Additional Information

AA222
Impedance Audiometer

Interacoustics

D-0115567-C – 2017/11

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1 About the AA222

The AA222 is a device combining audiometry and tympanometry. The target population for the AA222 covers all ages. The AA222 is designed to be used only by skilled personnel such as audiologists, ENT surgeons, doctors, hearing healthcare professionals or personnel with a similar type and level of education. The device should not be used without the necessary knowledge and training to understand its usage and how results should be interpreted.

Availability of the tests listed below, or specific settings within these tests on the hardware or in the software, depends on the license purchased.

The Audiometry module contains the following tests:

- Pure tone audiometry
- Weber
- Stenger
- Auto: Hughson-Westlake
- Alternate binaural loudness balancing (ABLB)
- Tone in noise (Langenbeck)
- Speech
- QuickSIN
- Short increment sensitivity index (SISI)

The Tympanometry module contains the following tests:

- Tympanometry 226, 678, 800 and 1000 Hz
- Ipsilateral reflexes
- Contralateral reflexes
- Reflex decay
- Reflex latency
- Eustachian tube function – non-perforated
- Eustachian tube function – perforated
- Eustachian tube function – patulous

2 General operation of the tympanometry module

2.1 Preparing for the tympanometry test

2.1.1 Tympanometry patient instruction

Place the patient on a comfortable chair or, if necessary, on an examination table. Younger children may feel more comfortable sitting on a parent's or nurse's lap. Show the probe to the patient and then explain the following:

- The aim of the test is to assess the mobility of the eardrum
- The tip of the probe will be inserted into the ear canal and has to make a perfect seal
- A small amount of air will flow through the probe to move the eardrum; it produces a sensation similar to pressing a finger slightly into the ear canal
- One or more tones will be heard during the test
- No active participation is expected from the patient
- Coughing, talking and swallowing will disturb test results

2.1.2 Visual inspection of the ear canal

Check the external ear canal for wax with an otoscope and remove any excessive wax to prevent the probe opening from clogging, as this would inhibit testing. Excessive hairs may have to be cut.

2.1.3 Placement of the contralateral phone

If the contra headphone is used, place the headband over the patient's head. The audiometric headphone is placed over the non-test ear (or contralateral reflex ear).

If the insert phone is used, mount the proper foam tip on the end of the tubing before inserting into the non-test ear.

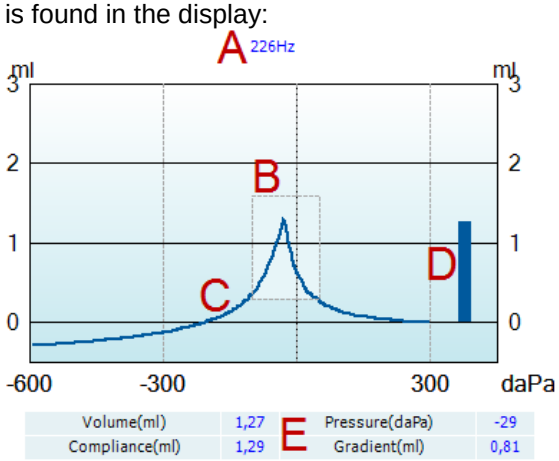
2.1.4 Selecting the correct ear tip

The table below can be used as a guide to help you select an appropriate ear tip size.

Age	Ear tips inserted *against* ear canal	Ear tips inserted *into* ear canal
0,5 y/o		Green pediatric ear tip
		Ear tip 3-5 mm, flanged
	Ear tip 7.5 mm, umbrella	Ear tip 4-7 mm, flanged
	Ear tip 9 mm, umbrella	Ear tip 5-8 mm, flanged
	Ear tip 10 mm, umbrella	Ear tip 7 mm, mushroom
	Ear tip 11 mm, umbrella	Ear tip 8 mm, mushroom
4 y/o	Ear tip 13 mm, umbrella	Ear tip 9 mm, mushroom
10 y/o		Ear tip 10 mm, mushroom
	Ear tip 15 mm, umbrella	Ear tip 11 mm, mushroom
		Ear tip 12 mm, mushroom
Adults	Ear tip 19 mm, umbrella	Ear tip 13 mm, mushroom
		Ear tip 14 mm, mushroom
Exeptional sizes	Ear tip 22 mm, umbrella	Ear tip 15 mm, mushroom
		Ear tip 19 mm, mushroom

2.2 Tympanometry

The default display of tympanometry tests shows graphs for both left and right ear. The following information is found in the display:



A The label above the graph indicates which probe tone frequency was used while measuring the recording that is plotted.

B The normative box which shows where the peak of the audiogram is expected in normal middle ear functioning. The size of the normative box can be customized in the protocol setup. Be aware that the placement of the normative box is dependent on the ear canal volume. This means that when the curves are shown in non-compensated view, the box will only be placed correctly after the ear canal volume has been determined.

C The tympanometry curve(s). The numerical values of the curve should be read from the left Y-axis. For tympanometry performed at 226 Hz the scaling is in ml. For all other probe frequencies, the unit at the Y-axis is mmho.

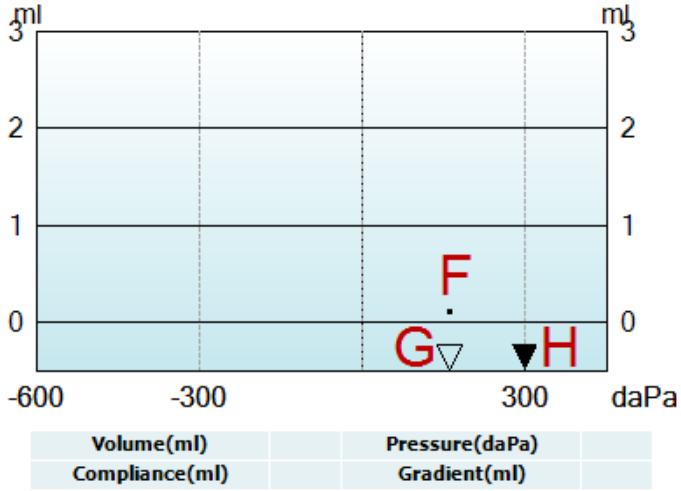
D The equivalent ear canal volume. In automated tympanometry, the acoustic admittance (Y) at the start pressure is taken as the reference value. In manually performed tympanometry, it takes the acoustic admittance at the highest recorded pressure as a reference. Be aware that at probe frequencies other than 226 Hz, the equivalent ear canal volume is read from right Y.

E The table with measurement values. Here you will find:

- **Volume**, the equivalent ear canal volume
- **Compliance**, the peak compensated static acoustic admittance. When the tympanogram is shown compensated for the ear canal volume, it is the compliance value at the peak
- **Pressure**, the tympanic peak pressure which is at the point of the curve where the highest compliance value is detected
- **Gradient,** If it is chosen to show gradient as **pressure**, it gives the tympanogram width at half the height of the peak compensated static acoustic admittance. If it is chosen to show gradient as **compliance**, it gives the average of the two compensated admittance values which are 50 daPa away from the peak pressure

If the automated measurement for some reason does not reach the end pressure as set in the protocol setup, the table will only show the equivalent ear canal volume.

Manual tympanometry testing



F The dot represents the measurement of the (non-compensated) acoustic admittance. It is only shown when not recording. During recording, the display will always be non-compensated.

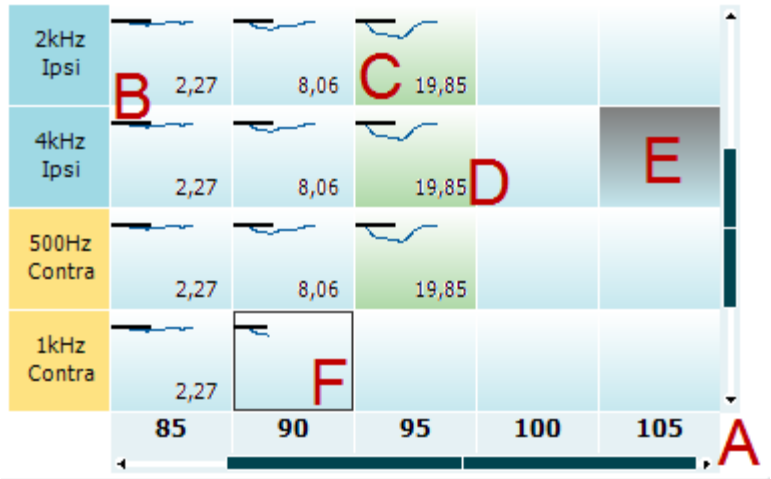
G The empty triangle indicates actual pressure.

H The full triangle is the pressure cursor showing the current target pressure. It is moved by turning the wheel.

2.3 Reflex

Note that in cases where your protocol has no reflex test included, you can temporarily include a reflex test in your protocol by pressing the **I Reflex C** button.

The default displays of reflex tests show a matrix of reflexes, which are measured in the order of appearance on the screen. The following information is found in the display:



A The reflex matrix shows graphs of equal stimulus types in the rows and equal stimulus levels in the columns. Note that scroll bars appear when more stimuli are available than can fit on the screen.

B Within the graph, the x-axis is the time scale on which the black bar indicates when the stimulus was given.

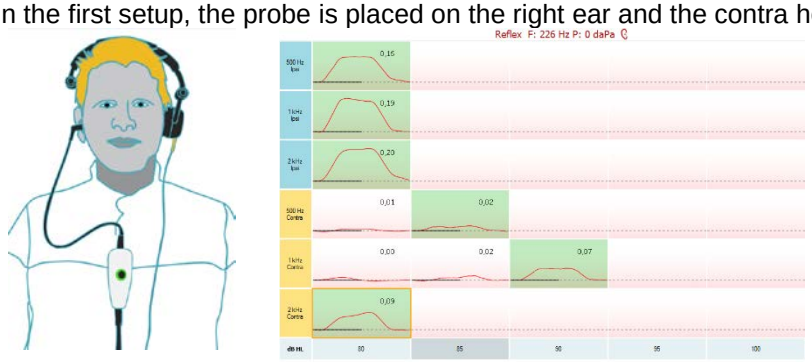
C A green square indicates that the reflex threshold is set (either automatically or manually) at the chosen stimulus level.

D The **Deflection value** is shown when this option is activated through the protocol settings.

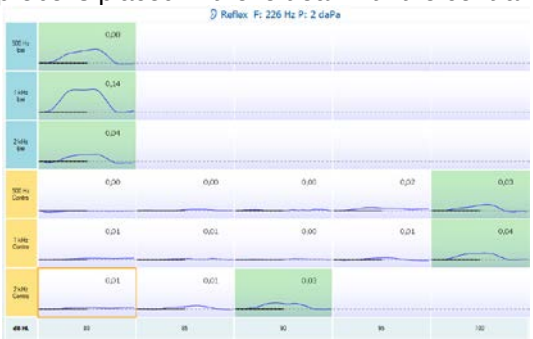
E A grey square indicates a stimulus level that is not available for that particular stimulus type.

F The square outlined in black indicates which section of the matrix has been selected or is currently being measured.

Note that the reflexes are indicated by the probe ear. This is shown as an example below.
In the first setup, the probe is placed on the right ear and the contra headphone is placed on the left ear.



In the second setup, the probe is placed in the left ear with the contra headphone placed on the right ear.



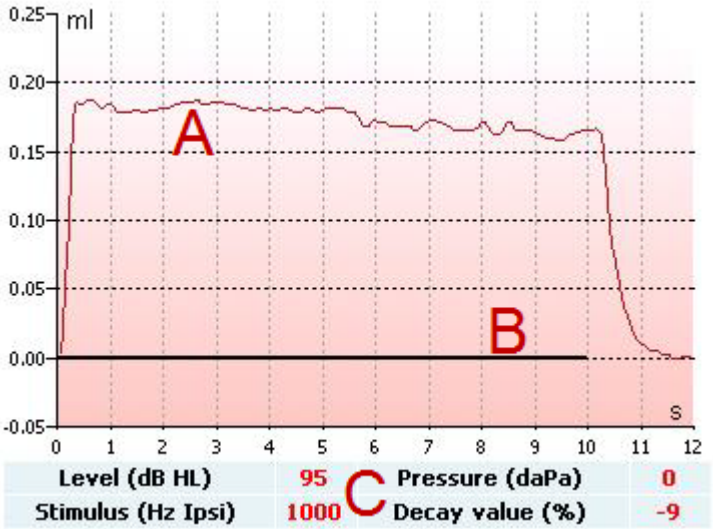
2.4 Reflex decay

Note that in cases where your protocol has no reflex decay test included, you can temporarily include a reflex decay test in your protocol by holding the **Shift** button while pressing the **I Reflex C** button. Pressing this combination also allows including and excluding a reflex decay test from running automatically.

The decay test will be automatically performed with an activator intensity of 10 dB above the reflex threshold. The test will show a pop-up and ask for the intensity of the activator in case:

- the reflex threshold cannot be found within the same protocol
- the required intensity is at or above the warning level as determined in the protocol settings
- the required intensity is above the maximum level that the transducer will permit for this particular activator

The default display of the reflex decay tests shows the graphs of the decay measurements from the selected ear. The following information is found in the display:



A The tympanometric curve.

B Within the graph, the x-axis is the time scale on which the black bar indicates when the stimulus was given.

C The table with measurement values which are only calculated if the measurement can be completed.

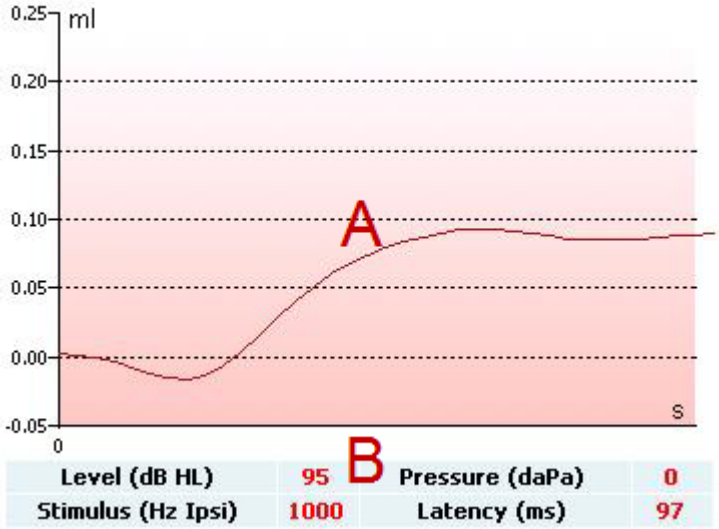
- **Level**, stimulus level.
- **Pressure**, the pressure at which the decay reflex is measured. Usually the decay test will be set up to use the peak pressure of a preceding tympanogram.
- **Stimulus**, stimulus frequency.
- **Decay value**, the percentage difference of the two reflex deflection values taken half a second after the stimulus started and half a second before the stimulus stopped. If decay is present, the percentage shows as a negative number. When the calculation results in numbers larger than 125 % or smaller than -115 % the outcome is invalid and will not be shown.

2.5 Reflex latency

The reflex latency test will be automatically performed with an activator intensity of 10 dB above the reflex threshold. The test will show a pop-up and ask for the intensity of the activator in case:

- the reflex threshold cannot be found within the same protocol
- the required intensity is at or above the warning level as determined in the protocol settings
- the required intensity is above the maximum intensity that the transducer will permit for this particular activator.

The default display of the reflex latency test shows the graphs of the latency measurements from the selected ear. The following information is found in the display:



A The first 300 ms of the tympanometric curve.

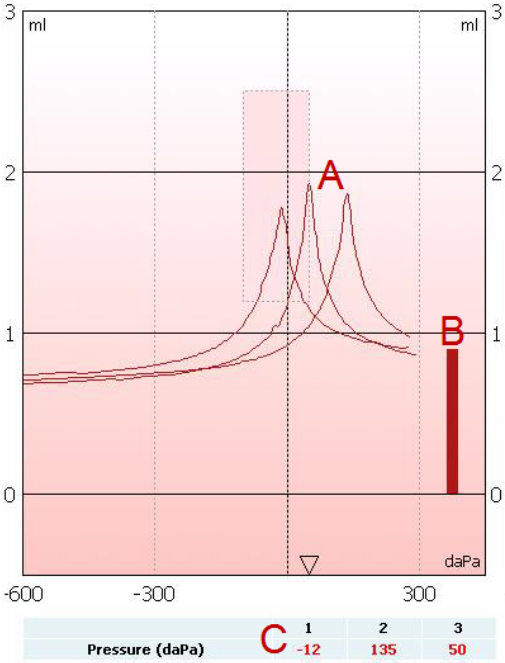
B The table with measurement values which are only calculated if the measurement can be completed.

- **Level**, stimulus level
- **Pressure**, the pressure at which the decay reflex is measured. Usually the decay test will be set up to use the peak pressure of a preceding tympanogram
- **Stimulus**, stimulus frequency
- **Latency value**, the time interval between onset of the stimulus and the point where 10 % of the reflex deflection value is reached. The reflex deflection value is measured as the average of the deflection between 250 and 300 ms after stimulus onset

2.6 Eustachian tube function – non-perforated eardrum

The display of the Eustachian tube function test for the non-perforated eardrum shows graphs for the selected ear in which the three tympanograms of the adapted Williams procedure are plotted. The Williams procedure keeps the pressure between the first and second tympanogram at the stop pressure, and between the second and third tympanogram at the start pressure. In between all tympanograms, the original Williams procedure involves asking the patient to swallow. In order to achieve a larger displacement in the tympanograms, we advise asking the patient to perform a Valsalva maneuver after the first tympanogram, then swallowing after the second tympanogram.

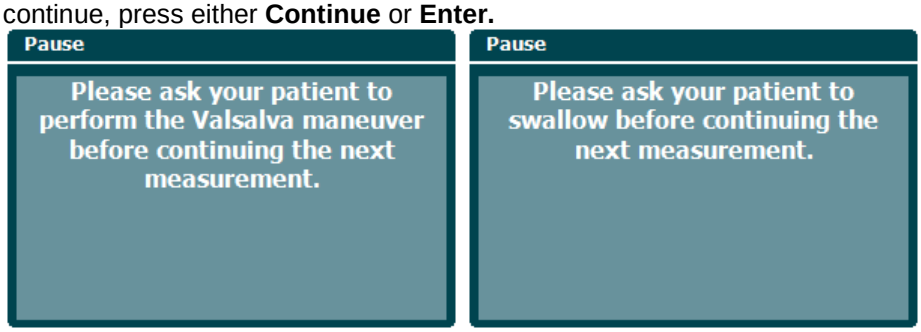
The following information is available during testing:



A The non-compensated tympanometric curves.

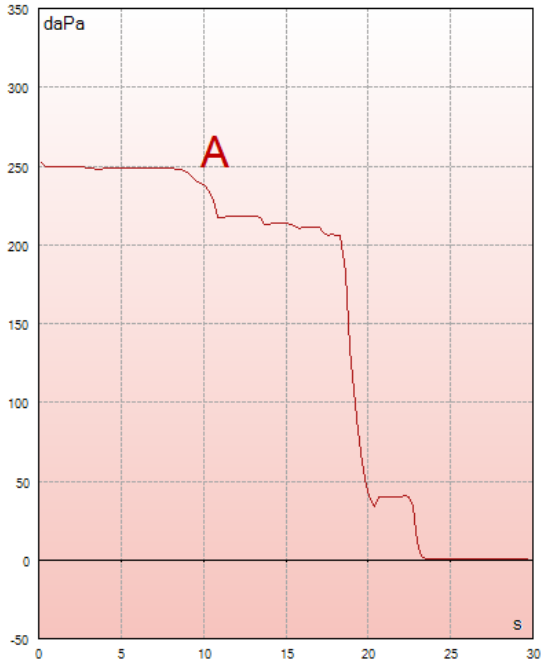
B The equivalent ear canal volume where the acoustic admittance (Y) at the starting pressure of the first tympanogram is taken as the reference value.

C The table shows the pressure values at which the three peaks are detected (or the highest equivalent volume if there is no peak).
An instruction is displayed between the three tympanograms to tell you how to direct the patient. To continue, press either **Continue** or **Enter.**



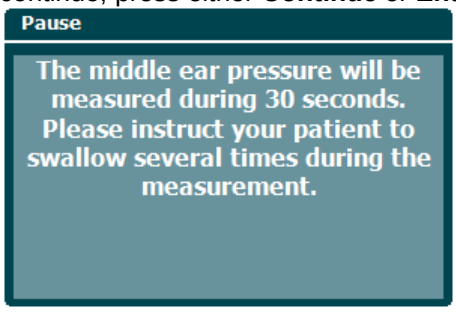
2.8 Eustachian tube function – perforated eardrum

The default display of the Eustachian tube function test for a perforated eardrum shows a graph for the selected ear. The following information is available during testing:



A The pressure curve showing that the pressure drops each time the patient swallows. Notice that an exponential release of pressure means that the probe sealing might not be sufficient.

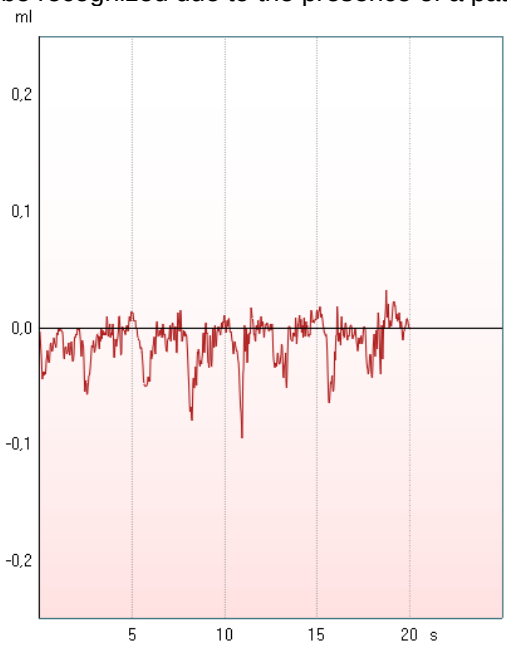
Before the measurement starts, an instruction is displayed to tell you how to direct the patient. To continue, press either **Continue** or **Enter.**



2.9 Eustachian tube function – patulous eustachian tube

The patulous Eustachian tube test is an impedance baseline test. It monitors changes in impedance over time without applying pressure changes or acoustic stimuli. When a patulous Eustachian tube is present you would typically expect to identify the breathing of the patient in the tympanometric curve. If the Eustachian tube is closed and the tympanic membrane is intact, you would expect to measure small tympanometric changes which can be caused by acoustic disturbances from around the patient, accidental displacements of the probe, or by spontaneous movements of the eardrum. Additionally, it is possible to measure movements due to the heartbeat as, for example, with a glomus tumor. Or the test can be used to measure reflexes where the stimulus is presented through an external device such as a cochlear implant.

