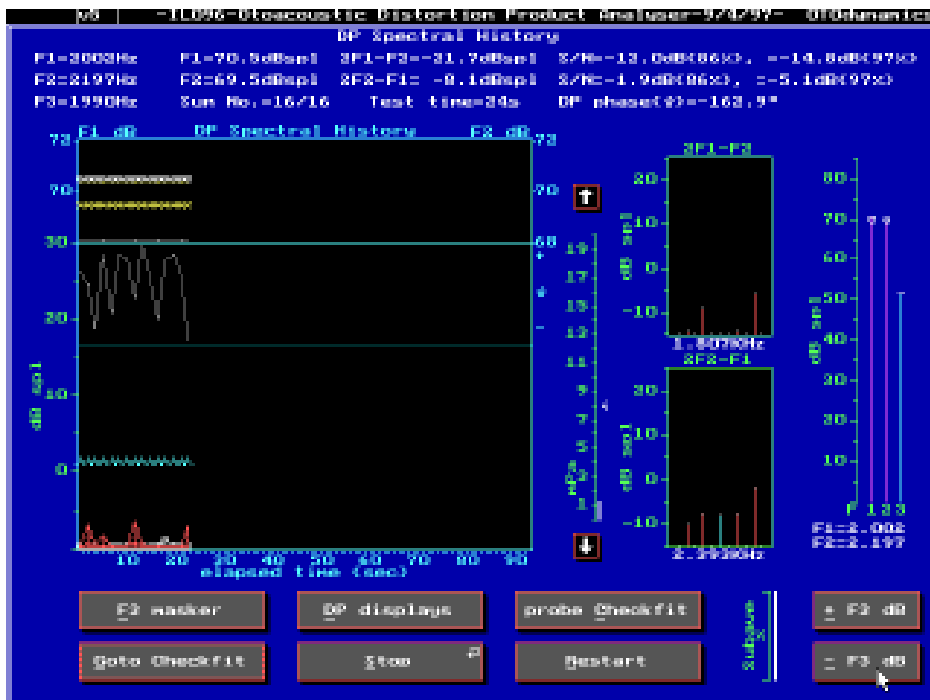


Fig 3

The suppressor tone can, if wished, be applied to the contralateral ear. The entire spectral history chart can be saved to disk and re-examined in detail at any time. Any of the other distortion products can also be recalled for examination from the file data.

To obtain a tuning curve, the threshold for suppression by F3 must be obtained at a range of different frequencies. The F3 masker key is used to set the frequency and initial level of F3. The plus (+) and minus (-) keys are used during the measurement to adjust the level of F3. The level of F3 is dynamically shown both in the stimulus level indicator on the right-hand side and also as a blue line on the data panel. Otodynamics is currently working on an automatic procedure for tuning curve determination. This will be supplied to ILO96 purchasers as soon as available.

Care of your ILO96 system

- Ensure that all parts are firmly screwed in and that the cable cannot become disconnected, as this can damage your computer.
- The ILO system has been designed with specific attention to robustness, longevity, easy maintenance and years of trouble free operation. It is, however, a complex piece of electrical equipment and requires that the operator accords the level of care normally applied to such devices.
- Run the test program periodically.
- Check that the system does not produce DP artefacts.

Probes and probe tips: Identification

Serviceable probes



SNS:
Newborn TEOAE
(blue)



SND:
Newborn DP+TEOAE
(yellow)

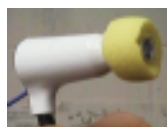


SGS:
General Purpose
TEOAE
(red)



SGD:
General Purpose
DP+TEOAE
(grey)

Standard probe



BP:
Adult DP+TEOAE

Laboratory research probe



LAB1:
Adult Triple-Tone

Service accessories



TPC: Coupler tubes
for SNS and SGS

BNS: Body and lid
for SNS probe

BGS: Body and lid
for SGS probe



DPC: Coupler tubes
for SND and SGD

BND: Body and lid
for SND probe

BGD: Body and lid
for SGD probe

NB: All DP probes are 8-pin variety and require an adaptor for 5-pin usage which is supplied free on request.

SNS and SGS serviceable probes and BS probes are supplied with serviceable 8-pin plugs. A 5-pin to 8-pin adaptor is also available on request.



