Service Manual
Impedance Audiometer
AT235

Service Manual

Interacoustics

Item No 8121970 – D-0106881 F – 2018/01

Table of Contents

1. Introduction

1.1 About this manual

This manual is for our Impedance Audiometer AT235. The contents of the manual cover instrument related data, such as disassembly, calibration and pump module maintenance. Technical specifications, schematics, parts & accessories list along with the firmware update procedure can be found as appendices in the back of the manual.

1.2 About warnings and cautions

Where applicable, the below warning, caution and notice symbols are used throughout the manual, indicating the level of attention required for a given action:

 WARNING	The **WARNING** label identifies conditions or practices that may present danger to the patient and/or user.
 CAUTION	The **CAUTION** label identifies conditions or practices that could result in damage to the equipment.
NOTICE	**NOTICE** is used to address practices not related to personal injury.

1.3 General information

We continuously strive to improve our products and their performance, hence the specifications in this service manual are subject to change without further notice.

The performance and specifications of our products can only be guaranteed if technical maintenance is conducted routinely every year. Technical maintenance should be carried out by qualified personnel authorized by Interacoustics.

We are happy to receive any inquiries about our products. Our contact details are:

Interacoustics A/S	Phone:	+45 6371 3555
Audiometer Allé 1	Fax:	+45 6371 3522
5500 Middelfart	Mail:	info@interacoustics.com
Denmark	Web:	www.interacoustics.com

2. Disassembly

WARNING

Before starting this procedure, make sure that the instrument is disconnected from the power supply.

This chapter contains a thorough introduction and guide to the AT235. Carried out by a technician authorized by Interacoustics, the most common action would be the pump module maintenance with the purpose of detecting any deterioration on the pump tube. We recommend that pump module maintenance is conducted every 2-3 years to ensure proper function of the device.
The chapter includes other common actions, except from calibration which is thoroughly described in Chapter 3 and Chapter 4.

Tools required

- Torx T8 and T10
- Unbrako Hex Key 1.5
- Nut screwdriver 5
- Cross-point screwdriver
- Flat-sided screwdriver

2.1 Maintenance of the pump module

The pump module should be checked and if applicable maintained on a regular basis. We have ensured direct access to the module with the purpose of avoiding total disassembly of the instrument for pump module maintenance.

By removing all 4 screws in the access panel, direct access to the pump is enabled.

Figure 1

This allows the module to be taken out, inspected and replaced if necessary (e.g., due to deterioration).

Figure 2

The panel can now be carefully removed by lifting it up in the top end and releasing the bottom from its holder.

Figure 3

The pump module which is attached to the access panel can now be flipped over. Please note that it is still attached with a cable and a tube.

Figure 4

Releasing the module from the instrument allows easier access. This is done by carefully releasing the tube on the right hand side.

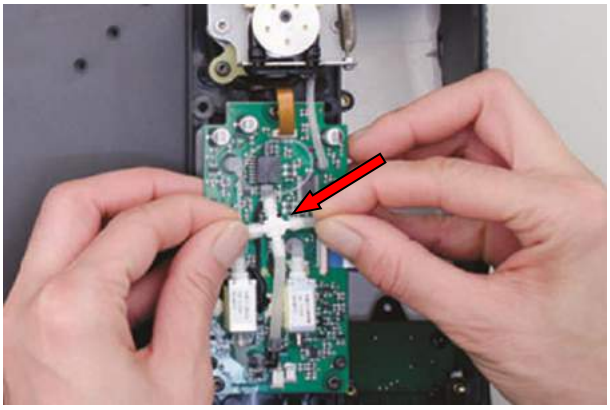


Figure 5

By sliding the black lock to the right allowing release of the cable, the module is no longer attached to the instrument.

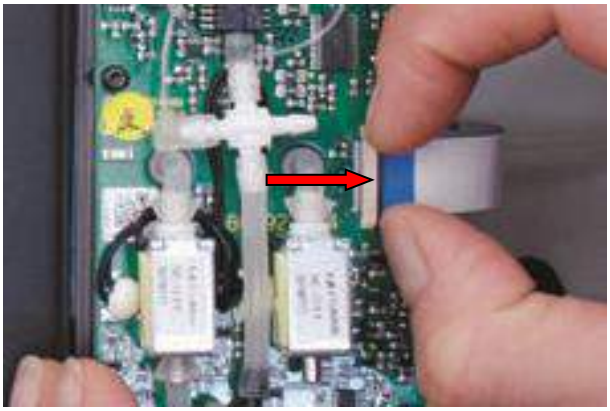


Figure 6

The silicone tube is easily removed from the pump outlet by pulling it apart gently. Pushing the pump arm slightly, the spring is ready to be unhooked.

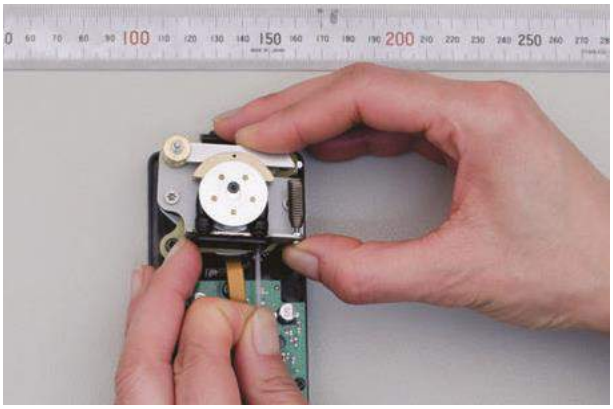


Figure 7

It is now possible to open the pump arm to the left, and the module is ready to be de-attached.

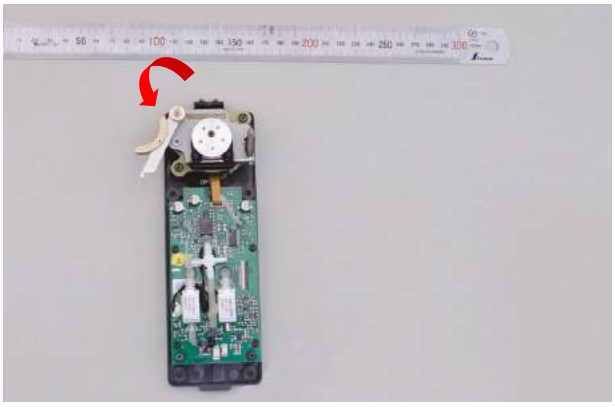


Figure 8

Remove the screw with an Unbrako key 1.5.

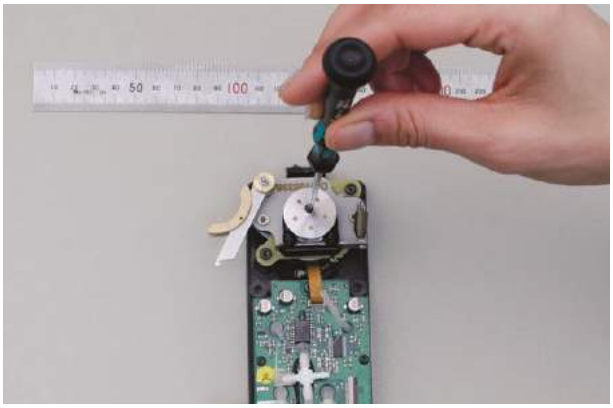


Figure 9

Figure 11

Use a flat bladed screwdriver to carefully open the lock mechanism holding the wheel in place.

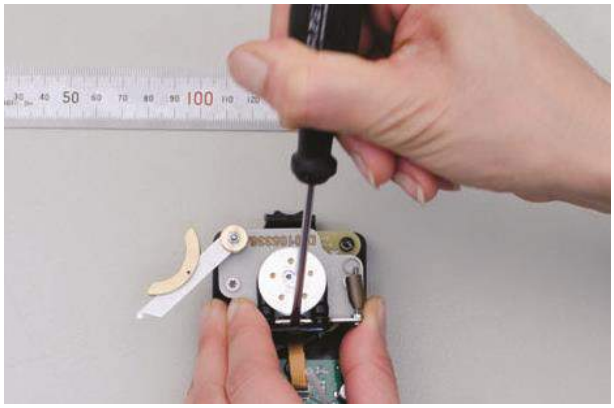


Figure 10

Once unlocked, the wheel with the pump tube can be lifted up and off of the module. It is now ready for replacement.

NOTICE

The wheel may have a tight fit and thus require some effort to remove.

2.2 Opening the cabinet

To disassemble the instrument, the top must be separated from the bottom cabinet. The cabinets are separated by removing the indicated screws with a Torx T10.

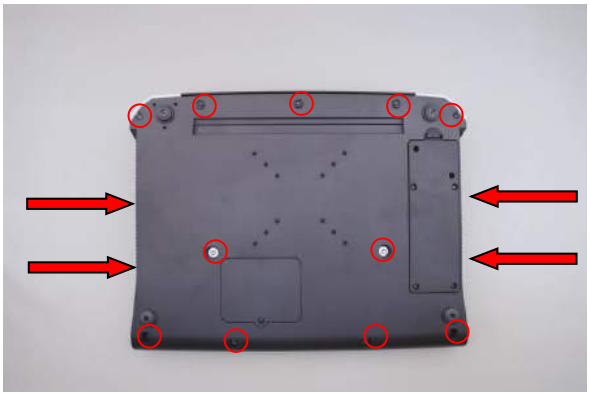


Figure 12

The panels are now loose for dismantling the parts. Be careful whilst separating as the parts are still attached with cables on the inside. Please note that the screen is not fully attached anymore.

Figure 13

By tilting the top, the cabinet is open for service.

Figure 14

Carefully, free the ribbon cable from the cabinet.

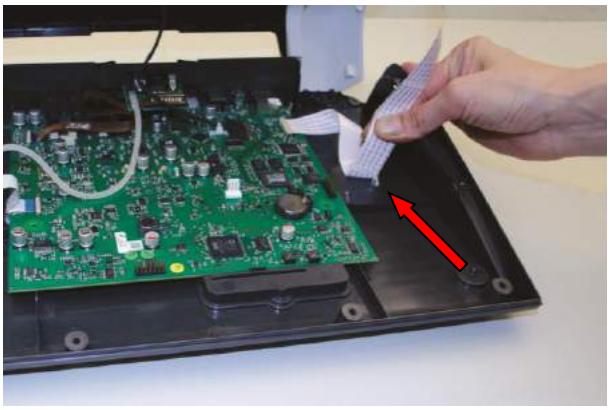


Figure 15

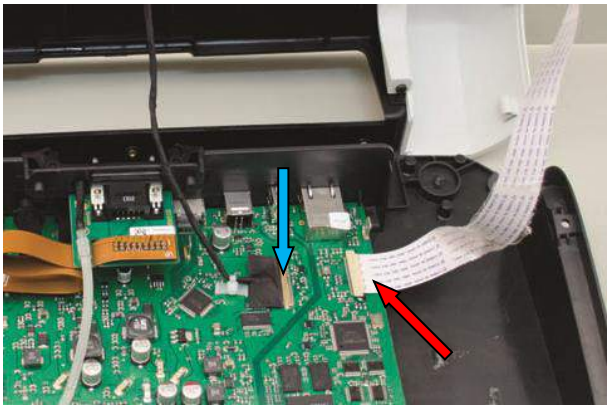


Figure 16

After releasing the ribbon cable and the display cable, the bottom and top cabinets are separated.

2.2.1 Main board

This chapter describes how the mainboard is removed.

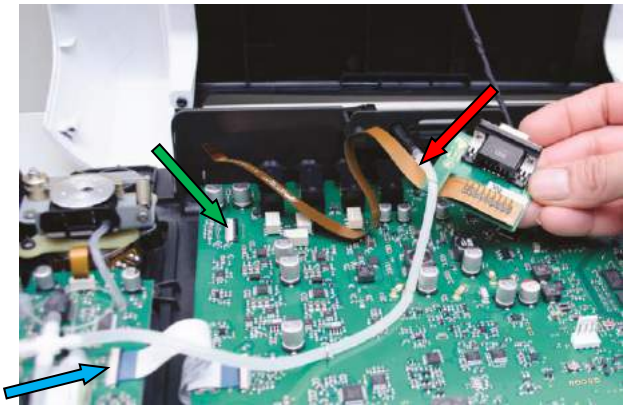


Figure 17

The probe connection board is released by unfastening the indicated points:

The white tube should be released at the indicated end and removed through the loops. The orange cable and the pump module cable are released by sliding their respective lock mechanisms to the right.

NOTICE

There are 4 screws holding the probe connection board in place. Two on the inside and two on the outer rear panel.

It is possible to change the probe connection board without removing the main board from the bottom cabinet.

Make sure that no tubes and cables are attached to the mainboard. Use the lock mechanism for releasing the main board from the frame.

Figure 18

The main board can now be removed from the cabinet by pulling it towards the cabinet front.

Figure 19

2.2.2 Rotary dial

For dismantling the rotary dial, remove the cover by flipping it off.

Figure 20

With a screwdriver, remove the 3 screws holding the cover in place.

Figure 21

Now, the 3 black screws holding the dial in place can also be removed with a screwdriver.

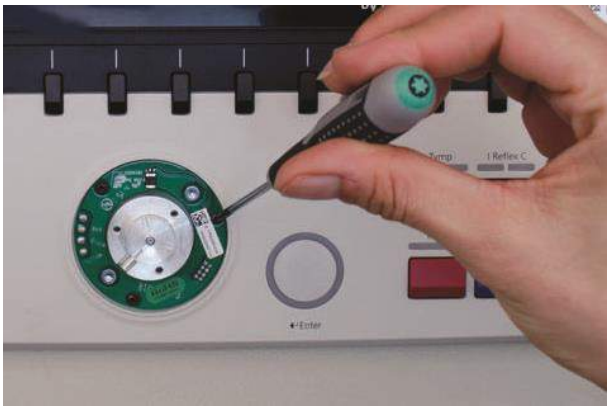


Figure 22

The rotary dial can now be removed from the top cabinet.

Figure 23

2.2.3 Display

To fully release the display from the cabinet, remove the screw from the rear panel cover and the 2 screws on the instrument, with a cross-point screwdriver.

Figure 24

By unlocking the snaps for the display cover, access is enabled when opening the panel.

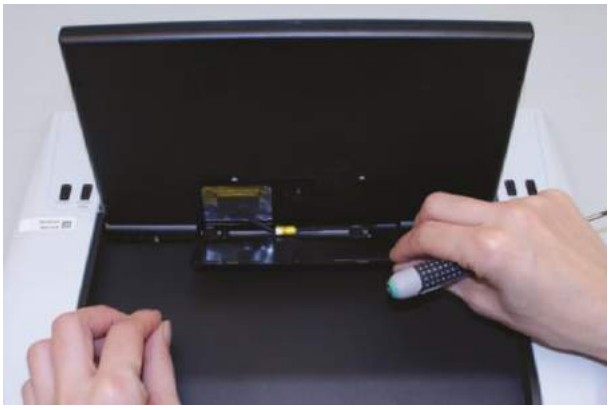


Figure 25

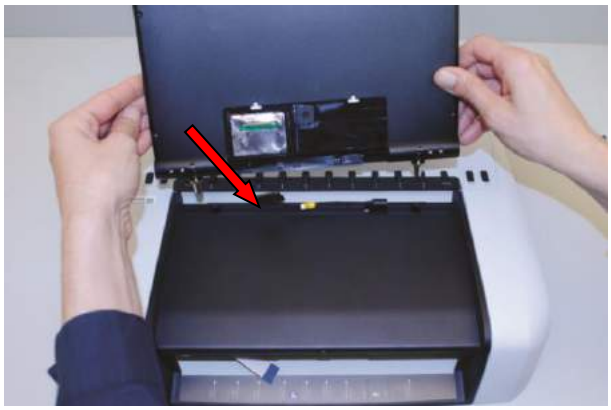


Figure 26

Remove the strip of kapton tape and then the display power cable. The display is now loose from the device.

NOTICE

The display is attached to the bottom cabinet, hence removal of the screws on the bottom cabinet is required before disassembly of the display is possible. Please refer to Opening the cabinet

2.2.4 Nice to know

Figure 27

Access to the SD card is possible when removing the panel and the screw holding it in place.

We highly recommend use of SD card types authorized by Interacoustics, as we otherwise cannot guarantee safe storage of the data.

NOTICE

Replacement of the SD card protocol overwrites present data and user settings.

This, however, does not affect the calibration of the device.

3. Calibration procedure for AT235

3.1 Service, adjustment and repair

Annual calibration (ANSI/ASA S3.6)
The calibration procedure will validate all relevant performance requirements given in ANSI/ASA S3.6. After the audiometric equipment has been submitted for calibration, a calibration certificate showing the values recorded must be filled out, signed and dated by the technician, demonstrating that the instrument conforms to all relevant requirements given in this standard.