The default display of the Eustachian tube function test for the patulous Eustachian tube shows the graph for the selected ear. Below is a real example of a measurement in which the breathing rhythm of the patient can be recognized due to the presence of a patulous Eustachian tube.



3 General operation of the Audiometry module

3.1 Pure tone audiometry

Please refer to the quick guide ‘Tone Audiometry’ (D-0113813)

3.1.1 Masking

Please refer to the quick guide ‘Audiometric masking’ (D-0113988)

3.2 Weber

Please refer to the quick guide ‘Weber’ (D-0113814)

3.3 Stenger

Please refer to the quick guide ‘Stenger’ (D-0113811)

3.4 Auto – Hughson-Westlake

Please refer to the quick guide ‘Hughson-Westlake’ (D-0113805)

3.5 Alternate binaural loudness balancing (ABLB) – Fowler Test

Please refer to the quick guide ‘Alternate Binaural Loudness Balancing (ABLB)’ (D-0113803)

3.6 Speech audiometry

Please refer to the quick guide ‘ Speech Audiometry’ (D-0113990)

3.7 QuickSIN – Quick signal in noise testing

Please refer to the quick guide ‘QuickSIN’ (D-0113808)

3.8 Short increment sensitivity index (SISI)

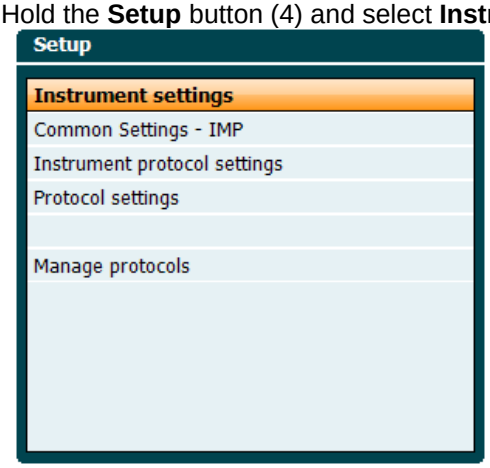
Please refer to the quick guide ‘Short Increment Sensitivity Index‘ (D-0113810)

4 Setup menu

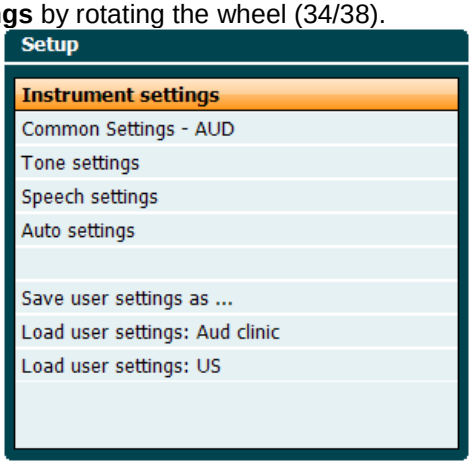
4.1 Instrument settings

Instrument settings is shared by the audiometry and impedance modules and contains all the general settings including license, light, date and time, and printer settings.

Hold the **Setup** button (4) and select **Instrument settings** by rotating the wheel (34/38).

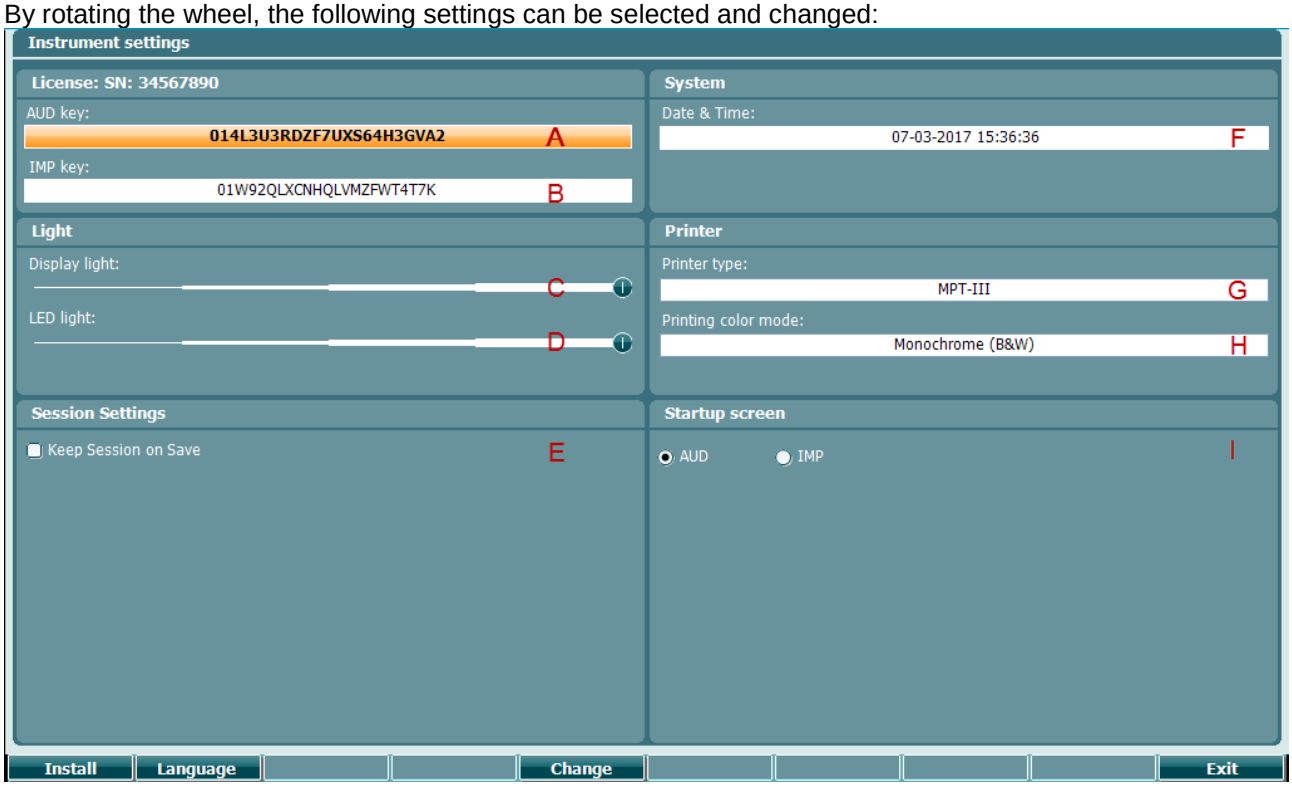


Impedance module



Audiometry module

By rotating the wheel, the following settings can be selected and changed:



License

A **AUD key**. When pressing the Change button a pop-up window opens in which you can enter a new license key for the audiometry module. The new license key is activated by pressing the Next button. The previous license key will not be changed if the new key is not a valid key.

B **IMP key**. When pressing the Change button a pop-up window opens in which you can enter a new license key for the impedance module. The new license key is activated by pressing the Next button. The previous license key will not be changed if the new key is not a valid key.

Light

C You can alter the **Display light** by holding the Change button and rotating the wheel. You will see the brightness of your screen change accordingly.

D You can alter the **LED light** by holding the Change button and rotating the wheel. You will see the brightness of the LEDs around the **Enter** button change accordingly. Note that the LED in the probe system cannot be adjusted.

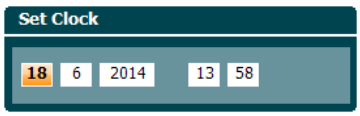
Session settings

E **Keep Session on Save** will keep the session on the device when pressing **save session**.

System

F When pressing the Change button while **Date and time** is selected you can manually alter the date and time.

The following window will pop up

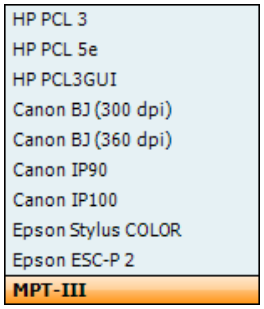


Use the wheel to select day, month, year, hour and minutes. Use the Change - and Change + buttons to adjust the number. Press the Set button to keep the changes and set the date and time, or press the Back button to reject any changes made.

When the AA222 is connected to the Diagnostic suite, your PC automatically updates the date and time.

Printer

G Under **Printer type** you can select which printer is connected to the USB port of your AA222. By default, the Sanibel MPT-III thermal printer is selected. The list below shows the currently supported printers:



H Under **Printer color mode** you can select your printer to print in black and white or 3 color (CMY) or 4 color (CMYK) mode.

Startup screen

I Selects the startup screen for either the Aud or Imp module.

In addition, the following buttons are available:

Pressing **Install** allows you to install new firmware on the AA222. By pressing **Install** the instrument will look for a USB dongle. If there is one or more installation file available, the installation process will then commence.

Holding the **Language** button and rotating the wheel (34/38) allows selection of one of the available languages. Note that you must restart the system before the new language setting can be used.

Press **Exit** to leave Instrument settings

4.2 Tympanometry setup menu

When holding the **Setup** button a menu pops up where you can select one of the options by rotating the wheel and then releasing the Setup button. By default, **Protocol settings** is selected in which you can temporarily or permanently change the settings used during testing. You can also create new protocols here.

In **Common settings - IMP** you can modify common functionalities for all impedance tests.

The **Instrument protocol settings** hold the default settings when tests are added to a protocol. This is also where you, for example, define which reflex stimuli are used by default, when adding contra reflexes to a protocol.

From **Protocol Settings** it is possible to create user-defined protocols. It is possible to modify each protocol individually in the same way as for the instrument protocol settings. Protocol settings applied in this setup only affect the given protocol.

In **Manage protocols** you can show/hide and delete protocols, and set the required region for factory protocols.

4.2.1 Common settings – IMP

For common settings - imp you can toggle between **Auto start** (default) and **Manual start**. Enabling **Manual start** forces the system to start each protocol on pause. When **Manual start** is enabled the light indicator on the device flashes to indicate that the measurement has been paused. You can then start the measurement by pressing **Enter** or by pressing the button on the probe/shoulder box.

4.2.2 Protocol settings

Press the **Setup** button to enter protocol settings.

Note that you can only change the protocol settings of a test if there is no data stored for that test. In instances where data is present, it will state at the top of the screen ‘Data is present, press **New session** to allow changing settings.

The following buttons are available while in protocol settings.

Note that all changes to the settings are stored immediately. Pressing **Exit** will therefore result in the settings being temporarily in use. After saving or clearing a session by the **New session** button, the original protocol settings are restored.

Press **Save** or **SaveAs** to permanently save protocol settings. Factory protocols can be temporarily saved (by pressing **Exit**) or saved with a new protocol name by pressing **SaveAs**. To save customized protocols under a new name, hold the **Shift** button and then press **SaveAs**.

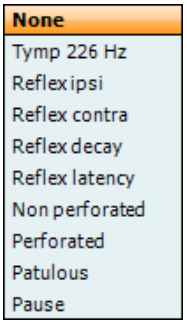
Moves one test up in the current protocol.

Pressing shift simultaneously will move the selected test upwards in the protocol.

Moves one test down in the current protocol.

Pressing shift simultaneously will move the selected test downwards in the protocol.

Use the wheel while holding the **Add** button to select which test is added at the bottom of the current protocol.



Note that each added test comes with the default settings as defined in the **Instrument protocol settings**.

Pressing **Remove** deletes the currently selected test from the protocol, without warning.

Use the wheel to browse through the different settings in the menu. Press **Toggle** to change the check boxes, or hold **Change** and rotate the wheel to change settings with more than two options. Touching the **Enter** button will also toggle between check boxes or browse through setting options.

4.2.2.1 Tymp settings

Select a tymp test in your Protocol settings. By rotating the wheel, the following settings can be selected and changed.

A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B **Probe tone frequency**. The frequencies which can be selected are 226 Hz (recommended for normal testing), 678 Hz, 800 Hz, 1000 Hz (usually recommended for testing babies up to 6 months of age.

C **Start pressure**. To select the start pressure for automated tympanometry. The start pressure can vary between +400 and -600 daPa. For calculating the equivalent ear canal volume, the measurement points at starting value are taken.

D **Stop pressure**. To select the stop pressure for automated tympanometry. The stop pressure can vary between +400 and -600 daPa.

E **Add reversed sweep**. When enabled, the automated tympanometry will run a tympanometry from start pressure to stop pressure and back to start pressure again.

F **Pump speed**. To select the pump speed for automated tympanometry. The stated pump speeds are dependent on the size of the ear canal or the cavity being used during the measurement. The numbers below are therefore rough estimates.

- **Automatic**, is the high pump speed which automatically slows down to low pump speed around the peak of the tympanogram. We recommend using this setting for screening and normal tympanometry tests.
- **Fast**, results in a constant speed of about 300 daPa/s.
- **Medium**, results in a constant speed of about 200 daPa/s.
- **Slow**, results in a constant speed of about 100 daPa/s.
- **Very slow,** results in a constant speed of about 50 daPa/s.

G **Manual mode minimum pressure** allows you to set the lower limit of the pressure range during manual tympanometry.

H **Manual mode maximum pressure** allows you to set the upper limit of the pressure range during manual tympanometry.

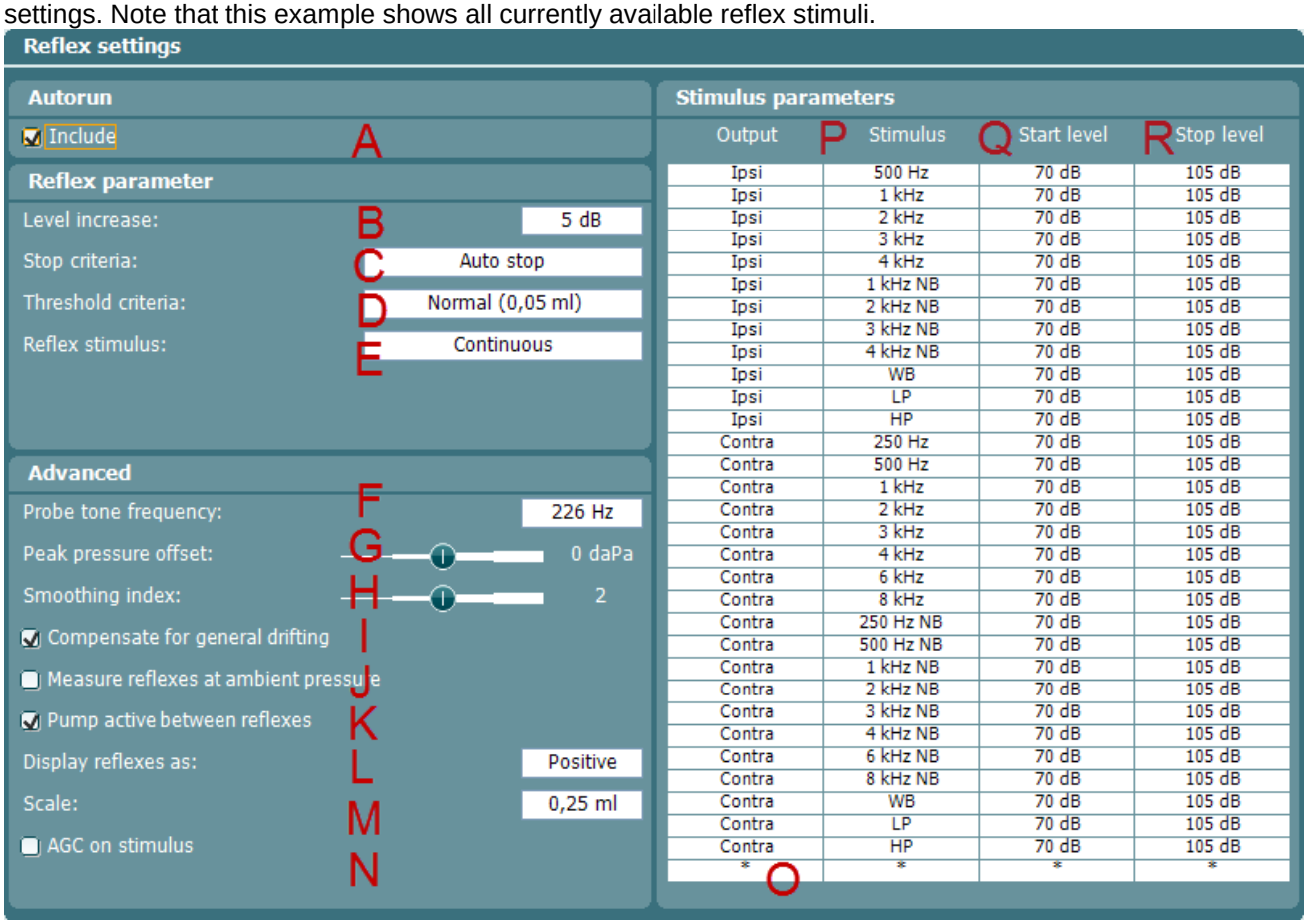
I **Gradient**. Gradient as either a measure of compliance (in ml) or as a measure of pressure (in daPa). Select to display the gradient.

J **Show normative box.** Select to show a rectangle in which the compliance peak is that expected under normal conditions of the middle ear.

K - N **Normative box.** Minimum and maximum pressure and compliance values are defined here.

4.2.2.2 Reflex settings

Select the reflex test in your Protocol settings. By rotating the wheel, you can select and change the following settings. Note that this example shows all currently available reflex stimuli.



A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B **Level increase**. This defines the incremental level of each step during the threshold measurement You can choose incremental levels from 1 dB to 20 dB.

C Choose either **Fixed number of reflexes** or **Auto stop**. When selecting **Fixed number of reflexes,** the reflex test will complete the sequence from **Start level** up to **Stop level**, also if the threshold criterion is attained before reaching **Stop level**. When **Auto stop** is chosen, the AA222 will detect the reflex threshold depending on the threshold criterion, and confirm the reflex at the same intensity.

The sequence then stops. The stimulus level will never exceed the intensity level which is set at **Stop level**.

D **Threshold criteria** let you set the sensitivity of the pass criteria. Three options are available:

- **Very sensitive (0.02 ml)** where a 'pass' is given for a change in compliance larger than 0.02 ml (at all probe tone frequencies).
- **Sensitive (0.03 ml)** a 'pass' is given for a change in compliance larger than 0.03 ml (at all probe tone frequencies).
- **Normal (0.05 ml)** where a 'pass' is given for a change in compliance larger than 0.05 ml (at all probe tone frequencies).
- **Robust (0.08 ml)** where a 'pass' is given for a change in compliance larger than 0.08 ml (at all probe tone frequencies).

E **Reflex Stimulus:** The reflex stimulus can be set to continuous or pulsed. With the ability to set the probe tone to pulsed it is possible to obtain a reflex at 1000 Hz ipsi.

F **Probe tone frequency**. The frequencies which can be selected are 226 Hz (recommended for normal testing), 678 Hz, 800 Hz and 1000 Hz.

G **Peak pressure offset** defines how far from the peak pressure the reflex is measured. When multiple peaks are found, the measurement is taken from the highest peak. Note that the automated reflex can only use the peak pressure when a tympanogram measured at the same frequency precedes the reflex test.

H **Smoothing index** allows you to choose the level of detail with which the reflex measurement is measured and displayed. A smoothing index of 0 means that smoothing is not applied. A smoothing index of 4 will smooth the curve significantly.

I Checking the **Compensate for general drifting** option ensures that the base of a reflex sequence remains at zero even when the probe seal is not completely tight. The compensation takes place just after a reflex measurement is completed. The reflex graph is then refreshed.

J **Measure reflexes at ambient pressure** allows you to measure reflexes while the tympanic peak pressure is being disregarded. When checked, measurements are performed at 0 daPa.

K **Pump active between reflexes**, when checked, ensures that the pressure is restored to peak pressure prior to each presentation of the stimulus. When not activated, the pump is used once for each stimulus type at the start of each reflex sequence.

L **Display reflexes as** either **Positive** or **Negative** makes the reflex curve flip over the x-axis. When **Positive** is chosen, you can normally expect the deflection to go in a positive direction. At probe tone frequencies other than 226 Hz, the compliance is less stiffness-controlled and when measuring an acoustic reflex it is then not uncommon to measure a negative deflection in adults. Therefore, the display of reflexes at these probe tone frequencies shows both a positive and negative scale of the y-axis. Changing this option to **Negative** will still mirror the graph over its x-axis.

M At **Scale** you choose the maximum values of the y-axis of the reflex graph. Note that for probe tone frequencies other than 226 Hz, the scaling is in mmho instead of ml.

N When the **AGC on stimulus** (automatic gain control) checkbox is ticked, the size of the ear canal is taken into account when adjusting the stimulus level. Without compensation, the intensity level will increase as the size of the ear canal decreases. Note that current tympanometry standards do not yet describe how AGC should be applied. We recommend that AGC is used when testing infant ears as, theoretically, with ear canal volumes smaller than 0.2 ml, the stimulus level can be increased by 20 dB or more. The AGC is applied for both the ipsilateral and contralateral insert.

O The table shows which reflexes will be tested. Selecting the bottom row enables the addition a new reflex sequence. Hold the Add Stimulus button while rotating the wheel to select the stimulus you wish to add. Note that rotating down gives ipsilateral stimuli, and rotating up gives contralateral stimuli. The table below shows which stimuli are available depending on the probe tone frequency and which side you are measuring. **NB** stands for narrow band noise. **LP** stands for low pass filtered noise which has a spectrum from 400 Hz up to 1600 Hz. **HP** stands for high pass filtered noise which has a spectrum from 1600 Hz up to 12 kHz. **WBN** stands for wideband noise which has a spectrum from 400 Hz up to 12 kHz.

P To select a reflex sequence from the table, hold the Stimulus button and change the stimulus type by rotating the wheel. Press the Remove Stim. button in order to remove the reflex sequence from the table.

