



Acoustic Rhinometer A1

User Software Manual and Installation Notes



Table of Contents

1. SOFTWARE INSTALLATION	3
2. HOW TO CONFIGURE THE SOFTWARE	6
3. STARTING A TEST	21
4. TO MAKE A NEW ACOUSTIC RHINOMETRY RECORD	22
5. TO COMPARE TEST RESULTS (L/R AND L/R-PRE AGAINST L/R-POST)	25
6. TO DELETE A TEST RESULT.....	28
7. BATCH TEST FACILITY (CLINICAL/RESEARCH VERSION ONLY)	29
8. DATA EXPORT FACILITY (CLINICAL/RESEARCH VERSION ONLY).....	31
9. Appendix	33

1. SOFTWARE INSTALLATION

COMPUTERS SUPPORTED

The A1 can be made to work on any PC which runs a Windows 10 or later based operating system which has a free USB socket.

N.B. Units which comply with EN 60950 should be used.

PRINTERS SUPPORTED

As these instruments operate in a Windows environment, print capability depends on you having installed a printer under Windows. Virtually any printer, which works under the version of Windows you have, will be suitable.

PC SECURITY REQUIREMENTS AND RECOMMENDATIONS

- When **installing** the software and **in use** – the PC **MUST NOT** be connected to the internet.
- Where possible, the software should be used on a non-administrative account with user logins. It may be installed initially on the administrator account.
- Ensure PC has a timed auto-lock feature set-up that requires user authentication to enable.
- Ensure the PC is up to date with anti-virus solutions.
- Keep PC firewall up-to-date.
- Regularly apply operating system and anti-virus updates.
- Data should be stored to a local file system only. If your company IT policy allows, encrypt the drive which you intend to save patient files. This means the data is unreadable without a decryption key (Microsoft account password). This could be done using BitLocker (see appendix for walk through)

INSTALLATION SEQUENCE

The software comes on 1 Thumb Drive (containing 2 folders). Ensure the USB packaging seal is intact before opening/use and that the USB Drive is branded “GM Instruments”. It is advisable to close any other programs you may be running while performing the installation as you may need to restart the PC during this operation.

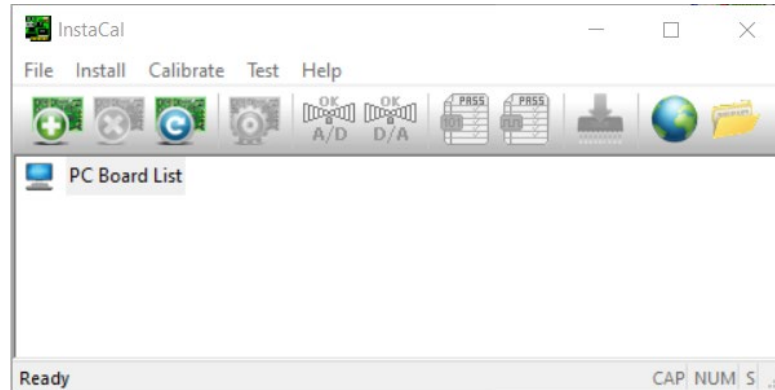
INTERFACE BOARD SOFTWARE (Measurement Computing) Ensure the USB cable is NOT connected to the A1 unit.

If you have a Thumb Drive put it in a free USB socket and navigate to it. Open the MC folder, and click on icalsetup.exe. Accept the defaults offered.

The program InstaCal and other driver software will be loaded to a folder called Measurement Computing.

INTERFACE BOARD HARDWARE

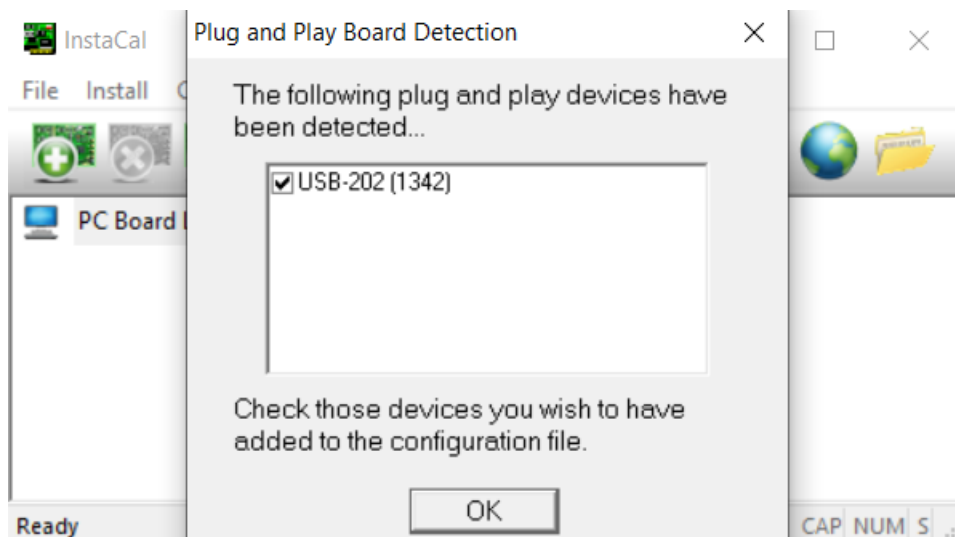
The next installation operation is to have your PC identify the USB A/D converter, which is built into the A1 unit. To do this, connect the A1 to your PC using the cable supplied. (It is not necessary to power up the A1 or at this stage or load its software) Click on the **Start button**, scroll down to **Measurement Computing**, select it and scroll down to **InstaCal** and click on it. **InstaCal** will show no boards installed as shown below.



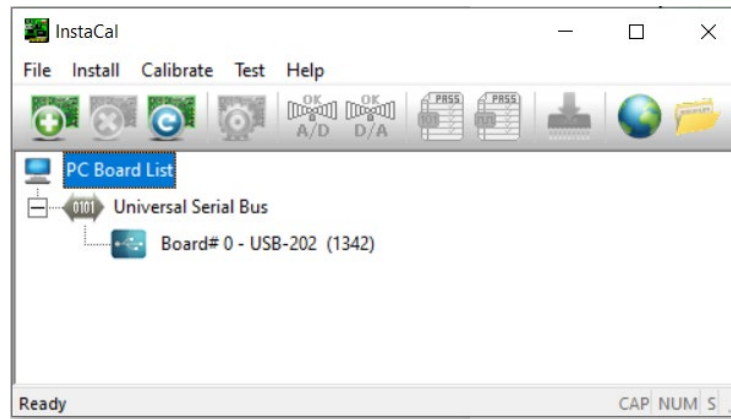
Wait for a few seconds as the USB interface is recognised and the drivers are loaded.

If this doesn't happen, click on **Install**, then **Refresh**. Once completed, the InstaCal screen will offer the opportunity to accept your USB board.

N.B. the serial number for the USB in each A1 is unique. The most recent units are for type 202, while older A1 units will have a 1208 USB module installed.



Click on **OK**



When InstaCal shows the screen above, (shown for a 202 module) USB installation is complete and InstaCal can be closed.

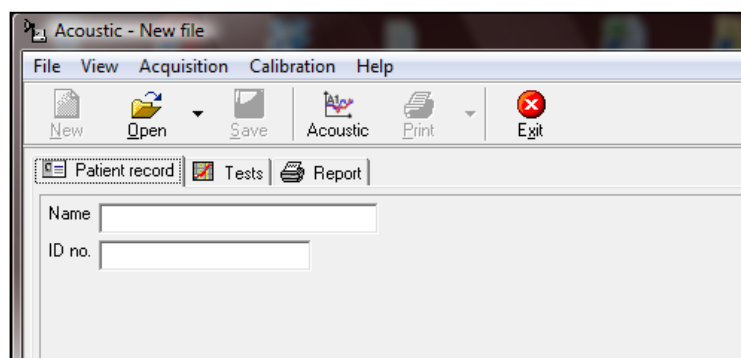
GMI SOFTWARE

Open the folder A1 on your Thumb Drive. Navigate to the file Setup-Acoustic_V3_X_X_XXXX.exe and click on it. Accept the defaults offered at each stage, until you are asked for the desired location for the .ini file – you will be offered the choice of the shared folder or the application folder. Unless you plan on using the system on a network, the application folder should be selected.

The A1 Acoustic Rhinometer program can now be started by clicking on:

The **Start** button and from the program list select Acoustic, then Acoustic.

The program opens a blank patient file as shown:



If you wish to change the fields listed in the Patient Record screen, this should be done at the beginning, before starting to save records. To do this, click on File, click on Close, click on File, click on Settings, select the Patient Record Tab and make the alterations you want, as described in the following pages.

If you wish to make measurements on a New subject, click on File, click on Close, then click on New.

If you wish to bring back a record of a Patient previously tested, click on Open.

2. HOW TO CONFIGURE THE SOFTWARE

Several elements within the program can be configured to suit your application.