Serviceable Transient OAE Probe Tips



T3E Twin-holed elliptical tip, fits 3mm ear canal, elliptical shaped end. Designed for small and premature newborns.



T4.5C Twin-holed conical tip, fits 4 to 5mm ear canal. Suitable for small newborns.



T5.5B Twin-holed blob shaped tip, fits 5.5mm ear canal. Suitable for most newborns.



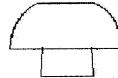
T6.5B Twin-holed blob shaped tip, fits 6.5mm ear canal. Suitable for large newborns and first year infants.



T8M Twin-holed, mushroom, fits 8-8.5mm ear canal. For infants and small adults.



T9M Twin-holed, mushroom, fits 9-10 mm ear canal. For most adults.



T11M Twin-holed, mushroom, fits 11mm ear canal.

T13M Twin-holed, mushroom, fits 13mm ear canal.

Standard Screening Mix
60% T4.5C, 30% T5.5B, 10% T6.5B



Serviceable TE+DPOAE Probe Tips



R4.8S Round/triangular-holed, straight-sided, fits 4.8mm newborn ear canal. For SND.

R5.8B Round/triangular-holed, blob-shaped, fits 5.8mm newborn ear canal. For SND.

R6.8B Round/triangular-holed, blob-shaped, fits 6.8mm newborn ear canal. For SND.

R8M Round/triangular-holed, mushroom, fits 8mm ear canal. For SGD probe.



R9M Round/triangular-holed, mushroom, fits 9-10mm ear canal. For SGD probe.

R11M Round/triangular-holed, mushroom, fits 11mm ear canal. For SGD probe.

R13M Round/triangular-holed, mushroom, fits 13mm ear canal. For SGD probe.



Standard Newborn & General Purpose TE+DP Probe Tips



C5.5B Cloverleaf-holed blob shaped tip, fits 5.5mm ear canal. Suitable for newborns. Use with HP or SND probes.



C8M Cloverleaf mushroom shaped tip, fits 8 to 8.5mm ear canal. Designed for infants and small adults. Use with CD or SGD probes.



Standard TE and TE+DPOAE Probe Tips



R9.5F Round-holed foam shaped tip, fits 9.5 to 10.5mm ear canal. Suitable for adults. For use with BS and BP probes.

Probes: Cleaning

The following is the suggested method of cleaning the Otodynamics ILO neonate probes. It should be noted that the probe is a precision assembly and as such care should be taken throughout in its handling and cleaning.

NB: Probes must be kept free from liquids.

Cable

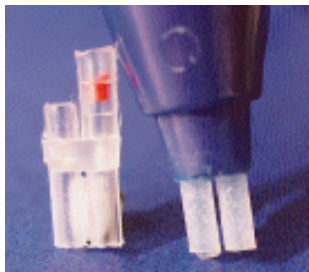
Cables may be cleaned with antiseptic fluid or wipes.

Probe casing

We recommend that the probe casing is cleaned using antiseptic wipes and dried with a tissue immediately afterwards. Liquids must not enter the sound tubes.

Sound tubes

Each probe assembly has at least two sound tubes. These are protected from ingress of foreign materials by the disposable probe tip. At the end of each tube a loudspeaker or microphone is found. Cleaning solution must not penetrate the tubes.



Serviceable probes

Serviceable probes have the sound tubes combined into a single coupler assembly, so that they can easily be replaced. This enables users to fit new couplers at intervals as a preventive measure and to deal with contaminated tubes. Apart from the new servicing procedure, the usage of these probes is exactly the same as for the non-serviceable equivalents and should always be as per the OAE system user documentation. The probe is supplied with five spare coupler assemblies, a spare body and lid, and a range of tips.

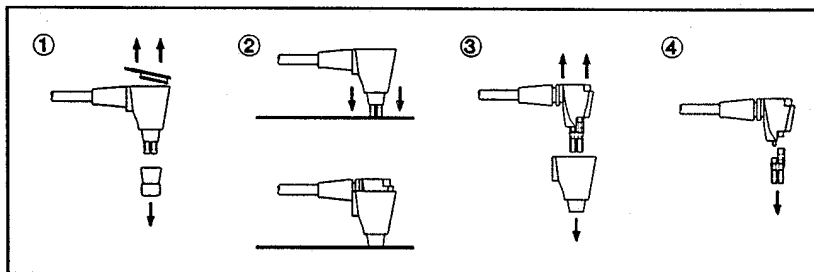
This guide gives instructions on disassembling and reassembling serviceable probes. They can be identified by the serial number on the cable sleeve near the plug, which begins with the letter 'S'. Newborn probes use a lower drive level to compensate for the smaller ear canal and it is important to use the correct probe type for a particular subject. Probes are therefore also colour coded according to their usage (see **Probes: Identification**).

