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Additional Information

Lyra



Interacoustics

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1 Launching IA OAE Suite

1.1 PC power configuration

NOTICE

Allowing the PC to go into sleep mode or hibernation may cause the IA OAE Suite software to crash when the PC wakes up again. From the Start menu of your operating system, go to the **Control Panel | Power Options** to change these settings.

1.2 Compatible devices

The IA OAE Suite software is compatible with Interacoustics Lyra, Eclipse and Titan.

This software can only record using the Eclipse or Lyra, but it can show OAE recordings from all the devices.

For Titan operations such as recording, protocol management and patient upload/download to the handheld device, the Titan Suite must be used. However once saved to the database, the IA OAE Suite software can be used to open and display the OAE recordings.

1.3 Starting from OtoAccess®

For instructions about working with the OtoAccess® database, please see the operation manual for OtoAccess®.

1.4 Starting from Noah

Ensure that the Lyra is connected before opening the software module. If the hardware is not detected, the IA OAE suite software is opened in reader mode.

To start the IA OAE Suite from Noah 4:

1. Open Noah 4
2. Search for and select the patient you want to work with.
3. If the patient is not yet listed:
 - Click on the **Add a New Patient** icon
 - Fill in the required fields and click **OK**
4. Click on the **IA OAE Suite software** icon at the top of the screen.

For further instructions about working with the database, please see the operation manual for Noah 4.

1.5 Simulation mode

Simulation mode can be enabled from **Menu | Setup | Simulation mode**.

Simulation mode allows simulation of the test protocols and provides simulated OAE measurements.

Print report previews can also be tested if needed.

When the software is launched, simulation mode is always disabled by default to ensure no “artificial recordings” are made by accident.

“Recordings” made in the simulation mode cannot be saved as the data are random and not patient related.







2 DPOAE

2.1 About DPOAE module

The Lyra with DPOAE is intended for use in the diagnostic audiologic evaluation and documentation of ear disorders using Distortion Product Otoacoustic Emissions. The target population for Lyra with DPOAE includes all ages.

The Lyra with DPOAE is designed to be used only by skilled personnel such as audiologists, ENT surgeons, doctors, hearing healthcare professionals or personnel with a similar level of education. The device should not be used without the necessary knowledge and training to understand its use and how results should be interpreted.

The DPOAE contains the following tests:

- DP-Gram
- DP-I/O Test

Availability of these tests or specific settings within these tests are dependent on the hardware or license purchased.

2.2 Preparing for the test

2.2.1 Regular probe test

Probe performance is crucial to DPOAE test results. We recommend that you conduct a probe test regularly to ensure that the probe is functioning correctly.

Refer to the probe test quick guide for further instructions.

2.2.2 DPOAE patient instruction

Place the patient on a comfortable chair or on an examination table if necessary. Small 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 test the hearing organ for its functionality
- The probe will be inserted into the ear canal and has to make a good seal
- Multiple tones will be heard during the test
- No participation is expected from the patient
- Coughing, moving, talking and swallowing will disturb OAE test results

2.2.3 Visual inspection of the ear canal

Otoscopy should be performed to inspect the ear canal for wax/cerumen or other debris, or for any anatomical abnormalities. The ear drum should be inspected for a possible perforation. The outer ear is where the recording of OAEs begins and ends, so it is important to be aware of any pathologic or non-pathologic conditions that may affect testing.

2.2.4 Test environment

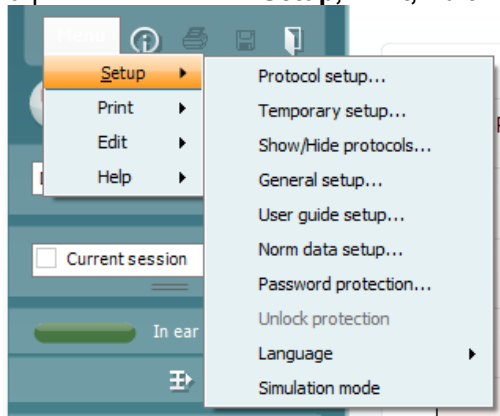
OAE testing should be conducted in a quiet test environment as constant or intermittent background noise can prolong test times or lead to incorrect results.



2.3 The DPOAE menu items

The following section describes the elements of the **Menu** which is accessible from both DPOAE and TEOAE module tab:

Menu provides access to **Setup, Print, Edit** and **Help**.



Menu | Setup | Protocol setup - view protocol settings, create custom test protocols, or copy and edit the default protocols. If data is measured before you enter the protocol setup, you are prompted to save or discard the data.

Menu | Setup | Temporary setup change the selected test protocol temporarily. If temporary changes are made to a protocol, its name appears ending with an asterisk. If data is measured before you enter temporary setup you are prompted to save or discard the data. In temporary setup the same options are available as in the normal protocol settings.

Menu | Setup | Show/hide protocols – show or hide protocols from the dropdown menu.

Menu | Setup | General setup - set norm data preferences, icons to be shown on the graphs, the default startup ear and print to PDF options.

Menu | Setup | User guide setup – edit the pictures and instructions displayed in the user guide.

Menu | Setup | Norm data setup – customize and import/export OAE norm data.

Menu | Setup | Password protection set a password for the suite. When activated, users cannot enter the protocol setup, show/hide protocols, general setup or norm setup.

Menu | Setup | Unlock protection – temporarily disable password protection.

Menu | Setup | Language – allows selection of one of the available languages. The language selection change will come into effect after the IA OAE Suite software is restarted.

Menu | Setup | Simulation mode – activate the simulation mode to run a simulation of the test protocols and view simulated OAE measurements.

Menu | Print | Print – print the current measurement using the print template that is linked to the current protocol. A print window will open allowing printer selection or setting changes before printing. You will be prompted to select a template if the protocol did not have a linked template.

Menu | Print | Print preview – see a preview of the current measurement using the print template that is linked to the current protocol. Note that you are prompted to select a template if the protocol did not have a linked template.



Menu | Print | Print wizard – open the print wizard to select or create a template for printing the current measurement.

Menu | Edit – export the data to an XML file.

Menu | Help | About – displays a dialog window showing the following information:

- IA OAE Suite software version
- Build version
- Firmware version
- Copyright information

Further, you can reach the Interacoustics website from this window by clicking on the link to www.interacoustics.com

By pressing the **License** button you are able to change the license keys of the device. The license keys for the device are specific for each serial number and define which modules, tests, protocol settings and other functionalities are available. Never change the license key without help of an authorized technician

Menu | Help | Documents – provides access to the digital versions of the Instructions for Use Manual and Additional Information manual (Adobe Reader required).

2.4 General operation of DPOAE

2.4.1 Probe check

The probe check graph provides visual feedback about the quality of the probe fit in the ear. The probe fit is assessed using a broadband stimulus and the corresponding probe check graph can help to indicate a leak or a blocked probe. A good probe placement has been achieved when the probe check graph shows a relatively flat response curve over a wide frequency area.

The stimulus that is used for the probe check is a broadband click. It is calibrated to give a reasonably flat response between 200Hz and 8000Hz when measured by calibration equipment. When presented in the ear and recorded by the probe microphone it typically results in a graphic like the one shown below.



It is generally said that when the best probe placement is achieved, the probe check will show a flat response over a wide frequency area. However, because the probe microphone is used for this monitoring, the intensities at the eardrum will be slightly different from those displayed on the graph. Therefore a dip, like in this example, around 5 kHz is normal and represents the situation measured at the end of the probe whereas at the eardrum the intensities are approximately the same as for the other frequencies.

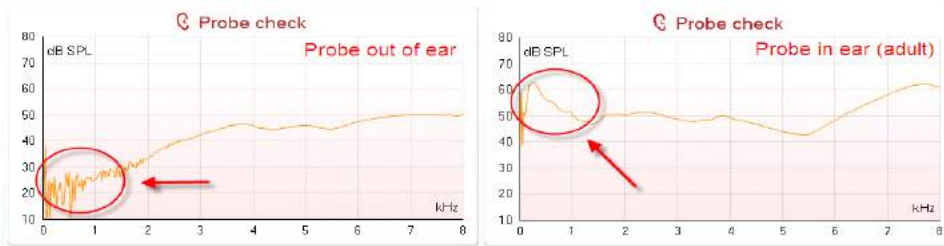
When monitoring the probe check graph you will normally also see noise that is being picked up by the system. A probe that is slowly moving out of the ear can be recognized by the typical frequency dip moving to a lower frequency range.



Below an example is shown for the adult ear where the probe has almost fallen out.



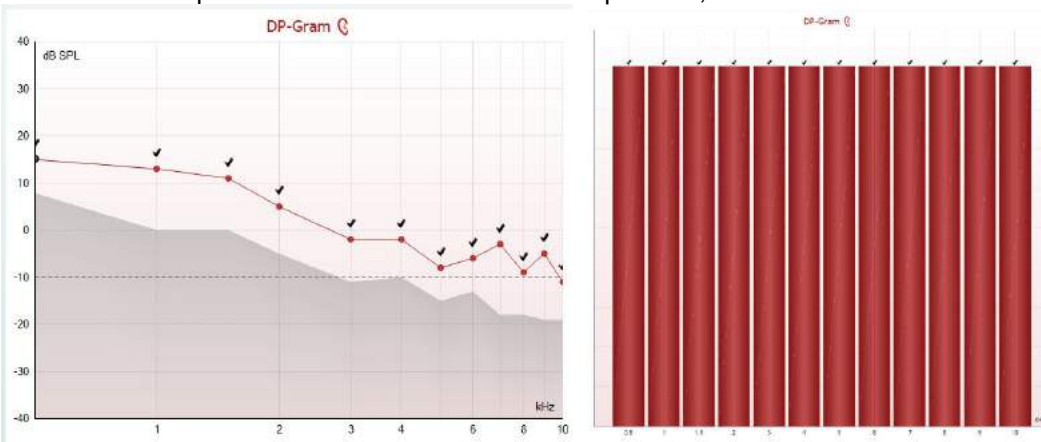
Looking at the low frequency area of the graph will also give you information about whether or not the probe is in the ear.



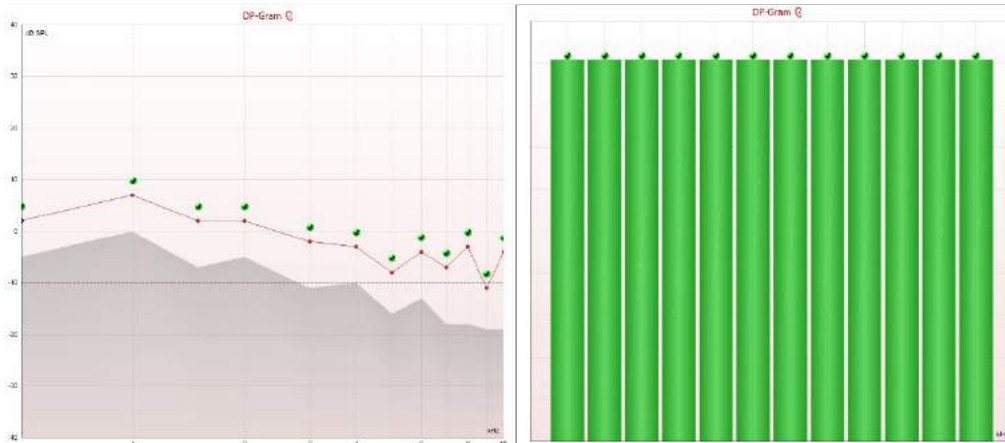
2.4.2 DP-Gram views

The DP-Gram can be shown in basic view or advanced view. Your preference for these views is defined in the protocol setup and can also temporarily be changed in the temporary settings.

The below examples show the data from the same protocol, but with the different views selected.



The left-hand graph shows the advanced view, while the right-hand graph shows the basic view. SNR criteria is met for the above two graphs, indicated by black checkmarks.



The left-hand graph shows the advanced view, while the right-hand graph shows the basic view. Include DP criteria is checked, so SNR, min. DP level & tolerance criteria is met for the above two graphs, for each frequency, indicated by green checkmarks.