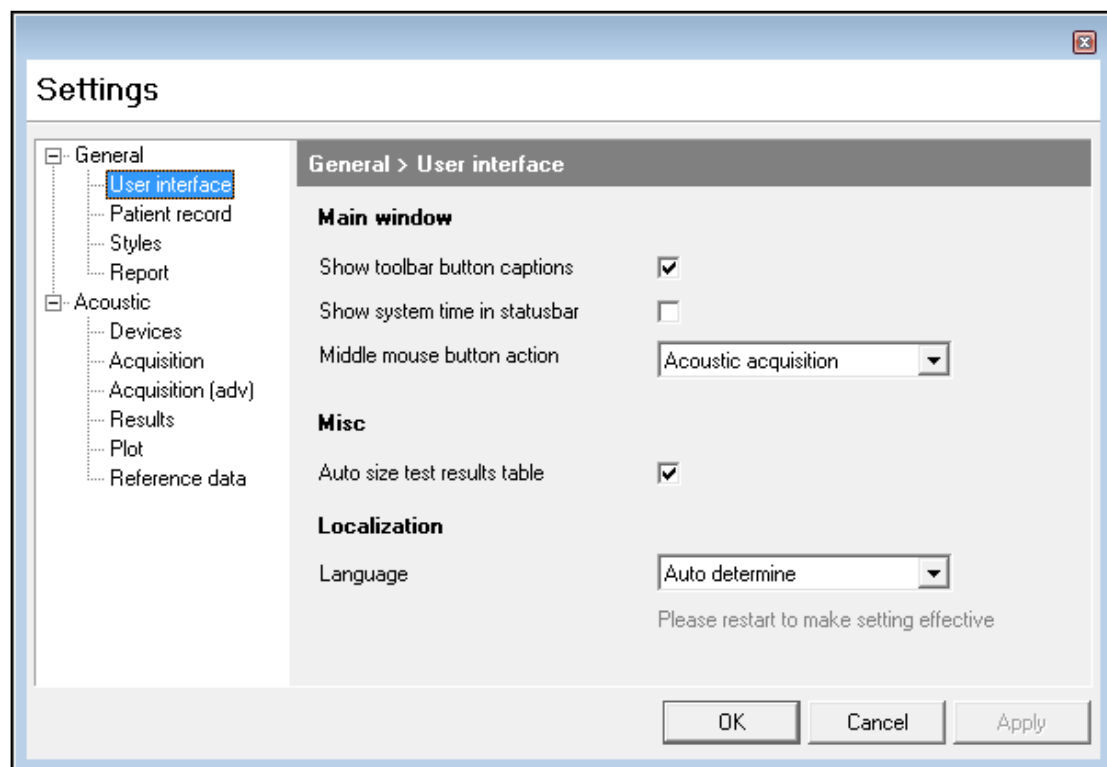
N.B. Although you may wish to reconfigure these elements again later it should be noted that fields within the Patient record screen cannot be changed after storing results for a particular subject as the stored information may become inaccessible – see page 10 for more details.

All changes are made by clicking on **File -> Settings**.

N.B. The values shown on the following screens (and particularly in the acquisition screens) are examples only, as every system is individually configured.

A new window named **Settings** is then displayed which shows two super-tabs, each of which contains subtabs with user-configurable items. The two tabs are labelled **General** and **Acoustic**.

GENERAL > USER INTERFACE TAB

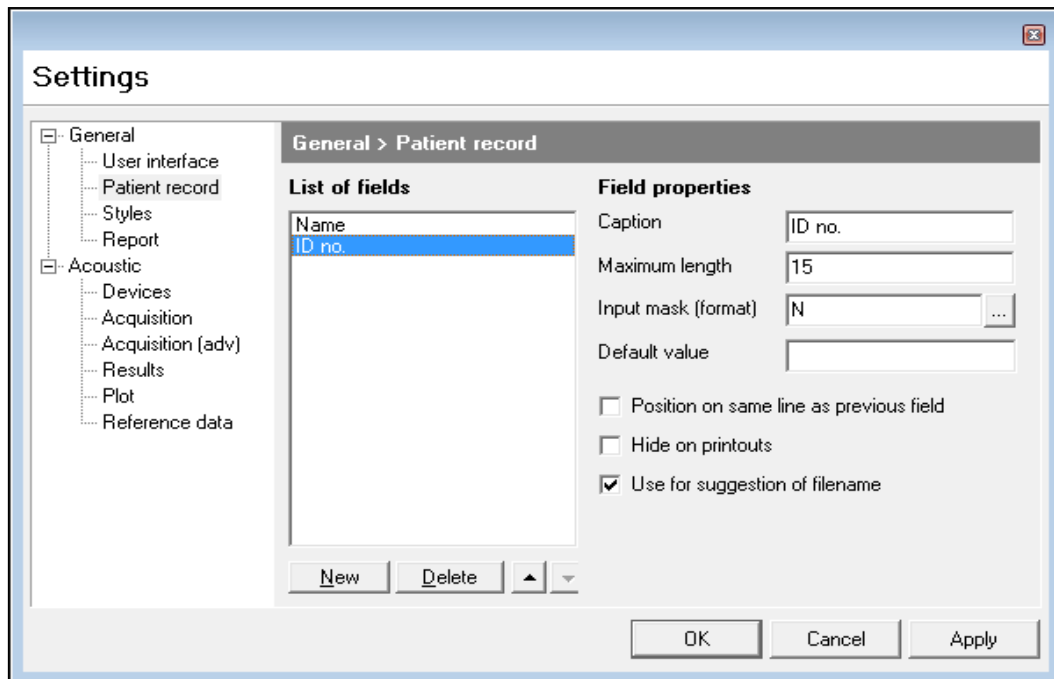


The **General > User Interface** tab allows you to:

- Show captions on the toolbar buttons
- Show the PC system time in the status bar
- Enable the middle mouse button to open the acquisition window

- Make the system adjust the graphics display following a test to allow space for the table of results appropriate to that test
- Make the system match the language set on the PC to any of the options supplied with the A1 software, when possible

GENERAL > PATIENT RECORD TAB



The **General > Patient record** information window can contain many fields. You can include as many or as few as you want, put them in any order, define what kind of data is acceptable for entry in any field and specify the size of each field. In these fields It is recommended to use reference numbers that do not identify the subject/patient's confidential details.

The Patient Record tab contains the following elements:

List of fields is a window which shows the current labels already selected for inclusion. If you click on one of these it can be edited or deleted or its position moved within the group. When highlighted, the information relating to its structure is shown on the right-hand side of the window under the following headings:

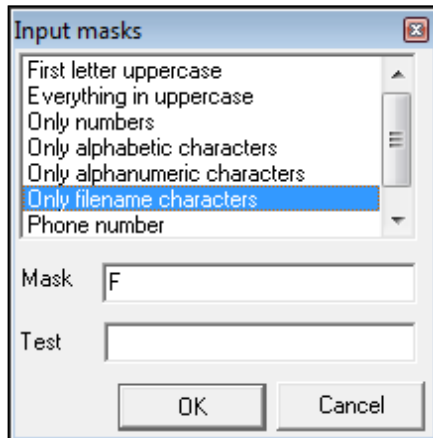
Caption - the current label selected for editing

Maximum Length - the number of character spaces allocated in the **Patient Information** window against that name

Input mask (format) - the conditions applied to character entry in the associated **Caption** field

In the above example, **ID no.** is highlighted in the **Lists of fields** window. The label **ID no.** is shown in the **Caption** field and it can be seen that currently space is allowed for 15 characters. The applied mask was one which only allowed valid filename

characters, and no spaces or other characters. Masks can be selected or changed by clicking on the button on the extreme right of the **Input mask (format)** field.



The **Input masks** window allows selection of the conditions you want to apply and has space below for you to test the restrictions. If you wish to keep the currently selected field, click on **OK**, and then on **Apply**.

If you wish to discard any field, highlight that field and click on **Delete**. If you want to add a new one, click on **New**.

If you want to change the order in which they appear, highlight the one you want to move and then use the **Up** and **Down** arrow buttons to the right of the **Delete** button.

You can place more than one item on a line by placing it below the item you want it lined up with and clicking on **Position on same line as previous field**.