Because serviceable probes have body and lid mouldings which must be removed from the probe for servicing, it is essential that probes are reassembled without mixing bodies and lids of one type with inner transducer assemblies of a different type. For this reason the body, lid and inner transducer assembly of each probe is made the same colour, so that users can be certain of component identity by ensuring matching colours. The OAE system display also indicates the sound level achieved in the ear canal, which should always be monitored during testing to ensure it is correct. An excessively high sound level is positively indicated by a warning message flashed onto the screen, providing an additional safeguard.

This guide also gives instructions on an occlusion test which must be carried out by the user after servicing, in conjunction with a probe cavity test, in order to confirm correct probe function.

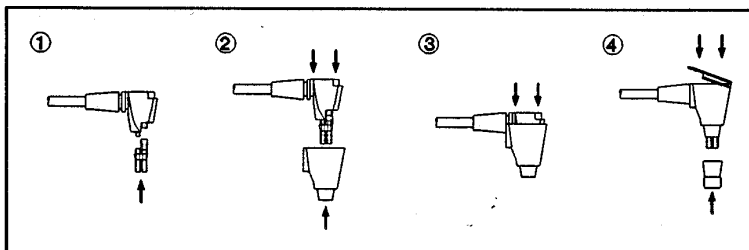
Disassembling the probe

First, unplug the probe from the system. Remove the tip by pulling off as shown in Fig 1, then remove the lid by lifting the tab on the cable edge of the lid, also shown in Fig 1, and remove the inner transducer assembly by pushing the coupler tubes down onto a hard surface, as shown in Fig. 2, then pulling out the inner transducer assembly by gripping it as shown in Fig. 3. Never remove it by pulling on the cable. Finally, pull the coupler assembly away from the inner transducer assembly as shown in Fig. 4. If the coupler assembly stays inside the body section of the outer shell, remove it with tweezers.



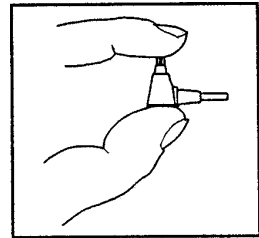
Reassembling the probe

Fit the coupler assembly to the inner transducer assembly as shown in Fig. 1, ensuring that the coupler has a red/orange component in the longer tube; this is important for correct sound level. Fit the body section of the outer shell as shown in Figs. 2 and 3, followed by the lid section of the outer shell, as shown in Fig. 4. Be sure to engage the edge of the lid opposite the tab first, with the tab aligned with the cable, and then click the lid into place using firm finger pressure only. After testing as described in the section below, fit the tip as shown in Fig. 4.



Testing after servicing

After reassembling the probe it is essential to carry out an occlusion test and a probe cavity test to confirm correct probe function. The occlusion test must be carried out without a tip fitted to the probe. Set the OAE system to checkfit and press a finger firmly over the end of the coupler assembly, closing both sound tubes. There should be no visible stimulus waveform or FFT. If either is visible then this indicates sound leakage inside the probe, caused by incorrect assembly, in which case the probe assembly must be corrected and confirmed by retest. If all is well carry out a probe cavity test before use, following the instructions in your system user documentation.



When to service

As with all probes it is important to:

- fit a new tip for each test
- visually check for unobstructed sound tubes when fitting the tip
- observe screen feedback during checkfit and testing to detect signs of contamination, e.g. low stimulus and/or response levels
- carry out regular probe cavity tests.

If contamination is visible in the sound tubes, **fit a new coupler**. In order to minimise downtime, we recommend fitting a new coupler at regular intervals as a preventive measure. The interval between changes will depend on the intensity of your testing program and the experience of the operators. For experienced operators once every one or two hundred tests may be appropriate; if you are less experienced then once every fifty tests might be a suitable starting point. If you need more couplers please contact your dealer.