2.4.2.1 DP-Gram basic view

The following information can be found on the **basic view** DP-Gram:



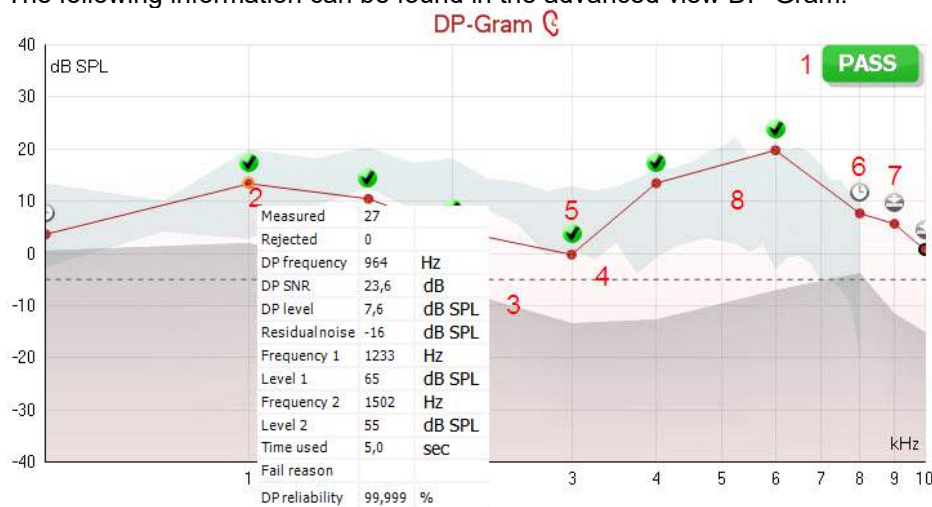
Enable Pass/Refer & Include DP criteria is checked, so SNR, min. DP level, tolerance and reliability criteria are met for the above graph, for each frequency, indicated by green checkmarks & PASS label.

1. **Pass or Refer** is displayed above the measurement as soon as the result is available. A user defined Pass/Refer criteria can be enabled within the protocol setup. When **Enable Pass/refer** is used, if the measurement is stopped before completion of the test, **Incomplete** will appear in the label.
2. The **Bar representation** shows the progress over time for each frequency measured in a bar graph format. When a bar becomes completely filled and changes to green, it has reached the stop criterion set in the protocol. Those bars that do not meet the stop criterion will remain in the color of the selected ear (red or blue).
3. **Check marks** above the green bars indicate that those frequencies have reached their stop criteria. When a user defined Pass/refer protocol has been created, although several bars might turn green it does not necessarily mean that it will result in a pass. For example, within the protocol setup it can be specified that particular frequencies are mandatory for reaching an overall pass.



2.4.2.2 DP-Gram advanced view

The following information can be found in the advanced view DP-Gram:

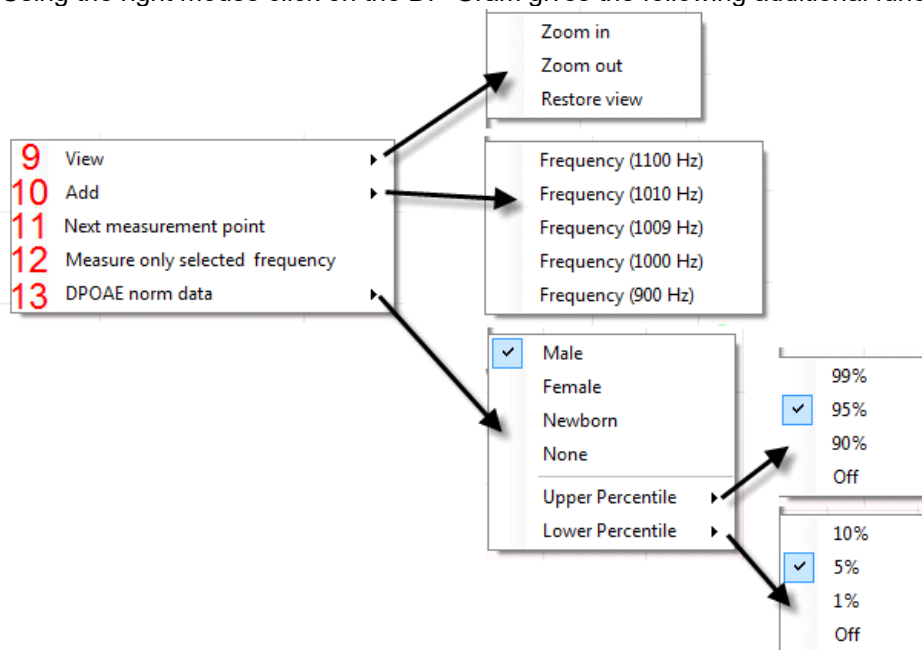


- The result can be labeled with **Pass** or **Refer** and is indicated above the measurement as soon as the result is available. A user defined Pass/Refer criteria can be enabled within the protocol setup. When **Enable Pass/refer** is used, if the measurement is stopped before completion of the test, **Incomplete** will appear in the label.
- Each **Measurement point** shows the absolute DPOAE level in dB SPL as a function of frequency. Selecting a measurement point by a left mouse click will show its details in the **Response & Zoom graph**. Hovering the mouse over a measurement point allows you to see the following details for that point:
 - Measured** indicates how many measurement samples were taken to get to the current result
 - Rejected** indicates how many samples were rejected due to too much noise
 - DP frequency** refers to the frequency (in Hz) where the main DPOAE can be expected. That is the $2f_1-f_2$
 - DP SNR** indicates the difference between the absolute value of the DPOAE and the noise floor around the **DP frequency**. This difference is the signal to noise ratio (SNR). Note that calculations are done with raw numbers after which rounding off takes place. Therefore the mathematical difference between the presented DP level and Residual noise level might differ slightly from the given number
 - DP level** indicates the absolute value of the DPOAE in dB SPL
 - Residual noise** indicates the average noise level (in dB) around the **DP frequency**
 - Frequency 1 (f1)** refers to the frequency of the first stimulus in Hz
 - Level 1** refers to the intensity of the first stimulus in dB SPL
 - Frequency 2 (f2)** refers to the frequency of the second stimulus in Hz
 - Level 2** refers to the intensity of the second stimulus in dB SPL
 - Time used** displays the number of seconds that were spent measuring the test frequency
 - Fail reason** indicates why the individual measurement did not meet the specified criterion as set in the protocol. Reasons displayed include:
 - S/N** meaning that the specified signal to noise ratio was not reached
 - DP tol.** meaning that the **DP level** fluctuated too much over time
 - Min lvl** meaning that the **DP level** did not reach the minimum required level
 - DP relia.** meaning that the **DP reliability** was not sufficient
 - DP Reliability** indicates the certainty that the measured OAE is not part of the noise within the same frequency area
- The **noise floor** is indicated by the upper limit of the gray area. The distance between the noise floor and the measurement point defines the DP signal to noise ratio (SNR).
- The **minimum required DP level** is shown as a dotted line across the graph. DPOAEs detected below the dotted line are considered to be insignificant.



5. The **DP found checkmark symbol**, a black checkmark in a green circle, indicates that this individual measurement met its specified criterion.
6. The **time out symbol**, a clock, indicates that the measurement has ended without reaching the specified criterion for the individual point within the time allowed. It is displayed during testing when “Include DP criteria as stop criteria” is deselected in the protocol setup. To hide this indicator from the test screen, de-select it in the General setup. .
7. The **noise floor symbol**, an arrow pointing at a line, indicates that the measurement has ended because the residual noise floor limit was reached. Choose whether or not this is displayed in the general setup.
8. Optionally, **DP norm data** can be imported or added to the software and is shown as a shaded area in the graph. The norm data can be used to indicate where DPOAEs might be expected for a normal population. Within the general setup you can set whether or not the norm data area is to be displayed. When norm data is displayed on the test screen, it will also appear on the print report.

Using the right mouse click on the DP-Gram gives the following additional functions:

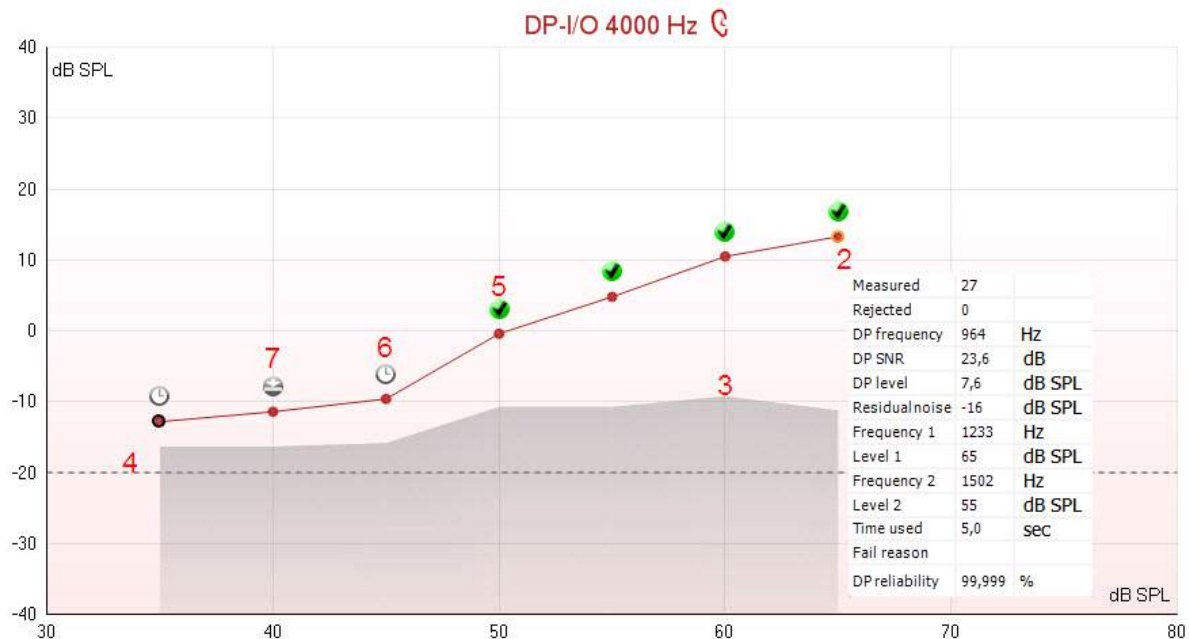


9. The **scroll wheel** of your mouse allows zooming in and out with respect to the frequency axis. Additionally you can **Zoom in**, **Zoom out** or **Restore view** by selecting the appropriate item from the right mouse click menu.
10. **Add** an additional frequency after testing of the original protocol has finished. Point and right click your mouse at the frequency that you would like to test. Click on **Add** then select an available frequency from the list to measure. After adding one or more frequencies you will notice that the **Start** button changes to say **Continue**. Clicking **Continue** will measure all inserted frequencies without a time limit. Press **Stop** when the additional points are sufficiently tested.
11. **Next measurement point** interrupts the automatic test procedure and starts testing the next frequency immediately. This function is available when max test point has been selected in the protocol.
12. **Measure only selected frequency** results in re-testing the currently selected measurement point only. Select a measurement point to re-test by right clicking on it. A black circle around the measurement point indicates that it is selected. After pressing **Continue** (where the **Start** button was) the selected point will be tested without a time limitation. Press **Stop** to stop testing.
13. **DPOAE norm data** allows you to change which DP norm data is shown in the DP-Gram.



2.4.3 DP-I/O (DP-input/output)

The following information can be found in the DP-I/O graph:



1. The results of the test are shown in the DP-I/O graph.
2. Each **Measurement point** shows the absolute DPOAE level in dB SPL as function the stimulus level for the tested frequency. Selecting a measurement point by a left mouse click will show its details in the **Response & Zoom graph**. Hovering the mouse over a measurement point allows you to see the following details for that point:
 - **Measured** indicates how many measurement samples were taken to get to the current result
 - **Rejected** indicates how many samples were rejected due to too much noise
 - **DP frequency** refers to the frequency (in Hz) where the main DPOAE can be expected. That is the $2f_1-f_2$
 - **DP SNR** indicates the difference between the absolute value of the DPOAE and the noise floor around the **DP frequency**. This difference is the signal to noise ratio (SNR). Note that calculations are done with raw numbers after which rounding off takes place. Therefore the mathematical difference between the presented DP level and Residual noise level might differ slightly from the given number
 - **DP level** indicates the absolute value of the DPOAE in dB SPL
 - **Residual noise** indicates the average noise level (in dB) around the **DP frequency**
 - **Frequency 1 (f1)** refers to the frequency of the first stimulus in Hz
 - **Level 1** refers to the intensity of the first stimulus in dB SPL
 - **Frequency 2 (f2)** refers to the frequency of the second stimulus in Hz
 - **Level 2** refers to the intensity of the second stimulus in dB SPL
 - **Time used** displays the number of seconds that were spent measuring the test frequency
 - **Fail reason** indicates why the individual measurement did not meet the specified criterion as set in the protocol

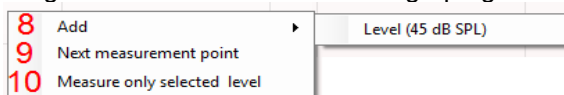
Reasons displayed include:

 - **S/N** meaning that the specified signal to noise ratio was not reached
 - **DP tol.** meaning that the **DP level** fluctuated too much over time
 - **Min lvl** meaning that the **DP level** did not reach the minimum required level
 - **DP relia.** meaning that the **DP reliability** was not sufficient
 - **DP Reliability** indicates the certainty that the measured OAE is not part of the noise within the same frequency area
3. The **noise floor** is indicated by the upper limit of the gray area. The distance between the noise floor and the measurement point defines the DP signal to noise ratio (SNR).