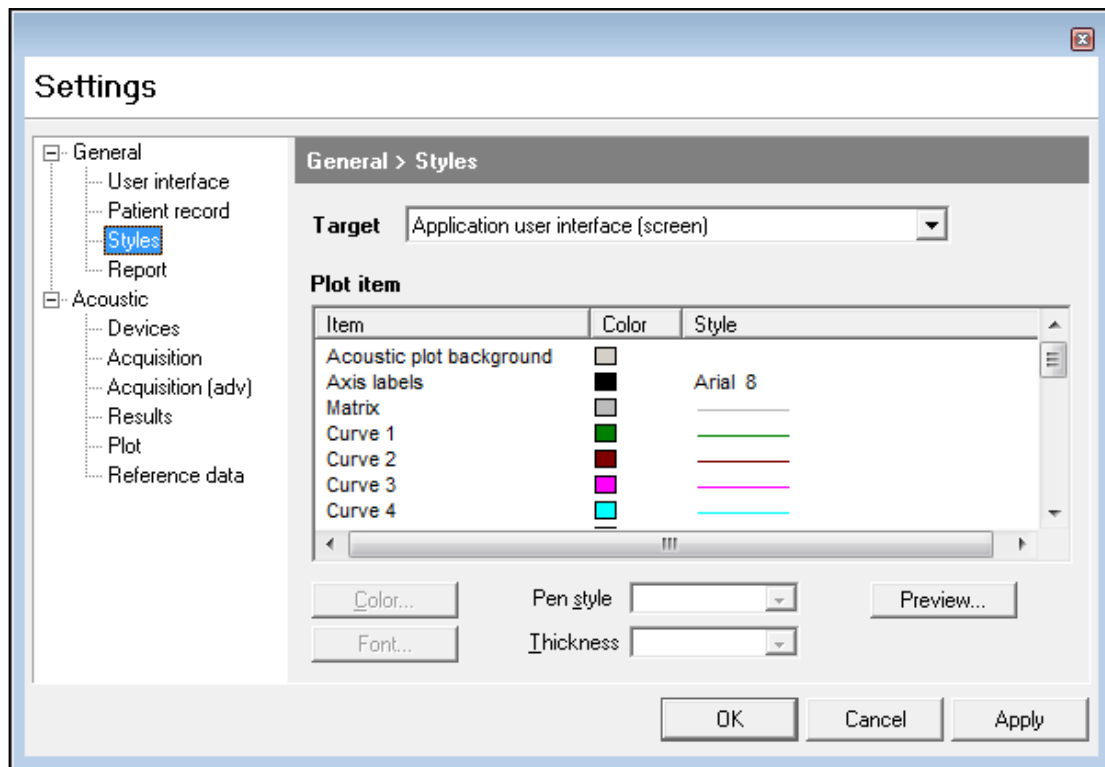
You can also hide a field from a printout by highlighting it and clicking on **Hide on printouts**.

A field can be used for the test file name by highlighting it and then clicking on **Use for suggestion of filename**.

N.B. The software will open in a blank patient record. If you wish to add or remove any fields from the Patient record screen or make changes to them you must first close the current record by selecting **File -> Close** from the main toolbar.

(This software enhancement has been made to stop patient files being accidentally corrupted – a side effect of a patient record being changed while open within the software).

GENERAL > STYLES TAB



The **General > Styles** tab allows you to set up colours and line styles for either the screen or the printout.

Target - here you can select **Application user interface (screen)** or **Report (printer)** for alteration

Plot Item - scrolling window which contains a list of the screen or printout elements whose colour, line style, or font can be changed

Color - colour palette, from which you choose the colour you want applied to the element selected in the item window

Style - displays the colour, line style or font currently set for the element shown in the item window

Pen Style - allows you to set different types of line for the selected element

Thickness - allows you to apply different line thickness to any line drawing element selected from the item window

Preview - window which lets you see the effect of a change

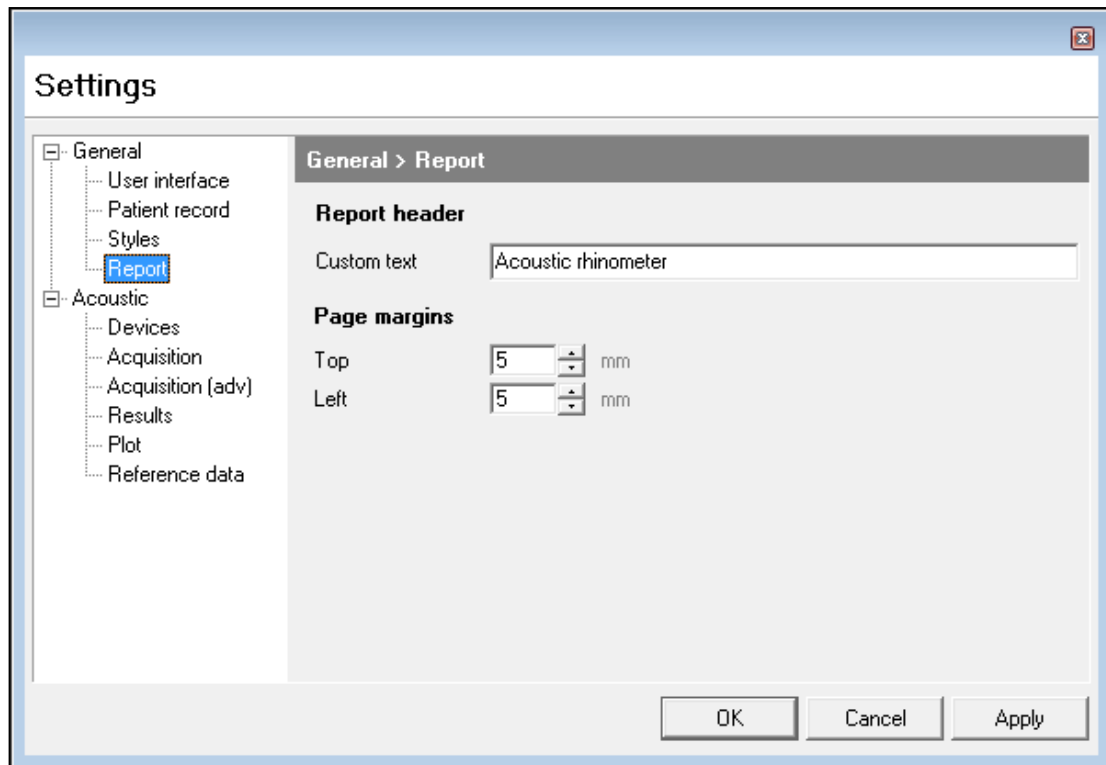
To make a change to the default settings select **Application user interface (screen)** or **Report (printer)** from the top dropdown menu, select an **Item** from the list, select your desired **Pen** colour and, if appropriate, **Pen Style** or **Thickness**. You can immediately see the effect of that change in the **Preview** window.

If you click on **Apply**, the change will be recorded and you can move to another element. If you click on **OK** instead of **Apply**, the change will be made, and recorded, but you will close the **Setup** window and return to the main screen.

Application User Interface (screen) & Report (printer)

Item Name	Item Description
Acoustic Plot Background (Testing screen only)	The background colour of the graphs viewed on the screen during testing
Axis Labels	Numbers marking the axes on the A1 graphs
Matrix	The non-zero grid lines for each graph
Curve 1 – Curve 10	Each of the captured curves shown on a graph at any given time
Acoustic MeanBase (L+R)	Colour of the left and right baseline curves when performing a comparison
Acoustic MeanComp (L+R)	Colour of the left and right comparison curves
Acoustic Goldnose	Curve relating to the Goldnose Acoustic Rhinometer calibration device
Graph Border / Graph Area	Colour of graph borders and background areas
Axes	Zero lines on the graphs
Results Values Text	All text in the tables
Subgraph Caption	Text in the “Remarks” box in the bottom right corner of the screen
Legend: Item Text/Box Frame/ Box Background	Colour of the frame, background within the frame and the text within the frame of a legend describing the information contained within a graph
Patient Record Background	Background of the main screen where patient details are entered

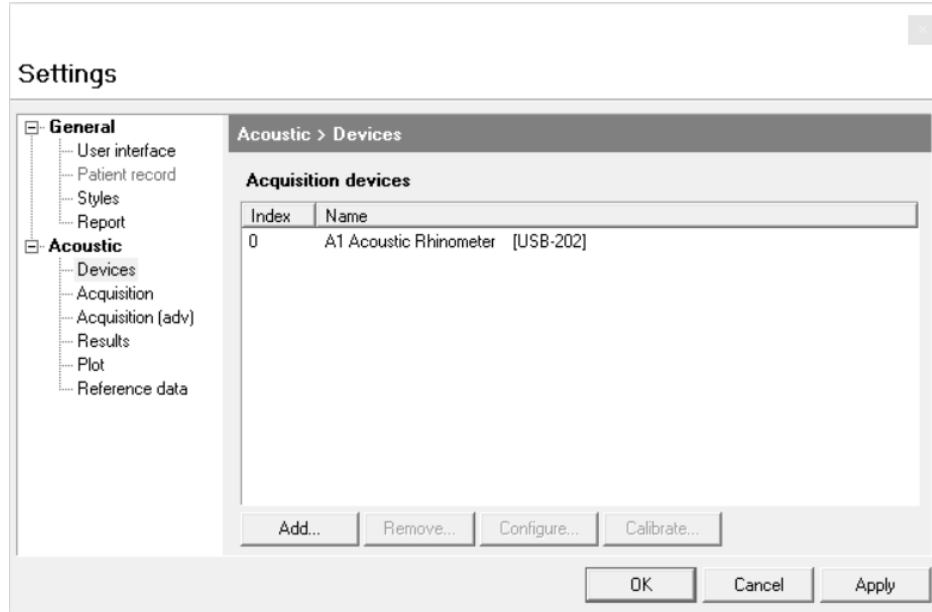
GENERAL > REPORT TAB



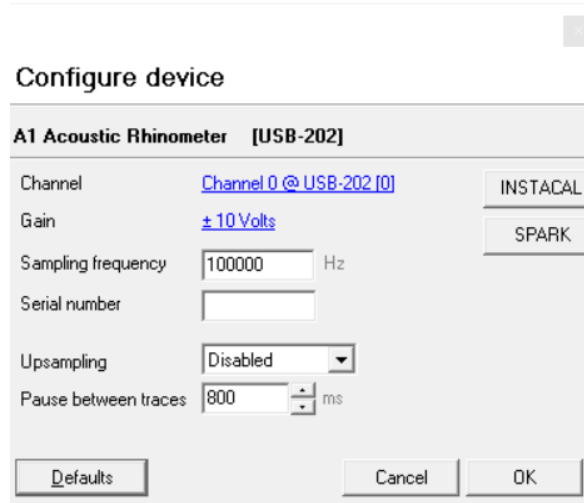
The **General > Report Tab** allows for the setting of a title which will appear on printouts and the alteration of printer margins. More detailed control of printer options is available in the normal Windows print driver dialogue box.