Remember the coupler is designed as a low cost disposable part - **if in doubt replace it! Do not attempt to clean the coupler as this may damage the acoustic filter.**

Remember!

- DO**
- *Use disinfectant wipes to clean probe shell*
 - *Discard all tips after use*
 - *Check calibration regularly*
 - *Change the sound tubes of serviceable probes regularly, or if they become contaminated*
- DO NOT**
- *Bend the cable near probe tip*
 - *Allow wax to be pushed up tubes*
 - *Use any liquid to clean the probe shell - liquid must not be allowed to enter the probe tube*

Troubleshooting with the ILO system

No signals are heard in the probe and/or no sound is detected

- First, check that the probe is not blocked
- Ensure that the probe is fitted to the Probe 1 socket
- Check the cable connection at the rear of the amplifier and make sure that the blue interface cable labelled A connects socket A of the amplifier to connector A of the computer card and B to B
- Check that the card is properly seated in the computer

The software fails to find the ILO card

- Check that the card is securely seated in the PC
- Remove any PC cards which may conflict with the ILO card, such as network, scanner, modem cards etc. If this cures the problem, it may be necessary to change the address of one of the cards or to operate the computer without this card.

The ILO system functions, but incorrectly

- Run the test program to identify the nature of the problem
- Consider whether the problem is due to a conflict with other cards in the system

Changing the address of the ILO card

- It is recommended that you use the ILO system with the factory-set address of 320H. If conflicts arise, it is possible to change the address of the ILO card from 200H to 3F0H by means of switch 1. Please consult a qualified person before making any changes. The software will require reconfiguration. We strongly recommend the removal of unnecessary cards from your PC as a solution to conflicts.
- The ILO card uses DMA3 for data transfer. If conflicts exist, this can be changed to DMA1 by your dealer. We strongly recommend you resolve conflicts by removal of any unnecessary cards from your PC.

If you are still experiencing problems

- Please contact your local dealer (see page 2 for details) quoting your system serial number and error codes if applicable.
- Alternatively, contact Otodynamics direct at:

**Otodynamics Ltd.
30-38 Beaconsfield Road
Hatfield
Hertfordshire
AL10 8BB
England**

Telephone:	+44 1707 267540
USA Toll Free:	800 659 7776
Fax:	+44 1707 262327
e-mail:	helpdesk@oae-ilo.co.uk
web site:	http://www.otodynamics.com

Technical specifications

Frequency response (3dB points):

Response amplifier: 413Hz (+26Hz) to 4882Hz (+357Hz)
Stimulus amplifier: 0Hz to 4417Hz (+282Hz)

Maximum output voltage level:

All probes except neonate: 350mV (+0.5dB) peak RMS
Neonate probes
(internal 20dB attenuator): 35mV (+0.5dB) peak RMS

Dimensions:

Amplifier: 163mm x 210mm x 75mm (6.4" x 8.3" x 3")
Interface card: 350mm x 110mm x 25mm (13.8" x 4.3" x 1")

Computer requirements:

386 or higher with 2MB memory, hard disk, VGA display,
1 full length ISA slot free.

External power:

Mains operation: 230v, 50Hz (or 110-120v AC, 60Hz for
USA), 60mA. (External power adapter).

The ILO96 must only be used with an Otodynamics
approved power supply. These units comply with
IEC601.1. Model numbers PSU96-230 (PSU96-115 for
USA and Canada).

For compliance with IEC601.1, any computer equipment
connected to the ILO96 must be certified to IEC stand-
ards (e.g. IEC 950) and configured to comply with
IEC601.1.1. Everybody who connects computer equip-
ment to this interface configures a medical system and is
therefore responsible for ensuring that the system
complies with IEC601.1.1. If in any doubt, contact the
technical service department of your local Otodynamics
representative.

Accessories:

Power adapter/charger, 12v 1A. two interface cables.
Serviceable neonate and general purpose screening
probes, neonate and adult DPOAE probes. Disposable
plastic tip supply. Calibration and probe service kits.