4. The **minimum required DP level** is shown as a dotted line across the graph. DPOAEs detected below the dotted line are considered to be insignificant.
5. The **DP found checkmark symbol**, a black checkmark in a green circle, indicates that this individual measurement met its specified criterion.
6. The **time out symbol**, a clock, indicates that the measurement has ended without reaching the specified criterion for the individual point within the time allowed. It is displayed during testing when "Include DP criteria as stop criteria" is deselected in the protocol setup. To hide this indicator from the test screen, de-select it in the General setup. .
7. The **noise floor symbol**, an arrow pointing at a line, indicates that the measurement has ended because the residual noise floor limit was reached. Choose whether or not this is displayed in the general setup

Using the right mouse click on the DP-I/O graph gives the following additional functions:

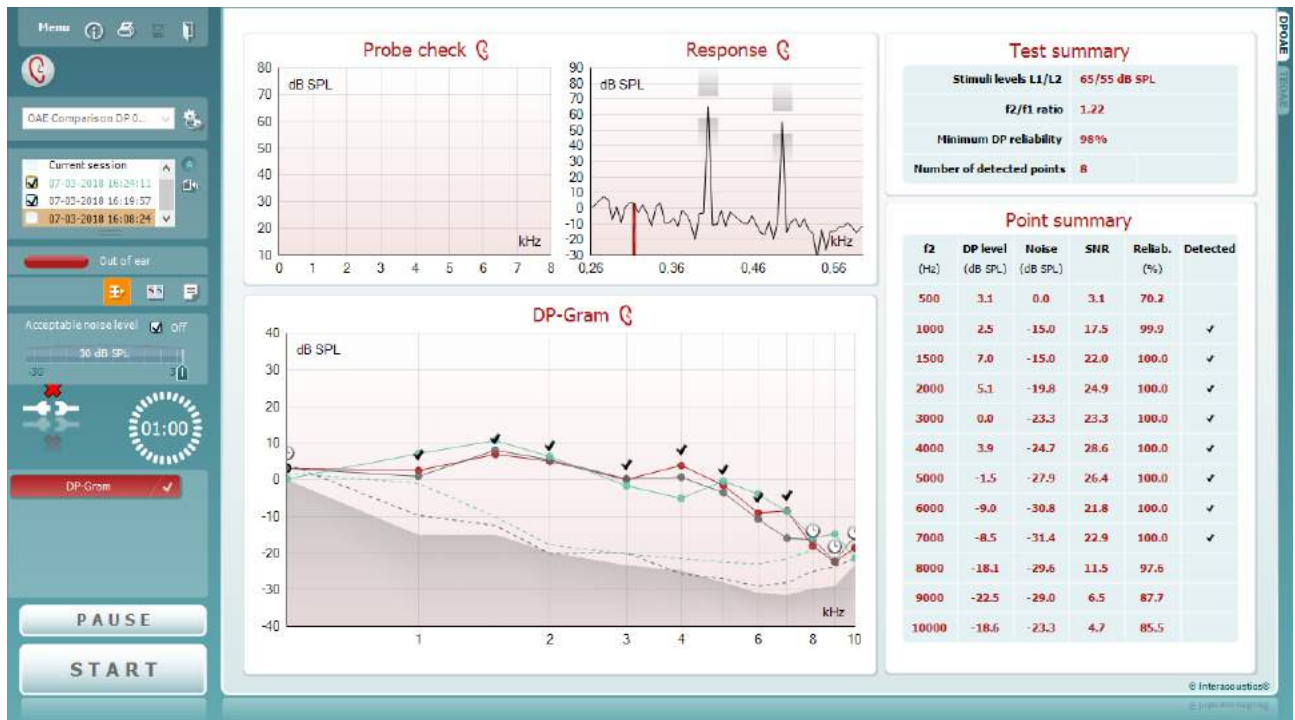


8. **Add** an additional stimulus level after testing of the original protocol has finished. Point and right click your mouse at the stimulus level that you would like to test. Click on **Add** then select an available level to additionally measure. After adding one or more levels you will notice that the **Start** button changes to say **Continue**. Clicking **Continue** will measure all inserted levels without a time limit. Press **Stop** when the additional points are sufficiently tested.
9. **Next measurement point** interrupts the automatic test procedure and starts testing at the next intensity immediately. This function is available when max test point has been selected in the protocol.
10. **Measure only selected level** results in re-testing the currently selected measurement point only. Select a measurement point to re-test by right clicking on it. A black circle around the measurement point indicates that it is selected. After pressing **Continue** (where the **Start** button was) the selected point will be tested without a time limitation. Press **Stop** to stop testing.

2.4.4 Comparing DPOAE data (historic overlay)

Multiple DPOAE sessions can be compared using the overlay function. This can be either the current session and multiple historic session or two or more historic sessions.

- 1 Highlight the first session for comparison by clicking on the date or Current session text. This will display the DPOAE results for the selected session.
- 2 Select the session/s for comparison by checking the box beside the session date/time. The overlaid session/s will appear on the DP-Gram graph in various colors corresponding to the colors of the session date/time. The colored dotted line of an overlaid session indicates the noise floor for the specific session.



Note, when the first session for comparison is selected, only comparable sessions show an active checkbox. Sessions from Titan, Lyra and Eclipse can be compared if the same protocol/parameters are used.

Sessions that are not compatible for comparison cannot be selected. This includes:

1. Sessions where a Pass/Refer label is given (as enabled in the protocol setup).
2. DP-Gram test results cannot be compared with DP I/O tests results.

2.4.5 Printing the overlaid sessions

When the historic overlay function is used on the test screen, the overlaid graph will automatically appear on the print template. The DP point summary and DP test summary table information on the printout reflects the session that was selected first.

2.4.6 Test summary table

The **test summary table** is updated during testing and displays information about the DPOAE measurement recorded.

Test summary			
1	Stimuli levels L1/L2	65/55 dB SPL	
2	f2/f1 ratio	1.22	
3	Min. DP reliability	98%	
4	No. of detected points	3	

DP-Gram Test Summary Table

Test summary			
5	Frequency	2000 Hz	
	f2/f1 ratio	1.22	
	Min. DP reliability	98%	
	No. of detected points	5	

DP I/O Test Summary Table



The following information is displayed in the **test summary table**:

1. **Stimulus levels L1/L2** displays the L1 and L2 stimulus levels in dB SPL
2. **f2/f1 ratio** displays the ratio between the f1 and f2 frequencies
3. **Min. DP reliability** displays the min DP reliability percentage required for detection of a DPOAE as selected in the protocol setup
4. **No. of detected points** indicates the number of DP points detected during testing
5. **Frequency** displays the DP I/O test frequency in Hz

2.4.7 Point summary table

The **point summary table** is updated during testing and displays information for each DPOAE measurement recorded.

The following information is displayed in the **point summary table**:

Point summary					
1 f2 (Hz)	2 DP level (dB SPL)	3 Noise (dB SPL)	4 SNR	5 Reliab. (%)	6 Detected
1000	12.2	-5.4	17.6	100.0	✓
1500	11.3	-12.0	23.3	100.0	✓
2000	7.2	-11.9	19.1	100.0	✓
3000	-0.1	-15.3	15.2	99.5	✓
4000	9.6	-17.2	26.8	100.0	✓
6000	24.3	-5.1	29.4	100.0	✓

DP-Gram Point Summary Table

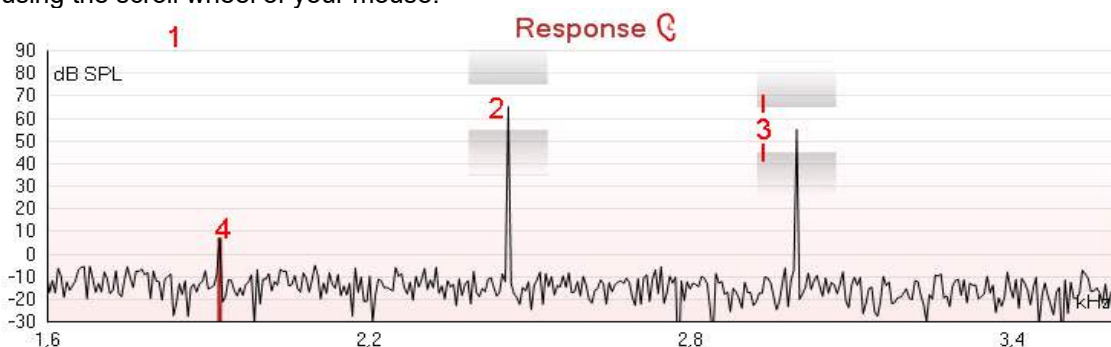
Point summary					
7 Level (dB SPL)	DP level (dB SPL)	Noise (dB SPL)	SNR	Reliab. (%)	Detected
45	5.1	-13.2	18.3	100.0	✓
50	6.9	-15.9	22.8	100.0	✓
55	4.6	-13.2	17.8	100.0	✓
60	-2.5	-8.5	6.0	98.4	✓
65	-5.3	-14.2	8.9	99.3	✓
70	10.2	-11.6	21.8	100.0	✓

DP I/O Point Summary Table

1. **Frequency** displays the f2 frequency in Hz.
2. **DP level** displays the DP level measured in dB SPL for the specific frequency.
3. **Noise** displays the noise for the specific frequency in dB SPL.
4. **SNR** displays the signal to noise ratio.
5. **Reliab.** displays the reliability percentage for the specific frequency as a percentage.
6. **Detected** displays a **check mark** when the specified DP point has met the criteria for a detected DPOAE.
7. **Level** displays the stimulus level in dB SPL.

2.4.8 Response and zoom graph

The following information can be found in the response & zoom graphs. Zooming in and out is possible by using the scroll wheel of your mouse.



1. The **response graph** shows the response recorded by the probe microphone (in dB SPL) as a function of the frequency (in Hz). Only the frequency range that is relevant for the currently measured or currently selected point is plotted.

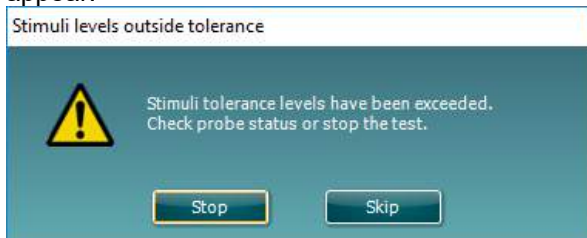


2. The **two test stimuli (f1 and f2)** are easily recognized as the two peaks in the response graph.
3. The **stimulus tolerance** is indicated by two shaded areas above and below the peak of the stimulus. The system will adjust the stimuli levels and as long as the peak stays in between the shaded areas the stimulus intensity is acceptable. If the system cannot match the intensity e.g. probe is out of ear, a warning is presented that stimuli is outside its tolerance. The **DPOAE frequency** at which the main distortion product is expected, at $2f_1-f_2$, is indicated as a colored bar (red or blue depending on the selected ear). Within the example above it is easy to identify that the DPOAE peak is significantly above the noise floor. When zooming in on this peak the residual noise floor can be seen on the graph and is indicated by gray shading behind the curve.

2.4.9 Probe status and stimuli tolerance

Before testing, the probe status is monitored and the probe status bar will change color and indicate whether the probe is in ear, out of ear or blocked. On pressing the START button, the probe status becomes inactive (grey) as it is no longer being monitored.

During testing, the stimuli tolerance is constantly being monitored for each frequency. The probe microphone monitors the output from the speaker, ensuring that the intensity output remains within a specified range (stimuli tolerance). When the stimulus intensity cannot be kept within the specified range, a pop-up will appear.



Typically, this indicates that a seal has been lost between the probe ear tip and the ear canal or has moved within the ear canal. Check the probe to ensure it is not blocked and/or replace the probe in the patient's ear if it has come loose.

When the probe is reinserted, the dialog box will automatically disappear once the stimuli tolerance has been reached and testing will continue.

If the stimuli tolerance cannot be reached after replacing the probe in the patient's ear, the user can press **Skip**. This will skip the testing the current test frequency.