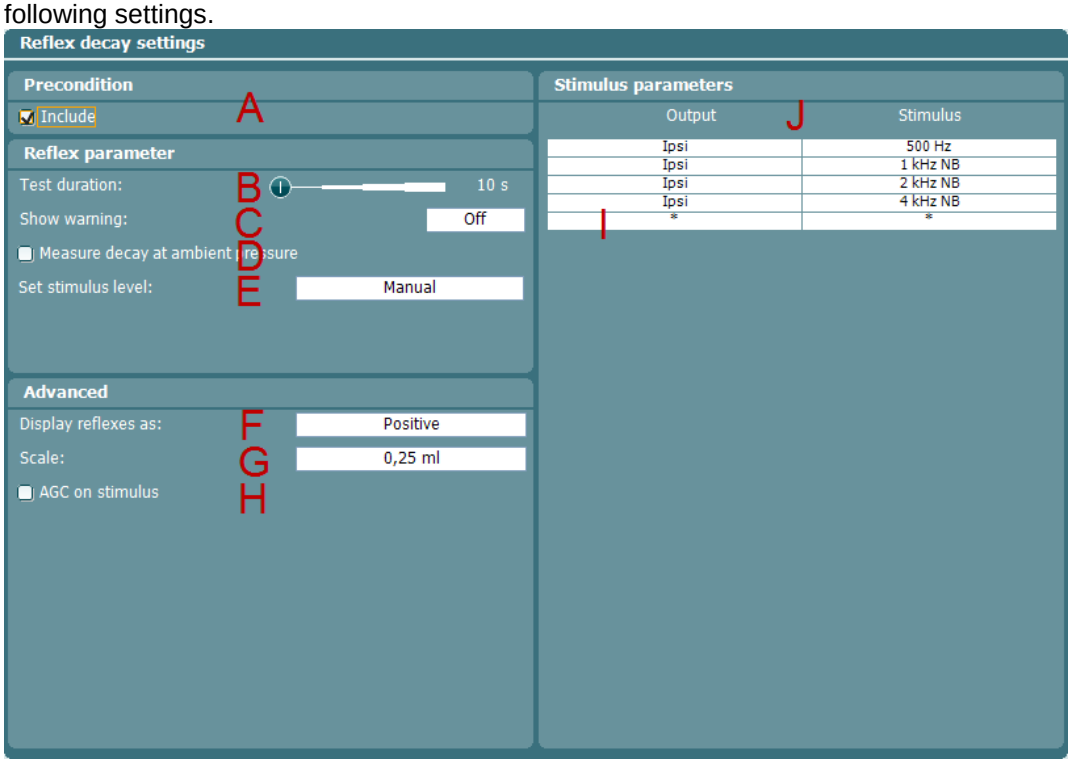
Q To select a reflex sequence start level from the table, hold the Start Level button while rotating the wheel to select the desired start level.

R To select a reflex sequence stop level from the table, hold the Stop Level button while rotating the wheel to select the desired stop level. For ipsilateral measurements at some frequencies, the maximum output is limited compared to contralateral measurements.

Probe frequency	**226 Hz**		**678 Hz**	**800 Hz**	**1000 Hz**
Ear side	**Ipsi**	**Contra**	**Contra**	**Contra**	**Contra**
Stimulus type (in Hz)		250	250	250	250
	500	500	500	500	500
	1000	1000	1000	1000	1000
	2000	2000	2000	2000	2000
	3000	3000	3000	3000	3000
	4000	4000	4000	4000	4000
		6000	6000	6000	6000
		8000	8000	8000	8000
		250 NB	250 NB	250 NB	250 NB
		500 NB	500 NB	500 NB	500 NB
	1000 NB	1000 NB	1000 NB	1000 NB	1000 NB
	2000 NB	2000 NB	2000 NB	2000 NB	2000 NB
	3000 NB	3000 NB	3000 NB	3000 NB	3000 NB
	4000 NB	4000 NB	4000 NB	4000 NB	4000 NB
		6000 NB	6000 NB	6000 NB	6000 NB
		8000 NB	8000 NB	8000 NB	8000 NB
	LP	LP	LP	LP	LP
	HP	HP	HP	HP	HP
	WB	WB	WB	WB	WB

4.2.2.3 Reflex decay

Select a reflex decay test in your Protocol settings. By rotating the wheel, you can select and change the following settings.



A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B **Test duration** sets the length of the probe tone to 10, 15, 20, 25 or 30 seconds.

C **Show warning** gives you the opportunity to set a level at which the AA222 will give a warning.

D **Measure decay at ambient pressure** allows you to measure reflex decay while the tympanic peak pressure is being disregarded. When checked, measurements are performed at 0 daPa.

E **Set stimulus level** allows you to set the stimulus level to either **Manual** or **Automatic**. **Manual** means that prior to the test, a pop-up window will ask you to set the stimulus level. When choosing **Manual** it is recommended to have **Show warning** off. Otherwise, you may be asked twice to set the stimulus level when it exceeds the warning level. **Automatic** means that the AA222 sets the stimulus level 10 dB above reflex threshold level. If that stimulus level exceeds the warning level or cannot be obtained, you will still be asked to set the stimulus level manually.

F **Display reflexes as** either **Positive** or **Negative** makes the reflex curve flip over the x-axis. When **Positive** is chosen, you can normally expect the deflection to go in a positive direction.

G At **Scale** you choose the maximum values of the y-axis on the reflex graph.

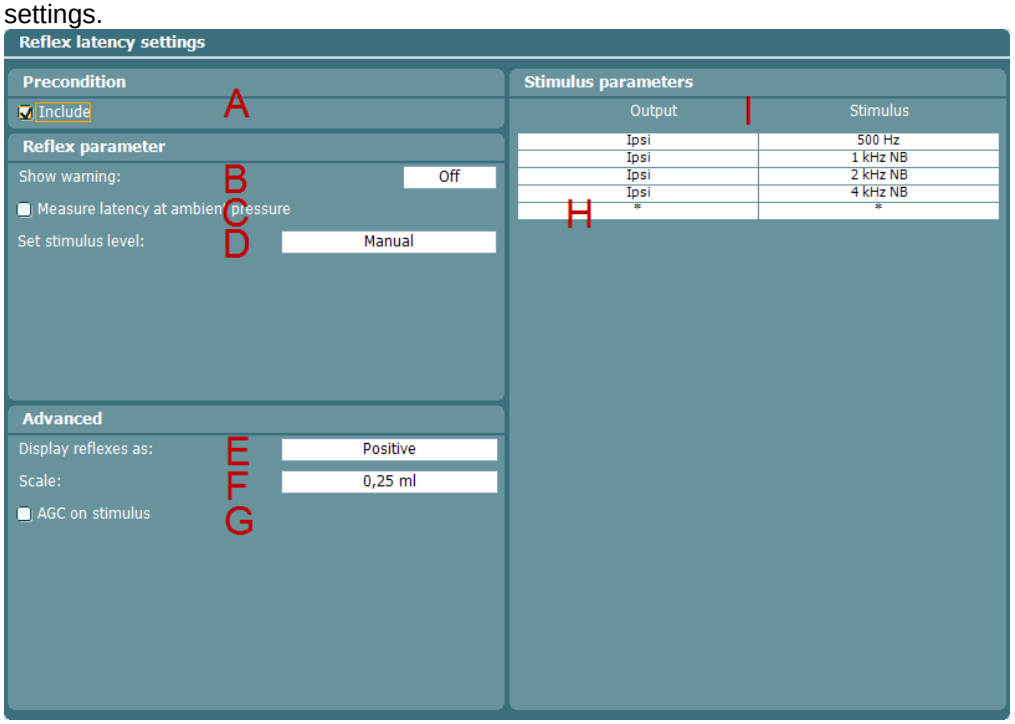
H When the **AGC** (automatic gain control) checkbox is marked, the size of the ear canal is taken into account for adjusting the stimulus level. Without compensation, the intensity level will increase as the size of the ear canal decreases. Note that current tympanometry standards do not yet describe how AGC should be applied. We recommend that AGC is used when testing infant ears, as, theoretically, with ear canal volumes smaller than 0.2 ml, the stimulus level can be increased by 20 dB or more. The AGC is applied for both the ipsilateral and contralateral insert.

I The table shows which reflex decay will be tested. Selecting the bottom row enables the addition of a new decay stimulus. Hold the **Add Stimulus** button while rotating the wheel to select the stimulus you wish to add. Note that rotating down gives ipsilateral stimuli and rotating up gives contralateral stimuli. **NB** stands for narrow band noise. **LP** stands for low pass filtered noise which has a spectrum from 400 Hz up to 1600 Hz. **HP** stands for high pass filtered noise which has a spectrum from 1600 Hz up to 12 kHz. **WBN** stands for wideband noise which has a spectrum from 400 Hz up to 12 kHz.

J To select a reflex sequence from the table, hold the **Stimulus** button while rotating the wheel, to change the stimulus type. Press the **Remove Stim.** button in order to remove the reflex sequence from the table.

4.2.2.4 Reflex latency

Select a reflex latency test in your Protocol settings. By rotating the wheel, you can change the following settings.



A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B **Show warning** gives you the opportunity to set a level at which the AA222 gives a warning.

C **Measure latency at ambient pressure** allows you to measure reflex latencies while the tympanic peak pressure is being disregarded. When checked, measurements are performed at 0daPa.

D **Set stimulus level** allows you to set the stimulus level to either **Manual** or **Automatic**. **Manual** means that prior to the test, a pop-up window asks you to set the stimulus level. When choosing **Manual** it is recommended to have **Show warning** off. Otherwise, you may be asked twice to set the stimulus level when it exceeds the warning level. **Automatic** means that the AA222 sets the stimulus level 10 dB above reflex threshold level. If that stimulus level exceeds the warning level or cannot be obtained, you will still be asked to set the stimulus level manually.

E **Display reflexes as** either **Positive** or **Negative** makes the reflex curve flip over the x-axis. When **Positive** is chosen, you can normally expect the deflection to go in a positive direction.

F At **Scale** you choose the maximum values of the y-axis on the reflex graph.

G When the **AGC** (automatic gain control) checkbox is marked, the size of the ear canal is taken into account for adjusting the stimulus level. Without compensation, the intensity level will increase as the size of the ear canal decreases. Note that current tympanometry standards do not yet describe how AGC should be applied. We recommend that AGC is used when testing infant ears, as, theoretically, with ear canal volumes smaller than 0.2 ml, the stimulus level can be increased by 20 dB or more. The AGC is applied for both the ipsilateral and contralateral insert.

H The table shows which reflex latency will be tested. Selecting the bottom row enables the addition of a new latency stimulus. Hold the Add Stimulus button while rotating the wheel to select the stimulus you wish to add. Note that rotating down gives ipsilateral stimuli and rotating up gives contralateral stimuli. **NB** stands for narrow band noise. **LP** stands for low pass filtered noise which has a spectrum from 400 Hz up to 1600 Hz. **HP** stands for high pass filtered noise which has a spectrum from 1600 Hz up to 12 kHz. **WBN** stands for wideband noise which has a spectrum from 400 Hz up to 12 kHz.

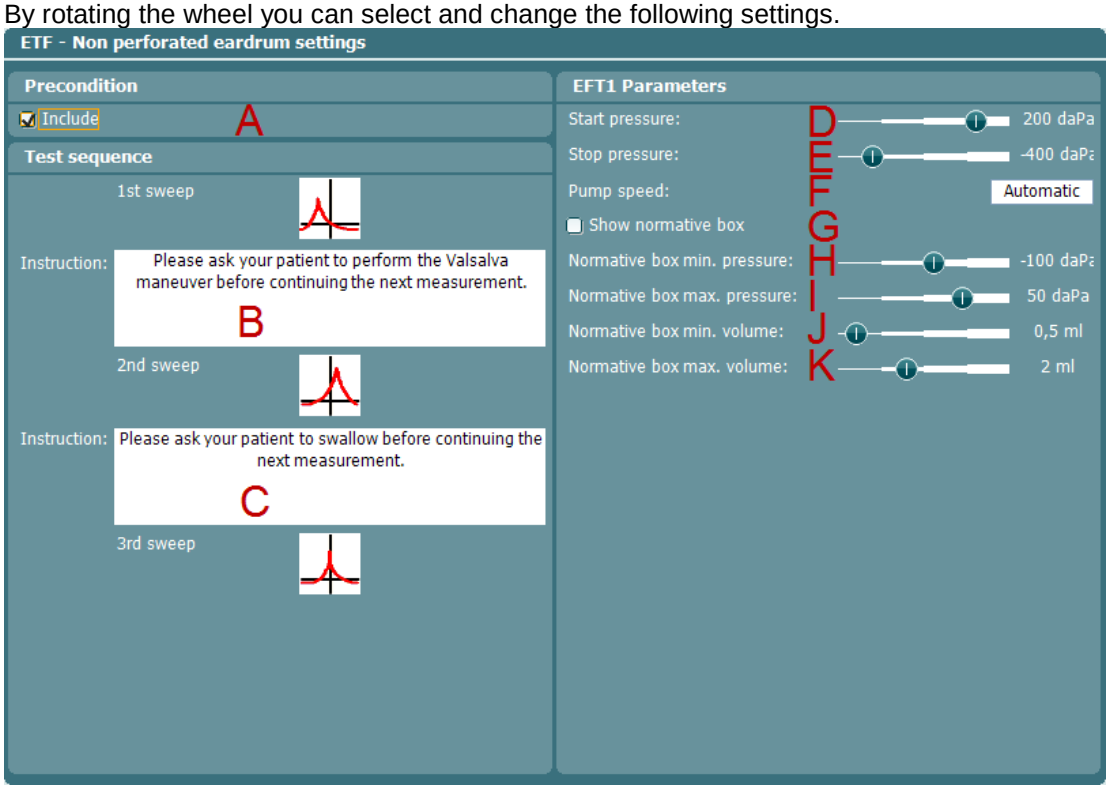
I When a reflex latency is selected from the table, hold the Stimulus button while rotating the wheel, to change the stimulus type. Press the Remove Stim. button in order to remove the reflex sequence from the table.

4.2.2.5 Eustachian tube function – non-perforated eardrum

Make sure that you select the test labeled as **Non-perforated** from the list of tests on the left of the screen.

The Eustachian tube function test for the non-perforated eardrum, or ETF 1, or Williams procedure, is set up to measure three tympanograms. It keeps the pressure between the first and second tympanograms at the **Start** pressure, and between the second and third tympanograms at the **Stop pressure**. After testing, the pressure is brought back to 0daPa. In between all tympanograms, a message informs you as to which instruction you should give to the patient. The original Williams procedure asks the patient to swallow in between the different tympanograms. Our advice is to ask the patient to perform the Valsalva maneuver after the first tympanogram and to swallow after the second tympanogram, because the expected deviations of the peak pressure will then be larger.

By rotating the wheel you can select and change the following settings.



A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B While selecting this instruction, press the Change button to open a pop-up in which you can alter the instruction that is shown in between the first and second tympanograms. Connect a pc keyboard to the USB port of the AA222 for easy typing options, including the use of special characters.

C While selecting this instruction, press the Change button to open a pop-up in which you can alter the instruction that is shown in between the second and third tympanograms. Connect a pc keyboard to the USB port of the AA222 for easy typing options, including the use of special characters.

D **Start pressure**. You can set the start pressure for the three automated tympanograms here. The start pressure can vary between +400 and -600 daPa.

E **Stop pressure**. You can set the stop pressure for the three automated tympanograms here. The stop pressure can vary between +300 and -600 daPa.

F **Pump speed**. You can select the pump speed for automated tympanometry here. The stated pump speeds are dependent on the size of the ear canal or cavity that is being used during the measurement. The numbers below are therefore rough estimates.

- **Automatic**, is the high pump speed which automatically slows down to low pump speed around the peak of the tympanogram. We recommend using this setting for screening and normal tympanometry tests

- **Fast**, results in a constant speed of about 300 daPa/s
- **Medium**, results in a constant speed of about 200 daPa/s
- **Slow**, results in a constant speed of about 100 daPa/s
- **Very slow,** results in a constant speed of about 50 daPa/s

G **Show normative box** displays a rectangle within which to expect the compliance peak under normal conditions of the middle ear.

H - K **Normative box.** Minimum and maximum pressure and compliance values are defined here.

4.2.2.6 Eustachian tube function – perforated eardrum

Make sure that you select the test labeled as **Perforated** from the list of tests on the left of the screen.
The Eustachian tube function test for the perforated eardrum, or Toynbee test, or ETF 2 puts the middle ear under a certain **Start pressure**. The pump is then stopped, and over time it is measured if the patient can release the pressure by opening the Eustachian tube. The patient is usually asked to swallow several times during the test.

By rotating the wheel, you can select and change the following settings.

A **Auto run**. When enabled, the test will run automatically as part of the protocol.

B While selecting this instruction, press the Change button to open a pop-up in which you can change the instruction that is shown at the start of the measurement. Connect a pc keyboard to the USB port of the AA222 for easy typing options, including the use of special characters.

C **Start pressure**. You can set the start pressure here. This can vary between +400 and -600 daPa.

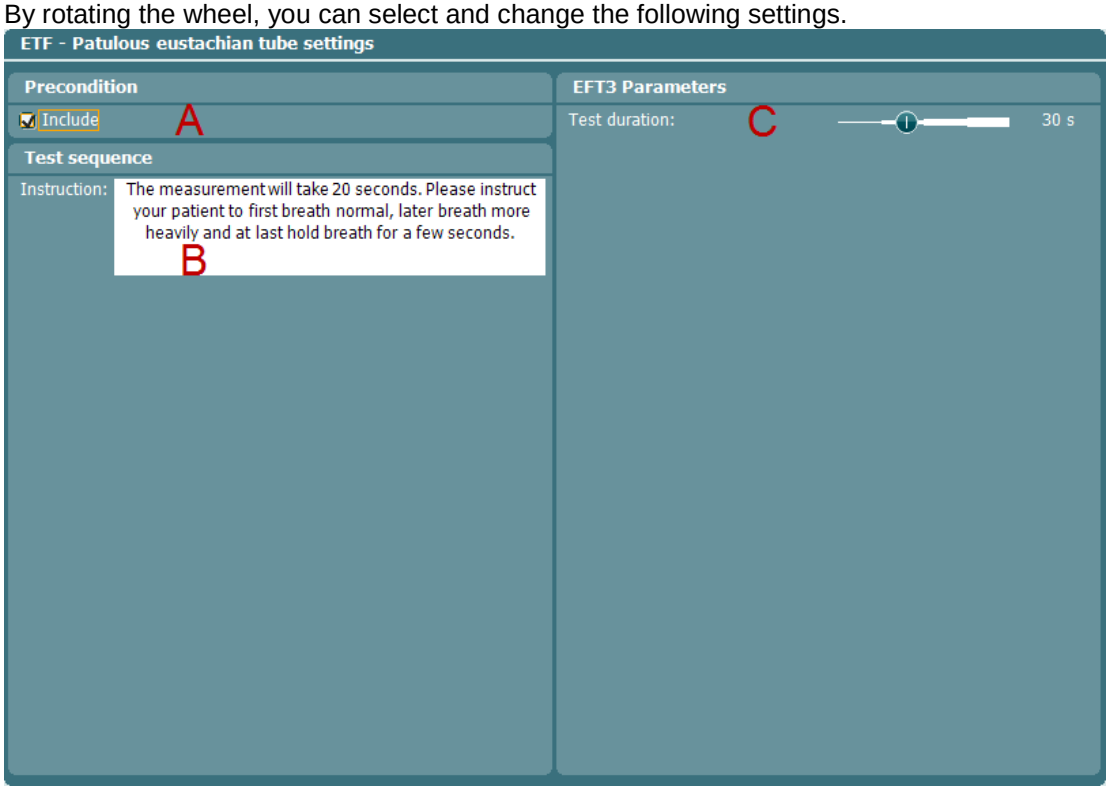
D **Test Duration**. You can set the test duration here. This can vary from 30 up to 150 seconds.

4.2.2.7 Eustachian tube function – patulous Eustachian tube

Make sure that you select the test labeled as **Patulous** from the list of tests on the left of the screen.

The Eustachian tube function test for a patulous Eustachian tube, or ETF 3, monitors the compliance of the eardrum over a certain period of time. If the Eustachian tube is spontaneously open, you expect to measure compliance changes due to movements of the eardrum. Typically, you expect to recognize the rhythm of breathing. Measuring the ETF 3 in a healthy subject only shows spontaneous disturbances in the compliance due to probe movement, acoustical disturbances in the patient's surroundings or spontaneous movements of the eardrum. With the precision of the AA222, it is not uncommon to measure a patient's heartbeat.

By rotating the wheel, you can select and change the following settings.



A **Auto run**. When enabled, the test will run automatically as part of the protocol.

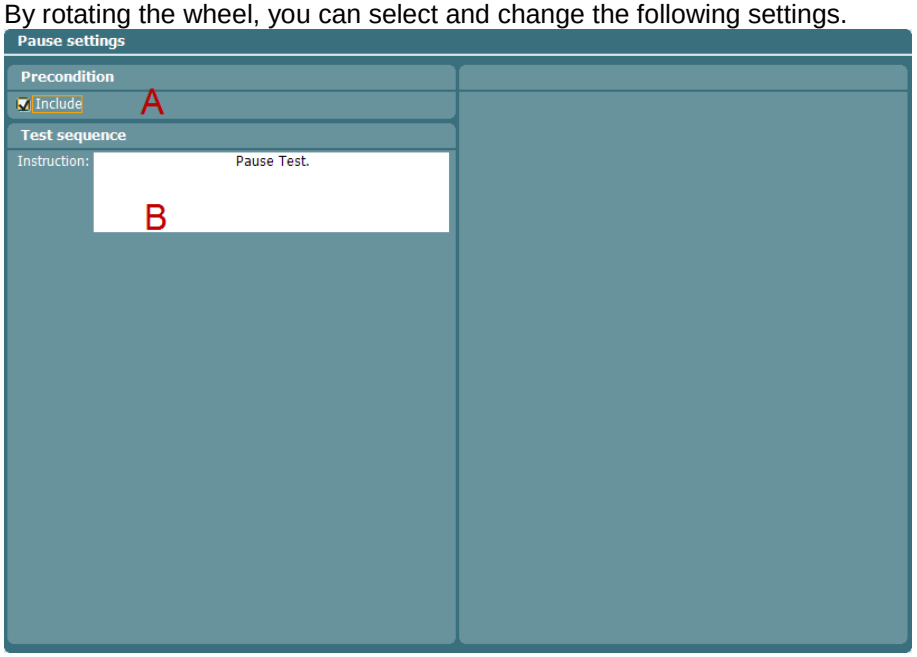
B While selecting this instruction, press the Change button to open a pop-up in which you can change the instruction that is shown at the start of the measurement. Connect a pc keyboard to the USB port of the AA222 for easy typing options including the use of special characters.