CAUTION

It is considered good practice to perform annual checks of the audiometric test room's noise level as part of the annual calibration using the applicable table per ANSI/ASA S3.1 *American National Standard Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms* to ensure that audiometer performance will not be affected by any changes in the audiometric test room's noise levels.

Annual calibration (IEC 60645-1)
A basic calibration shall be performed by a competent laboratory. The procedure shall be such that, after the audiometric equipment has been submitted for a basic calibration, it shall meet the relevant requirements given in IEC 60645-1.

NOTICE

We recommended that a calibration check label with the next date of calibration, is attached to the equipment

3.2 Equipment requirements

3.2.1 Equipment requirements for impedance calibrations

To ensure proper calibration of audiometric equipment, test instruments must be reliable, stable and their calibration certified. The minimum requirements for measuring equipment are:

1) A measuring amplifier with input for condenser microphone or a sound level meter, fulfilling Type 1 of the IEC 60651 requirements.
2) An acoustics coupler, 6cc and 2cc fulfilling the requirements of IEC 60318-3 and IEC 60318-5.
3) An occluded ear simulator/artificial ear fulfilling the requirements of IEC 60318-4 and IEC 60318-1.
4) A manometer with a range from at least +300 to -600 daPa and an accuracy of ± 5% of reading or ± 5 daPa, whichever is the greatest. Including a syringe (manual pump).
5) CAT55 calibration cavities (0.2/0.5 and 2.0/5.0ml).
6) We recommend the use of an acoustic calibrator for the control of the complete measuring chain.
7) A general purpose frequency counter.
8) A general purpose digital multimeter.
9) A general purpose oscilloscope for the purpose of tracing and monitoring signals.
10) An oscilloscope or peak-peak voltage measurement equipment.

3.2.2 Equipment requirements for audiometer calibrations

1) A Type 1 sound level meter – Octave band filter set (1/3 octave, with range from 125 Hz to 16000 Hz) must meet Type 1 sound level meter requirements (ANSI S1.4). Sound level meters should be checked before use by means of a calibrator.
2) A system to measure:
   - Frequency
   - Rise time
   - Fall time
   - Duration
   - Overshoot
   - THD (Total Harmonic Distortion)
3) A Piston phone or sound level meter calibrator.
   - An ear simulator ANSI/ASA S3.7 or IEC 60318-1, Part 1: Electroacoustics - Simulators of human head and ear Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones.
   - Acoustic Coupler – NBS–9A (6cc) ANSI/ASA S3.7, or IEC 60318-3, Part 3: Electroacoustics – Simulators of human head and ear – Part 3: Acoustic coupler for the calibration of supra-aural earphones used in audiometry.
   - IEC 60318-5, Electroacoustics – Simulators of human head and ear – Part 5: 2 cm^3 coupler for the measurement of hearing aids and earphones coupled to the ear by means of ear inserts.
4) Specification / calibration information for all microphones, filters, SLM, and couplers showing correction values required for maintaining accuracy.
5) Other couplers and adapters as stated or specified by the manufacturer of the audiometer.
6) Calibration reports/sheets that demonstrate that the audiometer meets the requirements and record the results of measurement during the calibration.

3.3 Calibration of test equipment

All test equipment used for the calibration of audiometers is to be calibrated annually. Calibration of all test equipment is to be performed by a laboratory which is traceable to the National Institute of Standards and Technology (NIST) or equivalent. Test equipment calibration documents are to be kept on file.

3.3.1 Calibration mode entering

Connection between the instrument and a computer, should be conducted as described in Installing the Diagnostic Suite.The calibration program is activated by starting the program and following the on-screen instructions. The program is found via the below path:

Windows 7: C:\Program Files (x86)\Interacoustics\Diagnostic Suite\CalibrationAD629AC40AT235.exe

3.4 Checklist for calibration [1]

This list is a useful tool to make sure that no aspect of the calibration process is forgotten, so we highly recommend using it as the structure when calibrating the Impedance Audiometer.

	Pass / Fail
Mechanical inspection	
Plug - verify that plugs appear intact and undamaged	
Cables - verify that the cable insulation appears intact	
Display - verify that display is intact and undamaged. The tilt function should also work properly	
Keyboard - verify proper tactility function of keys	
Rotary - verify that the dial functions without hinder	
Headband - check proper tension	
Headphone cushions - make sure that the cushions are functional	
Probe tip - verify that the probe tip is intact and undamaged. If damaged, replacement of the tip is recommended. Check that the probe tip is not blocked in any way	
Probe "handle" - verify that it is undamaged	
Masking devices - check that they are intact	
Headset - check that it is intact	
Electric test [2]	
Instrument indicators - upon switch-on of the instrument, make sure that the light indicators are properly illuminated	
Key test – check all keys incl. the rotary button for functionality from *Patient response / Keyboard* (the on/off key is exempted)	
Patient response – connect and check unit functionality from *Patient response / Keyboard*	
Probe switch button - verify that instrument and the probe interacts properly using the *button/LED test* function	
Probe indicator - using the *Diode* test [3], verify proper diode function	
Linearity of attenuator- test according to Attenuator test	
Puretone - by means of an oscilloscope, make sure that the sinus tone is clean	
Routing - verify that signals function with the remaining output options	
Unwanted noise - control whether there is unwanted noise on any of the chosen transducers	
Crosstalk - verify that crosstalk is less than -70 dB	
USB host - verify USB functionality by printing on a MPT3 printer	
Tone switch - can be verified from the audiometer mode by tapping the enter button lightly	
Acoustic test	
Puretone - by means of an oscilloscope connected to the coupler amplifier output OR a hearing test. Making sure that the sinus tone is clean, test at various frequencies, especially at low frequencies	
Calibration - verify that all units are compatible and correctly calibrated	
Volume measurement - follow description in Volume test	

[1] Post calibration and before operation, the instrument should be checked for normal function.

[2] Conducted with the calibration utility.

[3] Under the tympanometer tab.

3.5 Installing the Diagnostic Suite

The Diagnostic Suite is available as a CD rom. However, the free Diagnostics Suite upgrade package and the Diagnostic Calibration Tools are available from our website: www.interacoustics.com/distributor/login-page

The upgrade package enables upgrade from previous versions of the software.
The calibration tools contain the software required for the annual calibration of the following instruments:

AC40 AD226 AD629 AT235 AA222

Prior to the first time the instrument is connected to the computer, a USB driver for the purpose of storing data has to be installed on the computer. In the below section, a guide to proper installation of the software can be found.

Insert the Diagnostic Suite CD-ROM into the designated drive on the computer. Select *DiagnosticSuiteSetup.*

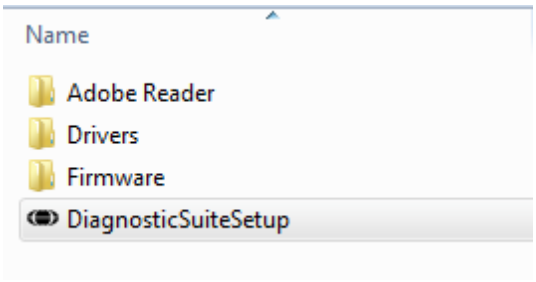


Figure 28

Select *Install* from the welcome page and allow the computer to install the software on the computer.

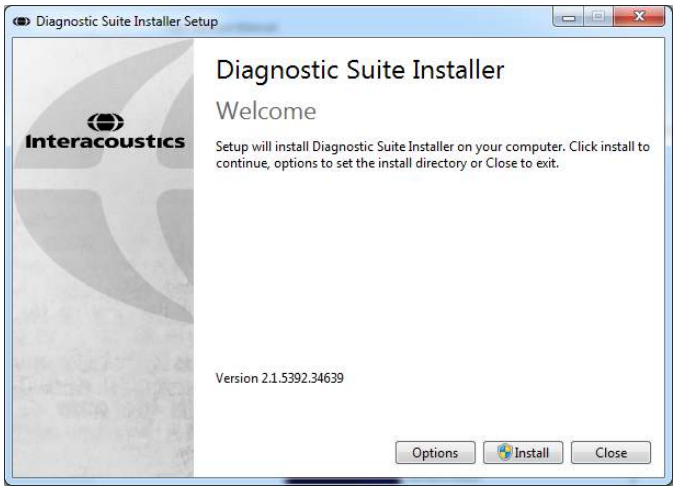


Figure 29

The computer now installs the software.

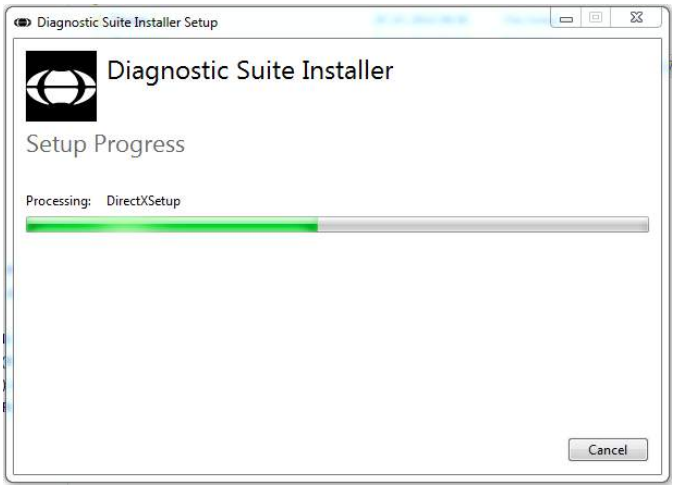


Figure 30

When the installation is completed, the Installer can be shut down by clicking *Close.*

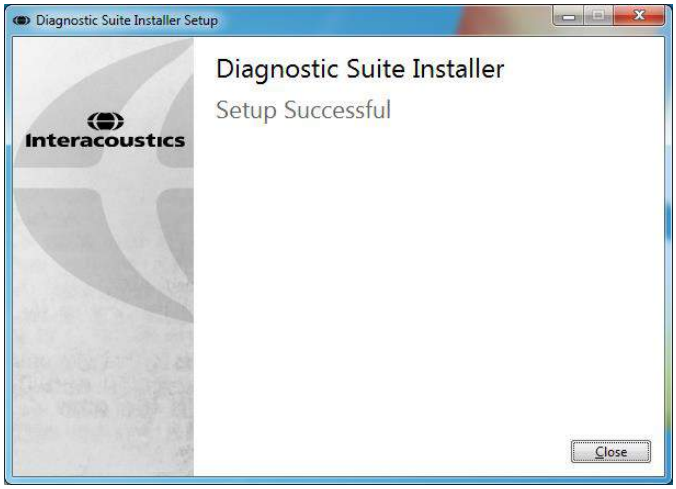


Figure 31

The driver has now been successfully installed, and AT235 is ready for connection to the computer.

Tip for use

Create a shortcut to the program

or

Pin it to the task bar for easier access

3.6 Main startup

Select C:\Program Files (x86)\Interacoustics\Diagnostic Suite\CalibrationAD629AC40AT235.exe

The startup screen should look as below with the *Connect* button highlighted to indicate correct connection.
If the *Connect* button is fully highlighted, the instrument is not properly connected. In this case shut down the application, open it and *Connect* again. Make sure that the instrument is connected correctly to a power source, and to the computer via a USB cable.

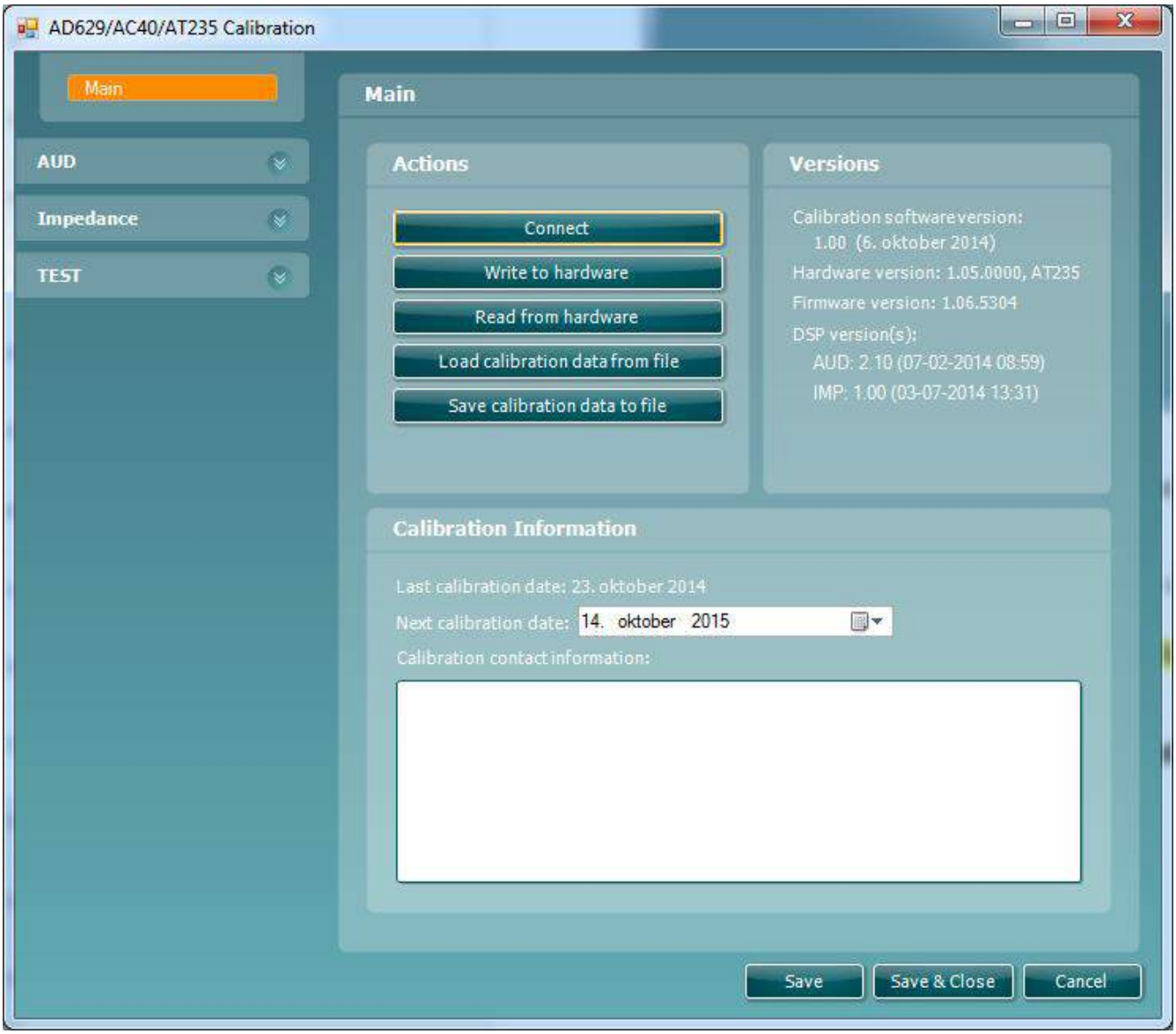


Figure 32

3.7 Saving the calibration data

There are two ways of saving the calibration data in the programme, and the only difference between the two is that method 1 is easier and ensures a continuous “saving flow”, should the computer or the equipment shut down in an untimely manner, for instance caused by a power outage.

Method 1.
Following each action simply save by selecting the *Save* button, as exemplified below.
Save can be used at any point to save the present values. All values in all screens are saved.
Save & Close saves and exits the application. In this case, a dialog box with the message “Calibration data successfully written to hardware” pops up when the action has been successfully completed.