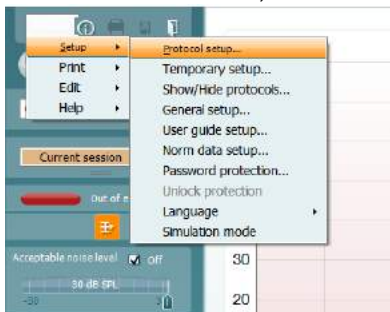


2.5 Protocol setup and criterion

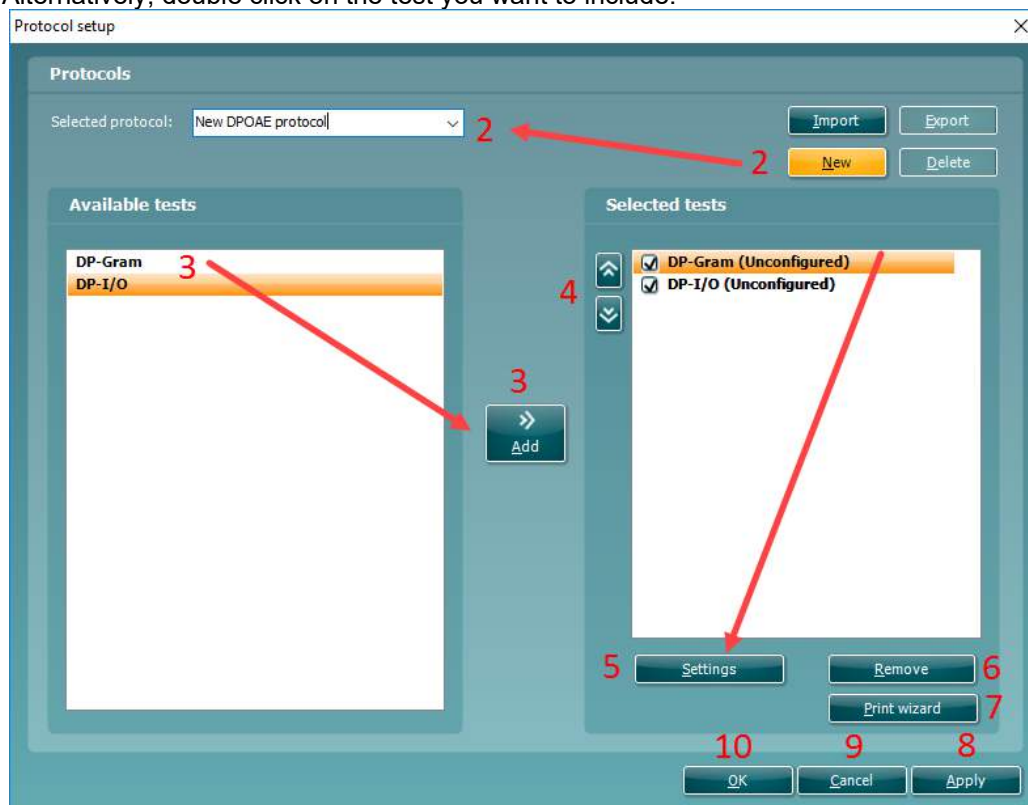
2.5.1 DPOAE protocol setup

To create or adapt your own personalized protocol you need to enter the **Protocol Setup** menu.

1. From the **DPOAE** tab, Select **Menu | Setup | Protocol Setup...**



2. Click on the **New** button and name your protocol.
 - a. You will be asked if you want to **create a copy of the selected protocol**. Select **Yes**, to copy the protocol settings of the selected protocol. Select **No**, to create the new protocol from default settings.
3. Select the test you want to include in your protocol from the list on the left and press **Add**. Alternatively, double click on the test you want to include.



4. The **arrow** buttons allow you to modify the order of the tests.
5. Select the test on the right that you want to modify the settings for and click on **Settings**. Alternatively, double click on the selected test. The **Test setup** window will open where the test settings are specified. Note that a test will show “(unconfigured)” beside it if it does not contain any settings. You must configure a test before you can save and exit the protocol setup.
6. The **Remove test** button is used to remove a test from the **Selected tests** list.



7. The **Print wizard** button takes you to the area where a print layout can be created and/or linked to the selected protocol.
8. Pressing **Apply** will apply any new settings made or changed within a protocol.
9. Pressing **Cancel** will close the protocol setup window and return you to the testing screen without saving any changes.
10. Pressing **OK** closes the protocol settings window after automatically saving all changes.

2.5.2 DP-Gram test settings

The following options are available in the **DP-Gram** test:

1. **Name of selected test.** You can choose to have more than one of the same type of tests in your protocol. You may therefore want to give each test an individual name, so it will be easier to recognize when running the complete test protocol.
2. The **Auto run** checkbox defines which tests will run automatically, one after the other, when START is pressed.
3. The **f₂ frequencies** to be used in the DP-gram are added to the frequency listing after typing them in and pressing **Add**.
4. Pressing **Add series...** opens the **Add series** window in which a series of frequencies can be added in the following way:
 - a) At **Number of frequencies** type in the number of frequencies that you would like to be part of the series
 - b) Define the **Start frequency**
 - c) Define the **Stop frequency**
 - d) Indicate if the series should spread the frequency evenly according to a logarithmic scale. If unchecked a linear scale distribution will be used
 - e) Press **Create** to add the series to the frequency listing
 - f) Press **Cancel** to cancel out of the **Add series** window
5. Press **Remove** to delete a selected frequency from the list
6. At **Level (L₁)** (under the **Basic** tab) the intensity at which the first stimulus f₁ is presented is defined. The intensity of f₁ is often referred to as the 'stimulus level'.
7. At **Acceptable noise level**, set the initial acceptable noise level limit between -30 and +30 dB SPL above which recordings are considered to be too noisy. During testing the acceptable noise level can be changed using the slider bar on the control panel.
8. Checking the **Acceptable noise level off** box will disable the rejection of any recordings even when there is too much noise in the recording.
9. Activating **Run descending** makes the testing run from the highest frequency down to lowest. By default, this option is enabled and the testing starts from highest to the lowest frequency.



Test setup

DP-Gram

Name of selected test
DP-Gram 1

☒ Autorun 2

DP-Gram settings (65 dB SPL)

Frequency (f2)
0

1000 Hz
1500 Hz
2000 Hz
3000 Hz
4000 Hz
6000 Hz

Add
Remove
Add series...

Basic Advanced

Level (L1) 65 dB SPL

Acceptable noise level 30 dB SPL

☒ Acceptable noise level off

☒ Run descending

Common test settings

Stop criteria DP criteria DP reliability Display

☒ Run in loops

Max point time Unlimited

Max test time 30 Seconds

☒ Include DP criteria as stop criteria

☐ Enable Pass/Refer

☐ Include DP criteria as stop criteria

Minimum number of points required for a pass 6

OK Cancel

Add series

Number of frequencies a
3

Start frequency b
500

Stop frequency c
8000

☒ Logarithmic d

e f

Create Cancel

DP-Gram settings (65 dB SPL)

Frequency (f2)
0 3

1000 Hz
1500 Hz
2000 Hz
3000 Hz
4000 Hz
6000 Hz

Add 4
Remove 5
Add series...

Basic Advanced

6 Level (L1) 65 dB SPL

7 Acceptable noise level 30 dB SPL

8 ☒ Acceptable noise level off

9 ☒ Run descending

Basic Advanced

10 Relation L1-L2 10 dB

11 Ratio f2/f1 1.22

12 Level tolerance 7 dB

13 ☐ Override in-ear detection

14 ☒ Use microphone compensation

10. The **Relation $L_1 - L_2$** (under the **Advanced** tab) sets the difference in intensity level between the two stimuli (in dB).
11. The **Ratio f_2/f_1** sets the ratio relationship between the two stimulus frequencies.
12. The **Level tolerance** defines the range within which the presented intensity of the stimuli are still acceptable. The number indicates the allowed difference in both a positive and negative direction from the intensity settings. More information about this can be viewed in the **Response & zoom graph**.



13. When **Override in-ear detection** is checked, ear canal volume is not considered for the stimulus. Instead the protocol will use a 711 coupler calibration as reference for the stimulus level. This functionality can be useful when in-ear detection is not possible to achieve because of a perforated eardrum or a PE-tube.
14. When the checkmark **Use microphone compensation** is checked, a method of stimulus control is activated to ensure accurate stimulus levels for small as well as large ear canals. For technical purposes, e.g. when testing the equipment against IEC 60645-6, the method can be deactivated.

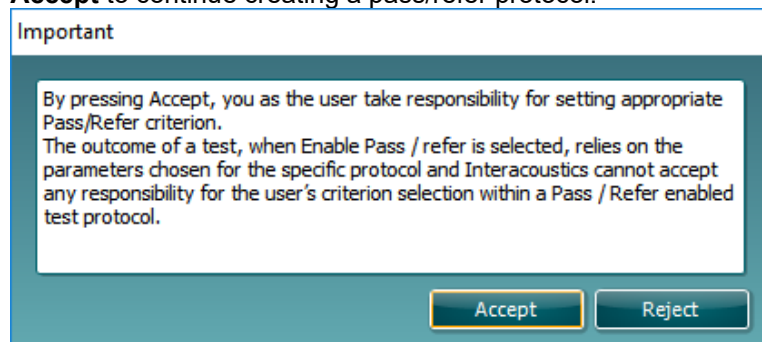
2.5.2.1 DP-Gram common test settings

The common test settings area is divided into four tabs – **Stop criteria**, **DP criteria**, **DP reliability**, and **Display**. The following options within each tab are described below.

Stop criteria

1. When **Run in loops** is selected, the **Max test time** option is available. Here you define how long the total DP-Gram test may take until it stops automatically by using the slider. Each test point (frequency) will be measured for a short period of time (approx 3 seconds) before continuing to the next one. After reaching the last test point in the series, it loops back to the first test point and will continue testing for all points that have not yet met the stop criterion until the maximum test time has been reached.
2. A **Maximum point time** can be set when **Run in loops** is unchecked/disabled. In this instance, each test point (frequency) will only be tested once for the set point time before it times out, unless it meets the stop criterion prior.
3. Selecting **Include DP criteria as stop criteria** results in the system measuring a specific point for no longer than needed to meet the DP criteria as setup on the next tab.
4. Checking **Enable pass/refer** results in the system labeling an overall test as either a **Pass** or **Refer** based on user defined **DP criteria**. If the measurement is stopped before completion of the test, **Incomplete** will appear on the label.

When **Enable pass/refer** is checked the following disclaimer window will appear. You must press **Accept** to continue creating a pass/refer protocol.



5. The **Minimum number of points required for a pass** must also be set. The overall Pass or refer result will depend whether the minimum number of individual frequencies reached the DP criteria. The overall result may also depend on whether all mandatory test points have reached the DP criteria as well (see item 12 below for more information).
6. Selecting **Include residual noise as stop criterion** causes the system stop testing at a frequency for which the residual noise has reached its indicated residual noise floor. The measurement at the specific frequency is considered to be so silent that a DPOAE would have been detected, if it were present. Measurements that reach the noise floor will stop testing and the result will indicate that the DP criteria was not met for the individual point.



Common test settings

Stop criteria DP criteria DP reliability Display

1 ☒ Run in loops 2 Max point time: Unlimited
Max test time: 30 Seconds

3 ☒ Include DP criteria as stop criteria

4 ☒ Enable Pass/refer Minimum number of points required for a pass 5 4

6 ☒ Include residual noise as stop criterion

DP criteria

Under the **DP criteria** tab both pass/detection and stop criteria are defined for each individual added frequency point. **Include DP criteria as stop criteria** and **Enable Pass/refer** from the **Stop criteria** tab use the settings here to determine whether a measured point meets the stop criteria. Note that all criterion in the row for the selected frequency must be met in order for be detected. Each individual criteria on its own is not sufficient.

7. To change more than one frequency's settings at the same time, use the **check boxes** beside the required frequencies. Check the box next to **f2** to select or de-select all frequencies in the list.
8. **Min. DP lvl.** Is the minimum level (in dB SPL) that an OAE must be measured at for it to meet the stop criteria.
9. **SNR** is the minimum signal to noise ratio that must be reached to meet the stop criteria. The signal to noise ratio (in dB) is the difference between the DPOAE level and the residual noise level.
10. **DP tolerance** defines how stable the OAE level must be over time in order for it to meet the stop criteria. The **DP tolerance** can be set to off, $\pm 2\%$ or $\pm 4\%$.
11. **Residual noise** allows you to define at which level the residual noise is considered to be so silent that a DPOAE would have been detected, if it were present. When the measured residual noise reaches the defined level, the measurement is stopped. Therefore, test time can be saved by enabling this feature.
12. **Required for pass** is where you define which measurement points are mandatory to reach a pass when **Enable Pass/refer** is checked for an overall result.

7 DP criteria 8 9 10 11 12

☐ f2	Min. DP lvl.	SNR	DP tolerance	Residual noise	Required for pass
☐ 500	-10	6	± 4 dB	-20	☐ Mandatory
☐ 1000	-10	6	± 4 dB	-20	☒ Mandatory
☐ 1500	-10	6	± 4 dB	-20	☒ Mandatory
☐ 2000	-10	6	± 4 dB	-20	☐ Mandatory

DP reliability

The **DP reliability** tab indicates and allows you to set how reliable the DPOAE measurement must be in order to allow the system to accept the measurement as a true DPOAE. Basically, the OAE is compared to the noise surrounding it and then the reliability represents the chance that the OAE is indeed not part of the noise. For this comparison, it is assumed that the noise is normally distributed.