C **Test Duration**. You can set the test duration here. This can vary from 30 to 150 seconds.

4.2.2.8 Pause

Within a protocol it is possible to implement a **Pause**. This can be used as a break in between tests or to give an instruction to the clinician before continuing with or ending a protocol.

By rotating the wheel, you can select and change the following settings.

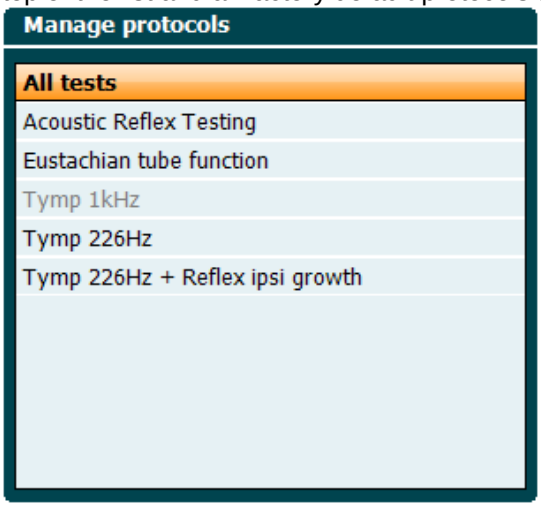


A **Auto run**. When enabled, the pause will automatically be part of the protocol. And the test will be paused with the pause is reached in the protocol.

B While selecting this instruction, press the Change button to open a pop-up in which you can change the instruction that is shown at the start of the measurement. Connect a pc keyboard to the USB port of the AA222 for easy typing options, including the use of special characters.

4.2.3 Manage protocol settings

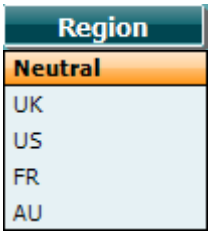
Hold the **Setup** button and rotate the wheel until you can select **Manage protocols**. A window pops up showing the currently available protocols on your instrument. By default, all custom made protocols are displayed at the top of the list and all factory default protocols are displayed at the bottom of the list.



The following buttons are available when the **Manage Protocols** window is open.

Press **Delete** to remove the protocol permanently from the instrument. You will be asked to confirm this action. The delete function is not available for factory default protocols.

The **Hide/ Unhide** buttons allow you to organize which protocols are visible when pressing the **Tests** button.



By holding the **Region** button and rotating the wheel, you can choose which default factory protocols are to be selected.

Press **Back** to close the **Manage Protocols** window.

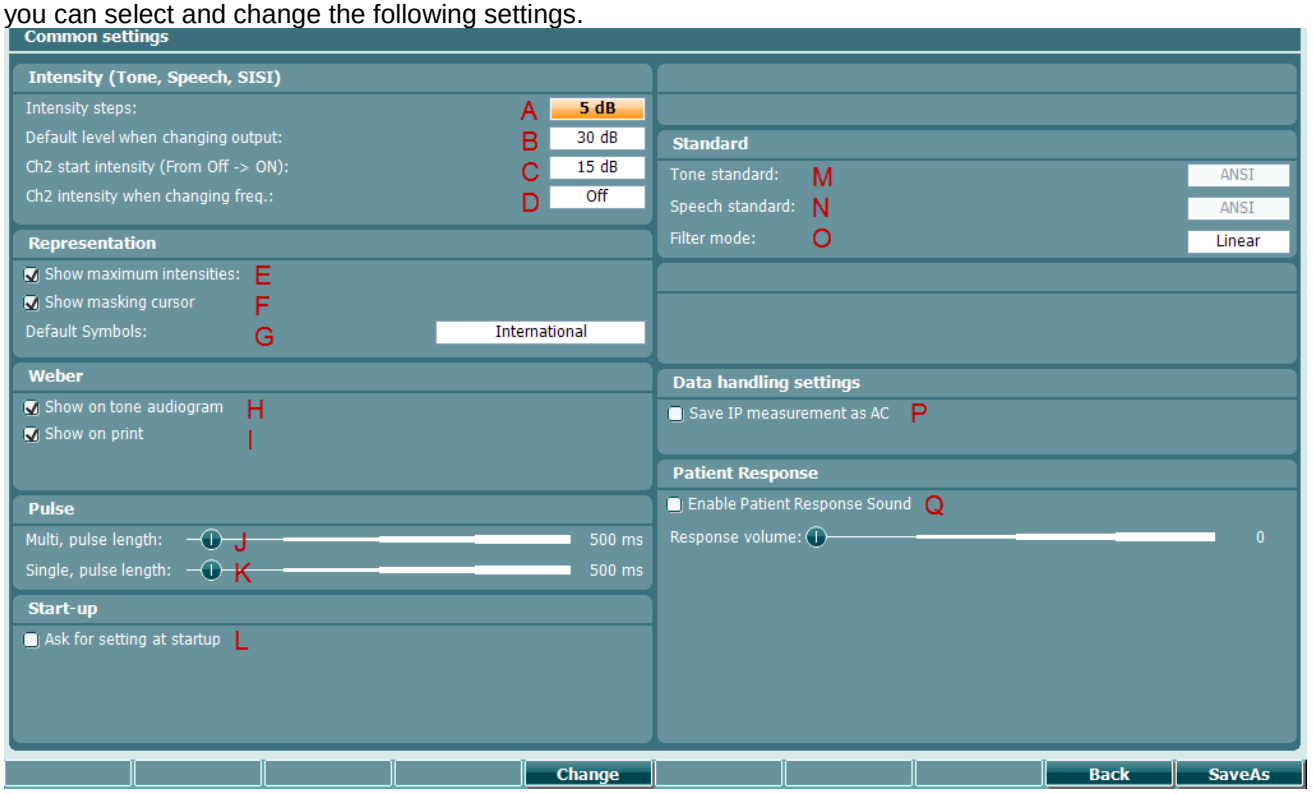
4.3 Audiometry setup menu

When holding the **Setup** button a menu pops up in which you can select one of the options by rotating the wheel and then releasing the Setup button. By default, the settings of the current test, **Tone settings** or **Auto settings** are selected. You can change these settings either temporarily or permanently. In **Common settings – AUD** you will find settings that apply to all audiometric tests.

When saving settings permanently they are assigned to an individual user by selecting **Save user settings as…** The Tone, Auto and Common settings are saved to the user that is specified.

4.3.1 Common settings - AUD

Hold the **Setup** button and rotate the wheel in order to select **Common settings - AUD**. By rotating the wheel you can select and change the following settings.



Intensity (Tone, Speech, SISI)

A **Intensity steps** is the default intensity step (1 dB, 2dB or 5 dB steps).

B **Default level when changing output** is the level that the channel will default to when changing output (changing transducer, changing test, changing ear).

C **CH2 start intensity (From Off -> On)** is the initial masking level when activating masking.

D **CH2 intensity when changing freq.** is the initial intensity on channel 2 when changing frequency.

Representation

E **Show maximum intensities** provides a display of the maximum intensity that can be presented for the given transducer at each frequency. The *Extended Range +20 dB* button can be pressed to go higher. The maximal loudness is determined by the transducer calibration.

F **Show masking cursor** enables and disables the display of the masking cursor in the audiogram.

G **Default Symbols allows you to** change between the symbol schemes: Australian standard, German, International, Japan, UKBSA, US symbols

Weber

H **Shown on tone audiogram** will display the Weber results on the pure tone audiogram.

I Select **Show on print** to have your Weber results printed on the audiogram**.**

Pulse

J Use the slider on **Multi** to adjust the pulse length (duty cycle 50%).

K Use the slider on **Single** to adjust the length of the single pulse.

Start-up

L Enable **Ask for setting at startup** to see the list of users when starting the device.

Standard

M **Tone standard** displays the standard used for RETSPL. To change this, simultaneously press shift, rotate to the field and select the required standard (ANSI, IEC, Norway or Sweden)

N **Speech standard** displays the standard used for RETSPL. To change this, simultaneously press shift, rotate to the field and select the required standard (ANSI, IEC, Norway or Sweden).

O **Filter mode** makes it possible to change the filter settings to either Linear (default), FF eqiv., or non-linear.

Data handling settings

P Enable the setting ‘Save IP measurement as AC to save the insert phone thresholds as AC.

Patient response

Q **Enable patient response sound** presents a sound in the monitor speaker, to the headset or speaker when the patient response is pressed. Adjust the level of the patient response sound with the **Response volume** slider.

In addition, the following buttons are available from **Common Settings – Aud.**

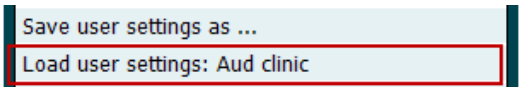
This is a multifunctional key that allows you to make changes to an individual setting that has been selected.

Press to alternate between enabling and disabling a selected setting.

Brings you back to the test screen. If a change is made and **Back** is pressed without pressing **Save as**, this change will be temporary.

Saves the user settings to a user. Press **New** to create a new user or **Delete** to delete an existing user. Multiple users can be created, if clinicians have different preferences to the setup.

Pressing the setup button from the audiometry module allows easy selection of the user-defined protocol.



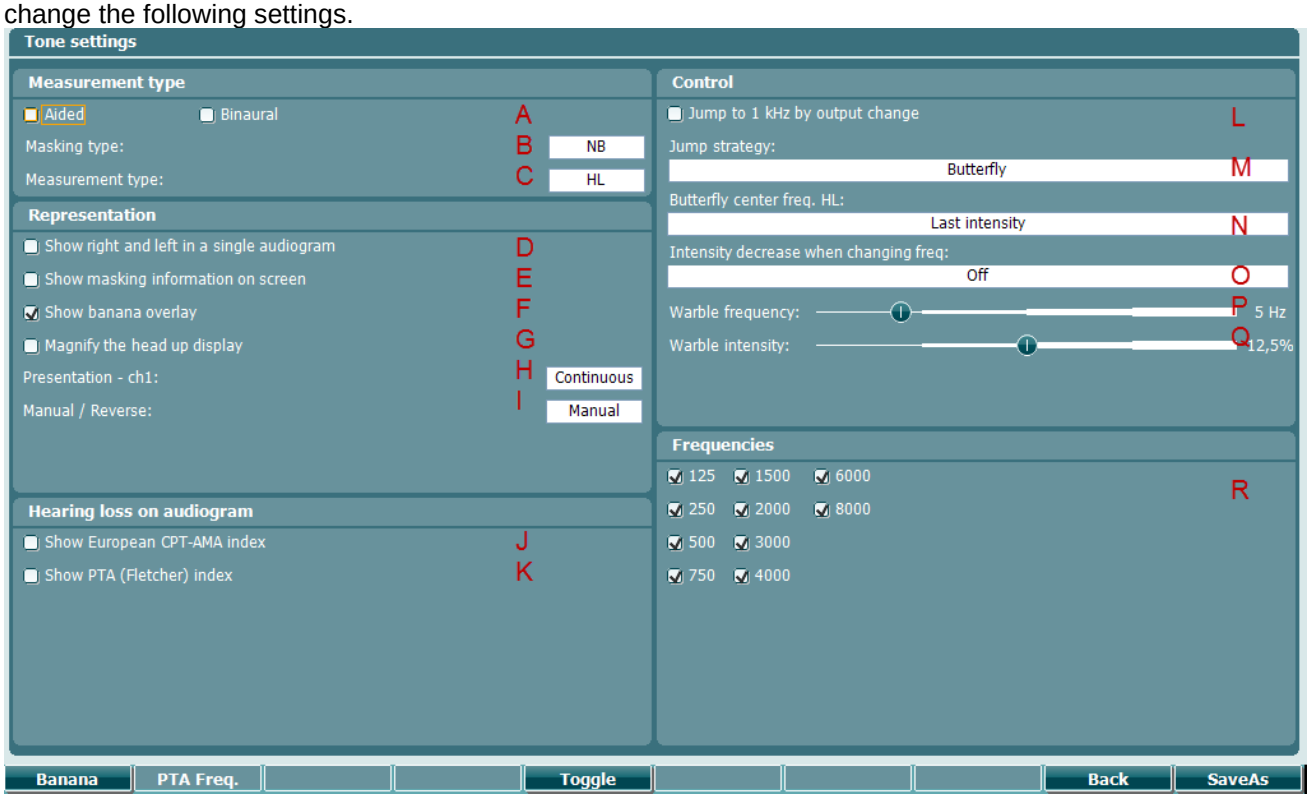
4.3.2 Working with user-defined setups (test protocols)

There are many different requirements regarding both the functionality and appearance of an audiometer, depending on the specific situation as well as factors such as national standards. When the device asks for settings at startup, the device will load the preferred protocol setup of a given clinician or clinic.

This provides the user with the flexibility to tailor the system according to their specific preferences. When creating a protocol, save the protocol to a given name. The user settings are then loaded either when selecting the defined protocol from the **Setup,** or when selecting the protocol list starting the device, if **Ask for setting at startup** is activated in common settings – Aud.

4.3.3 Tone settings

Hold the **Setup** button and rotate the wheel in order to select **Tone settings**. From tone settings you can change the following settings.



Measurement type

A In order to use dedicated symbols for **aided** and **binaural** measurements make sure you select the correct measurement type here.

B **Masking type** is the default type of masking used for tone audiometry; NB or WN.

C The default **Measurement type** to start with can be set here. The options are Hearing Level (HL), Most Comfortable Level (MCL), Uncomfortable Level (UCL) and Tinnitus.

Representation

D Select **Show right and left in a single audiogram** to view the audiometric results for the right and left ear in a single audiogram.

E **Show masking information on screen.** The masking table will be shown below the audiogram.

F **Show banana overlay** displays the speech banana in the audiogram. You can adjust the frequency and intensity of the banana by pressing the button Banana in the setup.

G Enabling **Magnify the head up display** defaults to displaying the numerical information of the transducer as large.

H Set the default presentation of channel 1 to Continuous, Single pulse, Multi Pulse.

I Set the default presentation to manual or reverse.

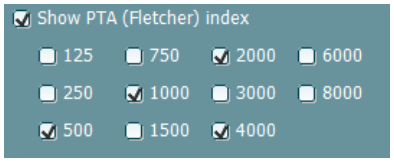
Hearing loss on audiogram

J You can enable or disable the **Show European CPT-AMA index**. When enabled, the European CPT-AMA is then calculated and displayed on the tone test screen. CPT-AMA ensures that the different frequencies are weighted in order to display a correct quantification of impairment due to the hearing loss. The weighting and intensity of each frequency are shown below. CPT-AMA is used as an average, indicating the severity of the hearing loss.

HV* (dB)	500 Hz	1000 Hz	2000 Hz	4000 Hz
10	0.2	0.3	0.4	0.1
15	0.5	0.9	1.3	0.3
20	1.1	2.1	2.9	0.9
25	1.8	3.6	4.9	1.7
30	2.6	5.4	7.3	2.7
35	3.7	7.7	9.8	3.8
40	4.9	10.2	12.9	5.0
45	6.3	13.0	17.3	6.4
50	7.9	15.7	22.4	8.0
55	9.6	19.0	25.7	9.7
60	11.3	21.5	28.0	11.2
65	12.8	23.5	30.2	12.5
70	13.8	25.5	32.2	13.5
75	14.6	27.2	34.0	14.2
80	14.8	28.8	35.8	14.6
85	14.9	29.8	37.5	14.8
90	15.0	29.9	39.2	14.9
95	15.0	30.0	40.0	15.0
100	15.0	30.0	40.0	15.0

Please refer to Sibylle Bertoli, Katharina Staehelin, Elisabeth Zemp, Christian Schindler,Daniel Bodmer & Rudolf Probst (2009) Survey on hearing aid use and satisfaction inSwitzerland and their determinants, International Journal of Audiology, 48:4, 183-195

K When **Show PTA (Flexher) index** is enabled, a pure tone average is shown in the top of the audiogram. You can then select the frequencies intended as part of the PTA calculation.



The default setting is 500, 1000, 2000, and 4000 Hz. In this calculation method all frequencies are weighted equally and averaged to give the figure.

Note: The PTA is calculated for insert phones and head phones. However, if values for both are stored, the threshold obtained at the best intensity is used.

Control

L Select **Jump to 1 kHz by output change** if you want to default to 1000 Hz when changing ear side.

M At **Jump Strategy** you define how the system automatically changes frequency when storing thresholds.

Bottom makes the cursor start at 1 kHz and move upwards in frequency as the thresholds are stored. After testing the high frequencies, the cursor will move back to re-test 1kHz and then move downwards. When jumping back to 1 kHz, the Butterfly strategy can be set to start the re-test at either the default start intensity or the intensity of the first threshold.

Butterfly makes the cursor start at 1 kHz and move upwards. When the high frequencies have been tested, the cursor will jump to the lowest test frequency and move upwards towards 1kHz.

None will cause no change when pressing store. The change is carried out manually using the hardkeys frequency up/down.

N **Butterfly center freq. HL** sets the intensity that is used when jumping to the butterfly center frequency after storing a point at highest or lowest frequency.

O **Intensity decrease when changing freq.** sets the number of decibels by which the intensity must decrease when jumping to the next frequency after storing a threshold.

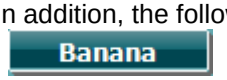
P **Warble frequency** adjusts the frequency modulation of the warble tone from 0-25 Hz.

Q **Warble intensity** adjusts the intensity modulation of the warble tone from 0-25%.

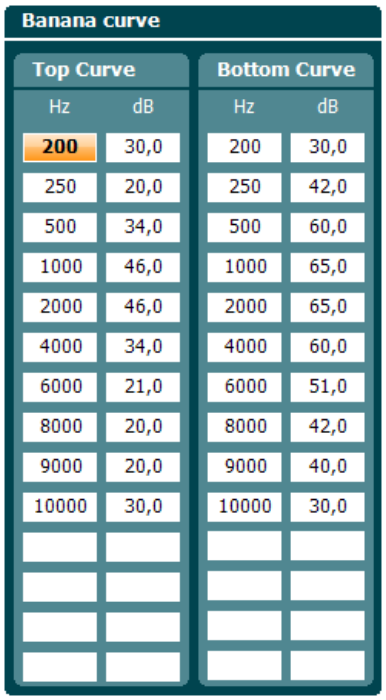
Frequencies

R Enable or disable the frequencies required for the pure tone audiometry assessment.

In addition, the following buttons are available in the tone settings:



Shows settings for the speech banana.



Banana curve

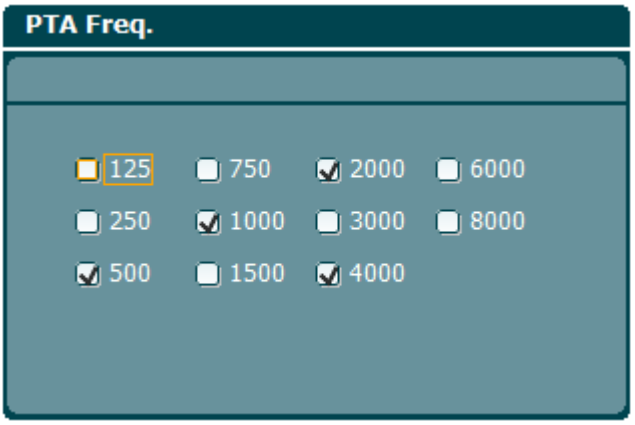
Top Curve		Bottom Curve	
Hz	dB	Hz	dB
200	30,0	200	30,0
250	20,0	250	42,0
500	34,0	500	60,0
1000	46,0	1000	65,0
2000	46,0	2000	65,0
4000	34,0	4000	60,0
6000	21,0	6000	51,0
8000	20,0	8000	42,0
9000	20,0	9000	40,0
10000	30,0	10000	30,0

Use **Change +/-** to change the frequency and intensity of the speech banana display.

Change - | Change +

PTA Freq.

When the 'Show PTA (Flecher) index is enabled, it is possible to set the intended frequencies used for the calculation of the PTA.



Change
Toggle

This a multifunctional key. Press **Toggle** to toggle between enable or disable for a selected setting. Press **Change** to change the setting selected.

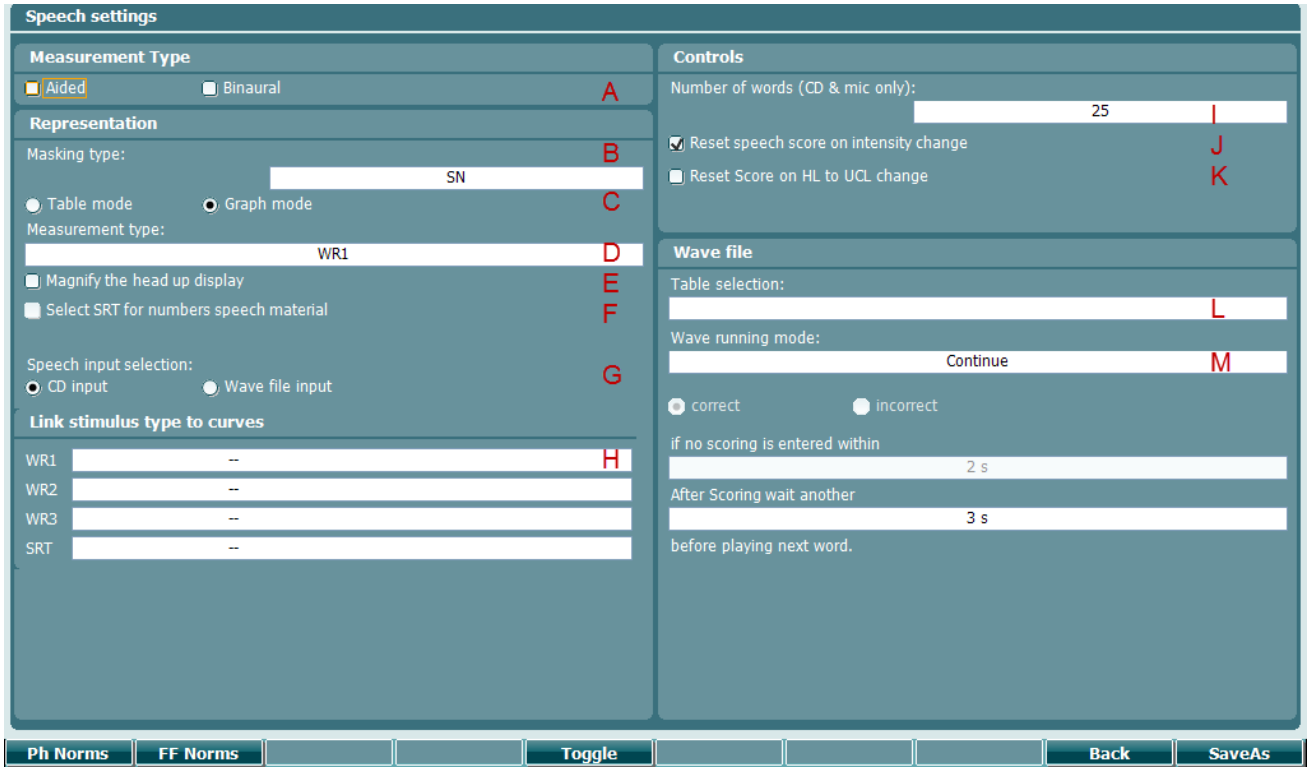
Back

Press back to return to the test screen.