Electrical protection:	ILO96 Unit: Class II, type BF. Charger: Class II. Classified for continuous use.
Liquid ingress:	Not protected against liquid ingress.
Mobility level:	Portable equipment.
Flammable gas protection:	Not suitable for use with flammable gases.
Environmental conditions:	The ILO96 can be transported and stored under at least the following conditions: <ul style="list-style-type: none"> • Temperature from 0°C to 40°C • Pressure range 23KPa to 101KPa • Relative humidity 10% to 95%

The ILO96 is designed to operate under at least the following conditions:

Indoor use:	<ul style="list-style-type: none"> • Temperature from 5°C to 40°C • Pressure range 23KPa to 101KPa • Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 5% relative humidity at 40°C
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OAE disposable probe tip biocompatibility:	Material cleared for medical use and for use in food packaging.
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Cleaning:	The ILO96 and power supply should only be cleaned using a soft, dry cloth. The unit is not protected against liquid ingress and organic solvents and other liquids should not be used.
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EMC effects:	<p>In certain cases of extreme electromagnetic interference from external sources, the operation of the ILO96 may be affected. The effects of any interference may take one of the following forms:</p> <ul style="list-style-type: none"> • The noise bar will periodically indicate a high level or the message 'TOO NOISY' will be displayed. This behaviour will not correspond with acoustic/mechanical interference. • The software may crash and report an error.
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Please note that it is not possible for the system to give a false positive result due to external interference. The worst that can happen is that the test may take longer to run or will need to be restarted. In the event that any of the above symptoms are observed, the best solution is to re-site the unit or the interfering equipment.

Acoustic stimulation levels: DPOAE: 20dB spl to 80dB spl in 1dB steps
 TEOAE: Click - to 94dB spl 34dB spl peak equivalent
 Toneburst - 500Hz to 8000Hz
 34-94dB spl fully programmable envelope

Measurement accuracy:

- Sound pressure level
 Standard probe response (uncorrected) +/-5dB over the range 500-6000Hz
- Frequency
 Internal frequency clock better than 0.1%
 Default frequency resolution 12.5Hz

Default settings:

- DPOAE frequency ratio 1:1.22
 Stimulus level 70dB, 70dB
- TEOAE wide bank click
 Stimulus 84dB in 1cc test cavity
 Summation mode - non-linear

Symbol explanations:



Type BF



Alternating current



Not used



Consult equipment documentation



Class II



Indicates that this product complies with the essential requirements of the EMC directive 89/336/EEC (Standard met: EN60601-1-2 : 1993)

Circuit diagrams:

Copies of circuit diagrams are available from Otodynamics upon request.

Appendix 1

Error messages

2	File not found
3	Path not found
4	Too many open files
5	File access denied
6	Invalid file handle
12	Invalid file access code
15	Invalid drive number
16	Cannot remove current directory
17	Cannot rename across drives
18	No more files
100	Disk read error
101	Disk write error
102	File not assigned
103	File not open
104	File not open for input
105	File not open for output
106	Invalid numeric format
150	Disk is write-protected
151	Bad drive request struct length
152	Drive not ready
154	CRC error in data
156	Disk seek error
157	Unknown media type
158	Sector Not Found
159	Printer out of paper
160	Device write fault
161	Device read fault
162	Hardware failure

Appendix 2

Additional information for users of the ILO96 OAE System

Overview of the ILO96 system

The ILO96 system comprises an IBM PC compatible full-length expansion card (ISA bus) and an externally powered amplifier unit which delivers stimulation to and receives responses from the OAE probes. The internally mounted computer expansion card is connected to the ILO96 external amplifier by two cables, each terminated with one 15-pin male 'D' type plug and one 25-pin male 'D' type plug. The connecting cables carry 5V digital and analogue signals to and from the amplifier unit.

Summary of instructions for installation

The ILO96 computer card should be installed into the host PC after all power connections have been removed. The host PC ground connection should be tested using a suitable appliance tester.

The 15-pin 'D' type plug on the ILO96 connecting cable should be plugged into the 15-pin socket on the rear of the ILO96 computer card and secured using a screwdriver. The 25-pin 'D' type plug on the ILO96 connecting cables should then be plugged into the 25-pin sockets on the ILO96 box and secured using a screwdriver. The power cords of both the computer and the ILO96 amplifier unit should then be connected to separate hard-wired power outlets. The two outlets must be on the same circuit.