13. **DP reliability** indicates the reliability percentage that has been set.



14. The **slider** allows you to set the DP reliability percentage. The lower the percentage, the faster testing can occur, however the reliability of the measurement will be less. The options available are:

- 98%
- 99%
- 99.9%
- 99.99%

By default, the DP reliability is set to 98%. For diagnostic testing we recommend using a reliability of at least 99.9% because that allows making conclusions for individual measurement points.

Display

Under the **Display tab**, options are available for setting how the results will be displayed on the test screen.

15. Under **Ears**, you can select:

- **Monaural view** – displays one ear at a time on the test screen
- **Binaural view** – displays both ears on the test screen
- **Summary view** – displays the test summary and point summary tables on the test screen. This option is only available when **monaural view** is selected.

These views can also be toggled temporarily on the test screen using the **monaural/binaural view** and/or **summary view** icons.

16. Under **Details**, you can select:

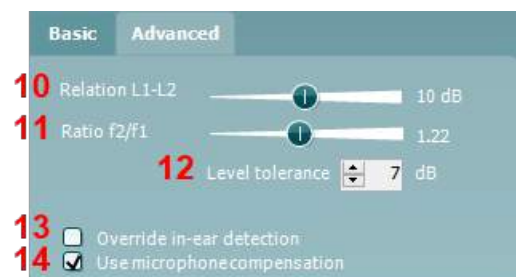
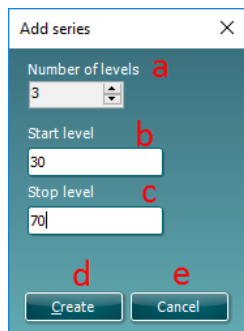
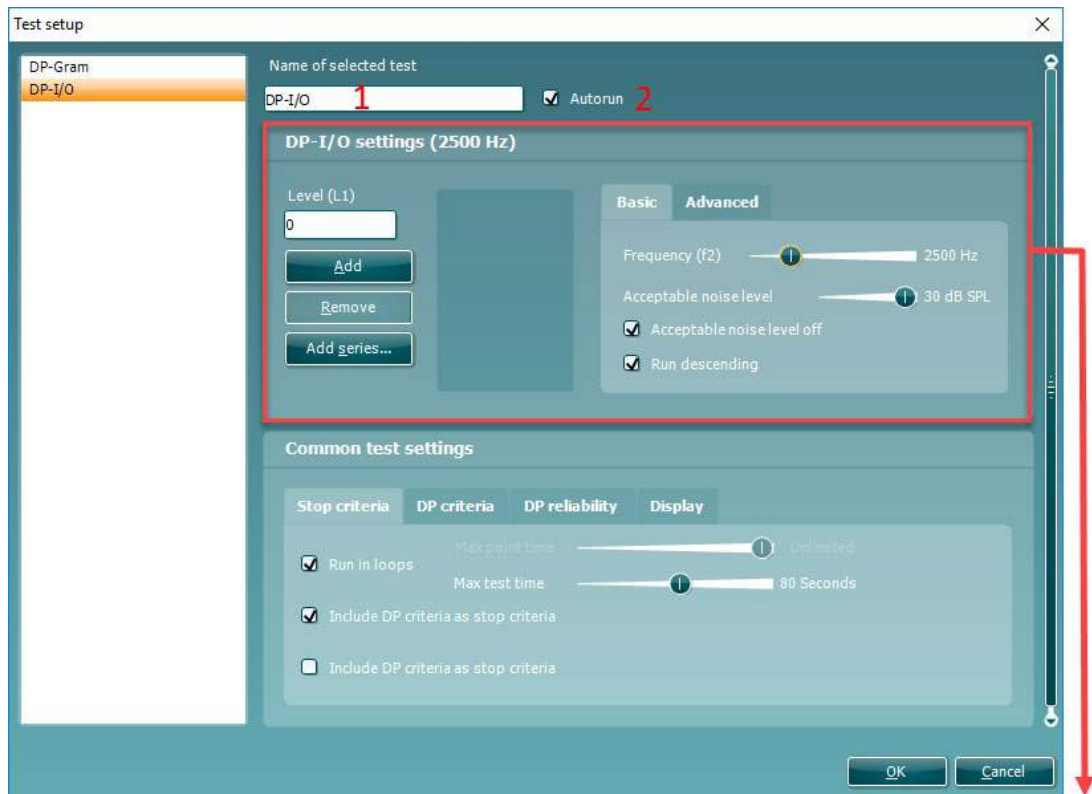
- **Probe check graph** – displays the probe check graph on the test screen
- **Response graph** – displays the response graph on the test screen
- **Basic view** – displays a simple bar view of the result
- **Advanced view** – displays a detailed view of noise and OAE response points on the graph



2.5.3 DP-I/O settings

The following options are available in the **DP-I/O** test:

1. **Name of selected test.** You can choose to have more than one of the same type of tests in your protocol. You may therefore want to give each test an individual name, so it will be easier to recognize when running the complete test protocol.
2. The **Auto run** checkbox defines which tests will run automatically, one after the other, when START is pressed. Note that when a protocol is used on the hand held unit, all tests will always be executed in the order they are in the protocol setup.



3. The **L₁** levels to be used in the DP-I/O test are added to the intensity levels listing after typing them in and pressing **Add**.
4. Pressing **Add series...** opens the **Add series** window in which a series of intensity levels can be added in the following way:
 - a) At **Number of levels** type in the number of intensities that you like to be part of the series
 - b) Define the **Start level**
 - c) Define the **Stop level**
 - d) Press **Create** to add the series to the intensity level listing
 - e) Press **Cancel** to cancel out of the **Add series** window.

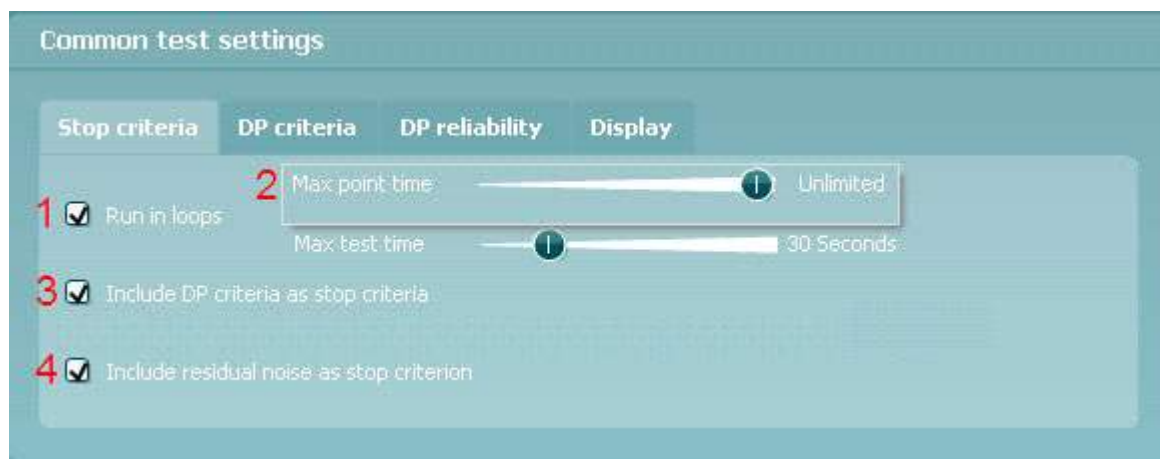


5. Press **Remove** to delete a selected intensity from the list.
6. **Frequency (f2)**, (under the **Basic** tab) defines the frequency to be used in the Input/Output test. Use the slider and the right and left arrow keys on your keyboard to set the **f2 frequency**.
7. At **Acceptable noise level** set the initial acceptable noise level limit between -30 and +30 dB SPL above which recordings are considered to be too noisy. During testing the Acceptable noise level can be changed using the slider bar on the control panel.
8. Checking the **Acceptable noise level off** box will disable the rejection of any recordings even when there is too much noise in the recording.
9. Activating **Run descending** makes the testing run from the highest down to lowest intensity. By default this option is enabled and the testing starts from the highest to the lowest intensity.
10. The **Relation L1 – L2** (under the **Advanced** tab) sets the difference in intensity level between the two stimuli (in dB).
11. The **Ratio f2/ f1** sets the ratio relationship between the frequencies of the two intensities. .
12. The **Level tolerance** defines the range in within the presented intensity of the stimuli are still acceptable. The number indicates the allowed difference in both positive and negative direction from the intensity settings. More information about this can be viewed in the **Response & zoom graph**.
13. When **Override in-ear detection** is checked, ear canal volume is not considered for the stimulus. Instead the protocol will use a 711 coupler calibration as reference for the stimulus level. This functionality can be useful when in-ear detection is not possible to achieve because of a perforated eardrum or a PE-tube.
14. When the checkmark **Use microphone compensation** is checked, a method of stimulus control is activated to ensure accurate stimulus levels for small as well as large ear canals. For technical purposes, e.g. when testing the equipment against IEC 60645-6, the method can be deactivated.

2.5.3.1 DP I/O common test settings

The common test settings area is divided into four tabs – **Stop criteria**, **DP criteria**, **DP reliability**, and **Display**. The following options within each tab are described below.

Stop criteria



1. When **Run in loops** is selected, the **Max test time** option is available. Here you define how long the total DP-I/O test may take until it stops automatically by using the slider. Each test point (intensity) will be measured for a short period of time (approx. 3 seconds) before continuing to the next one. After reaching the last test point in the series, it loops back to the first test point and will continue testing for all points that have not yet met the stop criterion until the maximum test time has been reached.
2. A **Maximum point time** can be set when **Run in loops** is unchecked/disabled. In this instance, each test point (intensity) will only be tested once for the set point time before it times out, unless it meets the stop criteria prior. The user can manually force the test to continue to the next point by right clicking on the graph and clicking on **Next measurement point** in the drop down list.



3. Selecting **Include DP criteria as stop criteria** results in the system measuring a specific point for no longer than needed to meet the DP criteria as set on the next tab.
4. Selecting **Include residual noise as stop criterion** causes the system stop testing at a intensity for which the residual noise has reached its indicated residual noise floor. The measurement at the specific intensity is considered to be so silent that a DPOAE would have been detected, if it were present. Measurements that reach the noise floor will stop testing and the result will indicate that the DP criteria were not met for the individual point.

DP criteria

Under the **DP criteria tab** both detection and stop criteria are defined for each individual added frequency point. **Include DP criteria as stop criteria** and **Enable Pass/refer** from the **Stop criteria tab** use the settings here to determine whether a measured point meets the stop criteria. Note that all criteria in the row for the selected frequency must be met in order for it to be detected. Each individual criterion on its own is not sufficient.

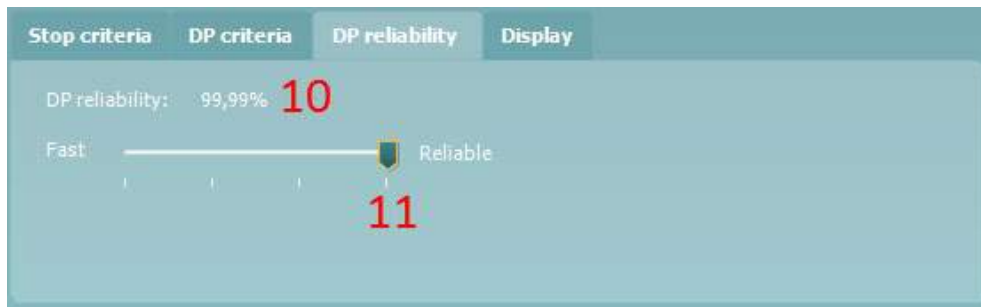
5. The **f2** column displays the test frequency for the DP-I/O test.
6. **Min. DP lvl.** Is the minimum level (in dB SPL) that an OAE must be measured at for it to meet the stop criteria.
7. **SNR** is the minimum signal to noise ratio that must be reached to meet the stop criteria. The signal to noise ratio (in dB) is the difference between the DPOAE level and the residual noise level.
8. **DP tolerance** defines how stable the OAE level must be over time in order for it to meet the stop criteria. The **DP tolerance** can be set to off, $\pm 2\%$ or $\pm 4\%$.
9. **Residual noise** allows you to define at which level the residual noise is considered to be so silent that a DPOAE would have been detected, if it were present. When the measured residual noise reaches the defined level, the measurement is stopped. Therefore, test time can be saved by enabling this feature.

DP reliability

The **DP reliability tab** indicates and allows you to set how reliable the DPOAE measurement must be in order to allow the system to accept the measurement as a true DPOAE. The OAE is compared to the noise surrounding it and then the reliability represents the chance that the OAE is indeed not part of the noise. For this comparison, it is assumed that the noise is normally distributed.