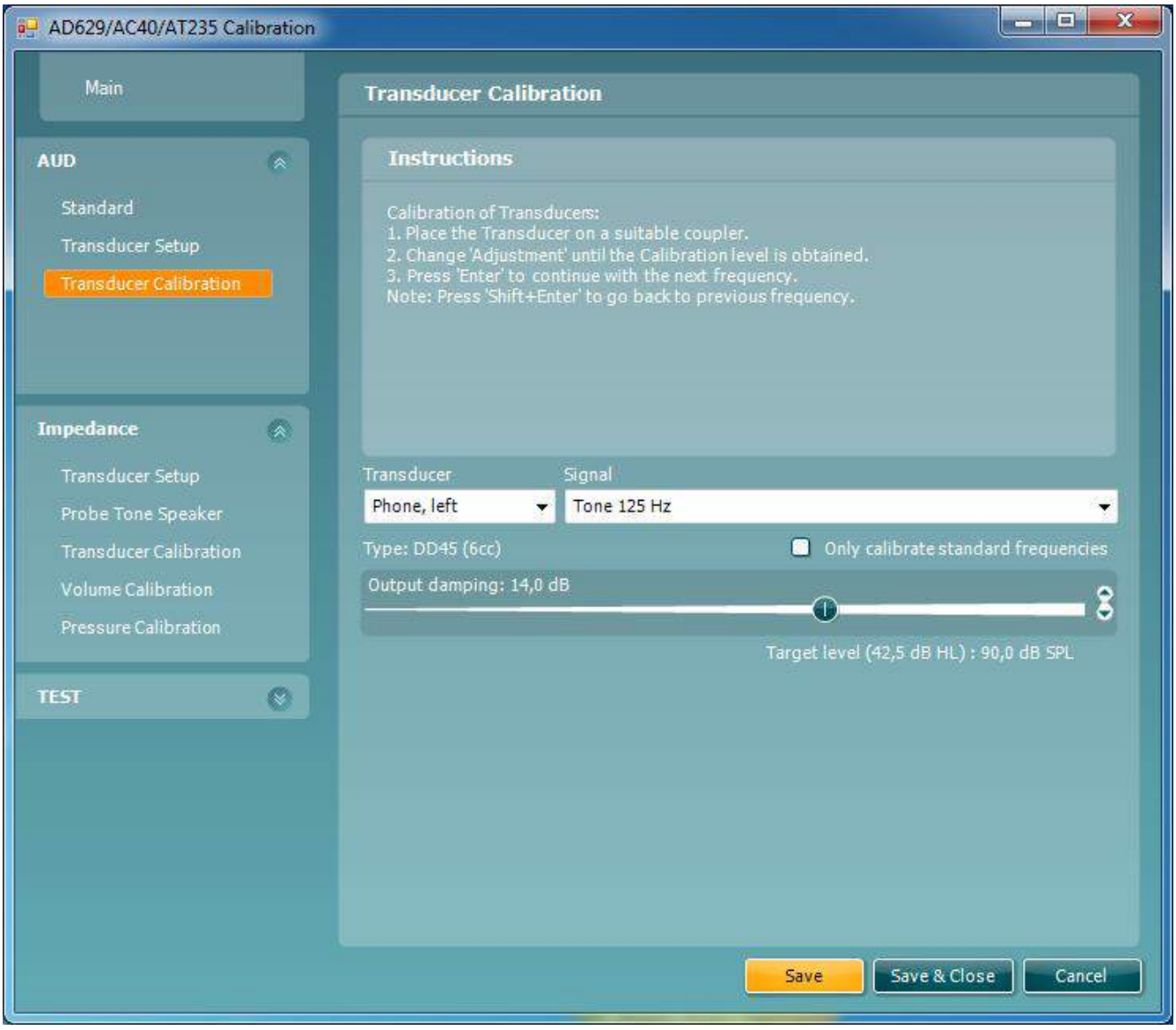


Figure 33

Method 2.
After a given action, go to the Main menu and select '*Write to hardware'* as illustrated below. A dialog box with the message *Calibration data successfully written to hardware* pops up when the action is successfully completed.

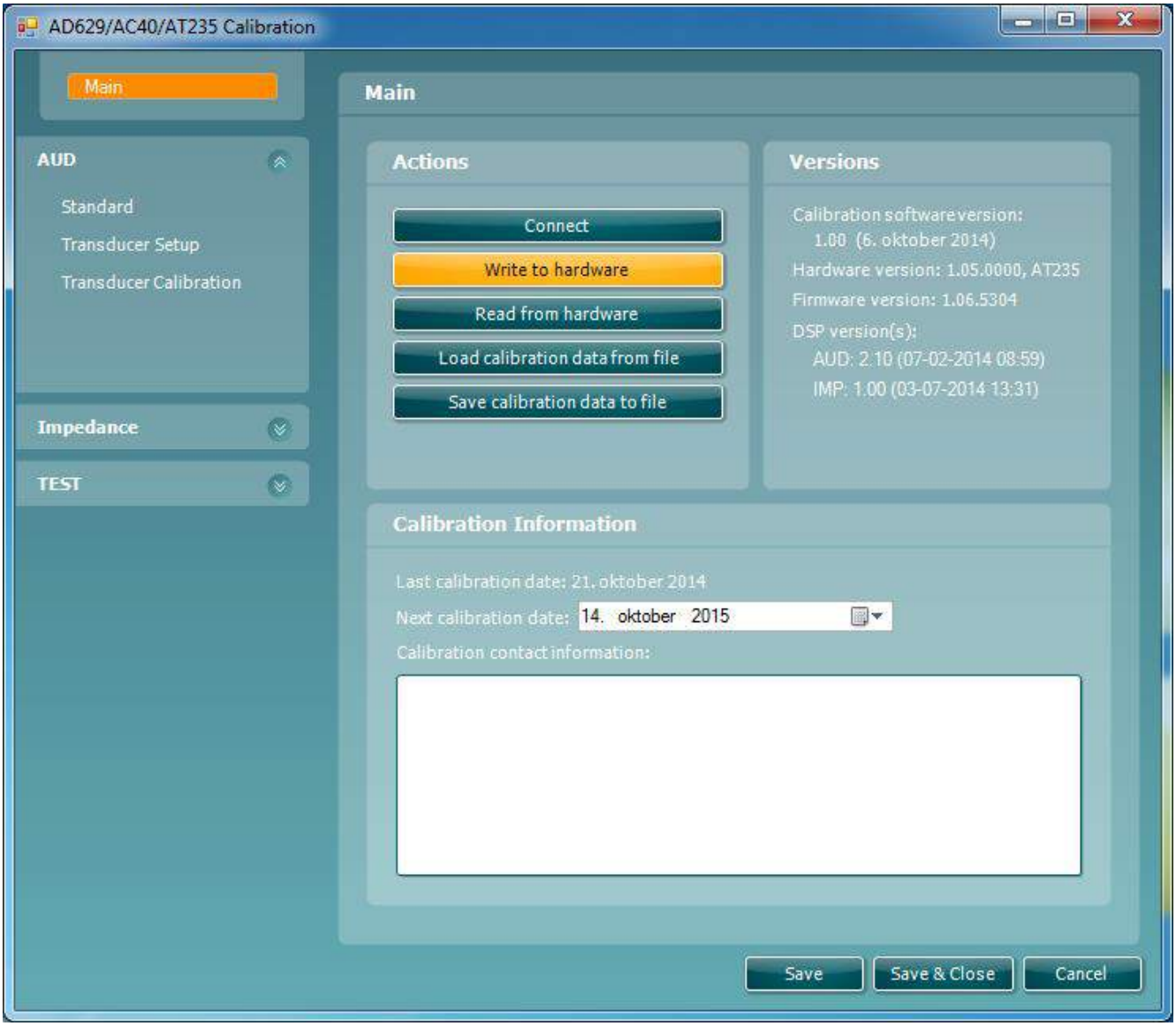


Figure 34

4. Calibration of transducers

4.1 Calibration standard for Impedance

4.1.1 Transducer setup

Select *Transducer setup* to upload the calibration values to the contra phone connected to the device.

NOTICE Switching between different transducers requires a new calibration of the transducer in question.

The probe contains calibration data for the Probe tone, IPSI and volume.

NOTICE Present calibration data will be over-written if saved! In this case, a total recalibration will be necessary for correct functionality of the selected item.

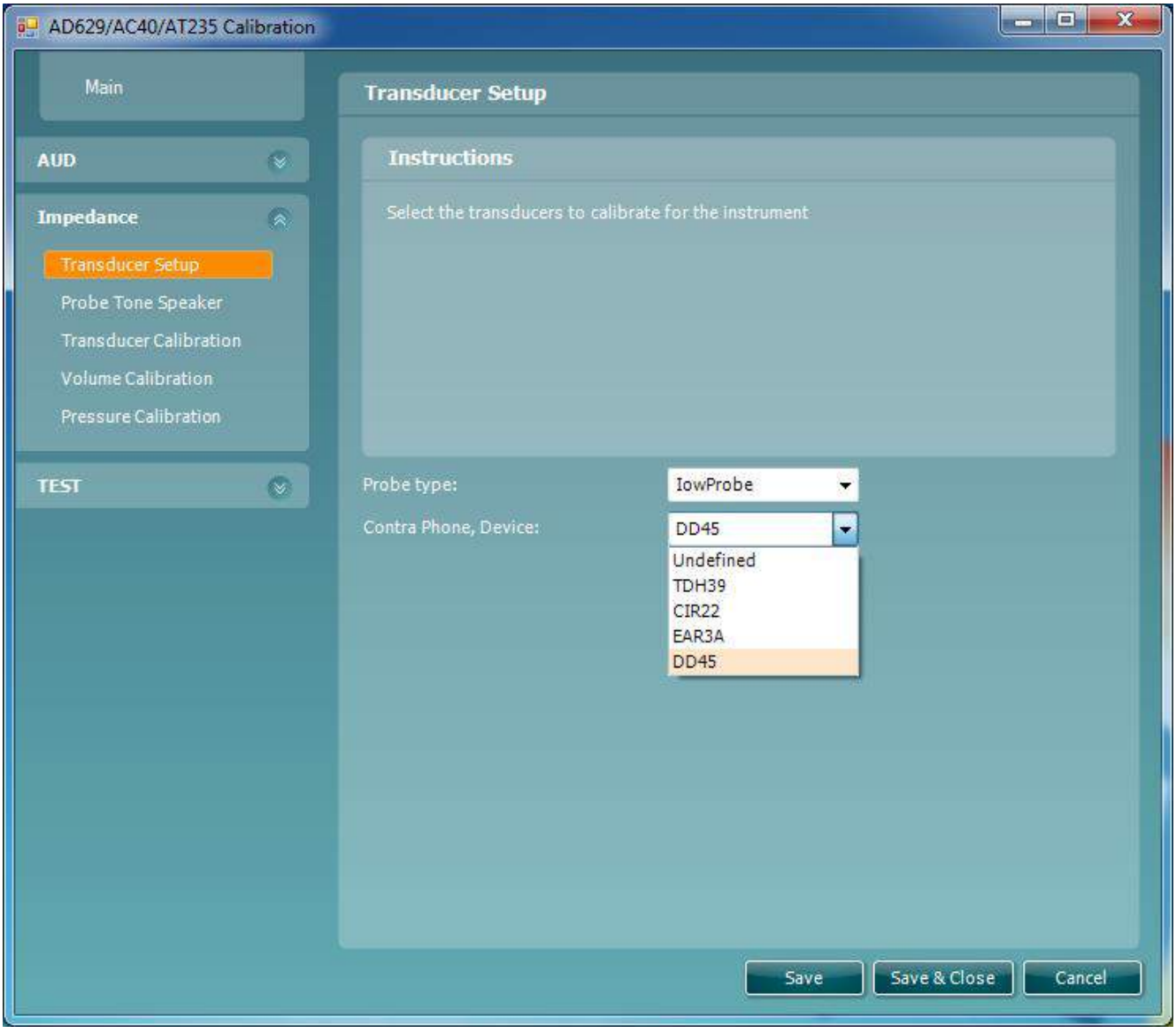


Figure 35

4.1.2 Probe tone speaker calibration

Select *Probe Tone Speaker* for calibration.

Connect the probe to a 2 cc coupler with corresponding preamplifier and RMS-meter.

Follow the on-screen instructions.

NOTICE It is essential to click '*Calculate Gain'* after each frequency level calibration.

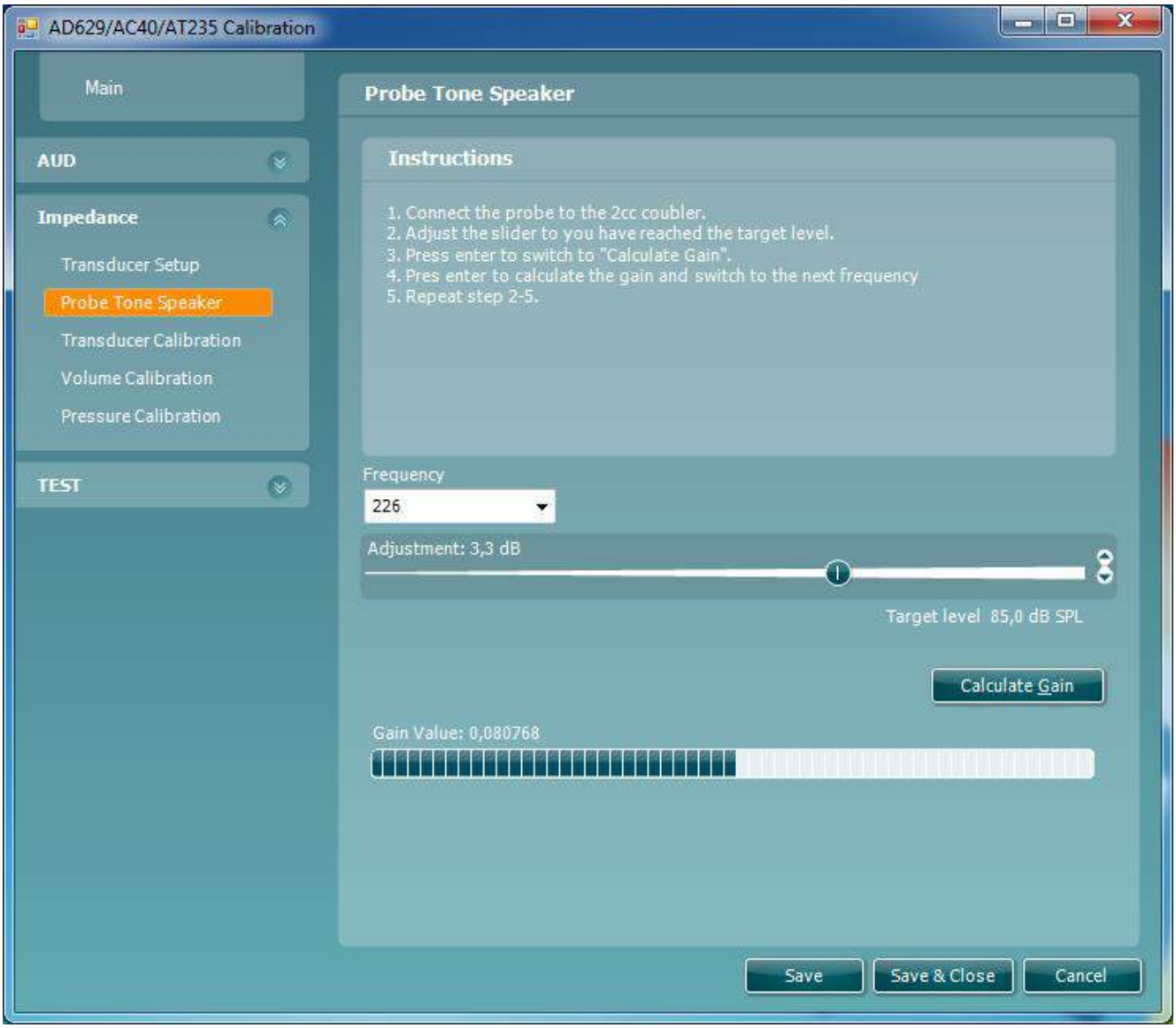


Figure 36

4.1.3 Transducer calibration

Select *Transducer calibration* to calibrate the transducers.

Select the relevant transducer and follow the on-screen instructions.

Upload defaults can be used when calibrating a new transducer in order to have a slide starting point closer to target.

Output damping is equal to attenuator settings.