SaveAs

Saves the user settings to a user. Press **New** to create a new user or **Delete** to delete an existing user. Multiple users can be created, if clinicians have different preferences to the setup.

4.3.4 Speech settings



Measurement type

A In order to use dedicated symbols for **aided** and **binaural** measurements, make sure you select the appropriate measurement type here.

Representation

B **Masking type** allows you to toggle between SN (speech noise) or WN (white noise) as the default masking signal.

C Toggles between a display of the speech in **Table mode** or **Graph mode**.

D Toggles between the **Measurement types**: SRT, MCL, UCL, WR1, WR2, WR3

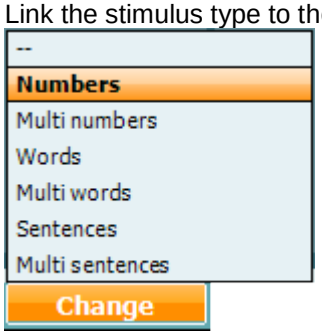
E **Magnify the head up display** magnifies the head up display on the test screen once enabled.

F **Select SRT for numbers speech material** enables SRT when material containing numbers is selected.

G **Speech input selection allows you to toggle between** CD input and Wave file input. Accordingly, the material used when pressing Speech (26) will come from either the CD or Wave file.

Link stimulus type to curves

H Link the stimulus type to the WR1, WR2 WR3 or SRT pressing the change button.



Controls

I **Number of words** indicates the number of words in the wordlist before the test stops. The counter applies to CD and microphone only.

J **Reset speech score on intensity change.** By enabling this function when an intensity change is made, the speech score will reset and start from the beginning.

K When enabled, **Reset score on HL to UCL change** ensures that if you toggle the test from HL to UCL, the scoring will restart so that the UCL test result does not then add on to the HL scoring.

Wave file

L Toggles between the different types of speech material available on the device in the **Table selection.**

M Set the preferred type of running mode: continue, manual, time out. When 'time out' is selected, the settings **correct** and **incorrect** will store the word as 'correct' or 'incorrect' respectively once timed out. Enter the number of seconds before timeout takes place in the box **if no scoring is entered within []s.**

To set the time between words after scoring, enter the time in seconds in the box within **After scoring wait another []s before playing the next word.**

In addition the following buttons are available from the speech setup:

Phoneme norm curves can be set for phonemes using headphones and for free field. Press **Ph Norms** to change the phoneme norms for the single and multisyllabic curve displayed in the speech graph.

Press **FF norms** to change the phoneme norms for the single and multisyllabic curve displayed for free field (FF).

Use the wheel for channel 1 to change the output of the frequency or intensity.
Use wheel 2 to move through the boxes.

Phone norm curves

Multi syllabic		Single syllabic	
dB	%	dB	%
12,0	0,0	16,5	0,0
15,0	20,0	20,0	11,0
18,5	50,0	22,5	20,0
20,0	58,0	25,0	33,0
22,0	70,0	26,0	40,0
24,0	80,0	30,0	55,0
27,0	90,0	31,0	60,0
30,0	100,0	35,0	72,0
		40,0	84,0
		46,0	100,0

This a multifunctional key. Press **Toggle** to toggle between enable or disable for a selected setting.

Press **Change** to change the setting selected.

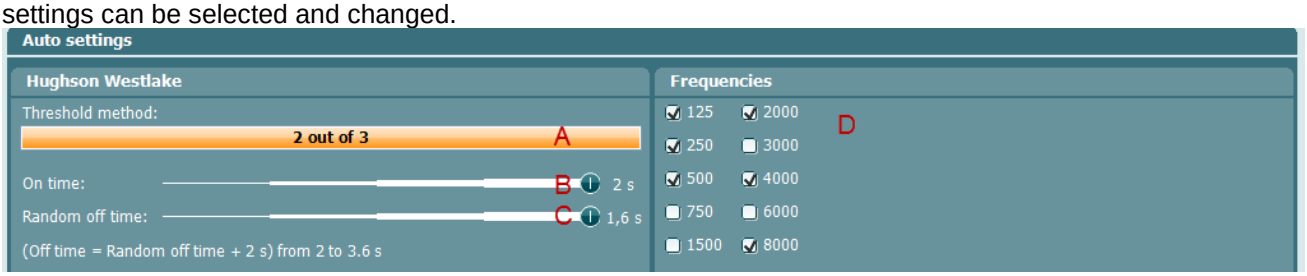
Press **Set** to set the setting for the one highlighted.

Go back

Save the user settings to a user. Press **New** to create a new user or **Delete** to delete an existing user. Multiple users can be created, if clinicians have different preferences to the setup.

4.3.5 Auto settings

Hold the **Setup** button and rotate the wheel in order to select **Auto settings**. By rotating the wheel, the following settings can be selected and changed.



Hughson-Westlake

A **Threshold method** uses 2 out of 3 or 3 out of 5 as the criteria for a threshold.

B **On time** changes the ‘on time’ from 0-2 s.

C **Random off time** changes the ‘off time’ from 0-1.6 s. Off time = random off time + 2 s from 2-3.6 s.

Frequencies

D Enable or disable the frequencies that should be part of the Békésy test.

In addition the following buttons are available from the Auto settings:

This a multifunctional key. Press **Toggle** to toggle between enable or disable for a selected setting.

Press **Change** to change the setting selected.

Go back

Save the user settings to a user. Press **New** to create a new user or **Delete** to delete an existing user. Multiple users can be created, if clinicians have different preferences to the setup.

5 Diagnostic suite

5.1 Transferring a custom symbol scheme from the suite to the device

1. It is possible to transfer a customized symbol scheme from Diagnostic suite to the device.
2. Go to **AUD – Menu – Setup – General Setup**
3. Edit the symbol scheme to your preference in the symbol editor.
4. From **General Setup – Instrument Settings** press **Upload Custom Symbols**.
5. The symbols will now be transferred to the device.
6. Disconnect the device from the PC.
7. Go to **Setup – Common settings AUD – Default Symbols** and select your custom symbols.

6 Operating through a database

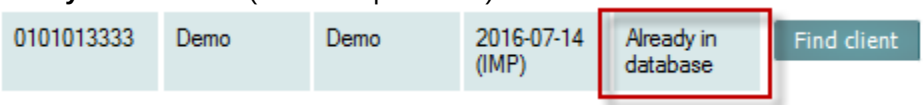
6.1 OtoAccess™

It is possible to operate the AA222 through Diagnostic suite to a database. This makes it possible to save the obtained data directly to either one client in Otoaccess™ or multiple clients in Otoaccess™.

6.1.1 Upload clients to the device and save the measurements to the clients

This way of transferring data is designed to transfer multiple clients simultaneously prior to starting testing. Once all the measurements are completed, this data can then also be transferred simultaneously.

1) Open Diagnostic suite through Otoaccess™ with a client selected, that is not used for storing any information to.
2) Go to the **Sync** tab and press **Client upload**. Select all the clients you wish to transfer to the device by highlighting them and pressing **Add.** The clients will now appear in the list on the right and will be added to the device.
3) Disconnect the device from Diagnostic **s**uite and start the session's measurements.
4) Once the session is completed, press **Save session** and select the client you would like to save the information to. Then press **Save** on the device.
5) At the end of the day connect the device to Diagnostic suite through Otoaccess™ and go to the SYNC tab. When the device is connected to the suite in the SYNC tab, it will state 'Online and PC controlled mode' on the AA222 screen. In the SYNC tab the clients will appear in a list (if not press **Refresh**).The data obtained on the device will automatically be transferred to the client in the Otoaccess™ database, and state '**Already in database'** (see example below).



6) Press **Save** or **Save & Exit** in the suite to save the data.
7) The data can then be used for further interpretation or review in Diagnostic suite through Otoaccess™.

6.1.2 Download the client information to one patient

1) Open Diagnostic suite through Otoaccess™ with your client selected.
2) Obtain the measurement on the device with the device connected to the Diagnostic suite including audiometry and impedance.
3) Once completed press **Save session** on the device. The measurement will be transferred to Diagnostic suite and appear in the Audiometry and Impedance tab.
4) From here it is also possible to print to PDF or a printer, so that the results can be shared externally. Please refer to the section regarding the Print Wizard for further information.
5) Press **Save** or **Save & Exit** in the suite to save the data to the selected client in Otoaccess™.

6.2 NOAH

It is possible to operate the AA222 through Diagnostic suite to a database. This makes it possible to save the obtained data directly to a client created in NOAH.

6.2.1 Download the client information to a patient using NOAH

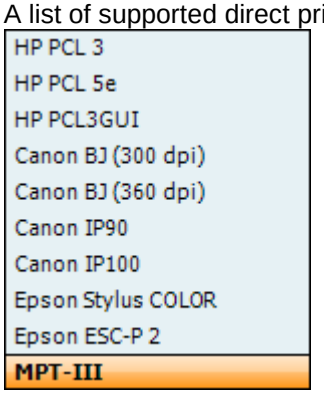
1) Open Diagnostic suite through NOAH with your client selected.
2) Obtain the measurement on the device with the device connected to the Diagnostic suite including audiometry and impedance.
3) Once completed press **Save session** on the device. The measurement will be transferred to Diagnostic suite and appear in the Audiometry and Impedance tab.
4) Press **Save** or **Save & Exit** in the suite to save the data in NOAH.
5) The data can then be used for further interpretation and fitting of hearing aids through NOAH.

7 Print

7.1 Printer direct

7.1.1 Installing the direct printer

- Ensure that the printer is powered and connected to the AA222 via the USB
- A list of supported direct printers will appear from the **Instrument setting – Default printers**



- Select the required printer from the list
- The printer is now setup for printing. Press **Print** on the AA222 to obtain a printout of the audiometry and impedance data

7.1.2 Modify the custom logo printout

- It is possible to change the print logo through Diagnostic suite. Connect the device to the PC and enter Diagnostic suite
- Ensure that the device is switched on and properly connected
- Go to **AUD – Menu – Setup – General Setup**
- From the instrument settings press **Upload Print Logo**
- Find the picture that you would like to add and press **Open.** The logo will now be transferred and ready for use on your print

7.1.3 Modify the custom logo printout witout PC connection

When not connected to a computer, AA222 direct printout allows results to be printed via a supported USB printer.[1] The printout logo is either downloaded via the Diagnostic Suite (in the *General Setup*) or configured with the below instructions:

[1] For further assistance regarding supported PC printers - please, contact Interacoustics customer service.

1. Open the program *Paint* from the program accessories folder.

2. Open *Image Properties* using the shortcut *Ctrl + E*

3. Set w*idth* to 945 and *height* to 190 as illustrated above. 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.

Insert a USB thumb drive with at least 32MB in total size.

8. Go to *My Computer*, right-click 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.

10. Click *Start* - depending on the size of your thumb drive this may take a moment. When the formatting is complete, you will receive a pop-up confirming successful formatting.

11. Copy the *update_user.logo.bin* file to the formatted thumb drive.

12. It is very important that this USB thumb drive is used for this file only.

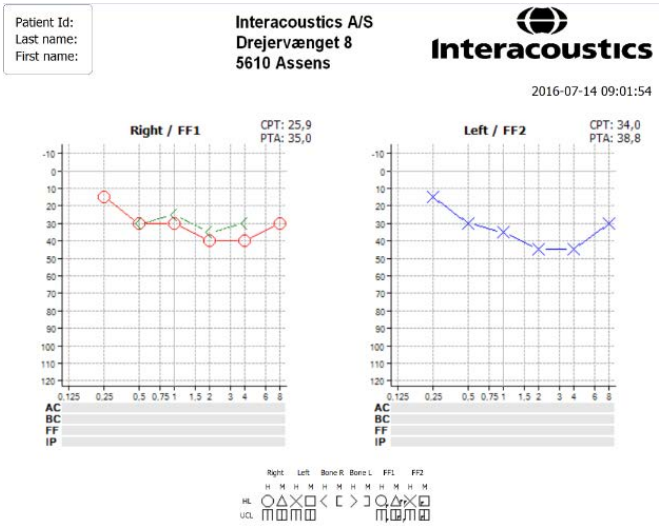
13. With the audiometer switched off, insert the thumb drive into any available USB port.

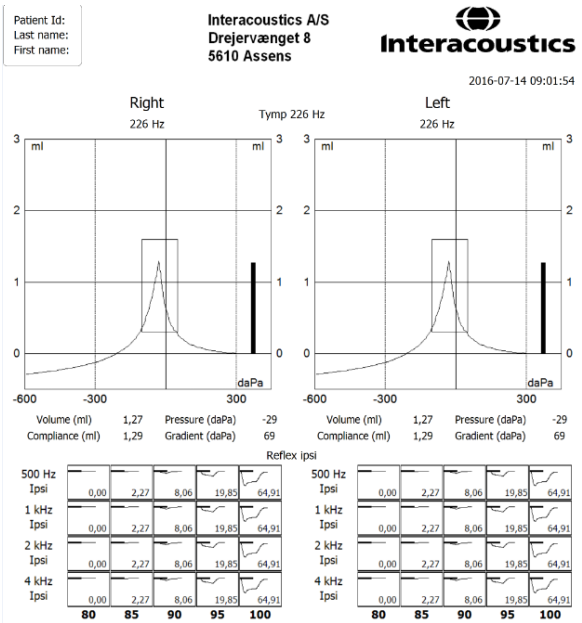
14. Then switch on the instrument and push the *Temp/Setup* option from the *Tone test* screen.

15. Enter *Common Settings via Setup/Tests*
16. When the question “Do you want to install?” appears, select *Yes*
17. After the installation is complete, select *Back* to access the testing screen.

7.1.4 Printing from a direct printer

It is possible to print the results of the different audiometry and impedance measurements on the direct printer. Below are some examples of the audiometry and impedance elements. If the name of the client has been entered on the device the patient information will appear on printout.





7.2 MPTIII (thermal printer)

7.2.1 Installing the Sanibel MPT-III thermal printer

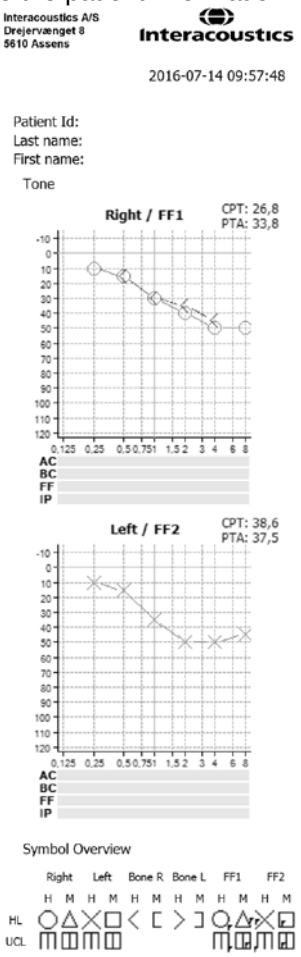
1. Ensure that the printer is powered by either battery or the power charger and that the paper is correctly placed in the printer. For a detailed description of how to operate the MPT-III thermal printer, please refer to the MPT-III Sanibel Mobile thermal mini printer user manual.
2. To set up the printer for MPT-III, press **Setup – Instrument settings – Printer type – MPT-III.**
3. Connect the MPT-III printer to the AA222 via the USB.
4. Turn on the printer.
5. The printer is now setup for printing. Press **Print** on the AA222 to obtain a printout of the audiometry and impedance data.

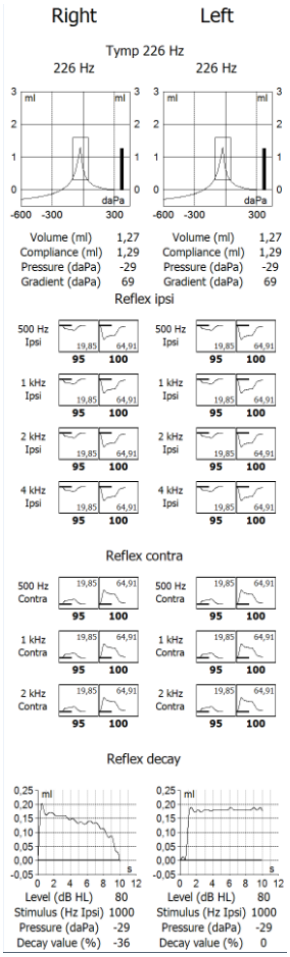
7.2.2 Modify the custom logo printout

1. It is possible to change the print logo through Diagnostic suite. Connect the device to the PC and enter Diagnostic suite.
2. Ensure that the device is switched on and properly connected.
3. Go to **AUD – Menu – Setup – General Setup**.
4. From the instrument settings press **Upload Print Logo**.
5. Find the picture that you would like to add and press **Open.** The logo will now be transferred, and ready for use on your print.

7.2.3 Printing from the MPT-III thermal printer

It is possible to print the results of the different audiometry and impedance measurements on the MPT-III printer. Below are some examples of the audiometry and impedance elements. If the name of the client has been entered on the device the patient information will appear on printout.



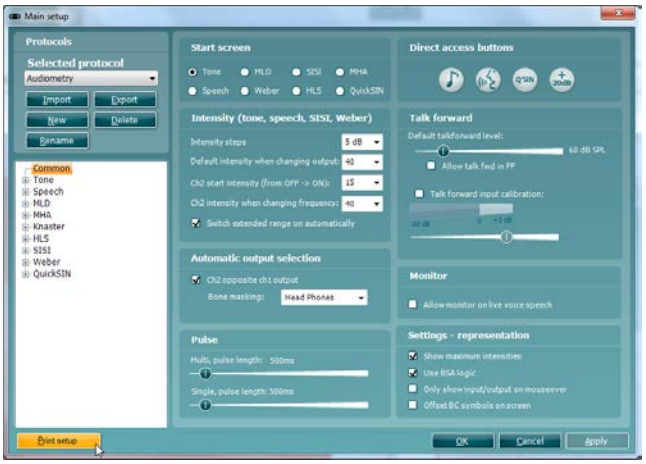


7.3 Print Wizard (Diagnostic suite only)

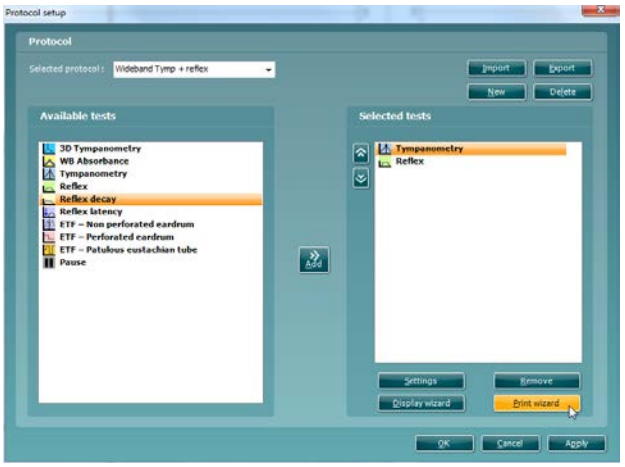
The Print Wizard is designed to make it easy to customise the print template, so that the data shared with others contains the information relevant to each individual clinic. The Print Wizard works with the Affinity suite, Callisto suite, Equinox suite, Diagnostic suite, Titan suite and VIOT suite. This enables you to combine data from various tests into one convenient printout.

7.3.1 Opening the Print Wizard

1. Open the Suite from your patient management system: Noah, OtoAccess™, or standalone.
2. You can access the setup for protocols from any of the tabs; VIOT, AUD, IMP, DPOAE, TEOAE, ABRIS, REM or HIT.
3. Press **Menu** – **Setup – AC440 Setup**, or **Menu – Setup – Protocol Setup** in the Titan suite. This will open a new window.
4. In the new window, you will find either **Print Setup** or **Print Wizard** (Titan suite). Please press this to open the Print Wizard.



Affinity, Callisto, Equinox, VIOT and Diagnostic suite

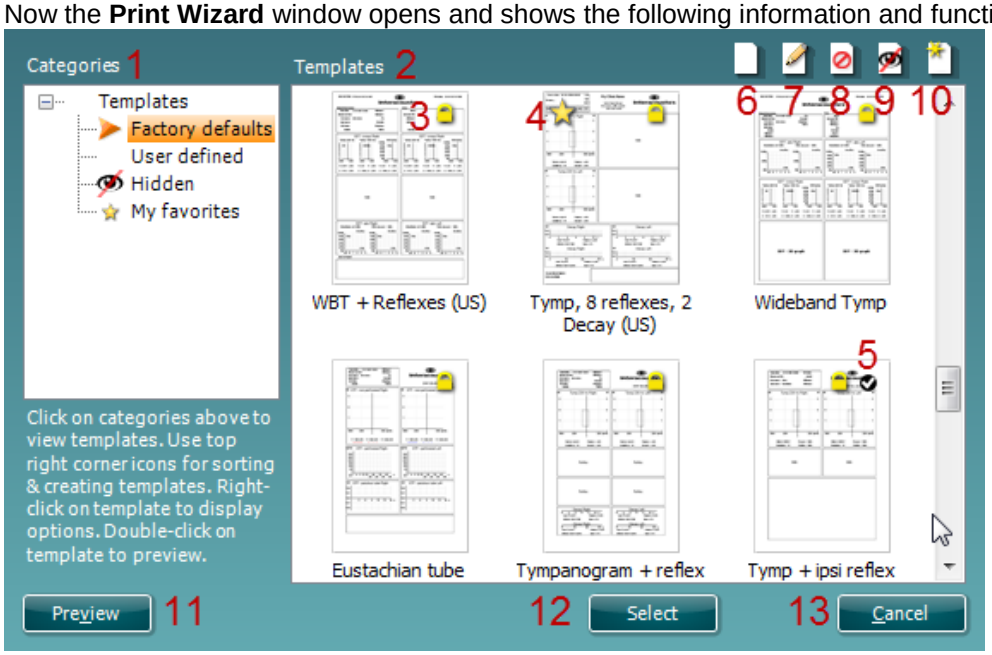


Titan suite

The print template created in this way is then linked to the individual protocol for quick printing.