ACOUSTIC > DEVICES TAB

The **Acoustic > Devices** screen shown below displays the USB device number assigned to the instrument [0]. If you then click on the device (**A1 Acoustic Rhinometer**, in the below example) the buttons at the bottom of the window become active.

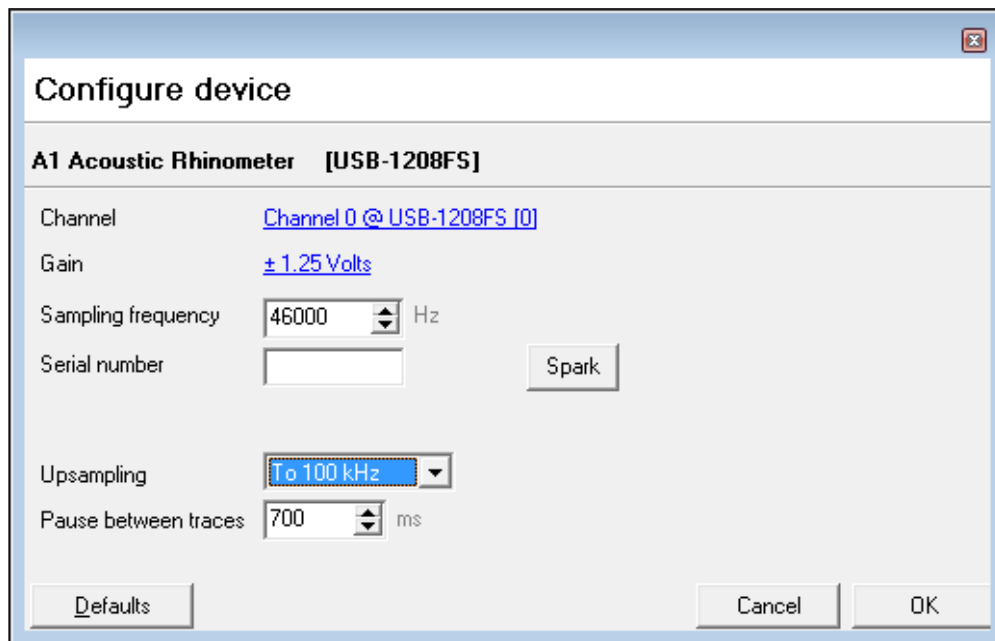


If you click on **Configure**, you will see:



When the USB interface is installed (**USB-202**), the window will show: the board number [0], the channel used for the microphone (which, by default, is channel 0), the selected gain setting (**±10 Volts**), the basic sampling frequency (100kHz), the upsampling option will be disabled, and the pause between each measurement (**700 mS**). These are the default settings for a **USB-202** interface and should not normally be changed.

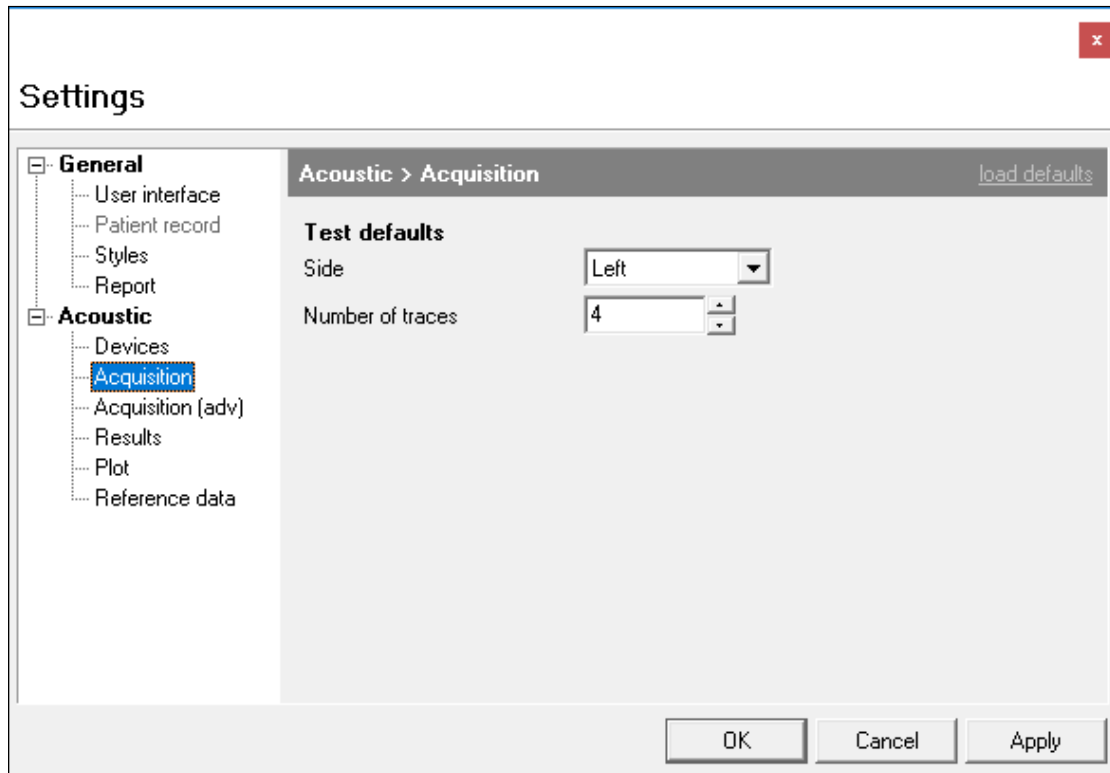
N.B. Earlier versions of the A1 may have also used a USB-1208FS interface, in this instance the window will show: the board number [0] and the channel used for the microphone (0), the selected gain setting (**± 1.25 Volts or ± 10 Volts**), also displayed are the basic sampling frequency (**46kHz**), the data processing upsampling equivalent (**100kHz**) and the pause between each measurement (**700 ms**).



When you click on **Calibrate** in the test acquisition window, you should have the A1 powered up, with the calibration plug fully inserted into the A1 sound tube. An updated calibration file will be generated and saved to the default folder – the same directory to which the program was installed.

The **Add** and **Remove** buttons allow the interface to be changed, if, for instance, you have an NV1 Rhinospirometer, which you want to install on the same PC. Each interface will be assigned a different number by InstaCal, and, therefore, as the default setting for both instruments is board 0, one or other must be changed to allow both to work. Normally there is no need to alter these settings.

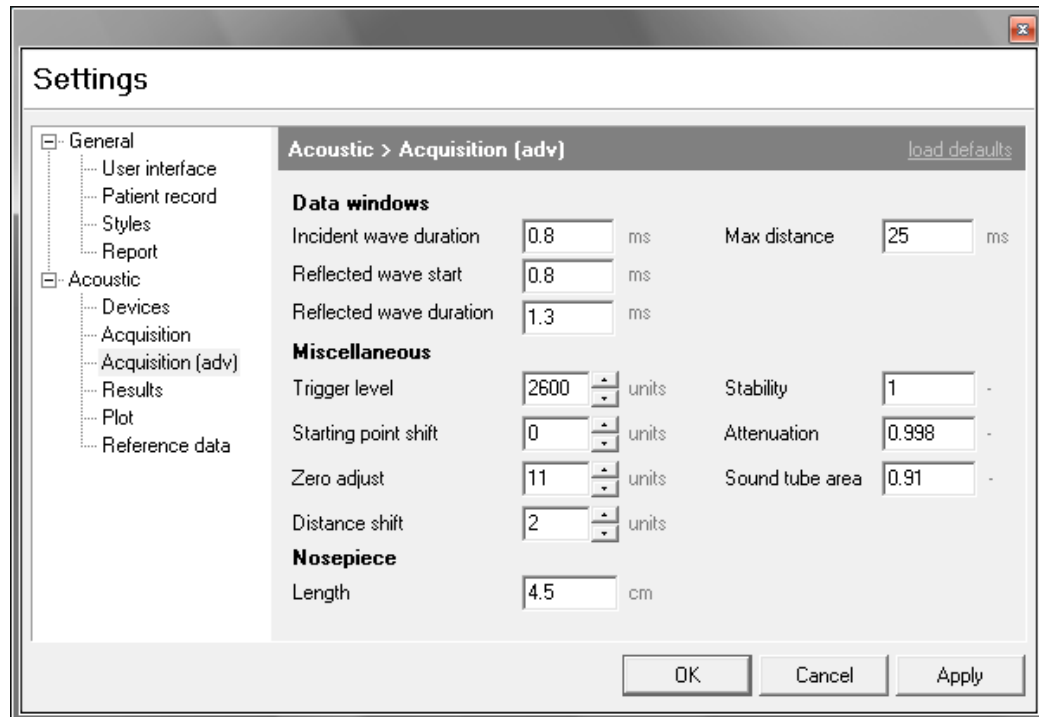
ACOUSTIC > ACQUISITION TAB



Side - sets the side of the nose which is, by default, to be tested first.