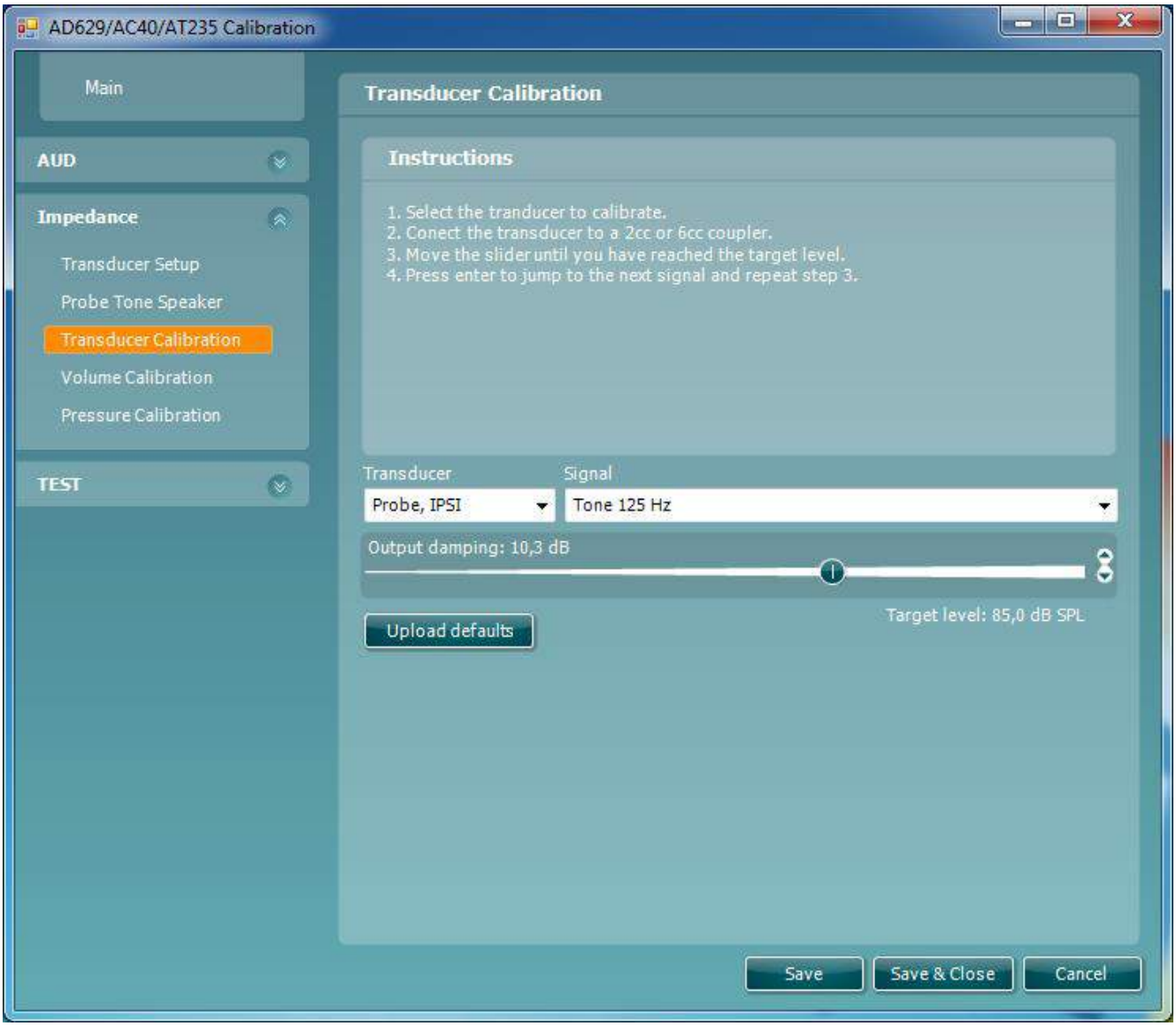


Figure 37

4.1.4 Volume calibration

Select *Volume Calibration.*

A CAT55 cavity set should be used. Background noise should be kept to a minimum.

Follow the on-screen instructions.

NOTICE

Height above sea level must be set before the volume calibration is conducted.

Verify that the result is successful when the calibration is completed in order to avoid problems later in the process.

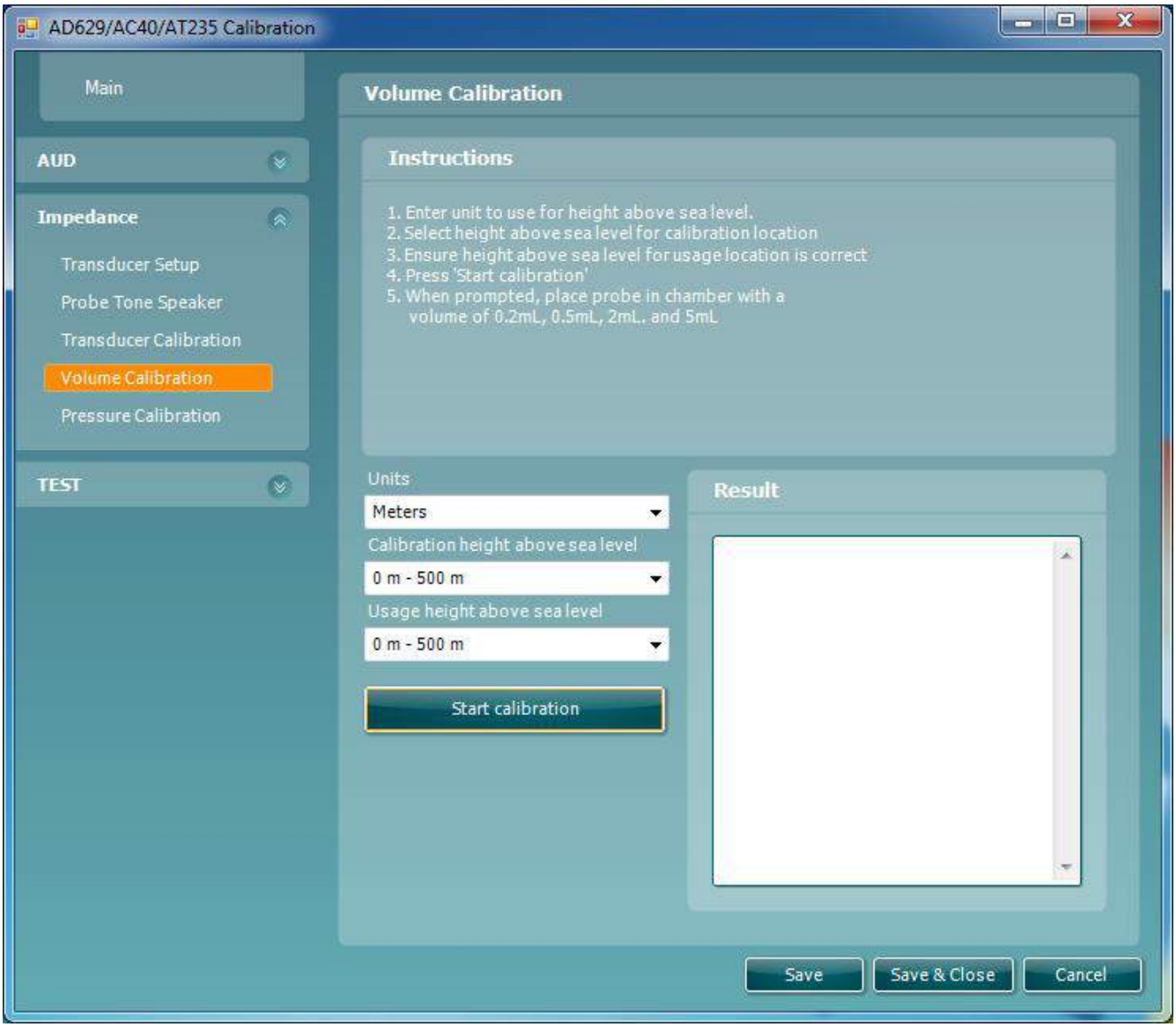


Figure 38

4.1.5 Pressure calibration

Select *Pressure Calibration.* Follow the on-screen instructions.

The Safety Valve itself is NOT calibrated; this is only a verification of the sensor. The Safety Valve calibration lies in the hardware and is therefore verified in the production process.

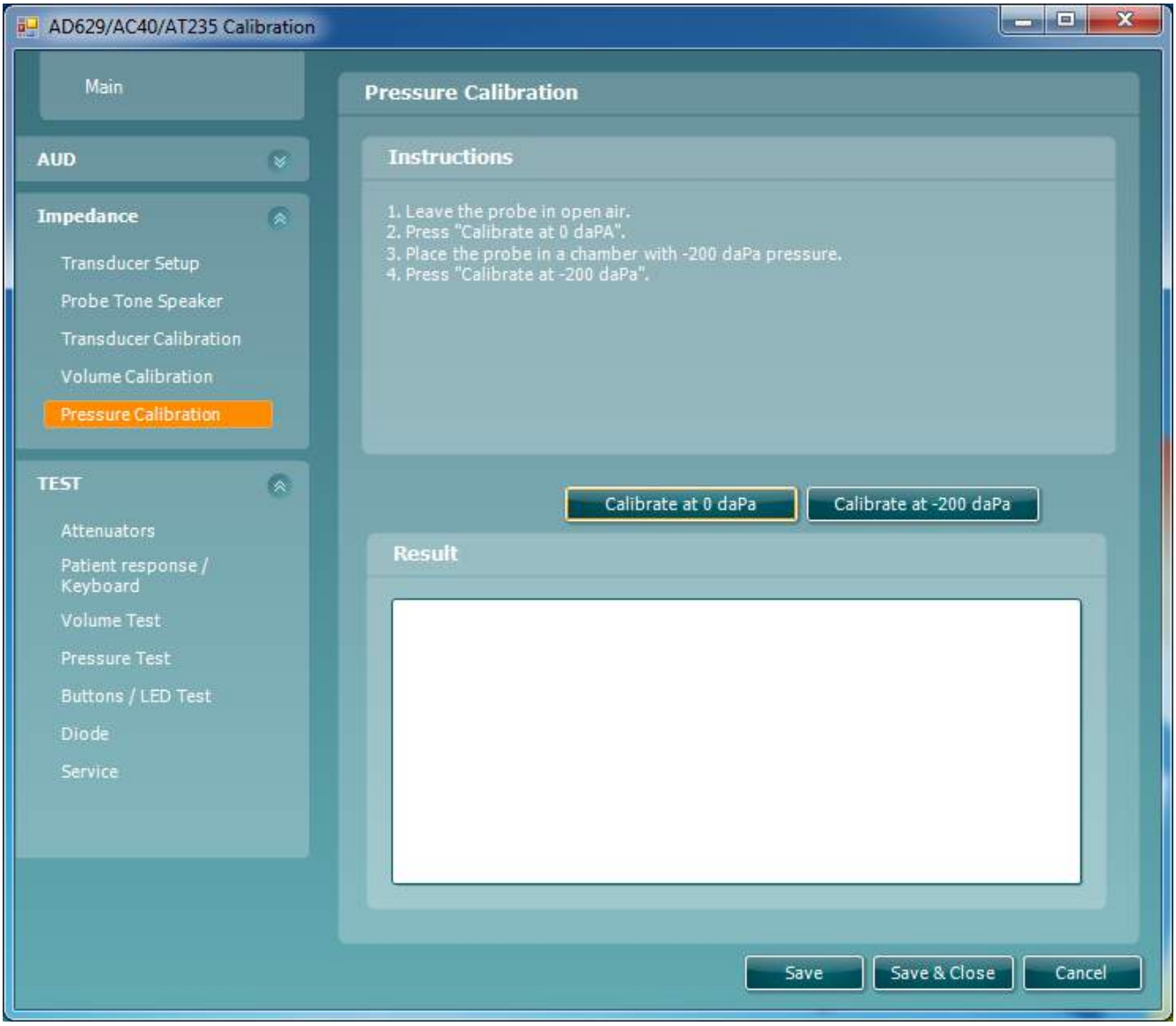


Figure 39

4.2 Calibration standard for Audiometer

Tone standard is selected via AUD and *Standard*. The options are IEC or ANSI.

Calibration method is selected via AUD and *Calibration method.* The options are SPL mode or HL mode.

SPL mode
The tab marked *'Standard'* is set to SPL (sound pressure level) by default, so taking the standard for the chosen transducer into account is not necessary. For correction of a 2cc or 6cc coupler/microphone, it is necessary to add or subtract from the 90dB SPL level which can be read on the sound level meter.

HL mode
If HL (hearing level) is selected, the calibration can be conducted as on a regular audiometer, where the standard is added to the HL values first, and the corrections for the coupler/microphone subsequently.

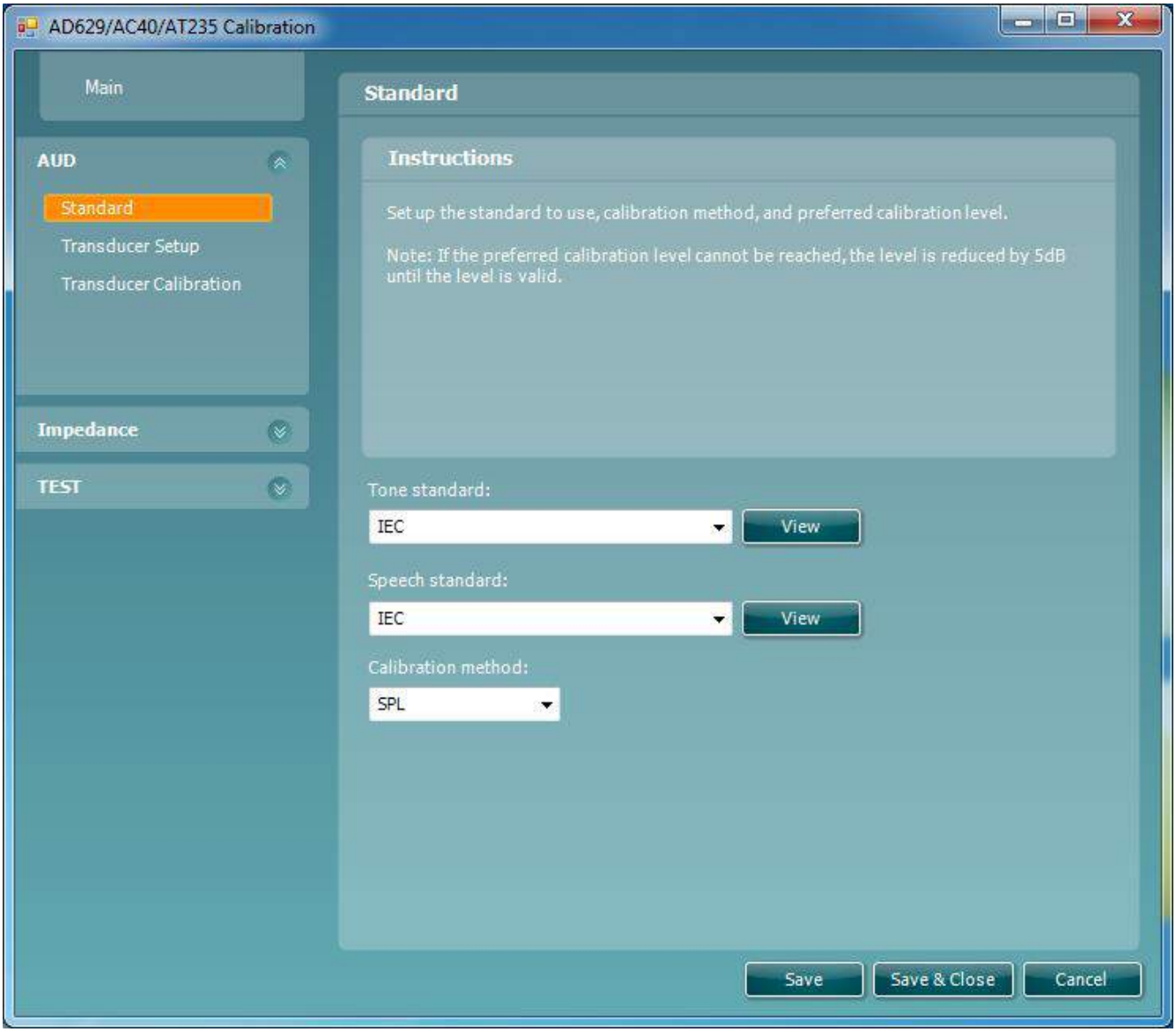


Figure 40

4.2.1 Selecting a transducer / how-to-guide

The following procedure is applicable for all transducer selections. Here, we have exemplified the procedure with the transducer type DD45, the standard transducer for this instrument.

Please note that following this section, a list with the specific equipment requirements for each suitable transducer type can be found as well as photos of the correct equipment setup. The procedure described below is applicable for all the listed transducers.

Example:

Select *Transducer Setup*.

Select *Headset phone* as type DD45.