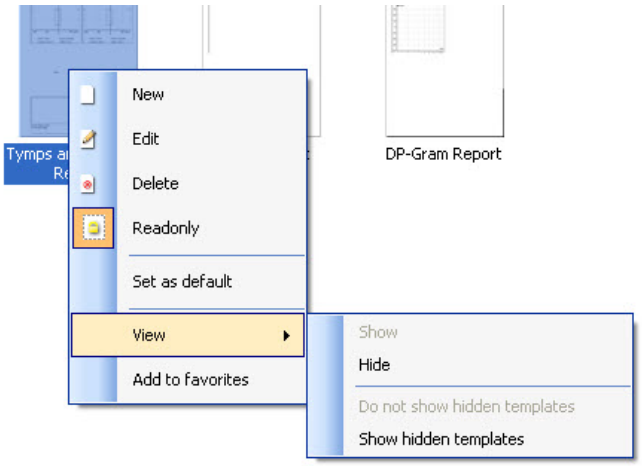
7.3.2 Print Wizard elements

Now the **Print Wizard** window opens and shows the following information and functionalities:



1. Underneath **Categories** you can select:
   - **Templates** to show all available templates
   - **Factory defaults** to show only standard templates
   - **User defined** to show only custom templates
   - **Hidden** to show hidden templates
   - **My favorites** to show only templates marked as favorite
2. The **Templates** viewing area displays the templates available in the selected category.
3. Factory default templates are indicated by the lock icon. These ensure that you always have a standard template and do not need to create a customized one. However, in order to edit these default templates, they must be saved under a new name. **User defined**/created templates can be set to **Read-only** (showing the lock icon), by right clicking on the template and selecting **Read-only** from the drop down list. **Read-only** status can also be removed from **User defined** templates by following the same steps.
4. Templates added to **My favorites** are marked with a star. Adding templates to **My favorites** allows quick viewing of your most commonly used templates.
5. The template attached to the selected protocol will have a checkmark.
6. Press the **New Template** button to open a new empty template.
7. Select one of the existing templates and press the **Edit Template** button to modify the selected layout.
8. Select one of the existing templates and press the **Delete Template** button to delete the selected template. You will be prompted to confirm that you want to delete the template.
9. Select one of the existing templates and press the **Hide Template** button to hide the selected template. The template will now be visible only when **Hidden** is selected under **Categories**. To unhide the template, select **Hidden** under **Categories**, right click on the desired template and select **View/Show**.
10. Select one of the existing templates and press the **My Favorites** button to mark the template as a favorite. You will now be able to quickly find the template when **My Favorites** is selected under **Categories**. To remove a template marked with a star from My Favorites, **Right-click** on the template and press the **My Favorites** button.
11. Select one of the templates and press the **Preview** button to display the print preview of the template on the screen.
12. Press **Select** to dedicate the selected template to the protocol from which you accessed the Print Wizard
13. To leave the Print Wizard without selecting or changing a template press **Cancel**.

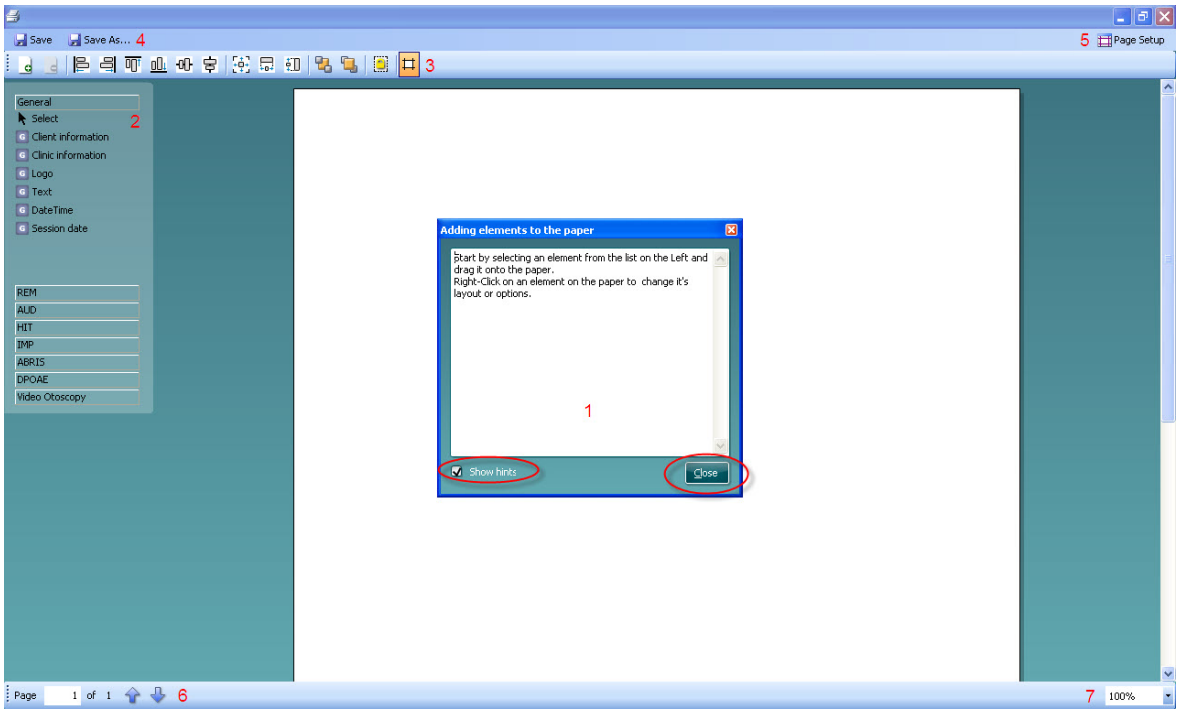
Right-clicking on a specific template provides a drop down menu offering an alternative method for performing the options as described above:



7.3.3 Designing a customised print template

After clicking on the **New Template** (or **Edit Template**) button, the design window below is displayed. On the left of the screen, you will see the elements which you can add to the layout. These are ordered by their corresponding test module. For example, everything for input into the print template associated with the AUD module, can be found under AUD.

1. On opening, a short description about how to create a template will show on the screen. Press **Close** to close the message box. Uncheck the **Show hints** checkbox, if you do not want this message to appear again.
2. This list shows the elements which can be dragged onto the blank template. Selecting **General** provides a list of the general elements. Template elements for each module are listed when selecting the relevant module name, for example **AUD, IMP, REM, HIT**. If other suites are installed, such as the Titan suite, the relevant suites will also be displayed.
   The handling and options for the different elements are discussed in a separate section below.



3. The taskbar includes numerous icons for customizing the elements that are dragged onto the blank template page. These are described in the following section.

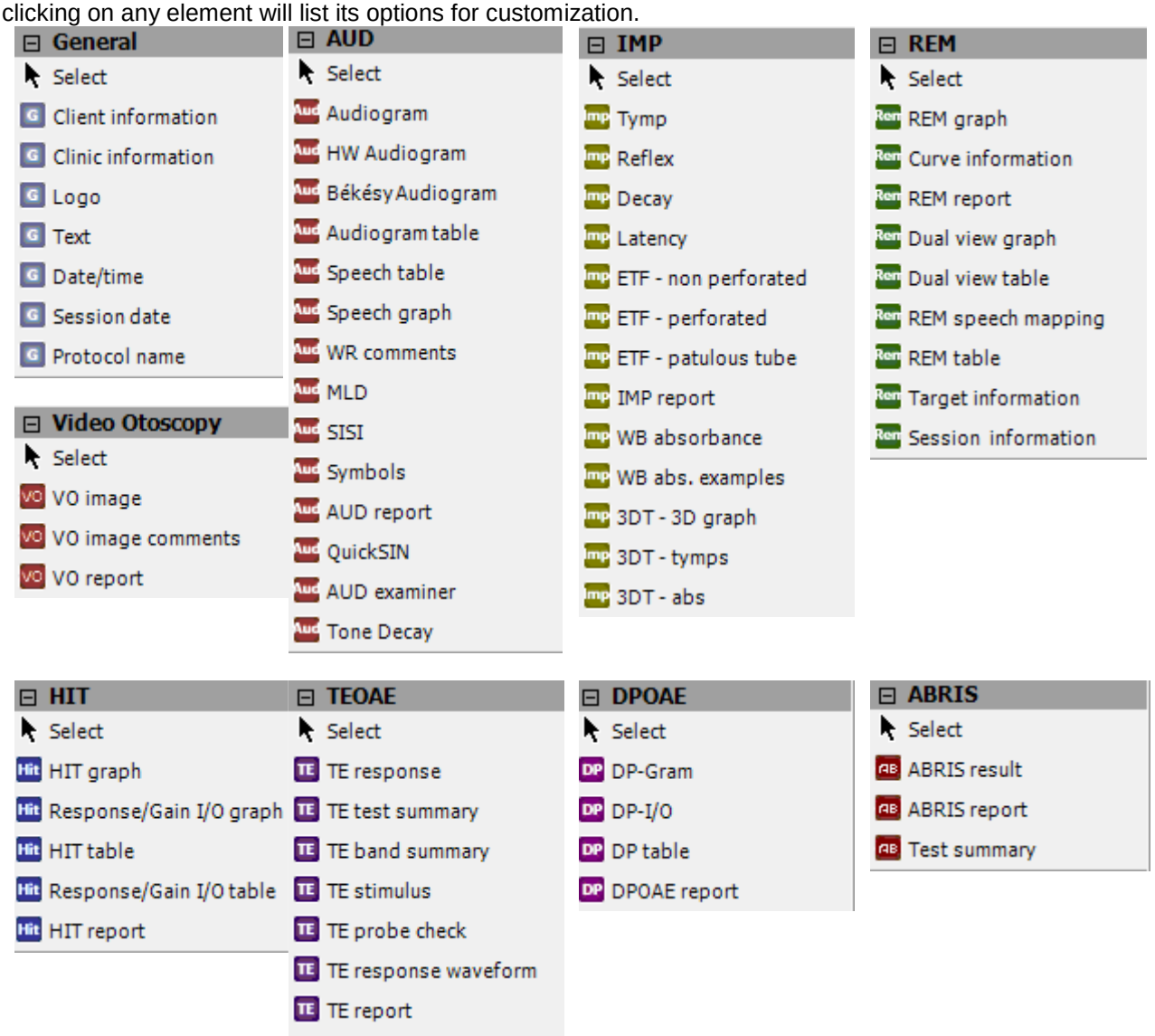
4. Press **Save** to save the print template and go back to the **Print Wizard** window. If you have created a new template you will be prompted to give it a name. Press **Save As…** if you have modified an existing template and want to save under a different name.
5. Pressing the **Page Setup** button opens the **Page Setup** window where you can choose the paper size, source, margins and paper orientation.
6. If the template has more than one page, use the up and down arrows, , to scroll through the different pages. You can also type in the page number that you would like to view and/or edit.
7. The **Zoom** drop down menu allows you to change the viewing size of the template on the screen.
8.

7.3.4 Taskbar

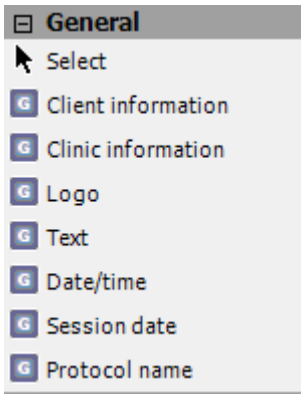
1. **Add page** to make a template of more than one page.
2. **Remove page**. You will be prompted for confirmation that you want to delete the page and all its contents.
3. **Align left**. If you select two or more elements (using the shift button on the keyboard) this button will align these elements on their left sides.
4. **Align right**. If you select two or more elements (using the shift button on the keyboard) this button will align these elements on their right sides.
5. **Align top**. If you select two or more elements (using the shift button on the keyboard) this button will align these elements along the top edge..
6. **Align bottom**. If you select two or more elements (using the shift button on the keyboard) this button will align thoee elements along the bottom edge..
7. **Align horizontal**. If you select two or more elements (using the shift button on the keyboard) this button will align these elements on their horizontal central axis.
8. **Align vertical**. If you select two or more elements (using the shift button on the keyboard) this button will align these elements on their vertical central axis.
9. **Make equal size**. If you select two or more elements (using the shift button on the keyboard) this button will make all sizes equal to the element that was placed on the page first.
10. **Same width**. If you select two or more elements (using the shift button on the keyboard) this button will make all widths equal to the width of the element that was placed on the page first.
11. **Same height**. If you select two or more elements (using the shift button on the keyboard) this button will make all heights equal to the height of the element that was placed on the page first.
12. **Send to back**. This button sends the selected element(s) to the back.
13. **Send to front**. This button sends the selected element(s) to the front.
14. **Lock element** locks (or unlocks) the selected element(s). This means that the position and size of the element is locked. When one of the taskbar functions is used on a locked element, it will automatically unlock.
15. **Display margins** toggles between showing and not showing the print margins as a broken line.

7.3.5 Design elements

Add template elements to the template page by using the select, drag and drop function.
Click on the desired element and drag it onto the template page. The element will appear as a small box in the upper left hand corner. Resize the element to the desired size and drag it to an appropriate location.
The section below describes the options available within each element once dragged onto the template. Right-clicking on any element will list its options for customization.



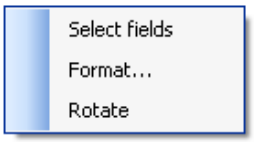
7.3.5.1 General



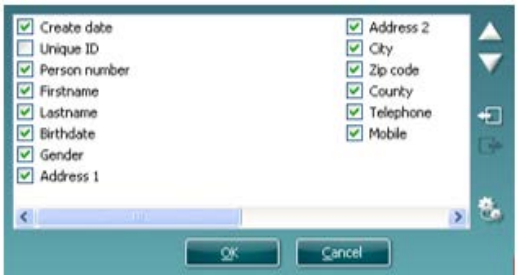
1. **Select**

   Select, let you select a window already on the print template and makes it possible to modify it.

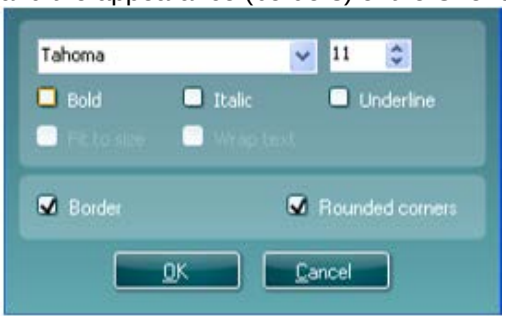
2. **Client information**



a. By right clicking on an element you can see **Select fields**. In **Select fields** you can change the order of the items by selecting one and pressing the up or down arrows. Pressing will create a new empty field that can be named and shown in the template. Change a field's name by selecting it, waiting for 1 second, and then left-clicking on the name. Pressing will remove user created fields. Press to restore the manufacturers' default fields.

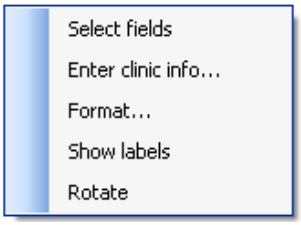


b. **Format…** opens the **Format client** window. Here you can change the font, font size and formatting, and the appearance (borders) of the **Client information** area.



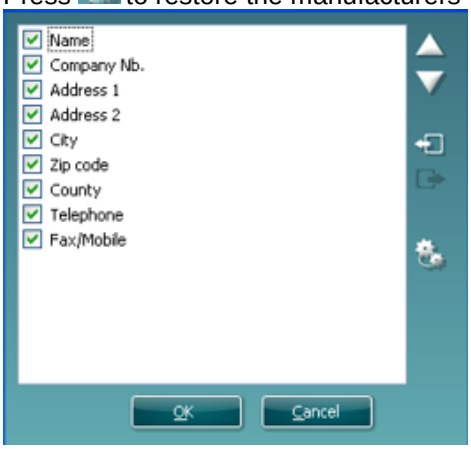
c. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

3. Clinic information



a. **Select fields** displays the **Select fields** window where you can select which items are to be shown in the clinic information element. You can change the order of the items by selecting one and pressing the up or down arrows. Pressing will create a new empty field that can be named and shown in the template. Change a field's name by selecting it, waiting for 1 second, and then left-clicking on the name. Pressing will remove user created fields.

b. Press to restore the manufacturers' default fields.



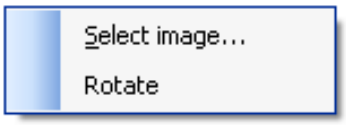
c. **Enter clinic info…** opens the **Clinic info editor** window. Here you can type and save the clinic information specifically for the selected print template. The **Create date** item cannot be changed as it will always show the current date and time.

d. **Format…** Here you can change the font, font size and formatting, and the appearance (borders) of the **Clinic information** area.

e. By selecting **Show labels**, the **Clinic information** fields can toggle between on and off.

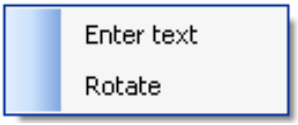
f. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

4. Logo



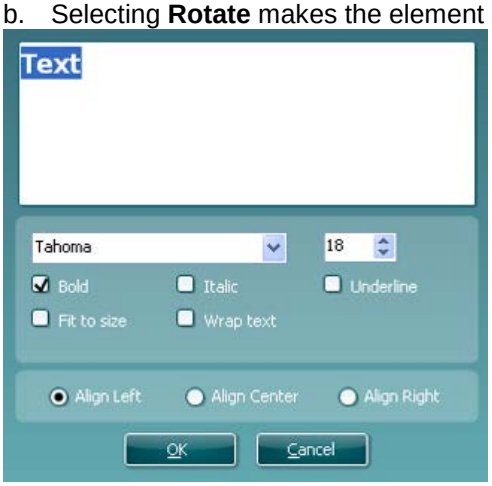
a. **Select image** opens a window where you can browse to find the image stored on your PC that you want to include in the template.
b. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

5. Text

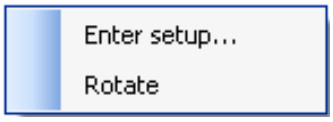


Text allows you to add additional text, e.g. footnotes, on your template.

a. **Enter text** opens the **Enter Text** window where you can type in freetext and choose the font type, size and formatting.
b. Selecting **Rotate** makes the element rotate 90 degrees clockwise.



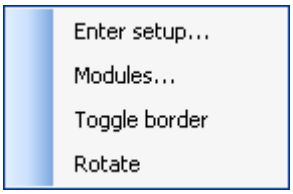
6. **Date Time**



Date and time allows you to put in a stamp on the template showing date and/or time of printing.

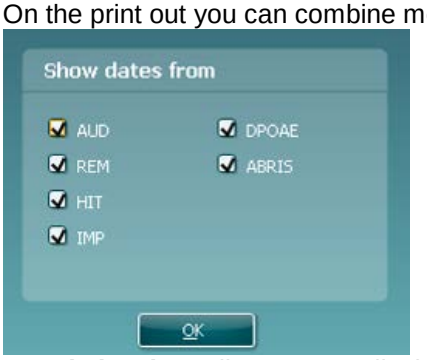
a. **Enter setup…**opens the **Date Time setup** window where you can choose the format in which the date and/or time appears in the template.You can also choose the font type, size and formatting.
b. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

7. **Session date**



Session date allows you to put in a stamp on the template showing date and/or time that the measurements were recorded.

a. **Enter setup…** opens the **Date Time setup** window, exactly as in 5a. Here you choose the format in which the date and/or time appears in the template. You can also choose the font type, size and formatting.
b. Selecting **Modules** gives the opportunity to define which modules' session dates will be shown. On the print out you can combine measurements from different suites.