The amplifier and the PC may be switched on in any order. A green indicator lamp will show that power is on in the amplifier. The connecting cables between amplifier and computer should never be disconnected while either of the two units is connected to the power (the VDU and any peripheral equipment of the PC is considered to be part of the PC for this purpose).

Safety considerations

Safety of the patient being tested with the ILO96 is assured by the double insulation provided by the plastic probe. No metal parts are accessible to the patient in this probe and the probe itself passes tests of leakage current (IEC601-1 type B applied part) both capacitively and inductively. The patient should not come into contact with any other part of the equipment, the amplifier or the computer.

As originally supplied, the operator may contact several components connected to the internal circuitry of the amplifier. The system should be powered down and removed from the power source when either the probes or test plugs are changed.

The reason for this precaution is that in the single fault condition of the safety ground being absent on the computer, then leakage current could flow from the exposed pins of the probe socket. In this fault condition, there is no safety ground to the internal circuitry of the amplifier.

To observe the noise interference, the TEOAE program is used and put in the checkfit condition. The key N is pressed in Version4 software and the key O is pressed in Version5 software. Both provide an oscilloscope display of the electrical signal passing to the computer. The time-base displays 20 msec. Fig 1 shows the true electronic noise level of the amplifier without the probe connected. Fig 2 shows the appearance of mild electrical interference - from fluorescent lights. The source of the interference should be found and removed. It helps to reduce this interference by ensuring all power is taken from adjacent sockets in the same circuit with trailing wires kept as close to each other as possible.

In the event of severe radio frequency (RF) interference, (fig 3), this is minimised by ensuring power is drawn from the adjacent sockets in the same circuit,. Under adverse conditions of RF interference, it is possible for the high gain terminals within the plastic probe to receive signals which can be demodulated by the amplifiers. Under these conditions, the equipment should be operated in an electrically screened environment.



Fig 1

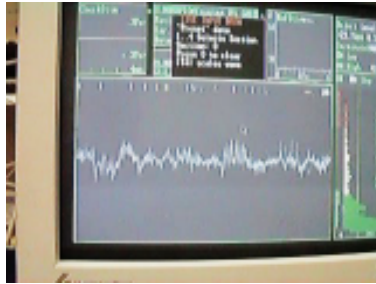


Fig 2

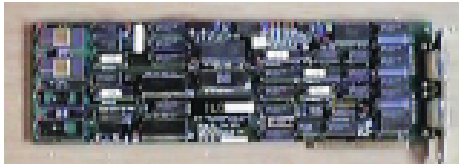


Fig 3

Appendix 3

Upgrading ILO92 to ILO96

You will need to inspect your ILO computer interface card to check the number of DAC chips installed.

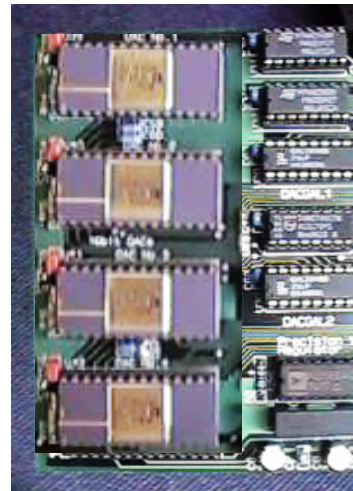


Remove the cover of your PC, as described previously. Observe the large chips at the end of the ILO card. These have a gold metal insert. Only the top chip is required for TEOAEs. The top two chips are needed for DPOAEs. Replace the computer cover.

The expandable ILO system has potential for expansion beyond the capability of current OAE systems. The ILO interface card can generate three sounds and so perform complex OAE suppression procedures, both binaurally and monaurally. The system is also capable of receiving input from two microphones, potentially allowing binaural OAE recordings to be made.

The development of these advanced OAE recording methods is the responsibility of the Institute of Laryngology & Otology (ILO) in its non-commercial research role. New procedures proven to be of clinical value will be introduced progressively, subject to clearance from the FDA.

Research workers wishing to participate in the development of OAE research may gain access to these advanced functions by upgrading their system to the ILO96 specification. This involves replacing the existing ILO92 amplifier with the ILO96 4-channel amplifier. The interface card remains unchanged, but must be fitted with its full complement of four DACs. Enhanced software is also required to access the new facilities.



Please contact Otodynamics or your dealer for further information (he may ask you how many chips are on your interface card).

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