Enter the serial numbers for the left and right phones in the fields *Left* and *Right.*

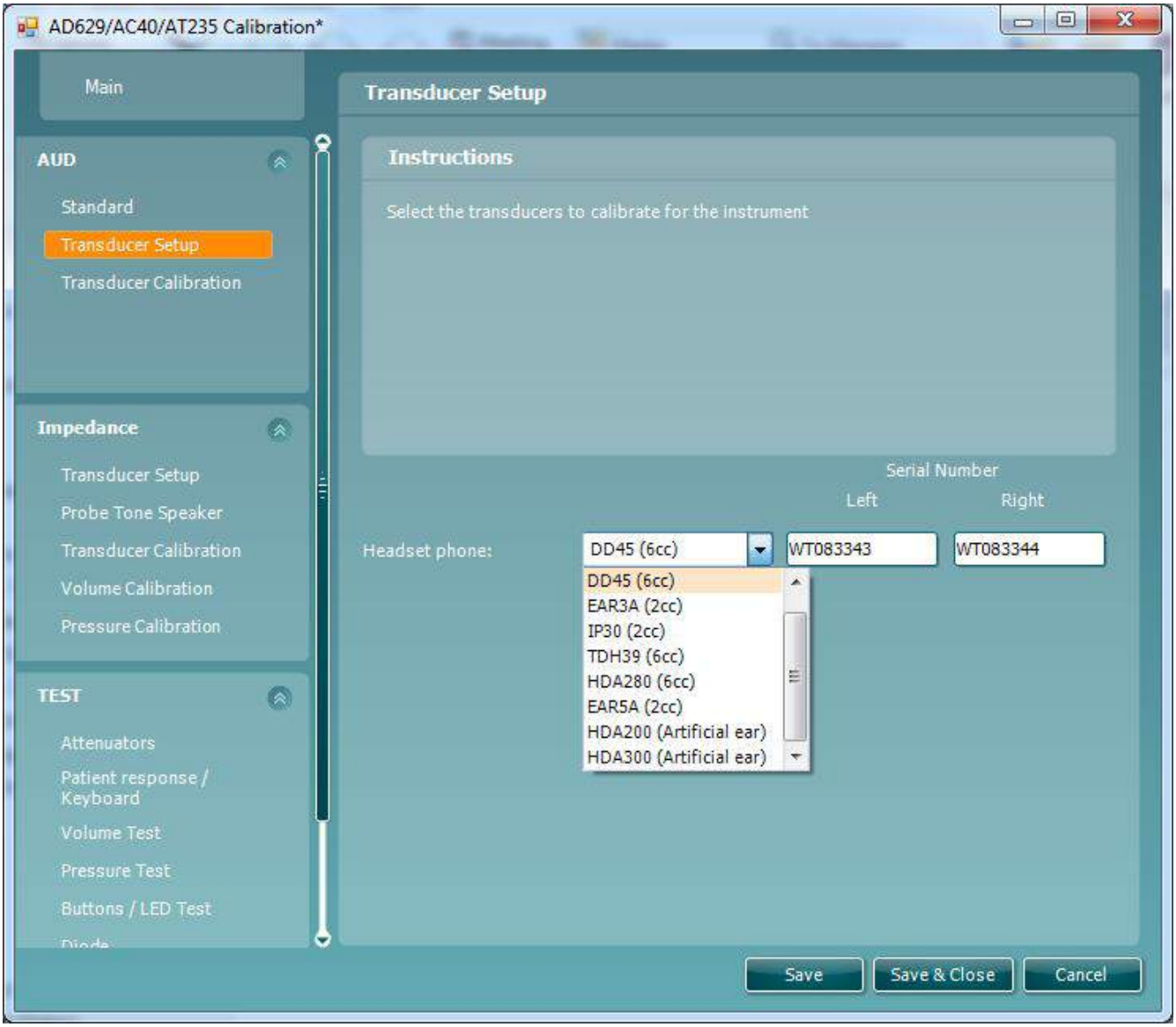


Figure 41

Figure 42

Calibration of DD45

Equipment needed for DD45 calibration

- Measuring amplifier
- Acoustical IEC 60318-3 (IEC 303) coupler
- Frequency counter
- Correction values for coupler

From the AUD menu, select *Transducer Calibration*.
Place the transducer on the 6cc IEC 60318-3 (IEC 303) coupler.

Adjust the slider until the calibration level is obtained on the measurement amplifier (i.e. 90 dB SPL).

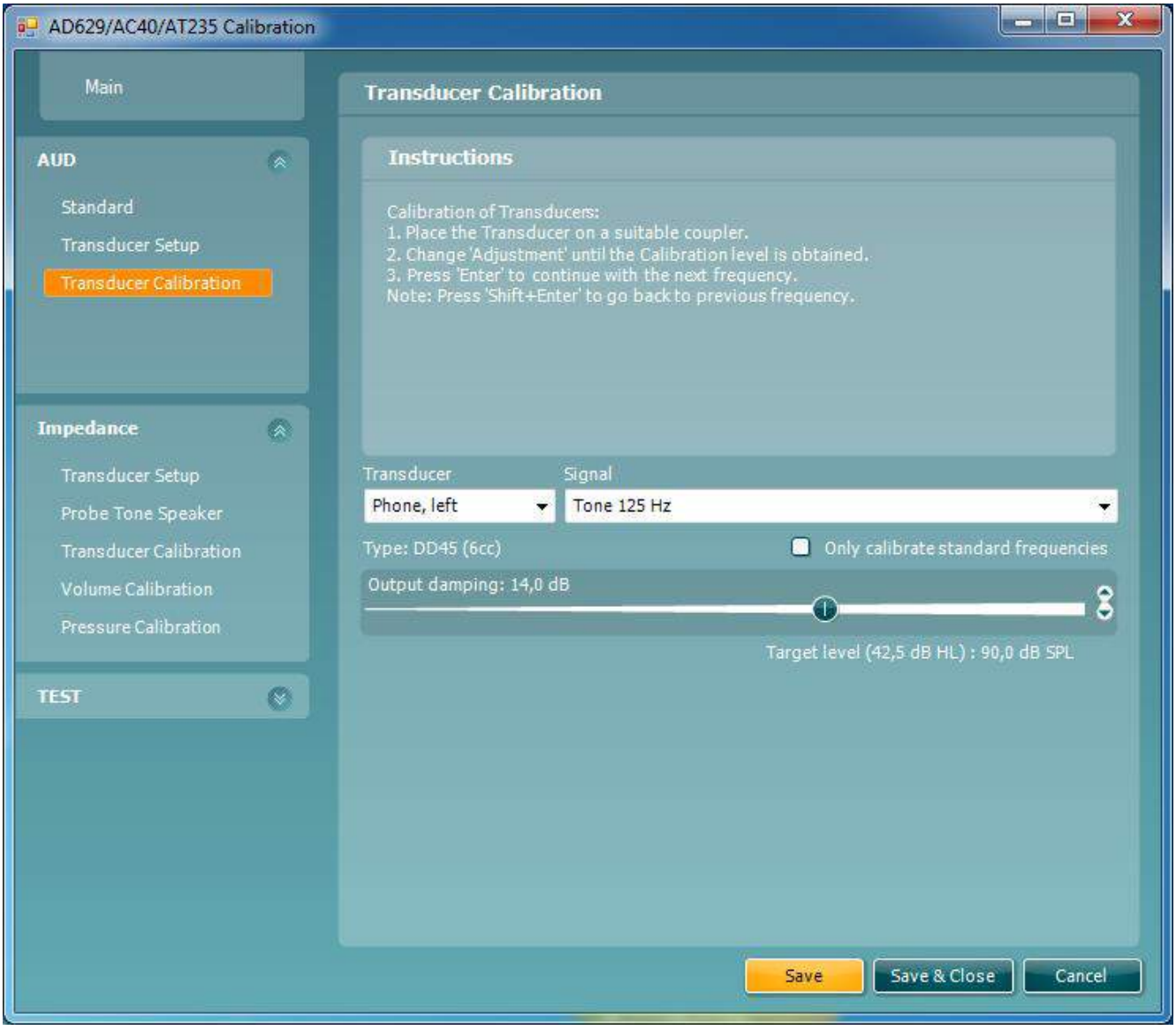


Figure 43

Check the frequency accuracy with a frequency counter. The accuracy has to be better than ±1%.
When the intended calibration level is obtained, use *'Enter'* to get the next frequency.
Repeat until all stimuli are calibrated, for both the left and right transducer.

NOTICE Do not forget to add or subtract the correction for your microphone

4.2.2 Transducer types and equipment requirements for calibration

Conduct the same procedure exemplified in Selecting a transducer / how-to-guide can be applied to all the transducers mentioned below.

Figure 44

TDH39

Equipment needed for TDH39 calibration:

- Measuring amplifier
- Acoustical IEC 60318-3 (IEC 303) coupler
- Frequency counter
- Correction values for coupler

From the AUD menu, select *Transducer Calibration.*
Place the transducer on the 6cc IEC 60318-3 (IEC 303) coupler as shown to the right.

Figure 45

EAR3A

Equipment needed for calibration of EAR3A:

- Measuring amplifier
- Acoustical IEC 60318-5 (IEC 126) coupler
- Frequency counter
- Correction values for coupler
- 30° adaptor cable

From the AUD menu, select *Transducer Calibration.*
Place the transducer on the 2cc IEC 60318-5 (IEC 126) coupler.

CIR 33

Equipment needed for calibrating the CIR 33:

- Measuring amplifier
- Acoustical IEC 60318-5 (IEC 126) coupler, fitted with eartip 10
- Frequency counter
- Correction values for coupler

From the AUD menu, select *Transducer Calibration.*
Place the transducer on the 2cc IEC 60318-5 (IEC 126) coupler.

Figure 46

5. Testing the tympanometer functionality

This chapter explains how to test the tympanometer.

5.1 Pressure test

Test maximum pressure limit (red dotted line)

Verify that the actual pressure does not cross the red dotted line at 600 daPa.
While at the current pressure, watch the pressure value in the bottom of the pressure test view. Make sure that the pressure does not drop more than 5 daPa (0.5 daPa/sec) during the next 10 seconds.

Release pressure by manually removing the probe from its cavity.
Set target pressure to -1000 daPa and verify that the actual pressure does not drop below the red dotted line at -800 daPa.

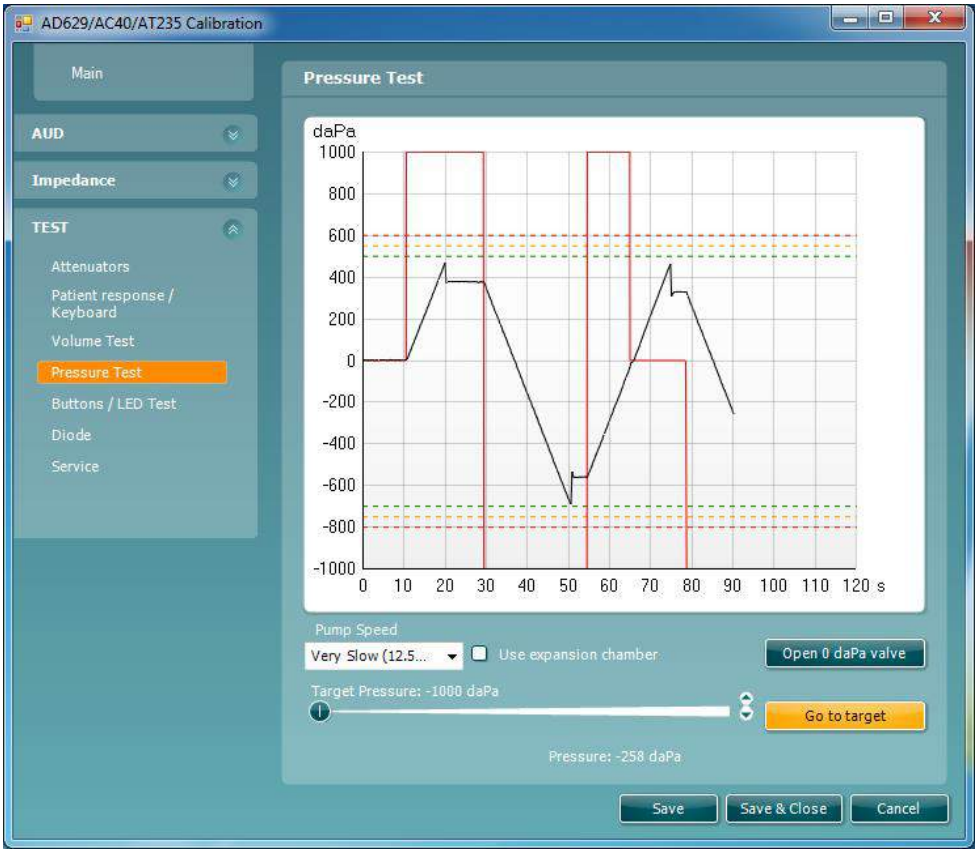
While at the current pressure, watch the pressure value in the bottom of the pressure test view. Make sure that the pressure does not drop more than 5 daPa (0.5 daPa/sec) during the next 10 seconds.
Release pressure by manually removing the probe from its cavity.

Test minimum pressure limit (green dotted line)

Place the probe in a 2ml hard wall cavity and select the slowest pump speed. Set target pressure to 1000 daPa and verify that the actual pressure does not cross the green dotted line at 500 daPa.
Set target pressure to -1000 daPa and verify that the actual pressure does not drop below the green dotted line at -700 daPa.

Select *Test* and then *Pressure Test.*

Place the probe in the 2cc cavity.



Reading the graphic

.. represents the criteria chosen with the slider and selected with *'Go to target'.*

.. represents the actual values of the chosen criteria.

.. represent the maximum and minimum required pressure levels.

Figure 47

5.2 Diode test

Select *Diode.*
Operation of the multicolor probe status indication LED is now enabled for testing.
This LED is situated at the rear of the probe body

Each of the seven colors becomes selectable with the purpose of verifying properly functioning LED glows.

Select *Test* and then *Diode Test.*

Check the functionality for all color options.

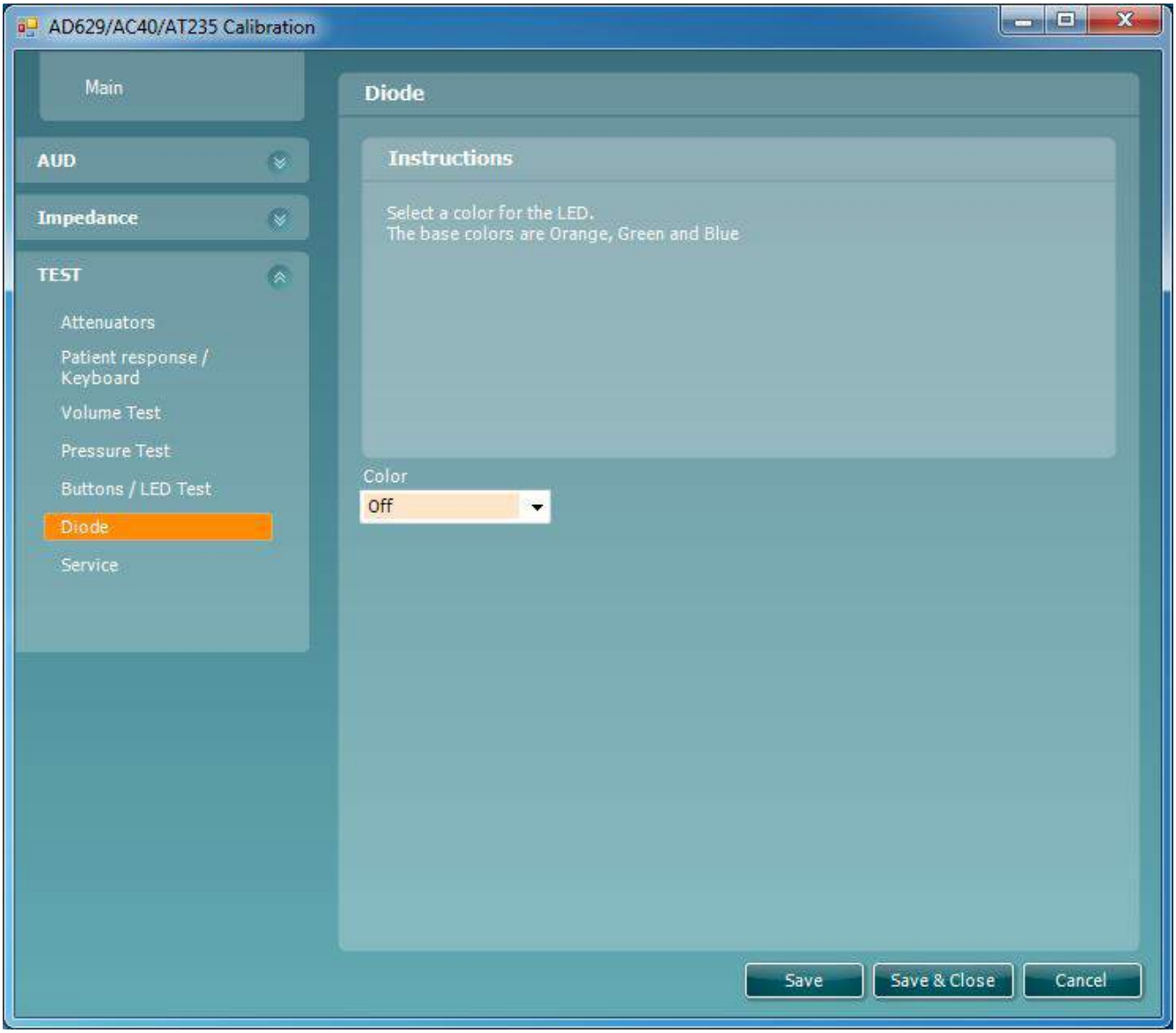


Figure 48

5.3 Volume test

Select *Volume test.*

A dynamic readout of the different probe tones volumes is displayed.