When acquiring acoustic data, the information can be obtained from a single measurement or from the average of a series of curves. The item labelled **Number of traces** specifies what is to constitute a single test.

ACOUSTIC > ACQUISITION (ADV) TAB



All the parameters set up within this dialog box are pre-set by GM Instruments, to give best possible performance on your system, and are stored on your program thumb drive. These settings **SHALL NOT** be changed without support from GM instruments Ltd. Contact support@gm-instruments.com with any queries on your device settings.

Every sound tube is different and, therefore, may have different setup parameters associated with it.

The **Distance shift** factor allows a small lateral movement of the measured data curve to give the best fit when comparing a measurement made with an artificial nose against the theoretical line produced by the profile of an artificial nose. It effectively compensates for variations in the speed of sound under different conditions.

Sound tube area, Zero adjust, Stability, Starting point shift and **Attenuation** factors are adjusted to provide optimum results when setting up the system using with the artificial nose and straight tube, as recommended by the standardisation committee.

The **Max distance** factor is normally set to **25 mS** to limit the size of the files which are created and saved. Normally, scaling of the horizontal axis is set to run from –5 cm to +15 cm, so the minimum requirement is a maximum distance of 20. If you want to measure further back, say to 25 cm, then the horizontal scale would need to be set to run from –5 to +25 and the maximum distance set to at least 30.

If an improper data message is produced during acquisition the **Trigger level** factor can be reduced to allow measurements to be made.

Data windows parameters are based on the physical dimensions of every sound tube and are, therefore, constant for every sound tube.

Nosepiece Length allows you to tell the software what nosepiece you are using to let it adjust the graphical display accordingly – this will normally be 4.5 cm.

ACOUSTIC > RESULTS TAB

Settings

Acoustic > Results

Volume calculation

Start distance cm

Stop distance cm

Cross-sectional area minima

Start distance cm

Stop distance cm

Hysteresis cm²

Comparison ranges

cm

Maximal 5 ranges: start-end. Separate ranges with comma (e.g. 0-5, 2-5)

Comparison distances

cm

Maximal 5 values. Separate values with comma (e.g. 3, 5, 7)

Miscellaneous

☒ Include totals

☒ Include Minimal Cross-sectional Area (MCA)

OK Cancel Apply

Volume calculation start distance and **stop distance** specify the section of the nose over which you want to calculate a volume.

Cross-sectional area minima specifies the section of the nose over which you want to look for turning points, and **Hysteresis** specifies what constitutes a turning point.

Comparison ranges allows you to specify the volumes reported between up to 5 pairs of distances, when a comparison display is on screen.

Comparison distances allows you to specify up to 5 distances at which cross-sectional areas will be reported when a comparison display is on screen.

Miscellaneous

The **Include totals** tick box is offered here to allow the standard result screen, when showing right and left side volumes etc., to also give a total nose figure. This summation may not be appropriate if you want to compare two right side or two left side measurements, and can therefore be switched off here.

Although the system will automatically report MCA1 and MCA2 (the first and second Minimum Cross-Sectional Areas found, starting from the front of the nose), it can also automatically determine which is the smallest and report it as MCA, if the box is ticked.

ACOUSTIC > PLOT TAB

Settings

Acoustic > Plot

Standard plot

	Horizontal	Vertical
Scaling type	Linear	Logarithmic
Minimum value	-5 cm	0.1 cm ²
Maximum value	15 cm	10 cm ²
Step size	1 cm	0.1 cm ²
Label frequency	1 cm	1 cm ²
Show origin value	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Linear plot

X-axis	Y-axis
0	-2
10	14

Miscellaneous

☐ Reverse left and right plots for comparison tests

OK Cancel Apply

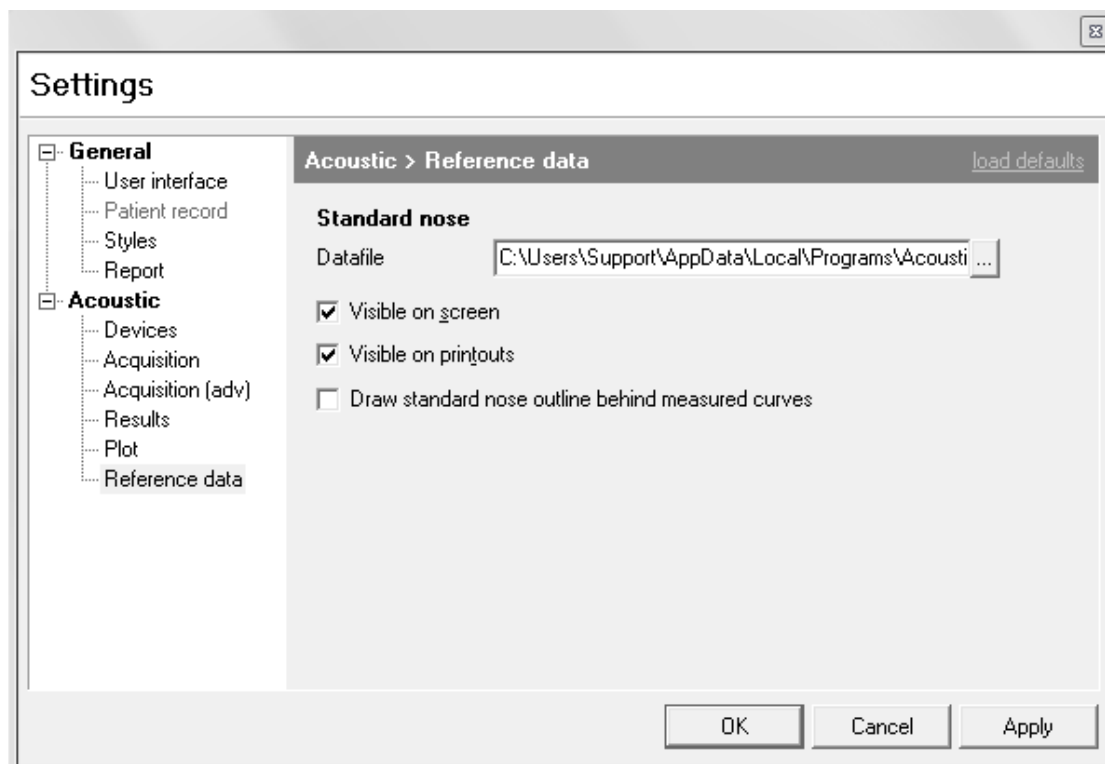
The scaling for the distance and cross-sectional area axes can be set up here, for the **Linear plot** and the **Logarithmic plot**, comparison and analysis view screens.

N.B. A logarithmic scale should not be assigned a minimum value of zero.

Miscellaneous

A tick box is offered to allow the side used to display the left/right results to be switched for comparison tests.

ACOUSTIC > REFERENCE DATA TAB



Validation of system performance can be made by comparing a theoretical **Standard nose** curve, with that obtained when making a measurement on a **Standard nose** model.

The A1 GMNose allows such a system check to be made. The **Acoustic > Reference data** tab shown above, allows the appropriate theoretical curve to be drawn on the screen in a colour and line style specified in the **General > Styles** tab, under control of check boxes on this screen.

The **Datafile** used under normal circumstances is called GMNOSE.DAT and can be selected from file by clicking on the button to the right of the **Datafile** window. The selected data file can be shown on screen if **Visible on screen** is selected and can be seen on printouts if **Visible on printouts** is selected.

The **Datafile** is drawn behind measured curves provided the 3rd tick box is selected.

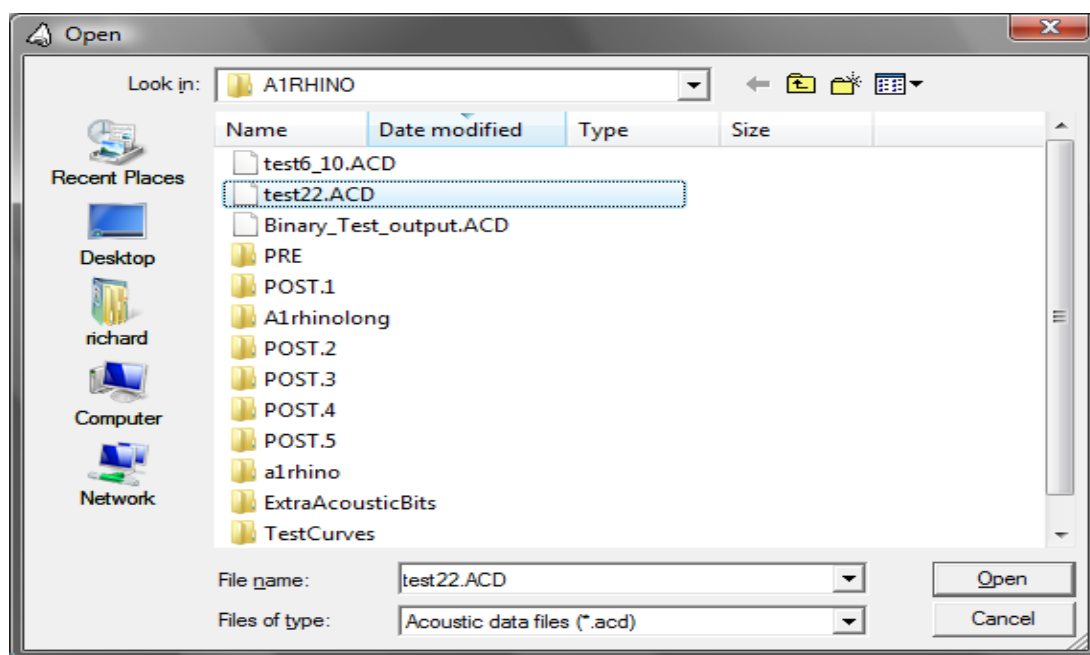
3. STARTING A TEST

TO PREPARE FOR MEASUREMENT ON A NEW SUBJECT

1. All current patient information and test results are cleared when the program is started, or if, having performed other measurements, you click on the **New** button.
2. In either event the cursor is set to the first field in the patient record window.
3. You can then enter the required patient details. Pressing the tab key after entering information in each field will take the cursor to the next one.
4. To make measurements (acquire), click on the Acoustic icon on the top toolbar.