10. **DP reliability** indicates the reliability percentage that has been set.
11. The **slider** allows you to set the reliability percentage. The lower the percentage, the faster testing can occur, however the reliability of the measurement will be less. The options available are:
 - 98%
 - 99%
 - 99.9%
 - 99.99%

By default, the DP reliability is set to 98%. For diagnostic testing we recommend using a reliability of at least 99.9% because that allows making conclusions for individual measurement points.



Display

Under the **Display** tab, options are available for setting how the results will be displayed on the test screen.

12. Under **Ears**, you can select:

- **Monaural view** – displays one ear at a time on the test screen
- **Binaural view** – displays both ears on the test screen
- **Summary view** – displays the test summary and point summary tables on the test screen. This option is only available when **monaural view** is selected.

These views can also be toggled temporarily on the test screen using the **monaural/binaural view** and/or **summary view** icons.

13. Under **Details**, you can select

- **Probe check graph** – displays the probe check graph on the test screen
- **Response graph** – displays the response graph on the test screen



2.6 General setup

The General setup is accessed by going to **Menu | Setup | General setup**.

Here, the following options are available to setup:

1. **Selected DPOAE norm data** allows you to select the norm data category you wish to display on the screen (Newborn, Male, Female, None). The Lower limit and Upper limit of the norm data can also be selected.
2. **Icons on graph** allow you to select whether or not to show the **timeout symbol**, the **noise floor symbol (min. level reached)** or the **DP found checkmark symbol** on the advanced DP-Gram graph or DP-I/O graph.
3. **Startup ear** allows you to select which ear the program will always start on as default. The selected startup ear applies to all modules.
4. The **Print button** can be set up to automatically print to PDF.
 - Check the **PDF print enabled** box to set the print icon to print to PDF functionality
 - Check the **Open after print** box to open the PDF document after printing
 - Select the **File location** to where the PDF document should be saved
 - Select **PDF filename configuration** to define the name of the file. Selecting the button will open another window to set the fields defining the name of the PDF file

Use the arrow keys to add fields to the file name. The adjustable delimiter will separate the different fields from one another.



2.7 User guide

The User Guide setup is accessed by going to **Menu | Setup | User guide setup**

The default setup for the User Guide has preselected guidance pictures and text.

Select guide pictures and test instructions and **Show user guide when module starts** to display the user guide upon start.



The following options are available:

1. Right clicking on a **Picture** allows you to add a new picture to assist with guidance. A Microsoft window will open allowing you to select pictures stored elsewhere on your PC. Navigate to and select the desired image and then click Open. The picture will be replaced with your chosen one.
2. The **Text** can be edited the text in the text box by simply placing the cursor in the white box with your mouse.
3. There are four available guidance pictures with text. Uncheck **Show** on the ones you do not want shown when the User guide is displayed.
4. Uncheck **Show user guide when module starts** if you do not want the User Guide to appear on the screen each time the module starts.
5. **Reset guide** allows you to reset the guide pictures and text to the default settings as when the software was installed
6. Pressing **OK** will accept any changes made and will close down the User Guide setup
7. **Cancel** will close down the User Guide setup without saving any changes made.



2.8 Temporary setup

The **Temporary setup** can be accessed in two ways and allows you to make temporary changes to the protocol currently shown in the protocol drop down list.

- Go to **Menu | Setup | Temporary setup**



- Click on the Temporary setup icon on the control panel

When a temporary change has been made to a protocol, the protocol name will then appear with an asterisk next to it. If data is measured before you enter temporary setup you are prompted to save or discard the data. In temporary setup the same options are available as in the normal protocol settings.

2.9 Norm data setup

The Norm data setup is accessed by going to **Menu | Setup | Norm data setup...**

By default, there is no norm data stored in the module. You may wish to collect data on a normal group of patients and create a norm data table that can be used to display a shaded norm data area on the DP-Gram graph.

The screenshot shows the 'Norm data setup' window. It has a title bar 'Norm data setup' and a close button. Inside, there's a tab 'DPOAE norm data'. Below the tab, there's a 'Select data sheet' dropdown menu with 'Norm data' selected (callout 1). To the right of the dropdown are 'New' (callout 2) and 'Remove' (callout 3) buttons. Further right are 'Import' (callout 4) and 'Export' (callout 5) buttons. Below these are input fields for 'F2 [Hz]', 'DP Hz', 'Mean', 'Stdv', 'P50', 'P1', 'P5', 'P10', 'P99', 'P95', and 'P90', each with a '0' value. Below these fields are 'Add row to' (callout 6) with a dropdown menu showing 'Male', 'F2/F1' with '1,22', 'L1' with '0', and 'Stimulus level' with '0'. To the right of these are 'Clear' (callout 7), 'Add/Save' (callout 8), and 'Delete' (callout 9) buttons. At the bottom are 'OK' and 'Cancel' buttons. A table with the same column headers as the input fields is shown at the bottom of the window.

The following explains the various options in the Norm data setup window:

- Select data sheet** allows you to select the data sheet to be used by the DPOAE module for displaying a shaded norm data area on the DP-Gram graph.
- New** allows you to create a new norm data sheet.
- Remove** allows you to delete a created norm data sheet.
- Import** allows you to import norm data from an excel spreadsheet.
- Export** allows you to export a norm data sheet to an excel spreadsheet.
- This section is where you enter the test parameters and result information. You can specify that the data relates to Males, Females or Newborns under the **Add row to** drop down box.
- Clear** removes all data entered into the fields in item 6.



8. **Add/Save** adds the entered information into a row in the data sheet.
9. **Delete** allows you to delete a selected row from the data sheet.
10. **OK** saves any changes to the data sheet and returns you to the test screen.
11. **Cancel** closes the Norm data setup window and returns you to the test screen without saving and changes.

2.10 PC Shortcuts

For quick operation from the keyboard the following hotkeys are available:

L	-	switch to left ear
R	-	switch to right ear
Space	-	start or stop
A	-	select or deselect all tests of a protocol
T	-	go into temporary settings
Ctrl S	-	save and new
Ctrl P	-	print
Ctrl N	-	delete all data and start new measurement
Page up	-	go one up in saved sessions
Page down	-	go one down in saved sessions
Arrow up	-	go one test up within the protocol
Arrow down	-	go one test down within the protocol
Arrow right	-	select next measurement point/jump to next point while testing
Arrow left	-	select next measurement point/jump to previous point while testing
Ctrl Shift L	-	saves probe check information in an xml file to the desktop



3 TEOAE

3.1 About TEOAE module

The Lyra with TEOAE is intended for use in the audiologic evaluation and documentation of ear disorders using Transient Evoked Otoacoustic Emissions. The target population for Lyra with TEOAE includes all ages.

The Lyra with TEOAE is designed to be used only by skilled personnel such as audiologists, ENT surgeons, doctors, hearing healthcare professionals or personnel with a similar level of education. The device should not be used without the necessary knowledge and training to understand its use and how results should be interpreted.

The TEOAE contains the following tests:

- TEOAE

Availability of these tests or specific settings within these tests are dependent on the hardware or license purchased.

3.2 Preparing for the test

3.2.1 Regular probe test

Probe performance is crucial to TEOAE test results. We recommend that you conduct a probe test regularly to ensure that the probe is functioning correctly.

Refer to the probe test quick guide for further instructions.

3.2.2 TEOAE patient instruction

Place the patient on a comfortable chair or on an examination table if necessary. Small 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 test the hearing organ for its functionality
- The probe will be inserted into the ear canal and has to make a good seal
- A click sound will be heard during the test
- No participation is expected from the patient
- Coughing, moving, talking and swallowing will disturb test results

3.2.3 Visual inspection of the ear canal

Otoscopy should be performed to inspect the ear canal for wax/cerumen or other debris, or for any anatomical abnormalities. The ear drum should be inspected for a possible perforation. The outer ear is where the recording of OAEs begins and ends, so it is important to be aware of any pathologic or non-pathologic conditions that may affect testing.

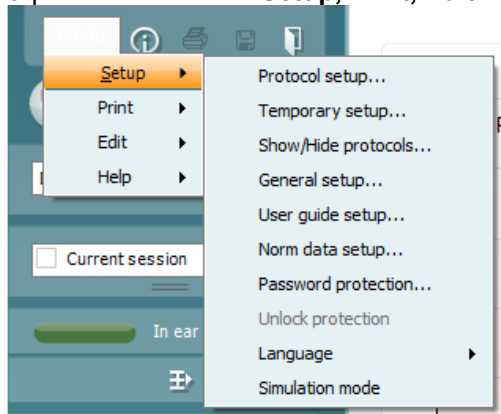
3.2.4 Test environment

OAE testing should be conducted in a quiet test environment as constant or intermittent background noise can prolong test times or lead to incorrect results.



3.3 The TEOAE menu items

Menu provides access to **Setup**, **Print**, **Edit** and **Help**.



Menu | Setup | Protocol setup - view protocol settings, create custom test protocols, or copy and edit the default protocols. If data is measured before you enter the protocol setup, you are prompted to save or discard the data.

Menu | Setup | Temporary setup – change protocol the selected test protocol temporarily. If temporary changes are made to a protocol, its name appears ending with an asterisk. If data is measured before you enter temporary setup you are prompted to save or discard the data. In temporary setup the same options are available as in the normal protocol settings.

Menu | Setup | Show/hide protocols – show or hide protocols from the dropdown menu.

Menu | Setup | General setup - set norm data preferences, the default startup ear and print to PDF options.

Menu | Setup | User guide setup – edit the pictures and instructions displayed in the user guide.

Menu | Setup | Norm data setup – customize and import/export OAE normative data.

Menu | Setup | Password protection – activate or deactivate password protection for the suite. When activated, users cannot enter the **Protocol setup**.

Menu | Setup | Unlock protection – temporarily disable password protection.

Menu | Setup | Language – allows selection of one of the available languages. The language selection change will come into effect after the IA OAE Suite software is shutdown and restarted.

Menu | Setup | Simulation mode – activate the simulation mode to run a simulation of the test protocols and view simulated OAE measurements.

Menu | Print | Print – print the current measurement using the print template that is linked to the current protocol. A print window will open allowing printer selection or setting changes before printing. You will be prompted to select a template if the protocol did not have a linked template.

Menu | Print | Print preview – see a preview of the current measurement using the print template that is linked to the current protocol. Note that you are prompted to select a template if the protocol did not have a linked template.

Menu | Print | Print wizard – open the print wizard to select or create a template for printing the current measurement.

Menu | Edit – export the data to an XML file.



Menu | Help | About – displays a dialog window showing the following information:

- IA OAE Suite software version
- Build version
- Firmware version
- Copyright information

Further, you can reach the Interacoustics website from this window by clicking on the link to www.interacoustics.com

By pressing the **License** button you are able to change the license keys of the device. The license keys for the device are specific for each serial number and define which modules, tests, protocol settings and other functionalities are available. Never change the license key without help of an authorized technician

Menu | Help | Documents – provides access to the digital versions of the Instructions for Use Manual and Additional Information manual (Adobe Reader required).



3.4 General operation of TEOAE

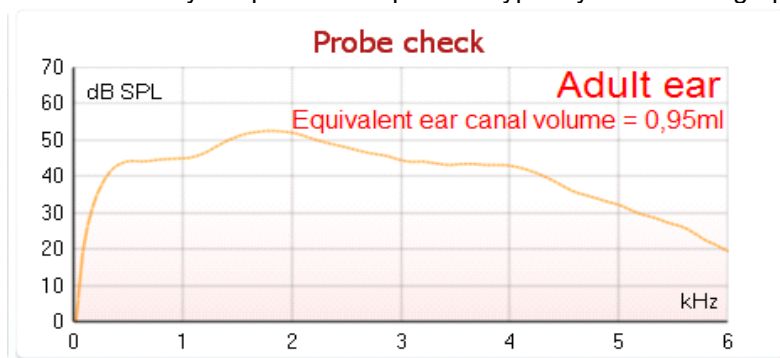
3.4.1 Probe check

The probe check graph provides visual feedback about the quality of the probe fit in the ear. The probe fit is assessed using a broadband stimulus and the corresponding probe check graph can help to indicate a leak or a blocked probe. A good probe placement has been achieved when the probe check graph shows a relatively flat response curve over a wide frequency area.

The following paragraphs give a few ideas about the information that can be gained from the **probe check graph**.

The **probe check graph** will appear on the display if it has been selected in the protocol setup.

The stimulus that is used for the probe check is a broad band click. It is calibrated to give a reasonably flat response between 200Hz and 8000Hz when measured by calibration equipment. When presented in the ear and recorded by the probe microphone it typically results in a graphic like the one shown below.



It is generally said that when the best probe placement is achieved, the probe check will show a flat response over a wide frequency area. However, because the probe microphone is used for this monitoring, the intensities at the eardrum will be slightly different from those displayed on the graph. A relatively flat spectrum from 500 Hz to 4000 Hz indicates a good probe fit.