NOTICE At higher probe tone frequencies, larger volume capacities cannot be measured correctly

Maximum volume for probe tone frequencies:

Frequency Hz	226	678	800	1000
Max. cavity volume	8.0 ml	5.0 ml	4.23 ml	3.39 ml

Select *Test* and then *Volume Test.*

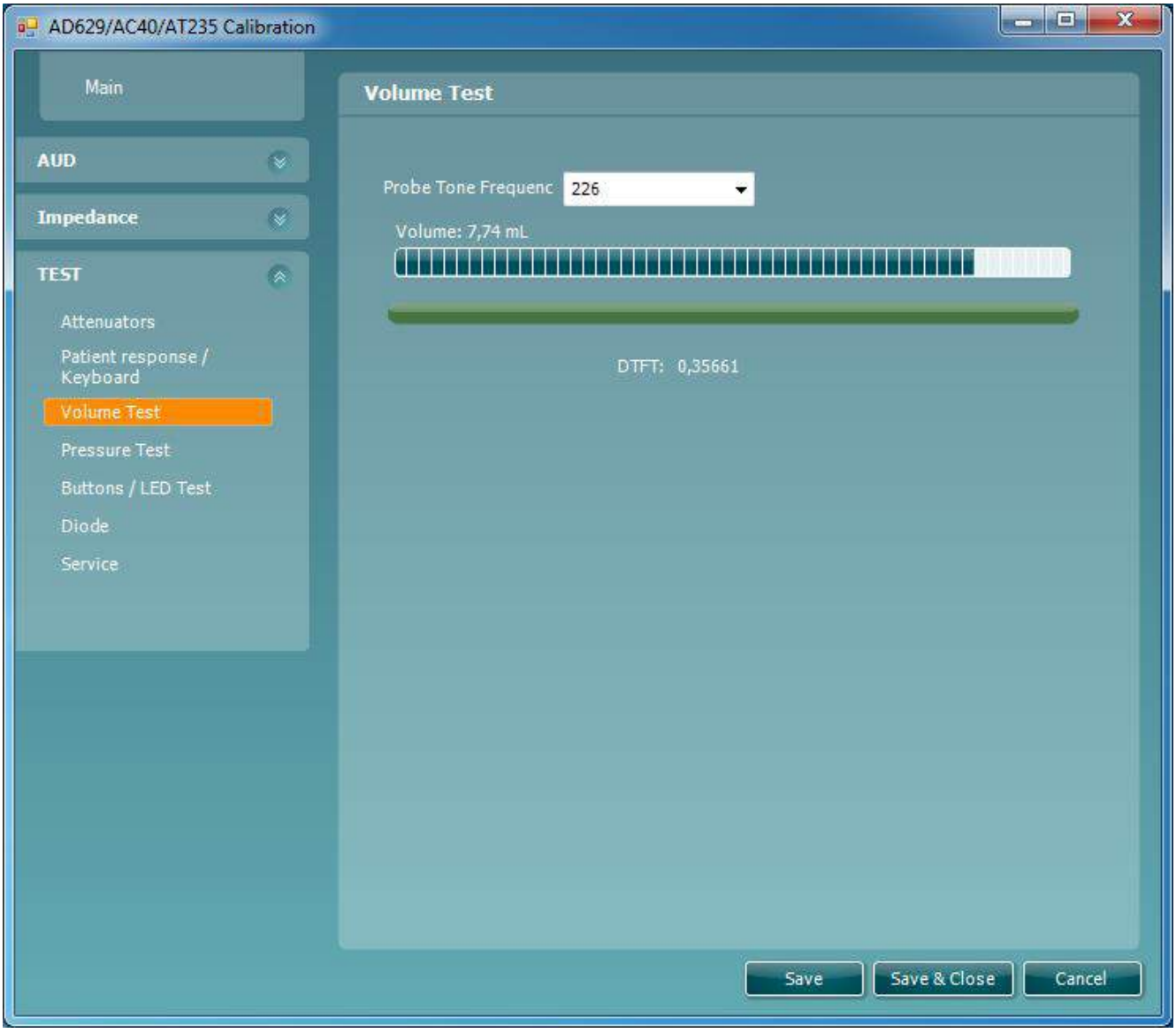


Figure 49

Control whether the tone 226 Hz is audible in the probe tip.

Place probe tip in a 2 cc cavity and check that the colored bar is changing color from blue to green.

The volume shows 2 ml (1.90 to 2.10 ml).

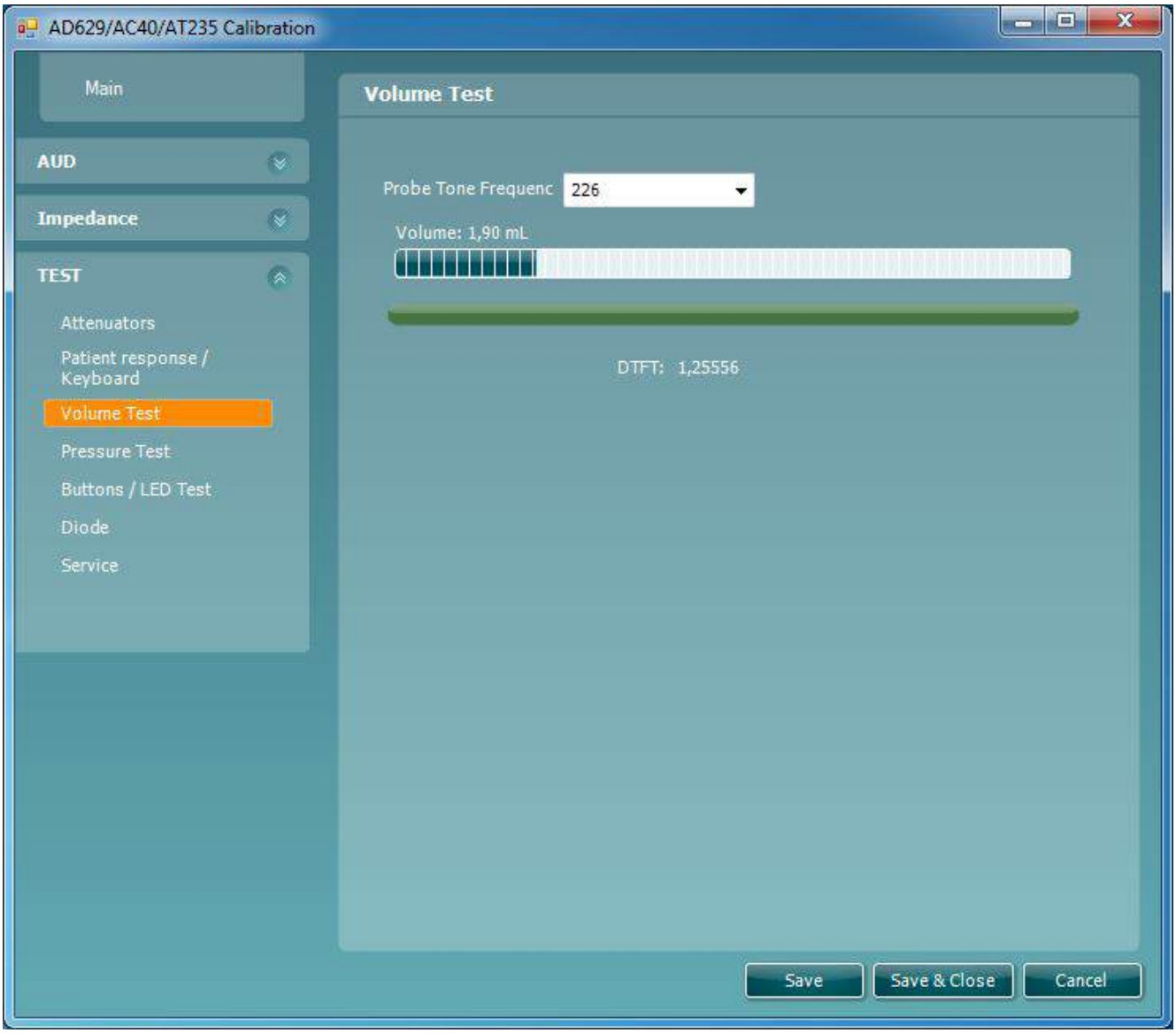


Figure 50

5.4 Attenuator test

This test screen enables a manual check of all the input/output channels of the instrument. The screen is divided into three sections, and must be used with utmost caution, as very high sound intensities can be reached.

CAUTION

Very high sound intensities can be reached.

1. *Output signals*
   In the signal output section, each of the output attenuators are controllable, enabling routing of the sound to a specific output (i.e. headphones, probe speaker etc.).
   - *Tone* switch ON/OFF
   - *Pulse* ON/OFF
   - *Stimuli frequency*

     The attenuator itself is divided into three sections (we refer to the block diagram for more information).

     Test points 5, 6 and 7 enable testing of each part of the attenuator.
   - Max. output = damping 0 - Min. output = damping 120
   - Fixed attenuator level 0 = no damping - Level 25 = add 25 dB attenuation/damping.
   - +20 dB attenuation, ON/OFF, ON = add 20dB on top of 4 + 5

     When damping is 20 dB or less the +20 box should be ticked. When damping is exactly 20 dB, ticking the +20 box is optional. Above 20 dB damping, the box should remain empty.
2. *Input Signals*
   In the signal input section, the functionality of an input can be verified. Via the dropdown menu the input is selected. The slider enables control of the input attenuator's amplification and the input level data on the VU-meter.
3. *Monitor / Talkback levels*
   This section verifies the functionality of the monitor / Talkback functionality. By changing position, control of the levels is enabled.

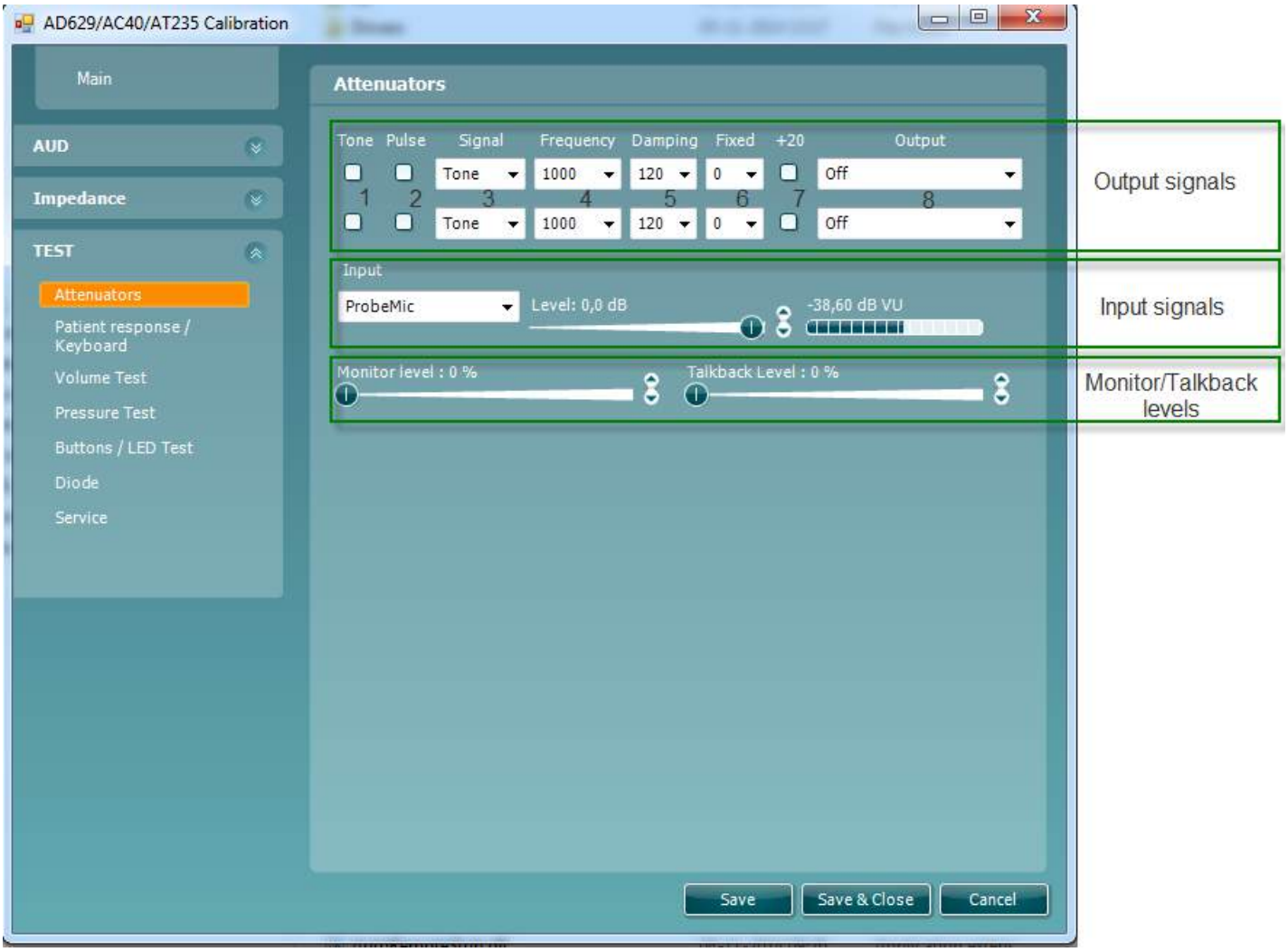


Figure 51

As illustrated below, make sure that the values are as follows:
0 dB = 3 V ± 0,3 V

This particular example is measured on the left output.

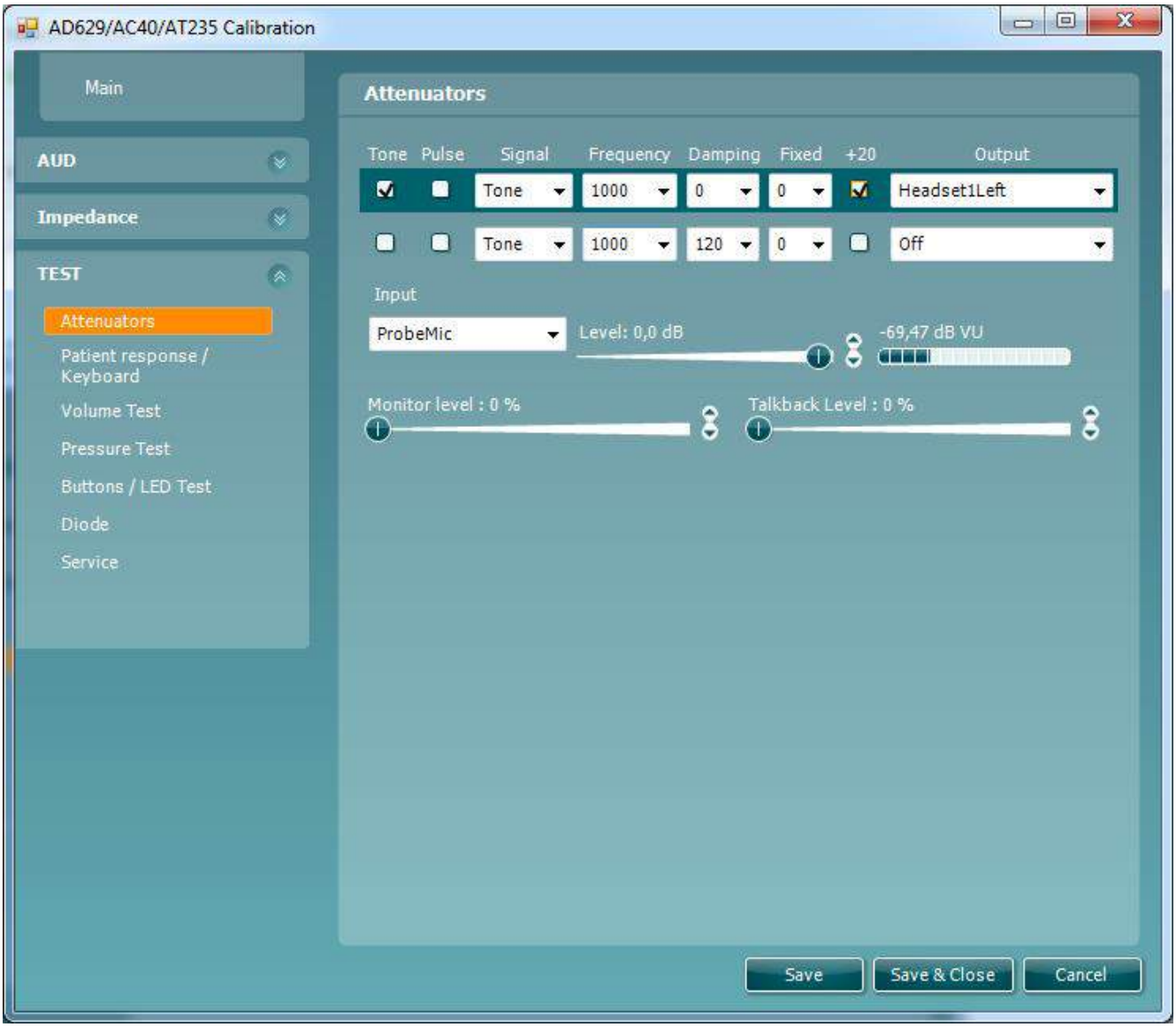


Figure 52

Now check at -60 dB = 3mV ± 0,3 mV
This particular example is measured on the left output.