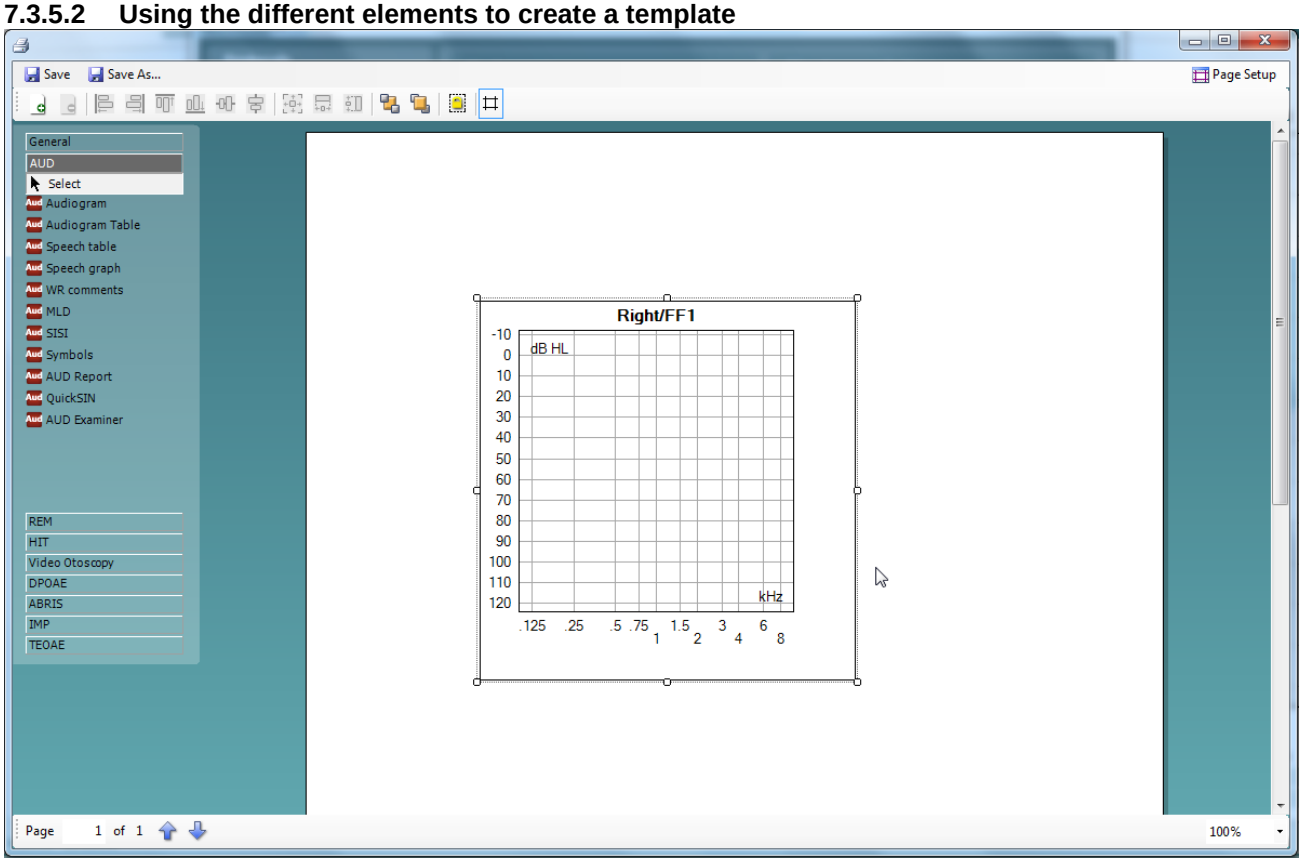
c. **Toggle borders** allows you to disable or enable the border around the **Session date** element.
d. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

8. **Protocol name**

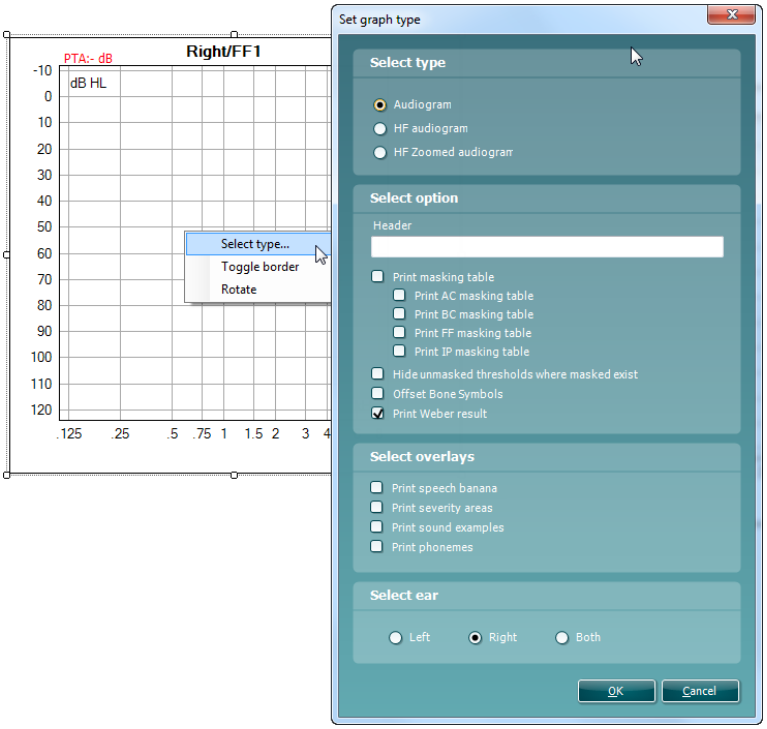
Protocol name allows you to display the protocol name/s on the template for the recorded measurement/s.

a. **Select modules** gives the opportunity to define which modules' protocol names will be shown. On the print out you can combine measurements from Titan suite and other Interacoustics suites (Callisto, Affinity, Equinox, Diagnostic).
b. **Toggle border** allows you to disable or enable the border around the **Session date** element.
c. Selecting **Rotate** makes the element rotate 90 degrees clockwise.

7.3.5.2 Using the different elements to create a template

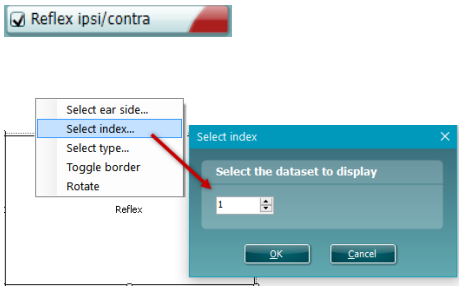


1. Once drawn, you can move the element to your desired position on the template and also **right click** to define the parameters of the information displayed. For instance, in the example displayed above, right clicking on the object allows you to 'select type'. Clicking on this opens a new window which will allow you to define options such as the test ear and include sound examples etc. Every object you input allows customization of the options the element can display. The options available for each can vary depending on the module element selected.
2. When right-clicking on an element you have the option to rotate that element and also to toggle the surrounding border.



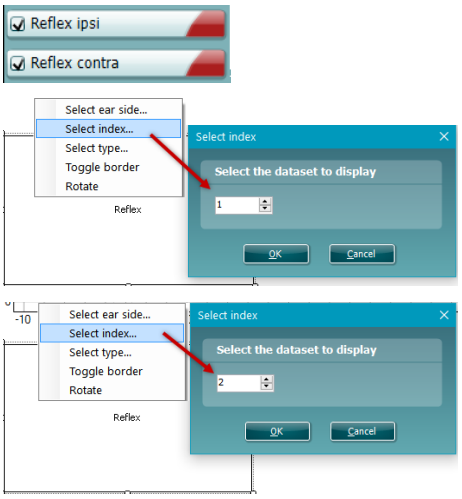
3. A reflex protocol can be set in two different ways which will affect the print setup of it.

Seperate ipsi and contra reflex protocols



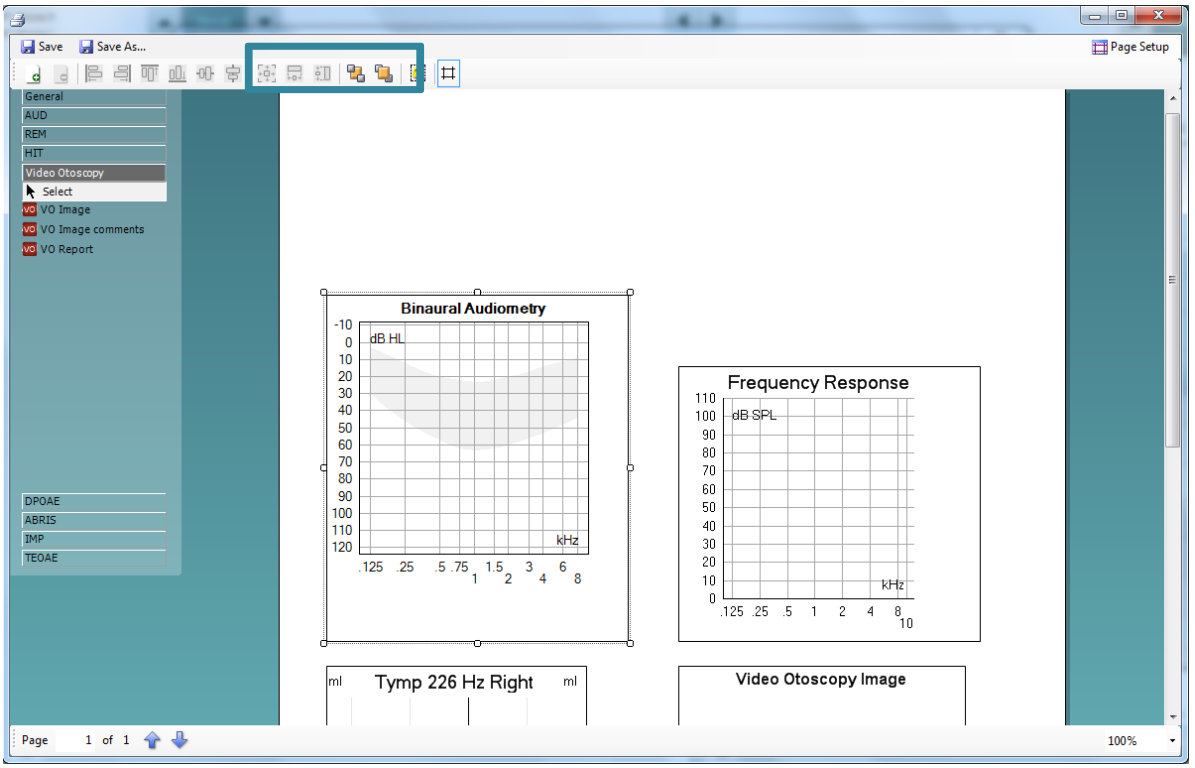
Ensure index is set for 1, it will by default

Combined ipsi and contra protocols



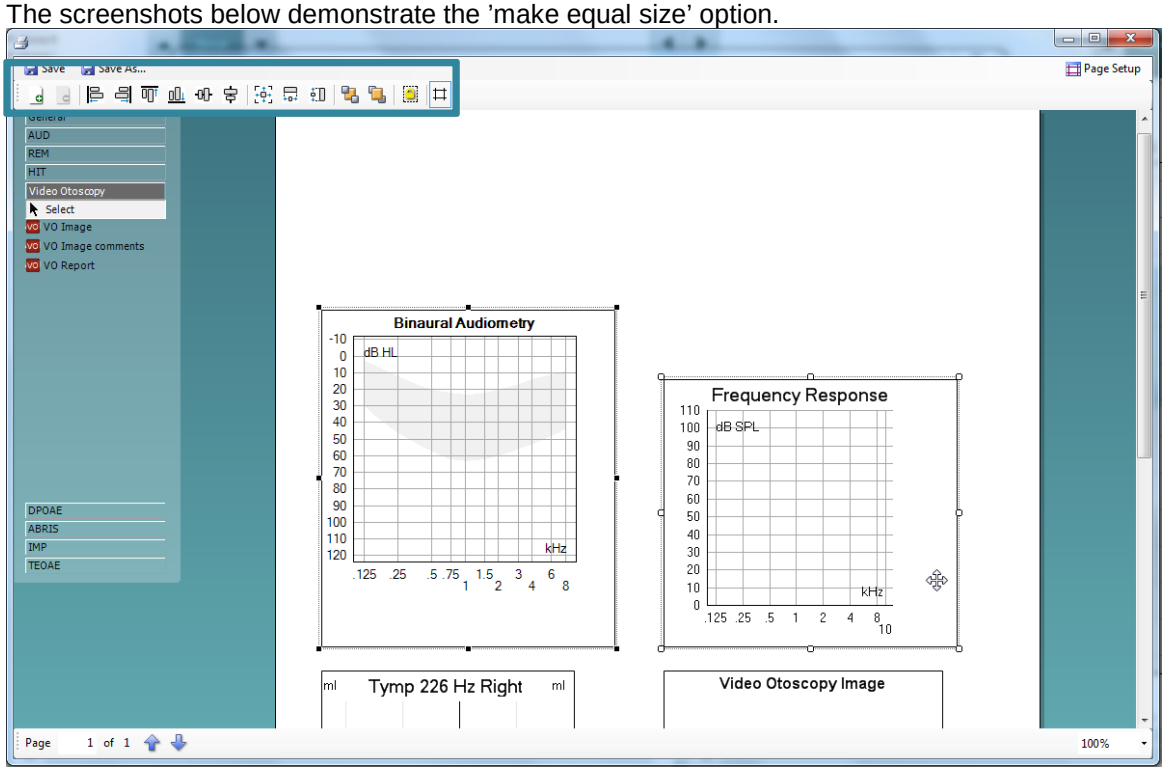
Set the ipsi to index 1 and conra to index 2.

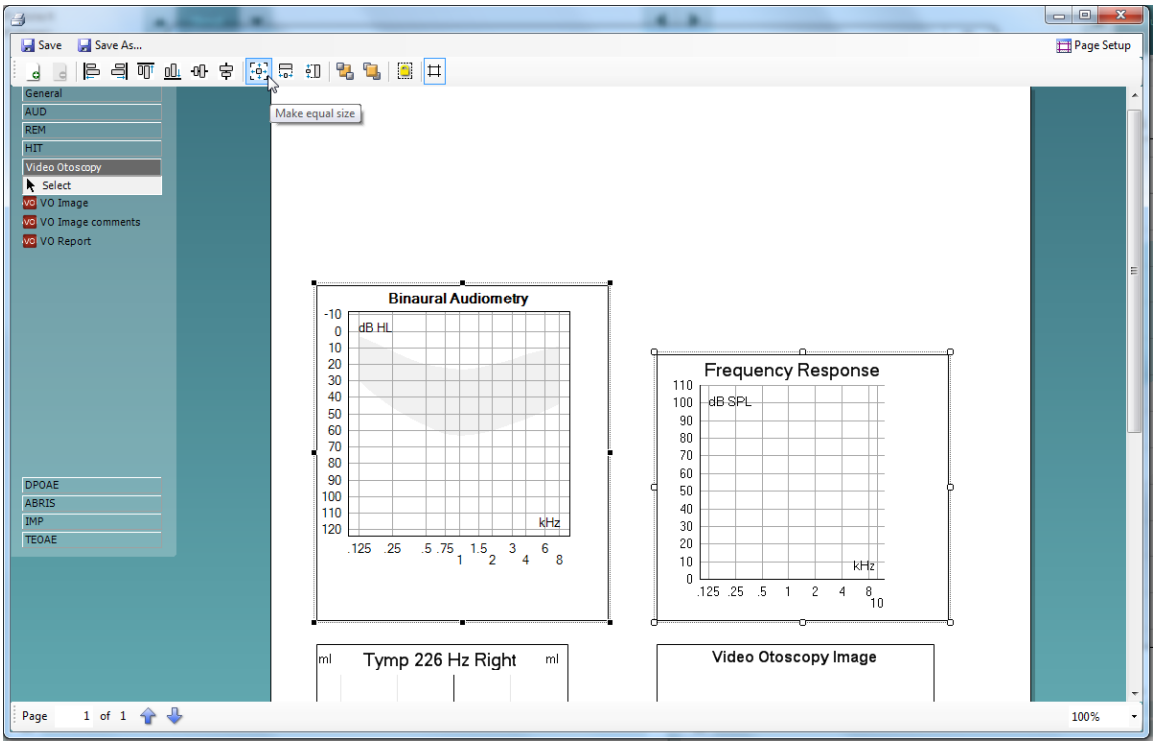
4. Once you have clicked in all of your elements and have configured them to your preferences, you will need to organise them. This can be done by moving them to the desired position and also sizing them similarly. There are tools to assist you with this. If you left-click on an element you will notice the highlighted tool bar below become active. The options available to you here are purely for ordering (e.g. to send items backwards/forwards).

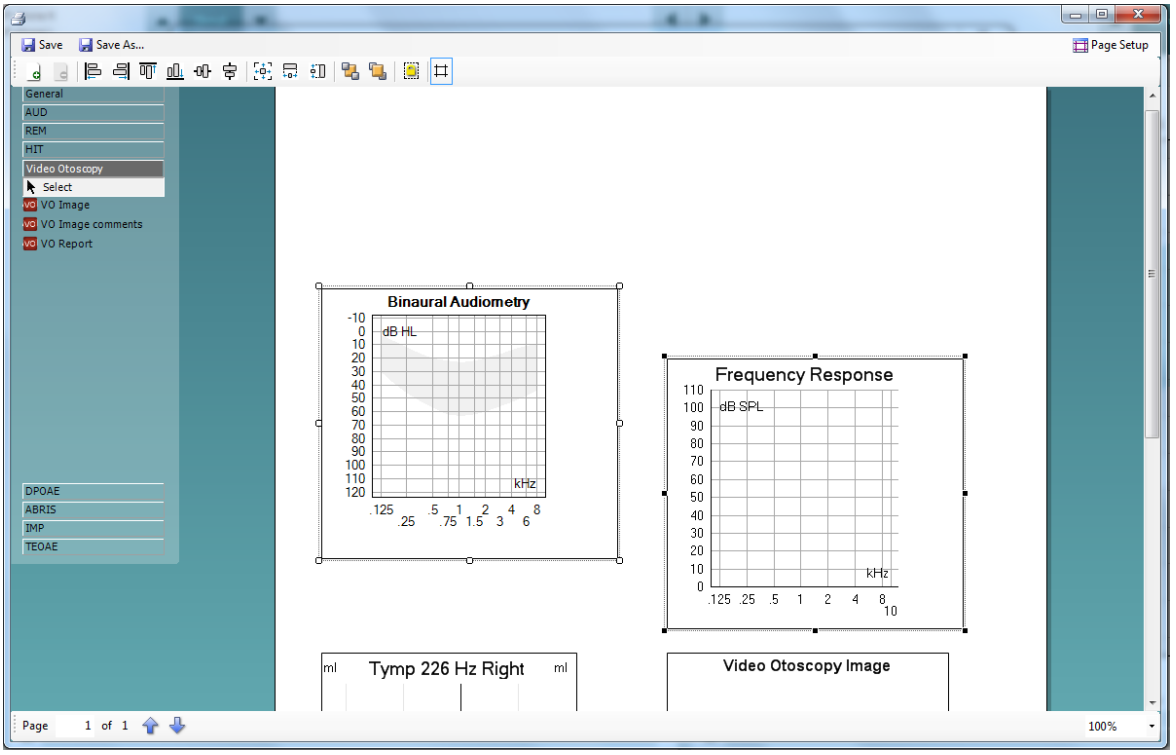


5. However, if you left-click on one element and then hold **Control** on your keyboard and left-click on another, you will then be able to activate the rest of this tool bar. This presents the sizing and alignment options. Hovering your cursor over each icon in this toolbar will reveal an explanation of its function.

   These settings make it easier to match the sizes of the elements you have added to your print template. The screenshots below demonstrate the 'make equal size' option.

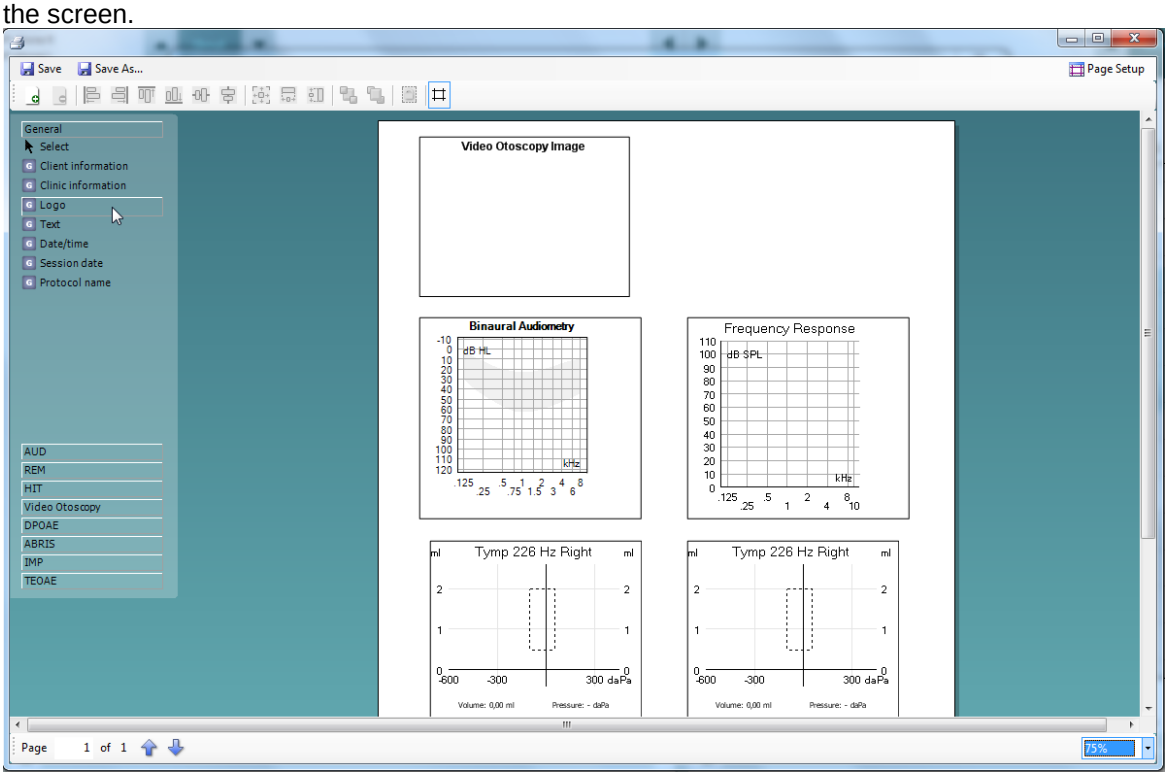




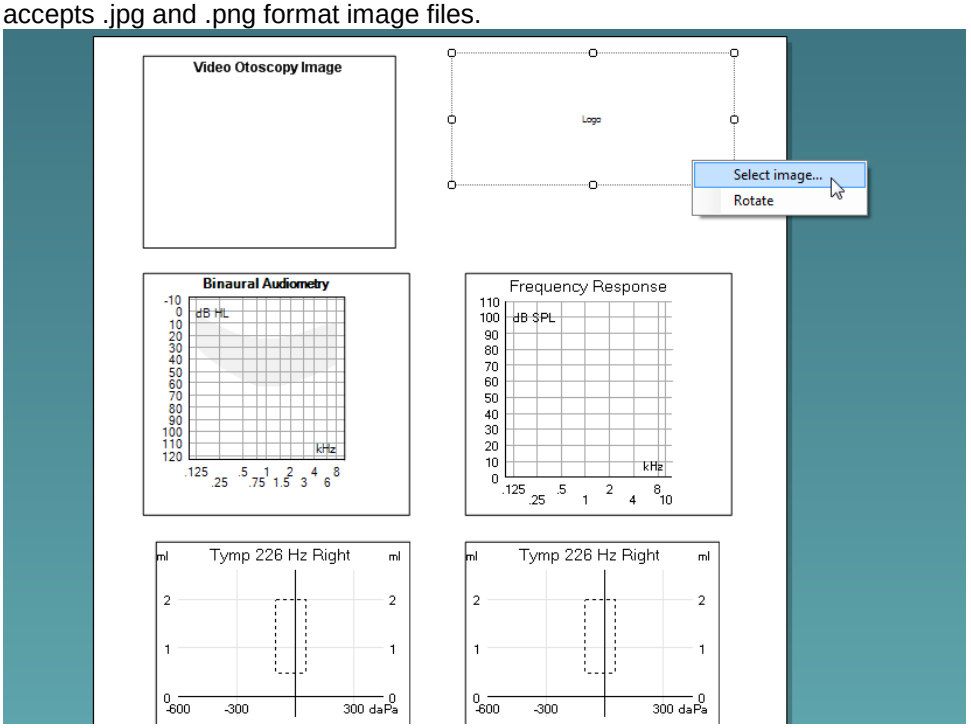


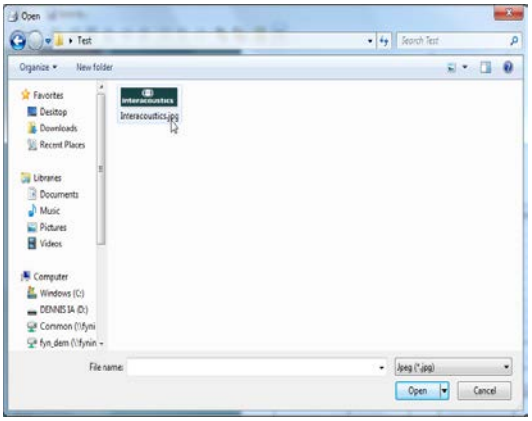
Notice how the first element clicked adopts the settings (size) from the second element.