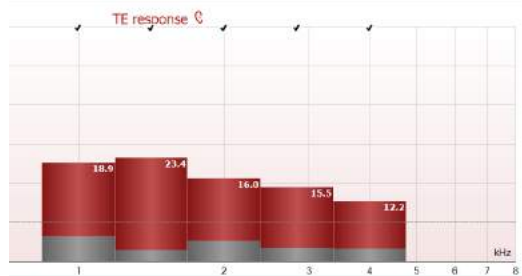
Looking at the low frequency area of the graph will also give you information about whether or not the probe is in the ear.



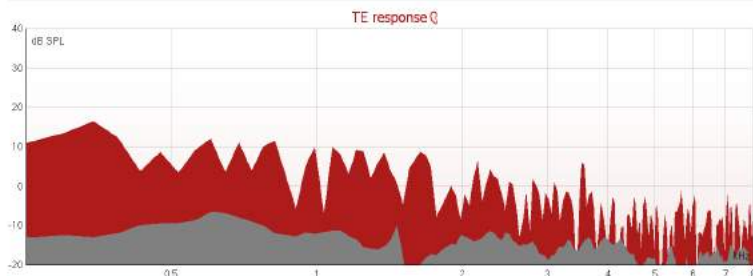


3.4.2 TE response graph views

The TEOAE response graph can be shown in **basic view**, **advanced view** or **FFT view**. Your preference for these views is defined in the protocol setup and can also temporarily be changed in the temporary settings.



Advanced view



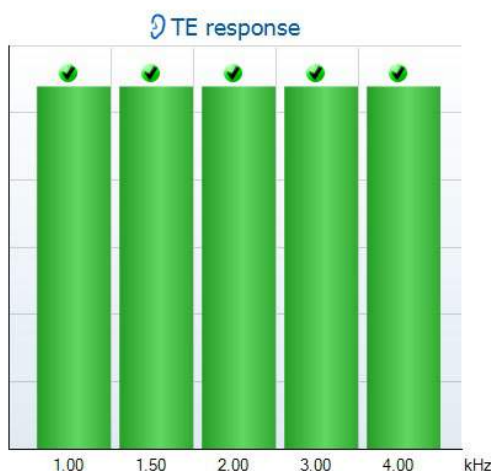
FFT view

3.4.2.1 TE response graph basic view

The following information can be found in the TEOAE **basic view**:



Basic view with Pass



Basic view without Pass/Refer label

1. **Pass** or **Refer** is displayed above the measurement as soon as the result is available. A user defined Pass/Refer criteria can be enabled within the protocol setup. When **Enable Pass/refer** is used, if the measurement is stopped before completion of the test, **Incomplete** will appear in the label
2. The **Bar representation** shows the progress over time for each frequency measured in a bar graph format. When a bar becomes completely filled and changes to green, it has reached the stop criterion set in the protocol. Those bars that do not meet the stop criterion will remain in the color of the selected ear (red or blue)
3. **Check marks** above the green bars indicate that those frequencies have reached their stop criterion. When a user defined Pass/refer protocol has been created, although several bars might turn green it does not necessarily mean that it will result in a pass. For example, within the protocol setup it can be specified that particular frequencies are mandatory for reaching an overall pass or other settings may determine that the test does not pass (e.g., Total OAE).



3.4.2.2 TE response graph advanced view

The following information can be found in the TEOAE **advanced view**:



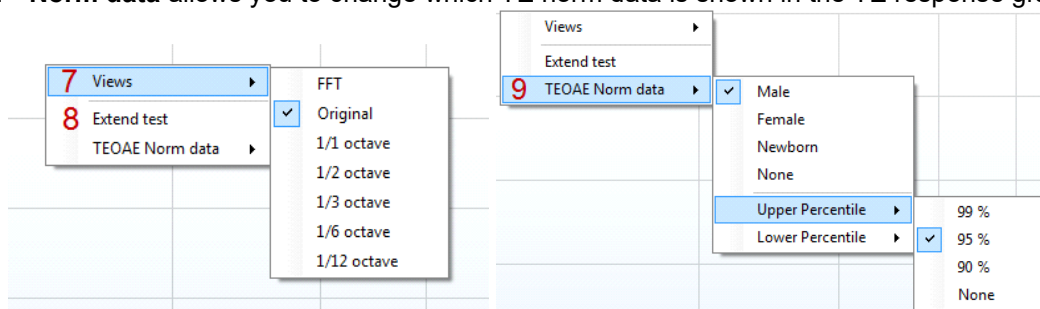
- The result can be labeled with **Pass** or **Refer** and is indicated above the measurement as soon as the result is available. A user defined Pass/Refer criteria can be enabled within the protocol setup. When **Enable Pass/refer** is used, if the measurement is stopped before completion of the test, **Incomplete** will appear in the label.
- Each bar indicates the **frequency band width**, the **level of signal (OAE)** and the **level of noise** in dB SPL. The **signal (OAE)** in each frequency band is displayed in either red/blue depending on the ear (right/left) selected. The **noise** in each frequency band is displayed in gray.
- Hovering the mouse over a **bar** allows you to see the following details for that point:
 - Measured** indicates the number of **sweeps** that were measured to get to the current result
 - Rejected** indicates the number of **sweeps** that were rejected due to too much noise
 - Band center** refers to the center frequency (in kHz) for the selected bar
 - Band start** refers to the starting band frequency (in kHz) for the selected bar
 - Band end** refers to the stopping band frequency (in kHz) for the selected bar
 - TE SNR** indicates the difference between the absolute value of the TEOAE and the noise floor for the specific band. This difference is called the signal to noise ratio. Note that calculations are done with raw numbers after which rounding off takes place. Therefore the mathematical difference between the presented TE level and Noise level might differ slightly from the given number
 - TE level** indicates the absolute value of the TEOAE in dB SPL
 - Noise level** indicates the average noise level (in dB SPL) for the selected band
 - Time used** displays the number of seconds that was spent measuring the selected band
 - Fail reason** indicates why the entire measurement did not meet the specified criterion as set in the protocol. Reasons displayed include:
 - Min. bands** meaning that the specified minimum no. of bands for a pass was not reached
 - Min. sweeps** meaning that the specified minimum no. of sweeps was not reached
 - Total OAE** meaning that the minimum total OAE value was not reached.
- The **noise** is indicated in each bar in gray. The distance between the noise floor and the top of the bar defines the TE signal to noise ratio.
- The **TE found checkmark symbol**, a black checkmark, indicates that this individual bar met its specified criterion.



6. Optionally, **TE norm data** can be imported or added to the software and is shown by two solid lines. The top line is the upper percentile and the bottom line is the lower percentile as selected in the **General setup**. The norm data can be used to indicate where TEOAEs might be expected for a normal population. Within the **General setup** you can define whether or not to display the norm data area.

Using the right mouse click on the **TE response graph** gives the following additional functions:

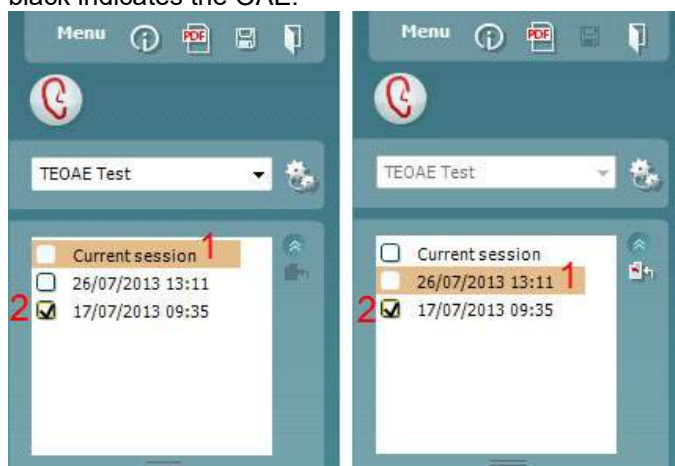
7. **Views** allows toggling from the **Original view** to **FFT view, 1/1, 1/2, 1/3, 1/6 or 1/12 octave band view**.
8. **Extend test** allows continued testing after the test has ended on its own or been manually stopped. The counter will count up in time from the already elapsed testing time without a time limitation. Press **Stop** to stop testing. Extend test is only available when the protocol is not enabled for PASS/REFER.
9. **Norm data** allows you to change which TE norm data is shown in the TE response graph.



3.4.3 Comparing TEOAE data (historic overlay)

Two TEOAE sessions can be compared using the overlay function. This can be either the current session and a historic session or two historic sessions.

1. Highlight the first session for comparison by clicking on the date or Current session text. This will display the TEOAE bands for the selected session.
2. Select the session for comparison by checking the box beside the session date/time. The overlaid session appears as a thin bar in grey and black. The lighter grey color indicates the noise, while the black indicates the OAE.





Note, when the first session for comparison is selected, only comparable sessions show an active checkbox. Sessions from *Titan*, *Lyra* and *Eclipse* can be compared if the same protocol/parameters are used.



Sessions that are not compatible for comparison cannot be selected. This includes:

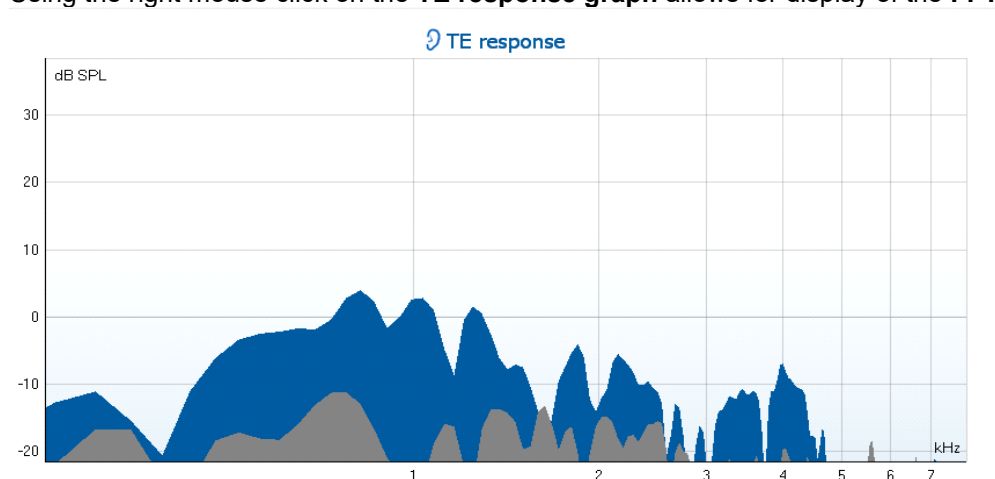
1. Sessions where a Pass/Refer label is given (as enabled in the protocol setup)
2. Sessions testing differing frequency bands (e.g., center vs custom)

3.4.4 Printing the overlaid sessions

When the historic overlay function is used on the test screen, the overlaid graph will automatically appear on the print template. The TE band summary and TE test summary table information on the printout reflects the session that was selected first.

3.4.5 TE response graph FFT view

Using the right mouse click on the **TE response graph** allows for display of the **FFT view**.

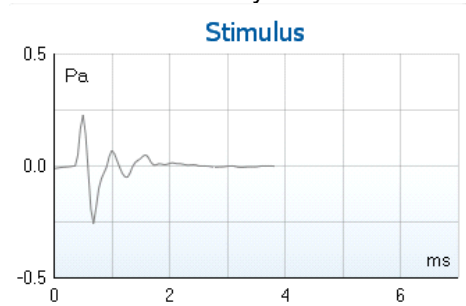




3.4.6 Stimulus graph

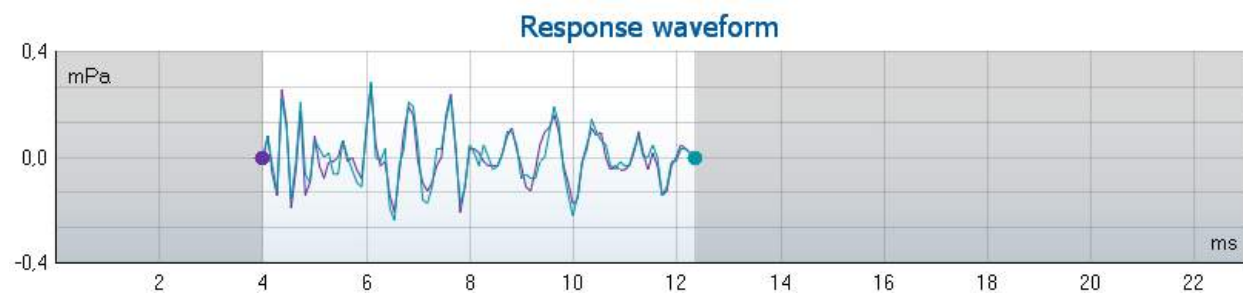
The **stimulus** graph displays the click stimulus being presented to the ear as a function of magnitude (Pa) over time (ms).