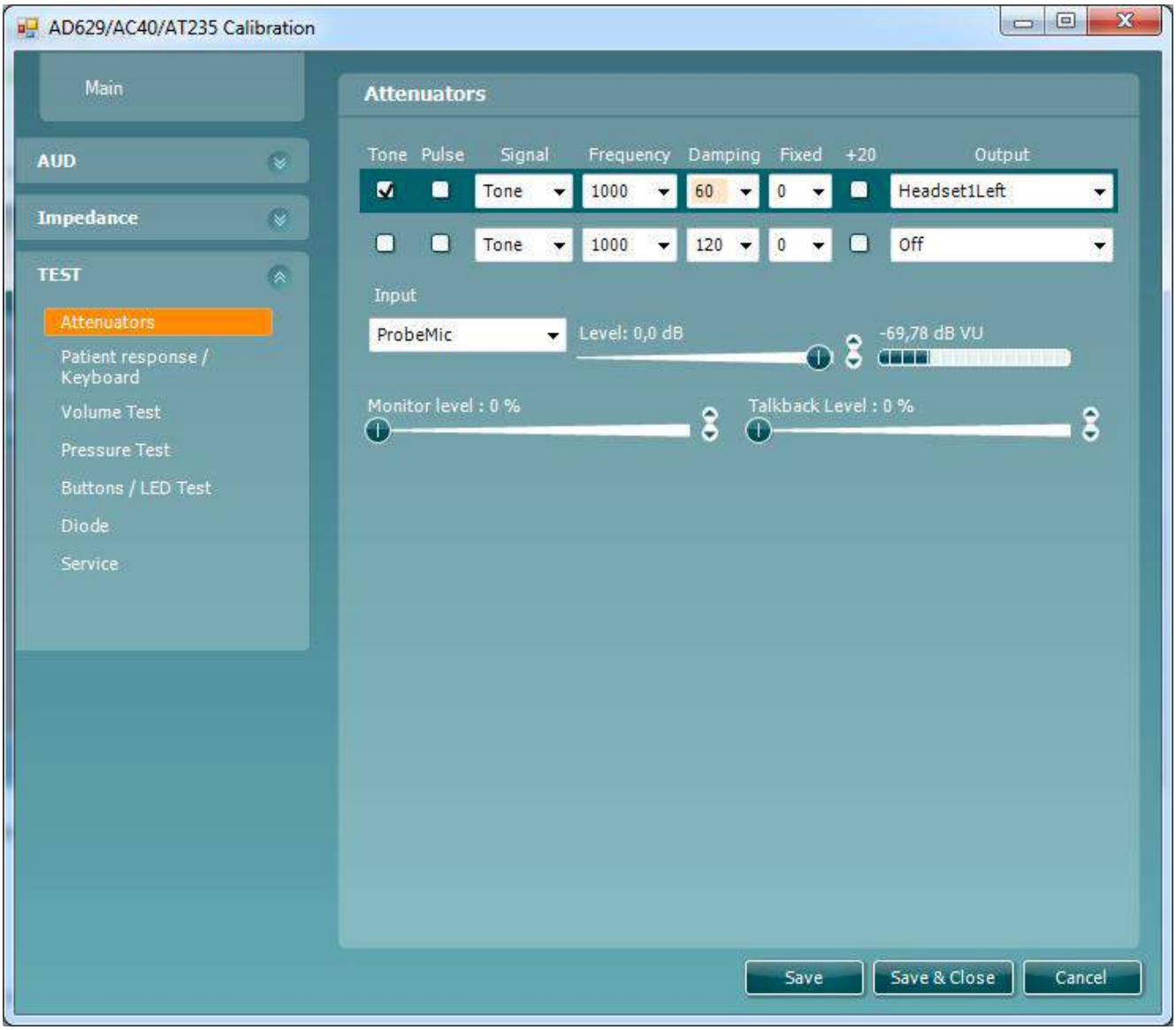


Figure 53

Repeat for the second attenuator using the *Headset1Right* output, making sure that the output corresponds with the selected.

APPENDICES

Appendix A - Technical specifications

General technical specifications

General

Medical CE-marking:	The CE certification indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is conducted by TÜV – identification no. 0123.	
Standards:	Safety:	IEC 60601-1, Class I, Type B applied parts
	EMC:	IEC 60601-1-2
	Impedance:	IEC 60645-5 (2004)/ANSI S3.39 (2012), Type 1
	Audiometer:	IEC60645-1 (2012)/ANSI S3.6 (2010), Type 4
Operation environment:	Temperature:	15 - 35 °C
	Relative Humidity:	30 – 90 %
	Ambient Pressure:	98 kPa - 104 kPa
	Warm-up Time:	1 minute
Display:	10 inch high resolution color display:	1024 x 600
Transport & storage:	Storage Temperature:	0 °C – 50 °C
	Transport Temperature:	-20 - 50 °C
	Rel. Humidity:	10 - 95 %
Internal storage:	500 clients and 50.000 sessions.	
Internal battery:		CR2032 3 V, 230 mAh, Li. Not serviceable by user.
PC control:	USB:	Input/output for computer communication. Data can be sent to and saved on the PC and stored in OtoAccess™ (Diagnostic Suite sync module is required).
Thermal printer (optional):	Type: MPT-III	Thermal MPT-III printer with recording paper in rolls. Print on command via USB.
Power supply:	UE60	Use only specified power supply unit UE60 type. Input: 100-240 VAC 50-60 Hz, 1.5 A Output: 24.0 VDC
Dimensions:	H x W x L	29 x 38 x 7,5 cm
AT235 weight:		2.5 kg

Impedance Measuring System

Probe tone:	Frequency:	226 Hz, 678 Hz, 800 Hz, 1000 Hz; pure tones; ±1 %
	Level:	85 dB SPL (≈ 69 dB HL) ±1.5 dB
Air pressure:	Control:	Automatic.
	Indicator:	Measured value is displayed on the graphical display.
	Range:	-600 to +400 daPa. ±5 %
	Pressure limitation:	-750 daPa and +550 daPa
	Pump Speed:	Automatic, Fast 300 daPa/s, Medium 200 daPa/s, Slow 100 daPa/s, Very slow 50 daPa/s
Compliance:	Range:	0.1 to 8.0 ml at 226 Hz probe tone (Ear volume: 0.1 to 8.0 ml) and 0.1 to 15 mmho at 678, 800 and 1000 Hz probe tone. All ±5%
Test types:	Tympanometry:	Automatic, where the start and stop pressure can be user-programmed in the setup function. Manual control of all functions.
	Eustachian tube function 1 - Non perforated eardrum	Williams test.
	Eustachain tube function 2 - Perforated eardrum	Toynbee test.
	Eustachian tube function 3 - Patulous Eustachian tube	Continuous sensitive impedance measurement.

Reflex Functions

Signal sources:	Tone - Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz, wide band, high and low pass.
	Tone - Ipsi, Reflex:	500, 1000, 2000, 3000, 4000 Hz wide band, high and low pass.
	NB noise – Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz
	NB noise – Ipsi, Reflex:	1000, 2000, 3000, 4000 Hz
	Stimulus duration:	750 ms
	Reflex Acceptance:	Adjustable between 2 % and 6 %, or 0.05 - 0.15 ml change of ear canal volume.

	Intervals:	Down to 1 dB step size.
	Intensity max.:	90, 100, 120 dBHL.
Outputs:	Contra Earphone:	TDH39 earphone, DD45 earphone, CIR insert and/or EARtone 3A insert for reflex measurements.
	Ipsi Earphone:	Probe earphone incorporated in the probe system for reflex measurements.
	Probe connection:	Connection of the electrical and air system to the probe.
Test types:	Manual Reflex:	Manual control of all functions.
	Automated Reflex:	Single intensities. Reflex growth.
	Reflex Decay:	Automatic, 10 dB above threshold and manually controlled with stimulus durations of 10.
	Reflex latency:	Automated, first 300 ms from stimulus start.

Audiometer Functions

Signals:

Frequencies Hz:	Intensities dB HL:
125	-10 to 70
250	-10 to 90
500	-10 to 100
1000	-10 to 100
2000	-10 to 100
3000	-10 to 100
4000	-10 to 100
6000	-10 to 100
8000	-10 to 90

Table 1

Test types: Auto Threshold Determination (Modified Hughson Westlake).
Auto testing: duration 1-2 s adjusted in 0.1 s intervals.

Calibration Properties

Calibrated Transducers:	Contralateral Earphone:	Telephonics TDH39/DD45 with a static force of 4.5 N 0.5 N and/or EARtone 3A and/or CIR insert phone.
	Probe system:	Ipsilateral Earphone: is integrated in the probe system. Probe frequency transmitter and receiver and pressure transducer is integrated in the probe system.
Accuracy:	General:	Generally the instrument is made and calibrated to be within and better than the tolerances required in the specified standards.
	Reflex Frequencies:	±1 %
	Contralateral Reflex and Audiometer Tone Levels:	3 dB for 250 to 4000 Hz and 5 dB for 6000 to 8000 Hz
	Ipsilateral Reflex Tone Levels:	5 dB for 500 to 2000 Hz and +5/-10 dB for 3000 to 4000 Hz
	Pressure measurement:	5 % or 10 daPa, whichever is greater.
	Compliance measurement:	5 % or 0.1 ml, whichever is greater.
Stimulus Presentation Control:	Reflexes:	ON-OFF ratio ≥ 70 dB Rise time = 20 ms Fall time = 20 ms A weighted SPL in Off = 31 dB

Impedance Calibration Properties

Probe tone	Frequencies:	226 Hz 1 %, 678 Hz 1 %, 800 Hz 1 %, 1000 Hz 1 %
	Level:	85 dB SPL 1.5 dB measured in an IEC 60318-5 acoustic coupler. The level is constant for all volumes in the measurement range.
	Distortion:	Max. 1 % THD
Compliance:	Range:	0.1 to 8.0 ml
	Temperature dependence:	-0.003 ml/C
	Pressure dependence:	-0.00020 ml/daPa
	Reflex sensitivity:	0.001 ml is the lowest detectable volume change.
	Reflex artifact level:	≥95 dB SPL (measured in the 711 coupler, 0.2 ml, 0.5 ml, 2.0 ml & 5.0 ml hard-walled cavities).
	Temporal reflex: characteristics: *(IEC60645-5 clause 5.1.6)*	Initial latency = 35 ms (5 ms) Rise time = 42 ms (5 ms) Terminal latency = 23 ms (5 ms) Fall time = 44 ms (5 ms) Overshoot = max. 1 % Undershoot = max. 1 %
Pressure	Range:	Values between -600 to +400 daPa can be selected in the setup.
	Safety limits:	-750 daPa and +550 daPa, 50 daPa
Barometric pressure:	The barometer pressure chances influence on the impedance measurement in the specified range (97300 - 105300 Pascal):	Admittance can vary inside: ± 4 % The pressure accuracy is: ±10 daPa or 10 %, whichever is greater.

Height above sea level: The pressure sensor used, is a differential/gauge type, meaning it measure the pressure difference and therefore not affected of the height above sea level:

Probe tones	0 meters	500 meters	1000 meters	2000 meters	4000 meters
226 Hz	1.0 mmho	1.06 mmho	1.13 mmho	1.28 mmho	1.65 mmho
678 Hz	3.0 mmho	3.19 mmho	3.40 mmho	3.85 mmho	4.95 mmho
800 Hz	3.54 mmho	3.77 mmho	4.01 mmho	4.55 mmho	5.84 mmho
1000 Hz	4.42 mmho	4.71 mmho	5.01 mmho	5.68 mmho	7.30 mmho

Table 2

The pressure accuracy is: ±10 daPa or 10 %, whichever is greater.
To minimize the influence of temperature, barometer pressure, humidity and height above sea level, it is always recommended to calibrate the unit in the local surroundings.

Temperature: The temperature have no theoretic impact on the impedance calculation, but the temperature has influence on the electronic circuits. This temperature influence for the standard specified temperature range (15-35 °C) is inside.
Admittance can vary inside: ± 5 %, ± 0.1 cm^3, $\pm 10^{-9}$ m^3/Pa·s, whichever is greater.

Reflex Calibration Standards and Spectral Properties:

General:	Specifications for stimulus and audiometer signals are made to follow IEC 60645-5	
Contralateral Earphone:	Pure tone:	ISO 389-1 for TDH39 and ISO 389-2 for CIR.
	Wide Band noise (WB):	Interacoustics Standard.
	Spectral properties:	As “Broad band noise” specified in IEC 60645-5, but with 500 Hz as lower cut-off frequency.
	Low Pass noise (LP):	Interacoustics Standard.
	Spectral properties:	Uniform from 500 Hz to 1600 Hz, 5 dB re. 1000 Hz level

	High Pass noise (HP):	Interacoustics Standard.
	Spectral properties:	Uniform from 1600 Hz to 10 KHz, 5 dB re. 1000 Hz level.
Ipsilateral Earphone:	Pure tone:	Interacoustics Standard.
	Wide Band noise (WB):	Interacoustics Standard.
	Spectral properties:	As *Broad band noise* specified in IEC 60645-5, but with 500 Hz due to lower cut-off frequency.
	Low Pass noise (LP):	Interacoustics Standard.
	Spectral properties:	Uniform from 500 Hz to 1600 Hz, 10 dB re. 1000 Hz level.
	High Pass noise (HP):	Interacoustics Standard.
	Spectral properties:	Uniform from 1600 Hz to 4000 Hz, 10 dB re. 1000 Hz level.
	General about levels:	The actual sound pressure level at the eardrum will depend on the volume of the ear.

The risk of artifacts at higher stimulus levels in reflex measurements are minor and will not activate the reflex detection system.

Reference Values for Stimulus Calibration

	Freq.	Reference Equivalent Threshold Sound Level (RETSPL) [dB re. 20 µPa]						Variation of Ipsi stimulus levels for different volumes of the ear canal Relative to the calibration performed on an IEC 126 coupler [dB]		Sound attenuation values for TDH39/DD45 earphones using MX41/AR or PN51 cushion [dB]
		ISO 389-1 (Interacoustics Standard)	ISO 389-2 (Interacoustics Standard)	ISO 382-2 (Interacoustics Standard)	ISO 389-1 Interacoustics Standard	Interacoustics Standard	ISO 389-4 (ISO 8798)	0.5 ml	1 ml	
	[Hz]	TDH39	EARtone 3A / IP30	CIR	DD45	Probe	NB Stimulus Correction Values			
RETSPL	125	45	26	26	47.5	41	4			3
	250	25.5	14	14	27	24.5	4			5
	500	11.5	5.5	5.5	13	9.5	4	9.7	5.3	7
	1000	7	0	0	6	6.5	6	9.7	5.3	15
	1500	6.5	2	2	8	5	6			21 (1600 Hz)
	2000	9	3	3	8	12	6	11.7	3.9	26
	3000	10	3.5	3.5	8	11	6	-0.8	-0.5	31 (3150 Hz)
	4000	9.5	5.5	5.5	9	3.5	5	-1.6	-0.8	32
	6000	15.5	2	2	20.5	3	5			26 (6300 Hz)
	8000	13	0	0	12	-5	5			24
	WB	-8	-5	-5	-8	-5		7.5	3.2	
	LP	-6	-7	-7	-6	-7		8.0	3.6	
	HP	-10	-8	-8	-10	-8		3.9	1.4	

Table 3

Reference equivalent threshold values for transducers

Impedance: frequencies and intensity ranges

AT235 Maximums IMP										
	TDH39		CIR		EARtone 3A / IP30		IPSI		DD45	
Center	Reading		Reading		Reading		Reading		Reading	
Freq.	Tone	NB	Tone	NB	Tone	NB	Tone	NB	Tone	NB
[Hz]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]	[dB HL]
125	80	65	90	70	100	85	70	60	75	60
250	100	85	100	85	110	100	85	75	100	85
500	120	100	110	100	115	105	100	85	120	100
750	120	105	110	105	120	110	100	85	120	105
1000	120	105	115	105	120	110	105	90	120	105
1500	120	105	115	105	120	110	110	90	120	100
2000	120	105	115	105	120	110	105	90	120	100
3000	120	105	115	105	120	110	95	90	120	105
4000	120	105	110	100	120	105	100	85	120	105
6000	120	100	95	95	105	100	85	80	110	90
8000	105	95	75	80	90	85	80	75	105	95
10000										
WB	-	115	-	115	-	115	-	95	-	120
LP	-	120	-	115	-	120	-	100	-	120
HP	-	115	-	115	-	120	-	95	-	120