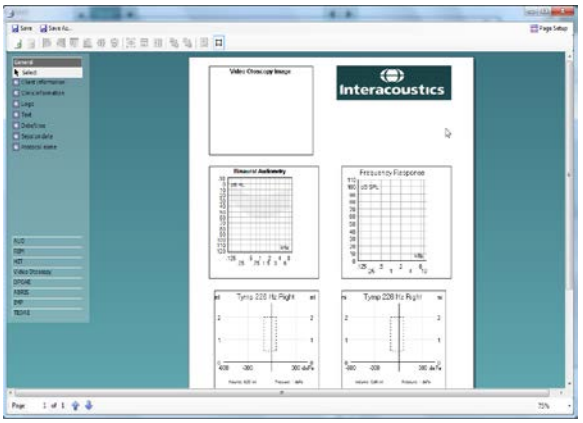
6. Continue to click and further customize your print template. Once completed you can add information on your clinic (via a blank **Test** box) and even a logo. You can do this via the **General** sub-tab on the left of the screen.



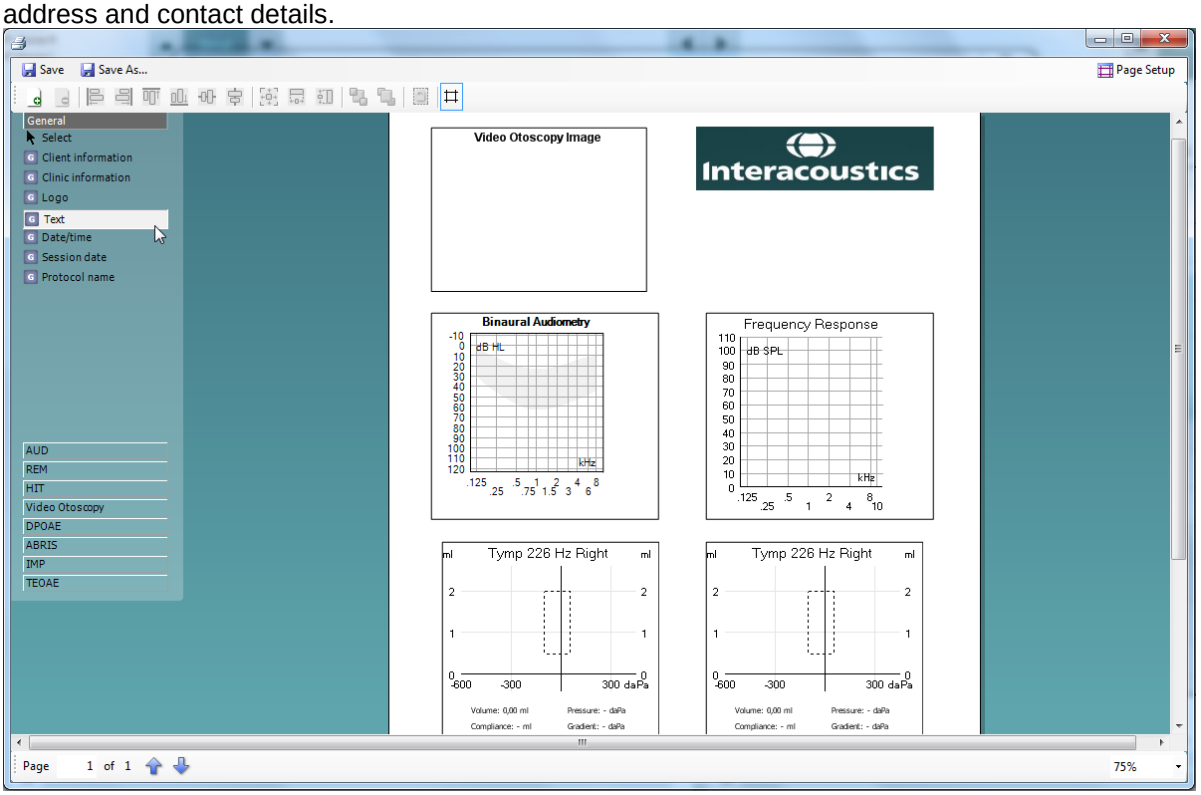
Drawing a logo element allows you to create a section on your print template where you can import a .jpg file. To do this, right-click on the element and click **Select image…** This opens the system dialogue where you can navigate to the image that you wish to input. Please note that the Print Wizard only accepts .jpg and .png format image files.

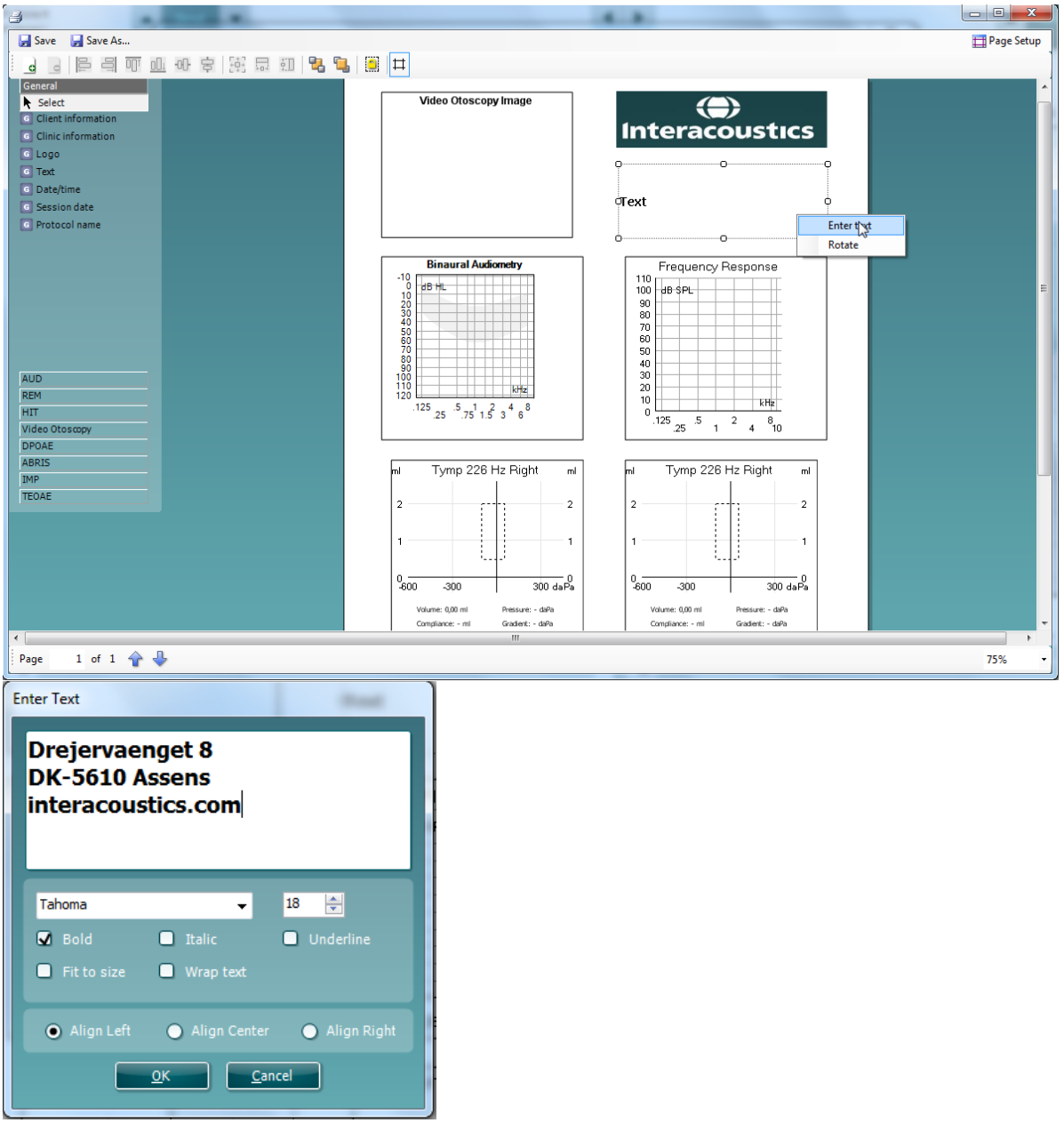




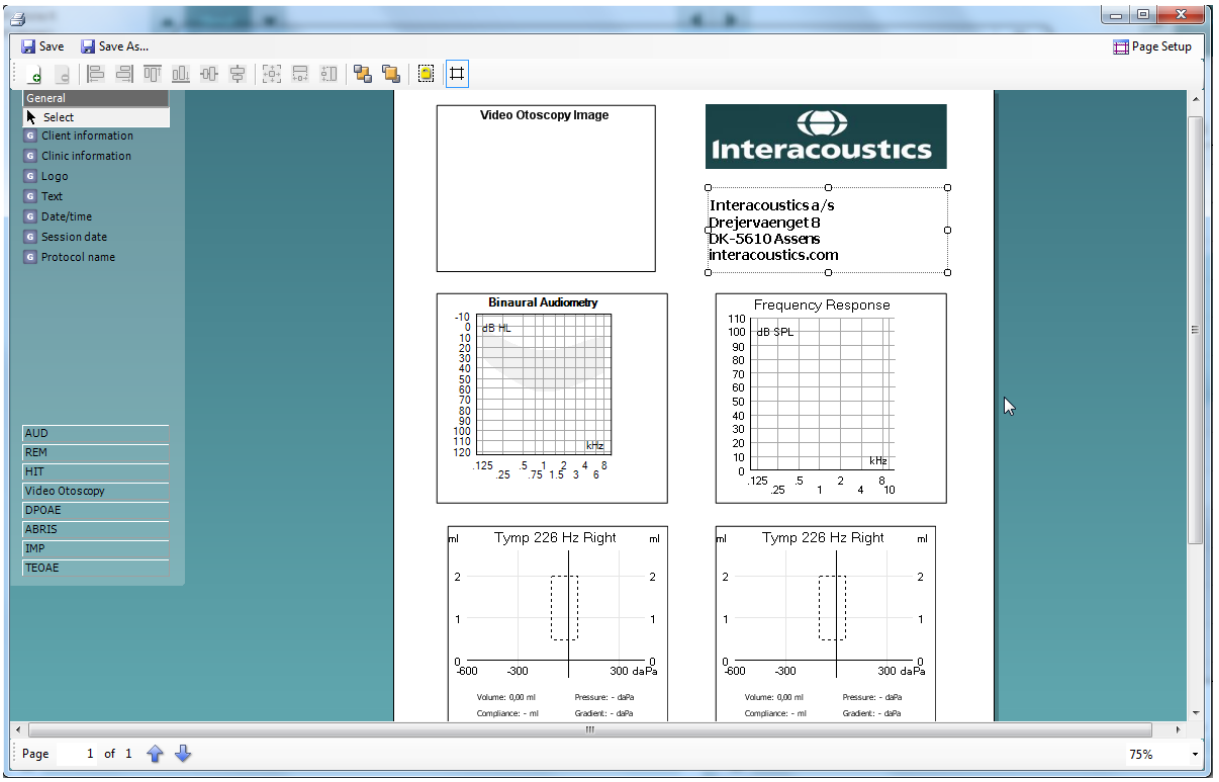


7. Finally, the screenshots below demonstrate the addition of a text box beneath the logo to show the site address and contact details.



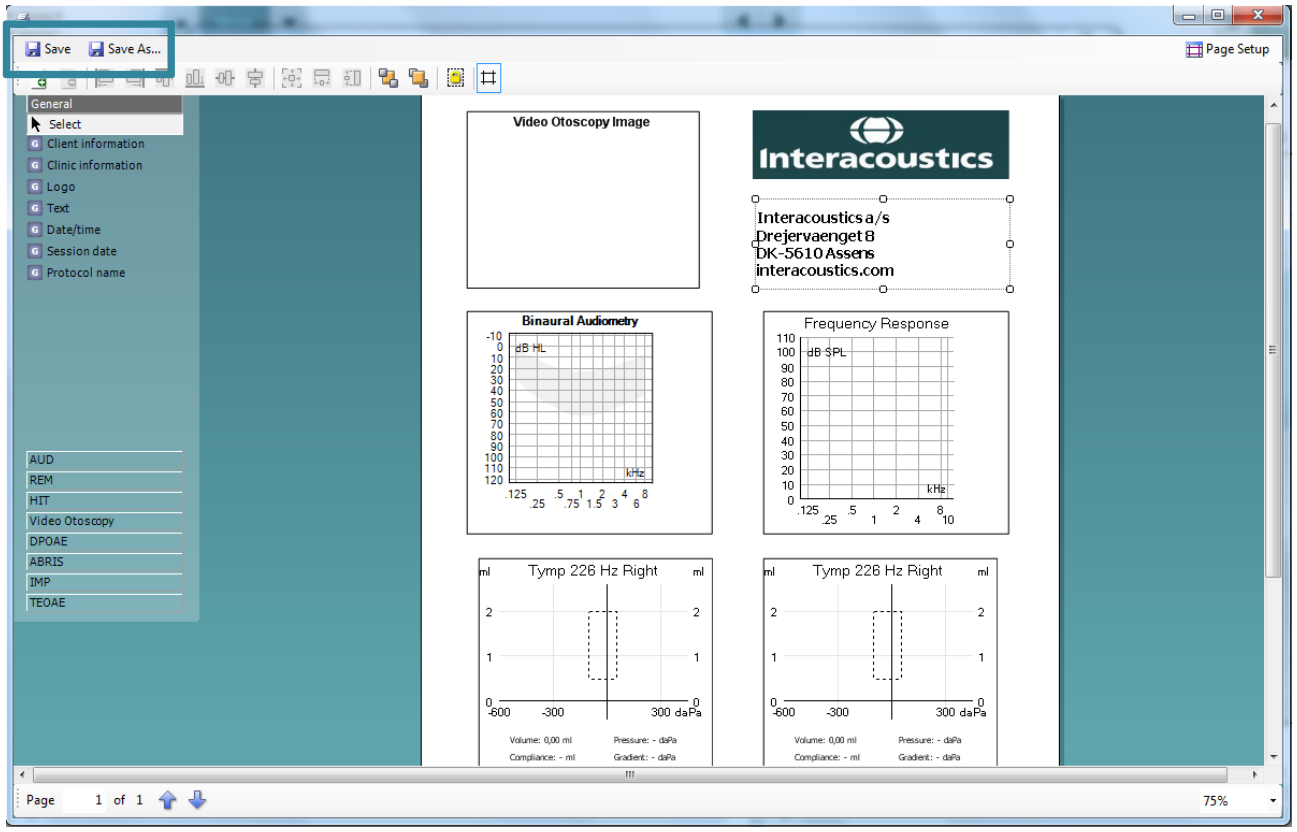


In this section, you can also alter the font and formatting of the text and how it will appear on your print layout. This text box will then be common to this particular print template when it is printed in the future.

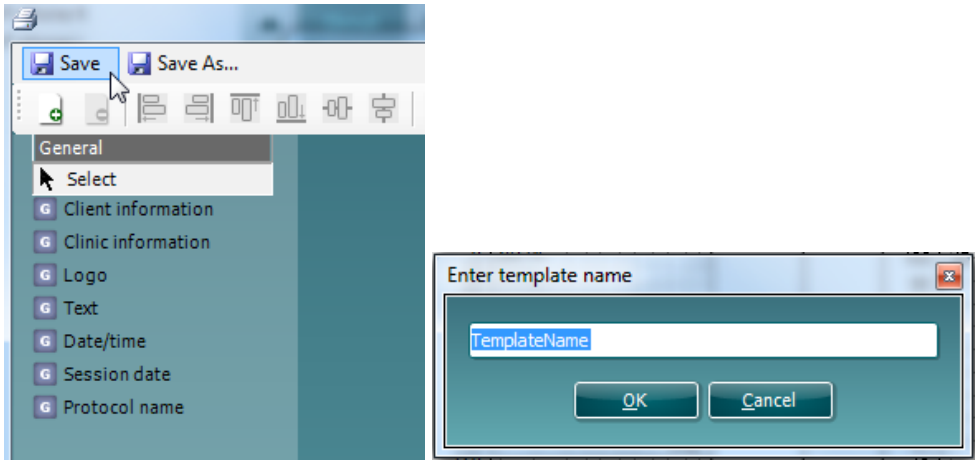

Save
Save As...
Page Setup
General
Select
Client information
Clinic information
Logo
Text
Date/time
Session date
Protocol name
AUD
REM
HIT
Video Otoscopy
DPOAE
ABRIS
IMP
TEOAE
Video Otoscopy Image
Interacoustics
Interacoustics a/s
Drejervaenget 8
DK-5610 Assens
interacoustics.com
Binaural Audiometry
dB HL
kHz
Frequency Response
dB SPL
kHz
Tymp 226 Hz Right
ml
daPa
Tymp 226 Hz Right
ml
daPa
Page 1 of 1
75%

7.3.6 Saving your print template

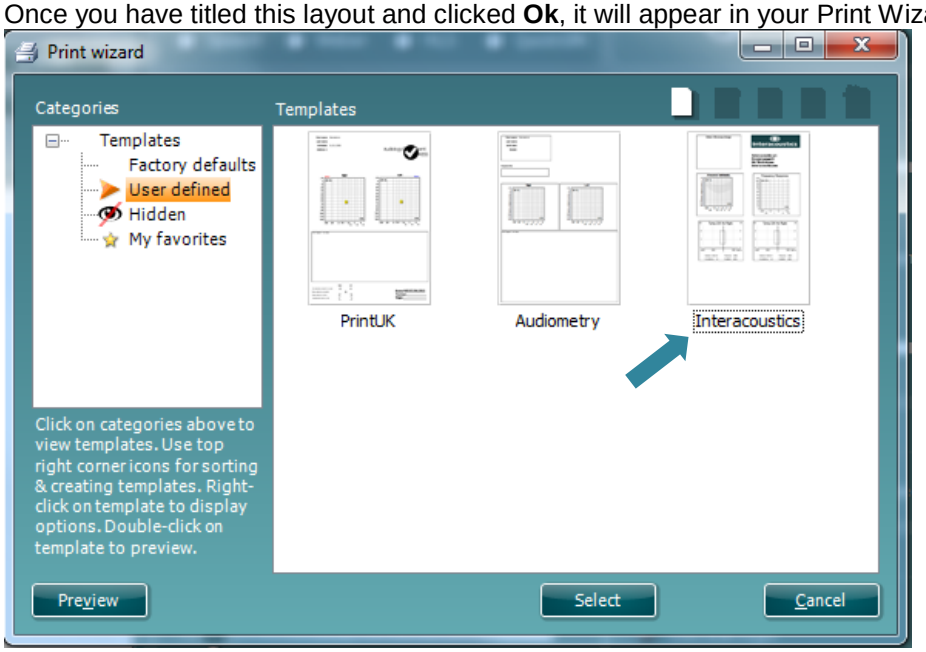
Now that you have completed your print template and have designed it in line with your preferences and requirements, you can click on **Save** or **Save As…** in the top left of the screen.



As this is a new print layout, **Save** will perform the same action as **Save As…** and a small window will appear requesting you to name your print layout.

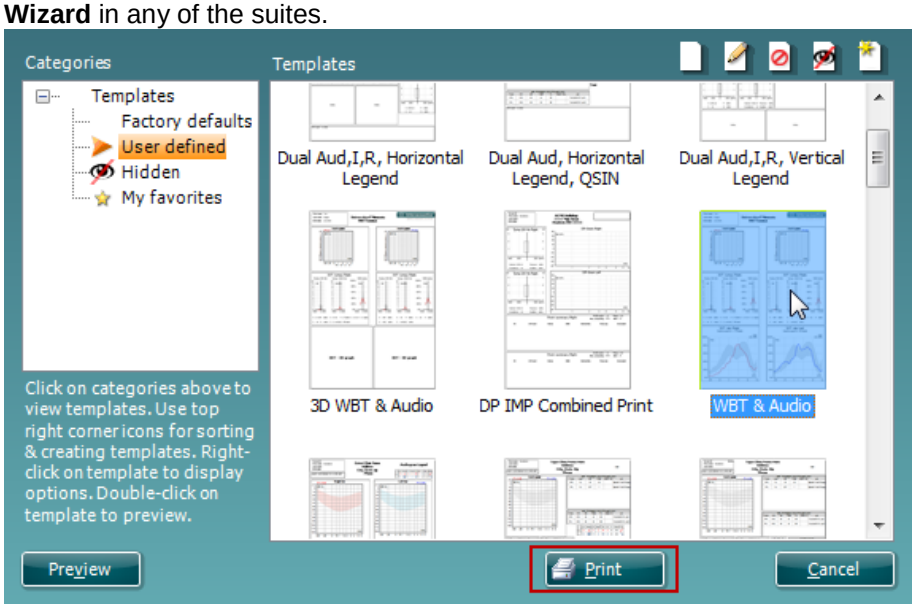


Once you have titled this layout and clicked **Ok**, it will appear in your Print Wizard as a new layout.



7.3.7 Editing a print template prior to printing

If you want to use a template different from the template linked to the protocol, go to **Menu – File – Print Wizard** in any of the suites.



1. Select the template that you wish to use.
2. You have the option to press **Preview** to check that it is as required. To edit the template, right-click and select **edit**.
3. Press **Print** to use the selected template for printing.