TO PREPARE FOR MEASUREMENT ON A REPEAT SUBJECT

1. Click **Open** and then, using the dialog box offered, go to the folder you store your results in and click on the appropriate subject's file name.
2. You will then be able to examine the patient details and check that you have the correct subject by clicking on the **Patient record** tab. Clicking on the **Tests** tab will show you all previous test dates and results for that patient.



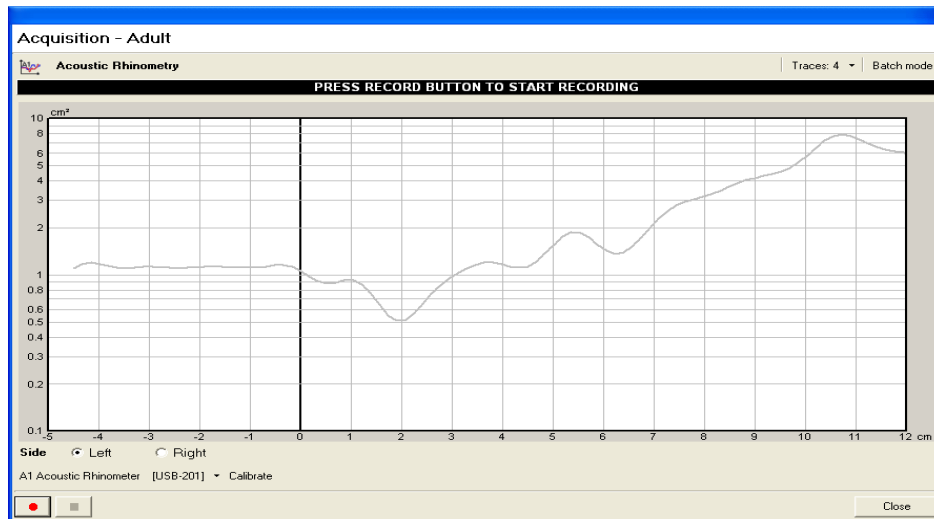
4. TO MAKE A NEW ACOUSTIC RHINOMETRY RECORD

Click on the Acoustic icon on the top bar and one of the following two windows will appear:

- 1) If no calibration file is found you will be prompted to **Calibrate**. With the A1 switched on and the calibration plug securely fitted to the end of the sound tube, click on the button marked **Calibrate**.

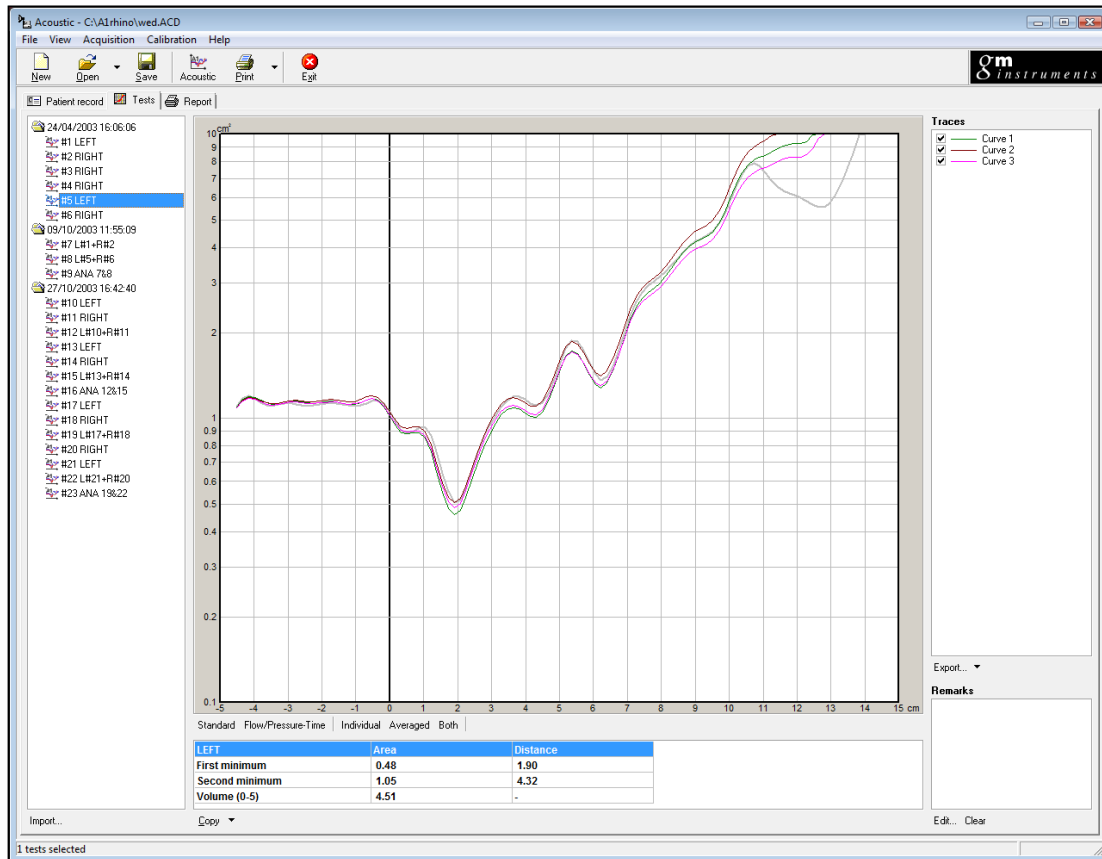


- 2) If a calibration file is found, you will see the screen below and can proceed to testing, or alternatively you can refresh the calibration by ensuring the A1 is switched on and that the calibration plug is correctly fitted, and clicking on the button marked **Calibrate**.



On the top bar, the number of **traces** representing a test can be changed from the default number (4). If you have a clinical/research version you can also switch on **Batch mode** to allow result validation (see page 28 for more details). The facility **Trigger on zero flow** is a specialised feature used in conjunction with a research-based combined acoustic and rhinomanometer sound tube.

- 3) Confirm that the side you want to test is selected (**left or right**), and once the patient is connected, click on the button with the red spot on it or, provided the mouse cursor is within the acquisition screen and you have this setting selected, your mouse middle button to begin the acquisition.
- 4) Once the pre-set number of measurements has been taken the system will stop taking in data, will show you the resultant curves, each of which is drawn in a different colour, and will add the test to the test list for that subject.



- 5) If any curve is obviously bad it can be de-selected by clicking in the appropriate check box in the **Traces** section on the right of the screen.
- 6) Comments can be added in the box found on the bottom right hand side of the screen by clicking **Edit...**, or removed by clicking on **Clear**. If required, additional testing can be done, or the current test can be printed by clicking on **Print**, or it can be saved by clicking on **Save** – if a full screen printout is required, the desired test should be highlighted and **Print on full page** should be selected by clicking on the arrow next to the **Print** icon.
- 7) The **Output** tab can be used to create a printout consisting of a number of curves selected by clicking in the check box on the left of the test list.
- 8) Additional facilities available from the screen includes:

Import --- This allows you to merge data from two saved files

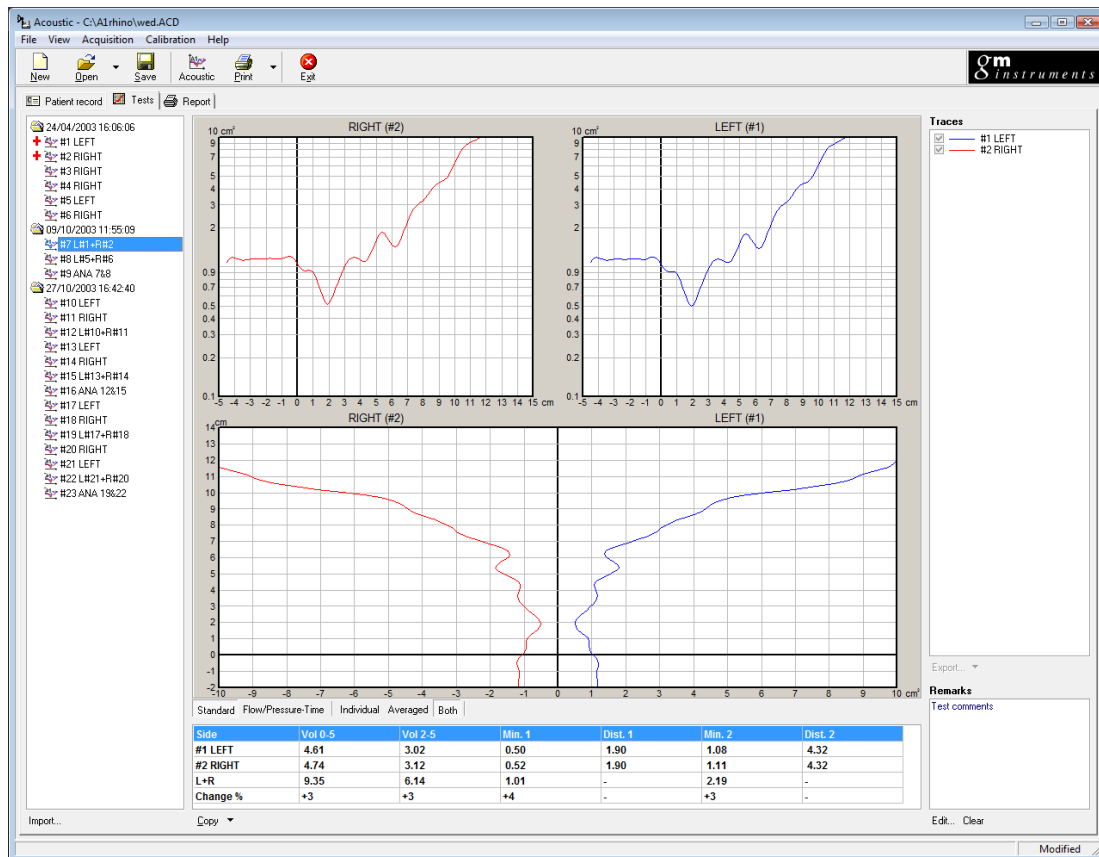
Export --- This allows the raw data to be sent to a text file

Copy --- This allows the calculated values to be put on the clipboard, ready to be pasted into a spreadsheet

5. TO COMPARE TEST RESULTS (L/R AND L/R-PRE AGAINST L/R-POST)

If you want to create a complete nose record from Left-side and Right-side results:

- 1) Select the **Tests** tab
- 2) Click on a Left test using the left mouse button
- 3) Hold down the ctrl key and click on the desired Right test using the left mouse button - both tests will now be highlighted. Release the ctrl button, right-click on either test result and click on **Create comparison test**.
- 4) A new test entry is created which shows the Left curve and the Right curve, which can be displayed in a number of different ways by selecting different toggle buttons, which are found below the graph



The above illustration shows a L/R comparison test, displayed in **Report** style.

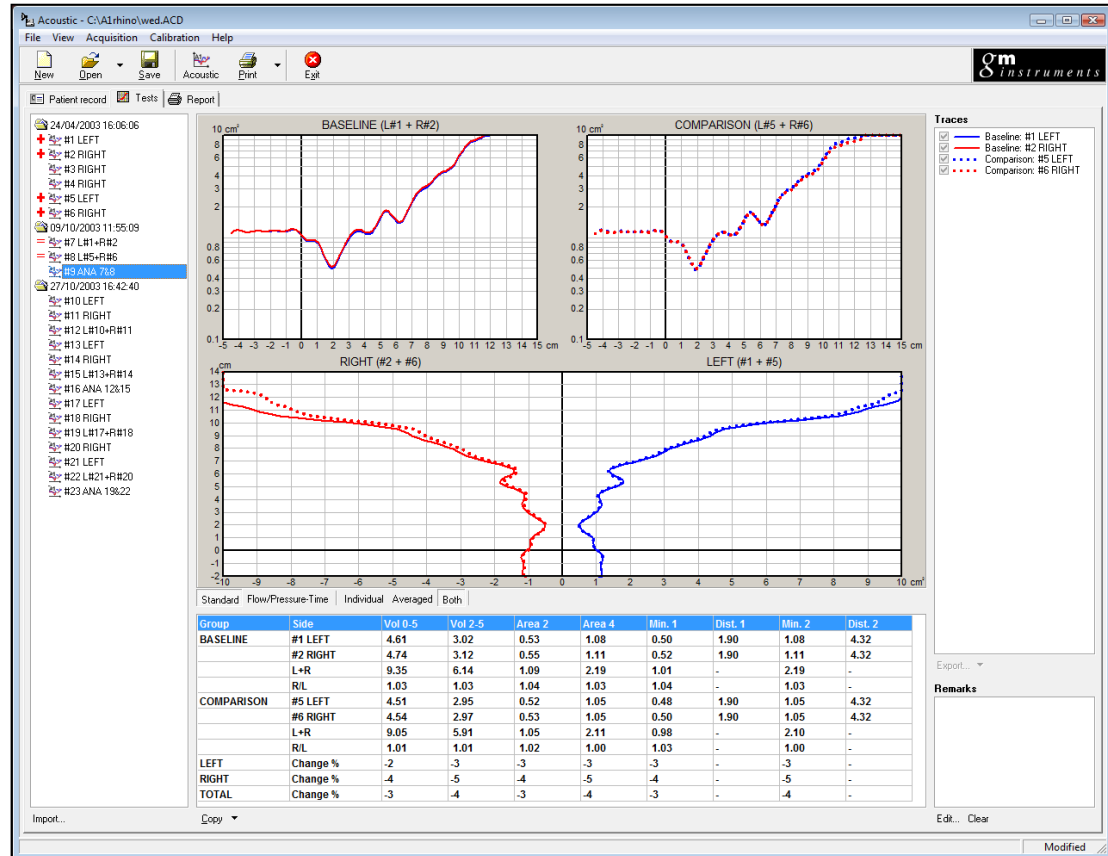
If you want to create a test which compares two Left side or Right-side results:

- 1) Select the **Tests** tab
- 2) Click on the test you want to use as the baseline test using the left mouse button
- 3) Hold down the ctrl key and click on the test you want to be the comparison test using the left mouse button. Both tests will now be highlighted. Click on one of the tests using the right mouse button and from the drop-down menu, click on **Create comparison test**
- 4) A new test entry is created called **COMP**, which shows both curves. This can be displayed in a number of ways, which can be toggled via buttons beneath the central window

It is also possible to compare a pair of total nose records. In this case one pair (L+R) record is designated as the baseline result and a second pair (L+R) is designated as a comparison result (colours and line styles for these are specified in the **Style** tab).

Left-click on one L+R curve to designate it as the baseline, then hold down the ctrl key and click on the L+R curve you wish to compare against. Right-click on either test and select **Compare** to produce a new record entry.

This new record is called an **ANALYSIS** record. When selected, a detailed examination of the two sets of results is possible, and the % change at different points is calculated.



6. TO DELETE A TEST RESULT

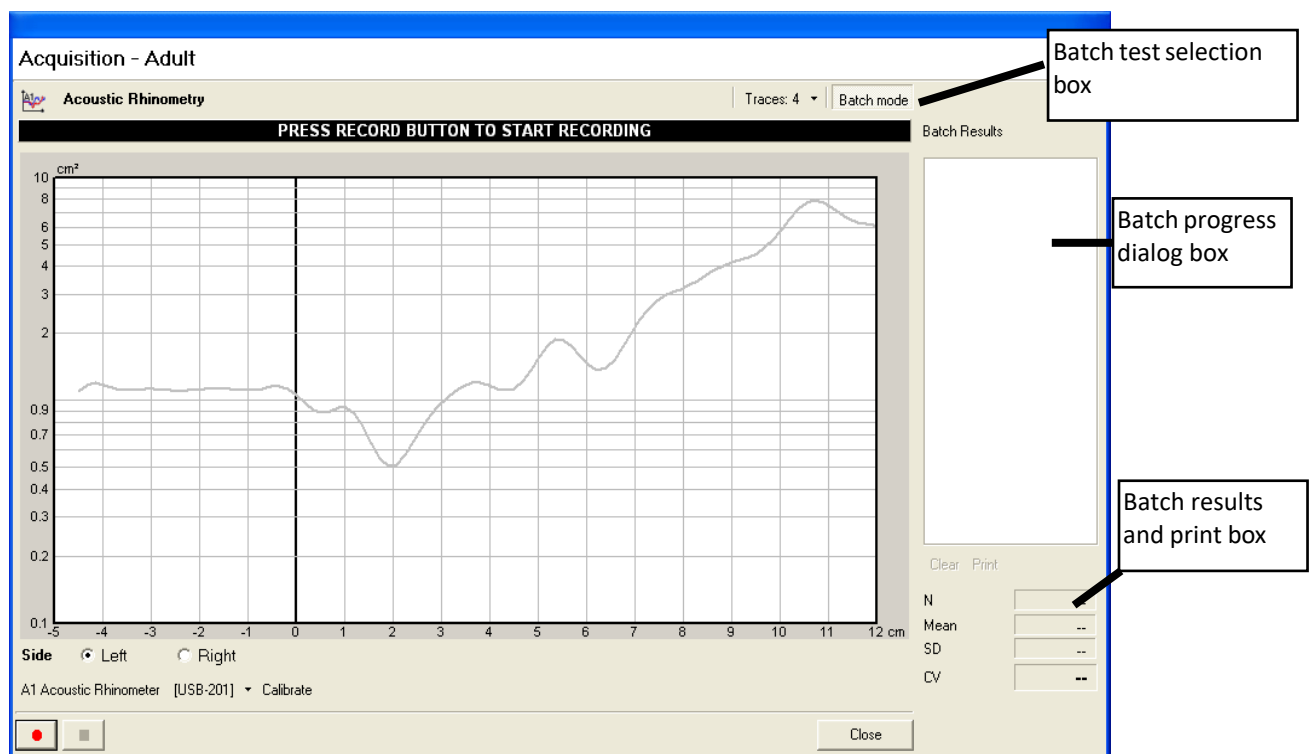
Select the test result to be deleted from the test list using the left mouse button to view it on screen, then right-click on the test and, from the menu which appears, select delete.