Table 4

Survey of reference and max. hearing level Tone Audiometer

ANSI DD45				
Coupler: IEC 60318-3 1998 (6ccm)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	PTB – DTU 2010		ISO 389-4 1994	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	47.5	85	51.5	65
250	27.0	105	31.0	85
500	13.0	120	17.0	100
750	6.5	120	11.5	105
1000	6.0	120	12.0	105
1500	8.0	120	14.0	105
2000	8.0	120	14.0	105
3000	8.0	120	14.0	105
4000	9.0	120	14.0	105
6000	20.5	110	25.5	95
8000	12.0	105	17.0	95
White Noise			0	120

Table 5

IEC DD45				
Coupler: IEC 60318-3 1998 (6ccm)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	PTB – DTU 2010		ISO 389-4 1994	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	47.5	85	51.5	65
250	27.0	105	31.0	85
500	13.0	120	17.0	100
750	6.5	120	11.5	105
1000	6.0	120	12.0	105
1500	8.0	120	14.0	105
2000	8.0	120	14.0	105
3000	8.0	120	14.0	105
4000	9.0	120	14.0	105
6000	20.5	110	25.5	95
8000	12.0	105	17.0	95
White Noise			0	120

Table 6

ANSI TDH39				
Coupler: ANSI S3.7-1995 (NBS-9A) / IEC 60318-3 1998 (6ccm)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ANSI S3.6-2010		ANSI S3.6-2010	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	45.0	85	49.0	70
250	25.5	105	29.5	90
500	11.5	120	15.5	105
750	8.0	120	13.0	105
1000	7.0	120	13.0	105
1500	6.5	120	12.5	105
2000	9.0	120	15.0	105
3000	10.0	120	16.0	105
4000	9.5	120	14.5	105
6000	15.5	120	20.5	100
8000	13.0	105	18.0	95
White Noise			0.0	120

Table 7

IEC TDH39				
Coupler: IEC 60318-3 1998 (6ccm)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ISO 389-1 1998		ISO 389-4 1994	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	45.0	85	49.0	70
250	25.5	105	29.5	90
500	11.5	120	15.5	105
750	7.5	120	12.5	105
1000	7.0	120	13.0	105
1500	6.5	120	12.5	105
2000	9.0	120	15.0	105
3000	10.0	120	16.0	105
4000	9.5	120	14.5	105
6000	15.5	120	20.5	100
8000	13.0	105	18.0	95
White Noise			0.0	120

Table 8

ANSI EAR 3A / IP30				
Coupler: ANSI S3.7-1995 (HA-2 with 5mm rigid Tube)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ANSI S3.6-2010		ANSI S3.6-2010	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	26.0	90	30.0	85
250	14.0	105	18.0	100
500	5.5	110	9.5	105
750	2.0	115	7.0	110
1000	0.0	120	6.0	110
1500	2.0	120	8.0	110
2000	3.0	120	9.0	110
3000	3.5	120	9.5	110
4000	5.5	115	10.5	105
6000	2.0	100	7.0	95
8000	0.0	90	5.0	90
White noise			0.0	110

Table 9

IEC EAR 3A / IP30				
Coupler: IEC 60318-5 2006 2ccm				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ISO 389-2 1994		ISO 389-4 1994	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	26.0	90	30.0	85
250	14.0	105	18.0	100
500	5.5	110	9.5	105
750	2.0	115	7.0	110
1000	0.0	120	6.0	110
1500	2.0	120	8.0	110
2000	3.0	120	9.0	110
3000	3.5	120	9.5	110
4000	5.5	115	10.5	105
6000	2.0	100	7.0	95
8000	0.0	90	5.0	90
White Noise			0.0	110

Table 10

ANSI CIR 33				
Coupler ANSI S3.7-1995 (HA-2)				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ANSI S3.6-2010		ANSI S3.6-2010	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	26.0	90	30.0	85
250	14.0	105	18.0	100
500	5.5	110	9.5	105
750	2.0	115	7.0	110
1000	0.0	120	6.0	110
1500	2.0	120	8.0	110
2000	3.0	120	9.0	110
3000	3.5	120	9.5	110
4000	5.5	115	10.5	105
6000	2.0	100	7.0	95
8000	0.0	90	5.0	90
White Noise			0.0	110

Table 11

IEC CIR 33				
Coupler IEC 60318-5 2006 2ccm				
Tone Audiometer				
	Tone		Narrow Band Noise	
	ISO 389-2 1994		ISO 389-4 1994	
Frequency	RETSPL	Max. HL	RETSPL	Max. HL
125	26.0	90	30.0	85
250	14.0	105	18.0	100
500	5.5	110	9.5	105
750	2.0	115	7.0	110
1000	0.0	120	6.0	110
1500	2.0	120	8.0	110
2000	3.0	120	9.0	110
3000	3.5	120	9.5	110
4000	5.5	115	10.5	105
6000	2.0	100	7.0	95
8000	0.0	90	5.0	90
White Noise			0.0	110

Table 12

Survey of reference and max. hearing level Tympanometer

DD45 Contra			
Center Frequency	Att. setting	Reading	
		Tone	NB
[Hz]	[dB HL	[dB HL]	[dB HL]
125	85	75	60
250	85	100	85
500	85	115	100
750	85	120	105
1000	85	120	105
1500	85	120	100
2000	85	115	100
3000	85	125	105
4000	85	115	105
6000	85	110	90
8000	75/70	105	95
WB	85	-	120
LP	85	-	120
HP	85	-	120

Table 13

TDH39 Contra			
Center Frequency	Att. setting	Reading	
		Tone	NB
[Hz]	[dB HL	[dB HL]	[dB HL]
125	85	80	65
250	85	100	85
500	85	115	100
750	85	120	105
1000	85	120	105
1500	85	120	105
2000	85	120	105
3000	85	120	105
4000	85	120	105
6000	85	120	100
8000	75/70	105	95
WB	85	-	115
LP	85	-	120
HP	85	-	115

Table 14

IOW IPSI Sp.			
Center Frequency	Att. Setting	Reading	
		Tone	NB
[Hz]	[dB HL	[dB HL]	[dB HL]
125	85	70	60
250	85	85	75
500	85	100	85
750	85	100	85
1000	85	105	90
1500	85	110	90
2000	85	105	90
3000	85	95	90
4000	85	100	85
6000	85	85	80
8000	75/70	80	75
WB	85	-	95
LP	85	-	100
HP	85	-	95

Table 15

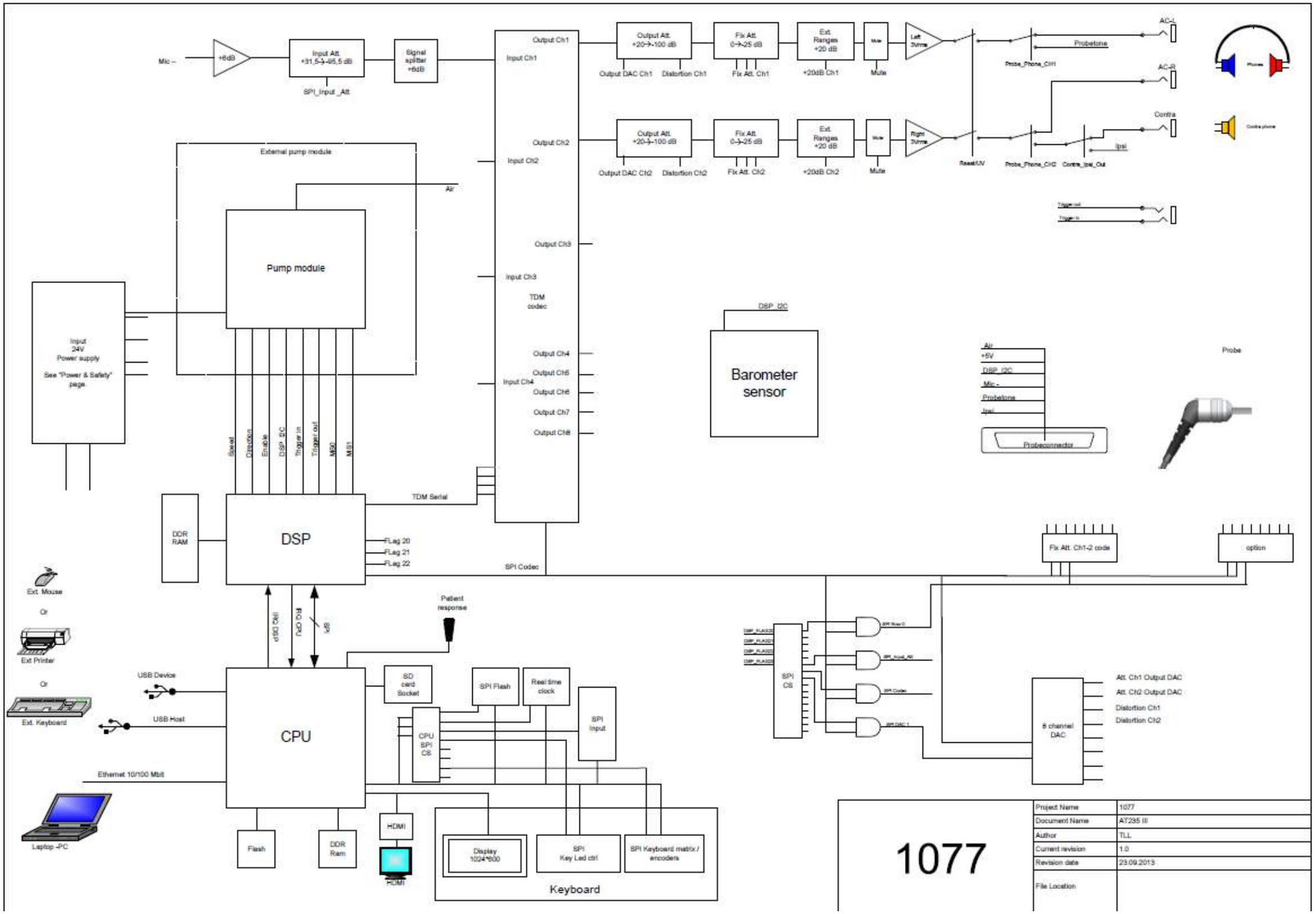
IP30 Contra / EAR 3A Contra			
Center Frequency	Att. setting	Reading	
		Tone	NB
[Hz]	[dB HL	[dB HL]	[dB HL]
125	85	100	85
250	85	110	100
500	85	115	105
750	85	120	110
1000	85	120	110
1500	85	120	110
2000	85	120	110
3000	85	120	110
4000	85	120	105
6000	85	105	100
8000	75/70	90	85
WB	85	-	115
LP	85	-	120
HP	85	-	120

Table 16

CIR 33 Contra			
Center Frequency	Att. setting	Reading	
		Tone	NB
[Hz]	[dB HL	[dB HL]	[dB HL]
125	85	90	70
250	85	100	85
500	85	110	100
750	85	110	105
1000	85	115	105
1500	85	115	105
2000	85	115	105
3000	85	115	105
4000	85	110	100
6000	85	95	95
8000	80/85	75	80
WB	85	-	115
LP	85	-	115
HP	85	-	115

Table 17

Appendix B - Block diagram



Appendix C - Parts & accessories

Accessories	Part number	Description
	8502562	Daily check cavity
	8011296	CAT50
	8108148	Diagnostic probe system 1077
	8108189	Clinical probe system 1077
	8503373	TDH39P contra headset P3045 neutral
	8106919	DD45 contra headset P3045
	8010937	CIR33 insert earphone kit
	8103323	IP30 insert phone 10ohm single contra
	8106339	DD45 audiometric headset

	8106355	TDH39 audiometric headset HBA headband
	8101884	IP30 insert phone 10ohm set
	8108835	Shoulder-strap - key kit
	8105761	Strap -key kit
	8104678	Assortment BET55 complete
	8106038	Probe floss kit
	8105696	Printer kit 1077
	8106795	Wall mounting kit 1077
	8103838	APS3 patient response switch
	8106790	Diagnostic probe holder 1077

Consumables	Part number	Description
	8500580	Kit eartip adaptor, 6pcs
	8500830	Eartip adaptor cleaning tool
	8011348	Probe cleaning tool
	Sanibel Supply	Eartips of various sizes Types: umbrella, mushroom, flanged
	Sanibel Supply	TPR MPT-III thermal paper 8500610
	Sanibel Supply	Foam pad HBC39 headset. 10 pcs (1 bag) 8002802

Spare parts	Part number	Description
	8108046	Pump tube kit 1077
	8107762	Probe tip kit 1077 incl. gasket
	8004140	Cable for pump 24 pins
	8000656	Pump module
	8102693	Gasket
	8108142	PCA mainboard 1077
	8108143	PCA keyboard 1077
	8108144	Bottom 1077
	8108145	PCA probe connection board
	8106874	Rotary encoder 1077

	8102178	Knob plastic 1077
	8102071	Display cable 1077
	8004158	Cable for keyboard 40 pins
	8101484	Rotary dial cover 1077
	8108146	Top cabinet
	8108147	Display 1077
	8101895	Power supply 24V 60W UE60-240250SPA3
	8507211	Contra headband P3045

Appendix D - Firmware update procedure

New firmware will be made available on the Interacoustics website. After downloading the zip file follow the below instruction:

1. Unzip the firmware archive on a new FAT32 formatted USB stick
2. Insert the USB in the unpowered instrument
3. Turn on the instrument and wait for Tone test
4. Enter *Common Setting* to 1.5 and below OR *Instrument setting* for 1.6 or higher using the Setup Button
5. Press the function key named *Install,* and follow the instructions on the instrument display
6. Wait for the instrument to return to Tone test

CAUTION

Restarting the instrument after installing the firmware may be necessary. Do not shut down the instrument or remove the USB stick while updating.

AT235 Stand Alone Unit - Print Logo Update

AT235 direct printout allows results to be printed directly after testing (via a supported USB printer – please contact Interacoustics customer service for a list of supported PC printers if in doubt). The printout logo can be configured via the audiometer itself (see below) or downloaded via the Diagnostic Suite (in the General Setup).

1. Open the program *Paint* which can be found in the accessories folder.
2. Open *Image Properties* using the shortcut Ctrl + E.

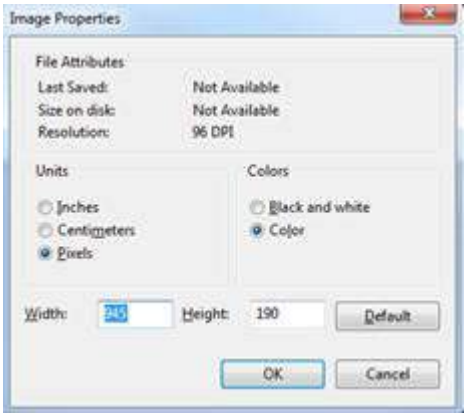


Figure 54

3. Set Width to 945 and Height to 190 as shown. Click *OK.*
4. Edit the image and the company data to fit inside the set area.
5. Save the created file as *PrintLogo.bmp.*
6. Zip the *PrintLogo.bmp* file to the following name format *Update_user.logo.bin*. The *update_user.logo.bin* file is now ready to be used
7. Insert a USB thumb drive with at least 32MB in total size
8. Go to *My Computer* and right click on the USB thumb drive and select *Format*

CAUTION

This action will erase everything on your USB thumb drive!

9. Ensure that FAT32 is selected as your *file system* - Leave other settings as listed.

Figure 55

10. Click s*tart* - depending on the size of your thumb drive this may take a moment. When the formatting is complete you will receive a pop-up indicating successful formatting.
11. Copy the *update_user.logo.bin* file to the formatted thumb drive.
12. It is very important that this file is the ONLY FILE on this USB thumb drive.
13. With the audiometer switched off, insert the thumb drive into any available USB port.
14. Then switch the instrument on and push the Temp/Setup Button from the Tone test screen.
15. Enter *Common Settings* using the Setup/Tests Button.
16. To the question “Do you want to install?” select *Yes.*
17. After the installation is completed, select *Back* to get to the testing screen.

Appendix E - Update News

The following modifications have been made to the instrument:

Date	Action	Remarks
2016-01-27	Update –parts & accessories: added 8502562, and 85033373 (photos included).	
2018-01-09	New technical specifications added. 8105760 replaced by 8108835. 8106918 replaced by 8507211. 8011091 replaced by 8103838. Visual update, and merging of manual and parts & accessories list. Added AA222 in paragraph 3.5 Installing the Diagnostic Suite	