7. BATCH TEST FACILITY (CLINICAL/RESEARCH VERSION ONLY)

Validation of test results is a facility which has proved to be invaluable in many situations. In acoustic rhinometry result variation is normally caused by distortion of the nose or leakage in the connections to it.

The batch test facility has been incorporated into the Clinical/Research version of the program in order to allow users to check for these sources of result variation.

The program offers the possibility of switching on the **Batch** process when you go into the acquire screen, by clicking on **Batch mode** in the top right corner of the window. An additional section of window is then added to the acquire screen, where a number of pieces of information will be added as test results are taken.



At the end of the first test **Start batch** will be shown in the progress dialog box. At this point the subject should be disconnected from the equipment, and then reconnected.

The red button in the bottom left corner should be clicked on again to start part two. Once completed, a coefficient of variance figure (**CV**) will be shown in the progress box, while additional information such as the mean resistance, standard deviation between values, and the **CV** figure are shown in the results section.

If the **CV** figure is low then there is a strong likelihood of the values being accurate, as the chance of creating the same distortion or leakage twice in succession is remote.

However, additional tests can be added to the batch (with the subject disconnected between each) if you want further re-assurance.

The batch values can be printed directly without any possibility of modifying the data by clicking on the batch print button.

When you close the batch test window, the tests are transferred to the normal test list for further examination and permanent storage.

8. DATA EXPORT FACILITY (CLINICAL/RESEARCH VERSION ONLY)

STANDARD PRINTOUTS

Graphical and numerical information can be outputted in the form of printed records either directly from the **Tests** screen by selecting the records required and clicking on the **Print** button, or as a composed report by clicking on the **Output** tab and selecting the records you want on your report. These can be viewed on the right of the screen prior to clicking **Print**.

SCREEN TRANSFERS

A single tap on your keyboard's **Print Scrn** key will transfer the contents of the screen to the clipboard, which can then be pasted into other record-keeping systems.

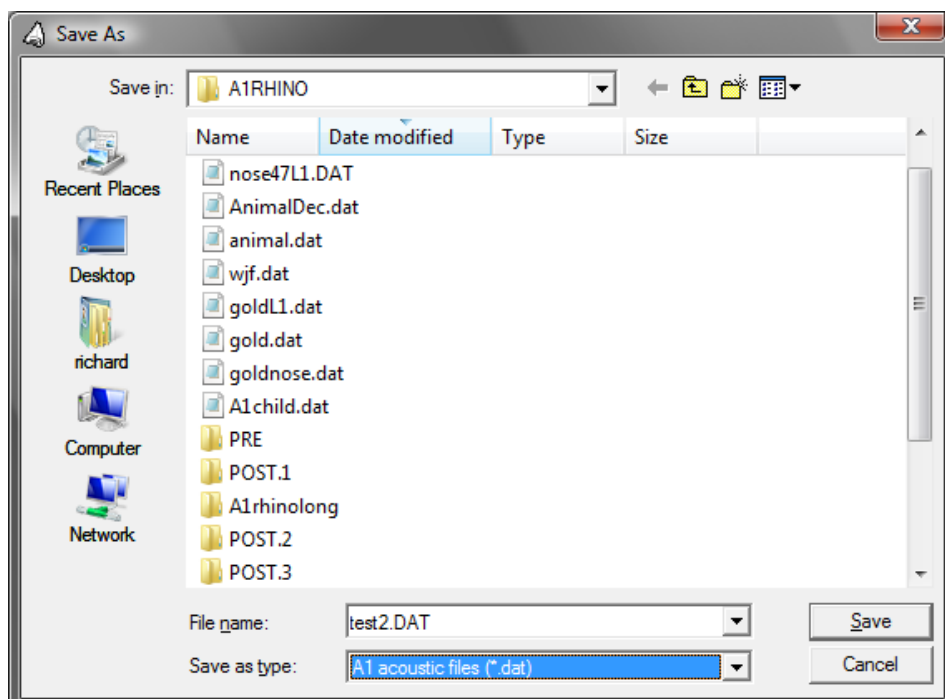
DATA OUTPUT

Numerical information can also be outputted from Clinical/Research versions of A1 in two ways.

- 1) Cross-sectional area values at pre-set time intervals:

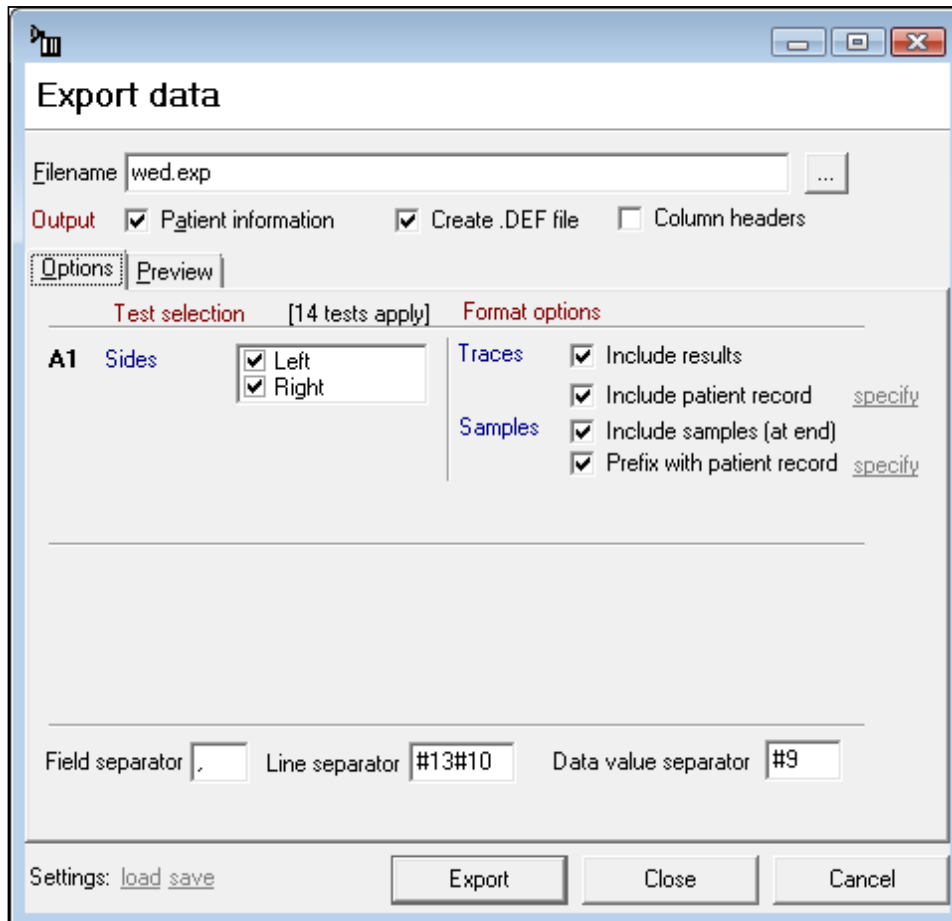
This is done by saving a record or group of records to a file of type .DAT.

The .DAT format saves cross-sectional area values sequentially at a fixed distance interval, which depends on the acquisition rate. At the standard sampling rate of 100kHz, area values are presented every 1.73 mm along the distance axis.



Click on **Save**, select files of type .DAT, enter the file name, if not entered automatically, and then click on **Save**. The saved file can then be viewed in Notepad or put into other software for processing.

- 2) The Clinical/Research version of the software includes an export facility, which can be found under the **File** drop-down menu, which, when clicked, presents you with a setup dialog box:



This allows you to select what patient information you want to export to a file of type .EXP, and whether the information should be calculated values, raw data, or a mixture of both.

As a companion to the .EXP file, a .DEF file can be created at the same time which names each item of data in the .EXP file.

Both types of file can be opened within commercial packages such as Microsoft Excel and subsequently processed in any way you wish.

9. Appendix

Steps for using BitLocker on Windows to encrypt PC storage drive

- Go to: Settings > System> Storage > Disks & Volumes
 - Select the drive you wish to encrypt (e.g. :C drive)
 - Select Properties
 - Select “turn on BitLocker”. Select again at the next prompt.
 - Select the option to back-up the recovery key (recover key can be found on your Microsoft account).
 - Select “Encrypt using disk space only”
 - Select “new encryption mode”
 - Check the "Run BitLocker system check" option.
 - Restart the PC.
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