The **scroll wheel** of your mouse allows for **zooming in and out** with respect to the magnitude (y) axis.



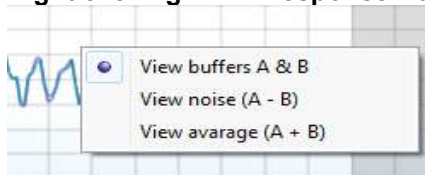
3.4.7 Response waveform graph

The **TE response waveform graph** shows the two superimposed averaged OAE waveforms (in light blue and purple). The waveforms are displayed as a function of magnitude (mPa) over time (ms). The waveform reproducibility percentage is derived from the correlation between these two overlaid waveforms.



1. **Clicking** on the aqua or purple circles at the end of each waveform and moving the mouse, allows for separation of the curves within the graph
2. The **scroll wheel** of your mouse allows for **zooming in and out** with respect to the magnitude (y) axis
3. The area outside the recording window is greyed out. The **recording window** start and stop time can be changed in the protocol setup

Right clicking on the **response waveform graph** allows for changing the display.



4. **View buffers A & B** is the default view showing the two superimposed averaged OAE waveforms
5. **View noise (A - B)** displays the noise in the waveform (Noise = A buffer - B buffer)
6. **View average (A + B)** displays the mean of the A and B waveforms



3.4.8 Test summary table

The test summary table is updated during testing and displays information about the TEOAE measurement recorded.

Test summary		
1	Stimulus level	83 dB peSPL
2	Stimulus type	Non linear click
3	Stimulus stability	-
4	No. of accepted sweeps	(80) 11
5	No. of rejected sweeps	-
6	Response reproducibility	-
7	Total OAE	-
8	A & B mean	-
9	A - B diff	-
10	No. of detected bands	-

The following information is displayed in the **test summary table**:

1. **Stimulus level** displays the protocol defined stimulus level in dB peSPL.
2. **Stimulus type** displays the click stimulus used for testing – **Linear** or **Non-linear click**.
3. **Stimulus stability** is displayed as a percentage and indicates the change between the stimulus level at the beginning of the measurement period and the subsequent level at a set point in time during the measurement. A stimulus stability of 90% or greater indicates a change in stimulus level of less than 1 dB throughout testing. A stimulus stability of 79% indicates a change of approximately 2 dB in stimulus level and a stimulus stability of 59% indicates a change of approximately 3 dB in stimulus level during testing.
4. **No. of accepted sweeps** displays the number of sweeps accepted and processed. Sweeps are only accepted if they are below the **acceptable noise level** (if set).
5. **No. of rejected sweeps** displays the number of sweeps rejected. Sweeps are rejected if recorded above the **acceptable noise level** (if set).
6. **Response reproducibility** is displayed as a percentage and indicates the correlation between the averaged responses in the A and B buffer waveforms within the **waveform reproducibility window**.
7. **Total OAE** value is the total (energy) level of the correlated portions of A and B response waveforms after removing the uncorrelated portions, calculated from the entire recording window.
8. **A & B mean** is the sound pressure level of the average of the A and B waveforms.
9. **A - B diff** is the average difference between the A and B waveforms and gives an indication of the residual noise in the recording.
10. **No. of detected bands** indicates the number of bands detected as meeting the criteria for an OAE based on the criterion set in the protocol setup.
11. The **minimum test requirements** as defined in the protocol are displayed beside some of the items in the table. These **numbers in parentheses** change to a **check mark** when the minimum requirement has been met during testing.



3.4.9 Band summary table

The **band summary table** is updated during testing and displays **band** information about the TEOAE measurement recorded.

The following information is displayed in the **band summary table**:

Band summary

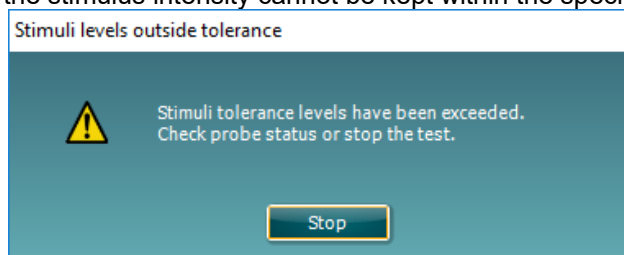
1 Frequency (kHz)	2 TE level (dB SPL)	3 Noise (dB SPL)	4 SNR	5 Detected
1.00	6.8	-11.8	18.6	✓
1.50	7.7	-10.6	18.3	✓
2.00	-2.9	-9.1	6.2	✓
3.00	6.2	-9.4	15.6	✓
4.00	5.6	-12.6	18.2	✓

1. **Frequency** displays the center frequency for each band in the test in kHz
2. **TE level** displays the overall TE level measured in dB SPL
3. **Noise** displays the noise for the specific band in dB SPL
4. **SNR** displays the signal to noise ratio
5. **Detected** displays a **check mark** when the specified band has met the criteria for a present TEOAE

3.4.10 Probe status and stimuli tolerance

Before and during testing, the probe status is monitored and the probe status bar will change color and indicate whether the probe is in ear, out of ear, blocked, leaking or too noisy.

During testing, the stimulus stability is constantly being monitored. The probe microphone monitors the output from the speaker, ensuring that the intensity output remains within a specified range (stimuli tolerance). When the stimulus intensity cannot be kept within the specified range, a pop-up will appear.



Typically, this indicates that a seal has been lost between the probe ear tip and the ear canal or has moved within the ear canal. Check the probe to ensure it is not blocked and/or replace the probe in the patient's ear if it has come loose.

When the probe is reinserted, the dialog box will automatically disappear once the stimuli tolerance has been reached and testing will continue.

If the stimuli tolerance cannot be met after replacing the probe in the patient's ear, the test must be stopped. Ensure a good probe placement in the patient's ear and then restart the test.



3.5 Protocol setup and criterion

Ensure that the protocol that you select or create is valid for the test population and for the expected clinical outcome. Protocols generally differ between those used for Newborn Hearing Screening where a clinical outcome is based on a single test versus those used in a diagnostic follow up situation where the OAE result forms part of an overall test battery approach where many tests are analyzed to form a conclusion.

The following section describes how to create a protocol in the protocol setup and provides some information about things to consider when setting various parameters.

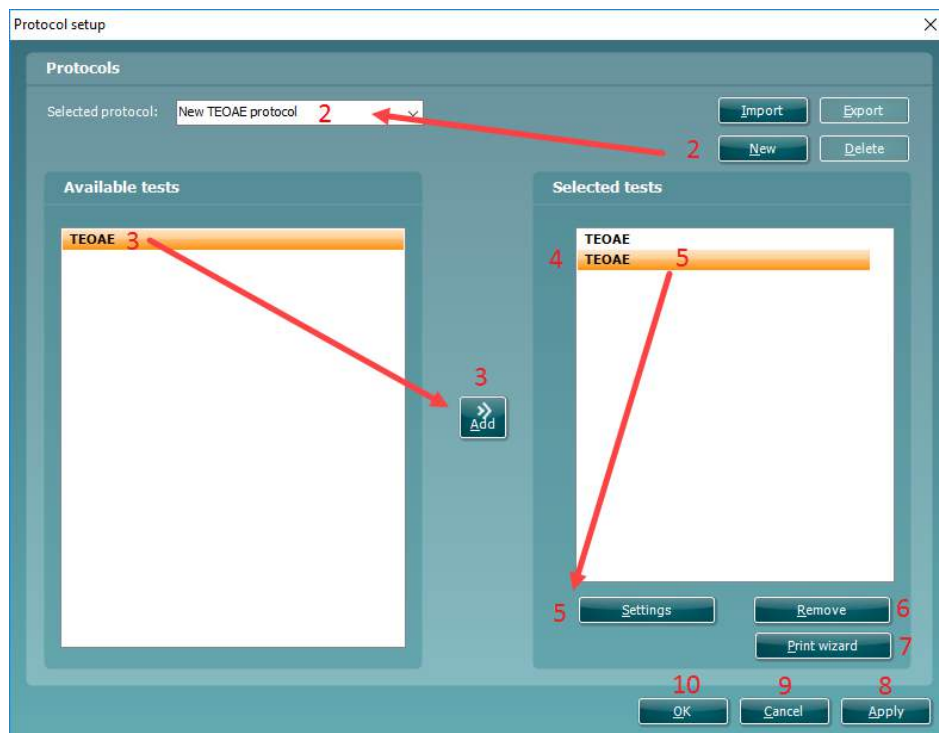
3.5.1 TEOAE protocol setup

To create or adapt your own personalized protocol you need to enter the **Protocol Setup** menu.

1. From the **TEOAE** tab, Select **Menu | Setup | Protocol Setup...**



2. Click on the **New** button and name your protocol.
 - a. You will be asked if you want to **create a copy of the selected protocol**. Select Yes, to copy the protocol settings of the selected protocol. Select No, to create the new protocol from default settings.
3. Select the test you want to include in your protocol from the list on the left and press **Add**. Alternatively, double click on the test you want to include. More than one TEOAE test can be included in a protocol.
4. Select the test on the right that you want to modify the settings for (it will be highlighted orange)
5. Double click on the selected test or click on **Settings** to enter the **Test setup** where protocol settings can be modified. Default settings are applied, but these can be changed.
6. The **Remove** button is used to remove a test from the **Selected tests** list.
7. The **Print wizard** button takes you to the area where a print layout can be created and/or linked to the selected protocol.
8. Pressing **Apply** will apply any new settings made or changed within a protocol.
9. Pressing **Cancel** will close the protocol setup window and return you to the testing screen without saving any changes.
10. Pressing **OK** closes the protocol settings window after automatically saving all changes.



3.5.2 TEOAE band settings

The following options are available in the **TEOAE** test:

1. **Name of selected test.** You can choose to have more than one of the same type of tests in your protocol. You may therefore want to give each test an individual name, so it will be easier to recognize when running the complete test protocol.
2. The **Auto run** checkbox defines which tests will run automatically, one after the other, when START is pressed. Note that when a protocol is used on the hand held unit, all tests will always be executed in the order they are in the protocol setup.
3. **Method** offers two frequency band creation options: **Center** and **Custom**.
 - **Center** allows for selecting the center frequency for testing. This test method is the most popular method used for TEOAE testing as each band stimulates approximately the same number of hair cells on the basilar membrane
 - **Custom** allows the ability to choose the start and stop frequency for each custom band (clinical version only). The custom method would typically be used by researchers
4. **Check boxes** allow you to select or deselect the frequency bands for testing when using the **Center** frequency band method.
5. The **Frequencies** column displays the selected frequency bands for testing.
6. The **Start** and **Stop** fields allow the free text entry of the start and stop frequency when using **Custom** bands.
7. Press the **Add** button after entering the **Start** and **Stop** frequency or press enter on the keyboard.
8. Press the **Delete** button to remove individual frequency bands selected with a checkmark.
9. Press the **Clear** button to clear all frequency bands from the frequencies list.
10. Select the preferred **Stimulus type** (under the **Basic** tab) from the dropdown list. **Non linear** or **Linear** click are available. A non-linear click stimulus is typically used in both screening and diagnostic OAE testing. Caution should be used when testing with a linear stimulus as it has more chance of producing artifact responses. If using a linear stimulus, the stimulus level for testing does not usually exceed 70-75dB SPL.
Please note that the linear click is licensed and might not be available in case the license was not purchased.
11. The **Stimulus level** slider bar allows selection of stimulus level for testing between 30-90 dB peSPL. When a stimulus level below 50 dB peSPL is selected, the probe check is disabled during testing.



Typical stimulus levels usual range from 80-84 dB SPL. If using a linear stimulus, the stimulus level for testing does not usually exceed 70-75dB SPL.

12. At **Acceptable noise level**, sets the initial acceptable noise level limit between +30 and +60 dB SPL above which recordings are considered to be too noisy. During testing the acceptable noise level can be changed using the slider bar on the control panel.
13. **Level tolerance** defines the range in which the presented stimulus is still acceptable. The number (in dB) indicates the allowed difference in both a positive and negative direction from the stimulus level. When the level tolerance exceeds the limit set, a warning is given on screen.
14. When **Override in-ear detection** is checked, ear canal volume is not considered for the stimulus. Instead the protocol will use a 711 coupler calibration as reference for the stimulus level. This functionality can be useful when in-ear detection is not possible to achieve because of a perforated eardrum or a PE-tube.



3.5.3 Common test settings for a TEOAE test

The common test settings area is divided into four tabs – **Stop criteria**, **TE criteria**, **Recording window**, and **Display**. The following options within each tab are described below.

Stop criteria

1. **Test: in seconds** allows defining the **maximum test time** from 30 seconds to 30 minutes. The **maximum test time** is how long the take may take until it stops automatically. Testing continues until the **maximum test time** has been reached unless the stop criterion for the test has been met.
2. **Test: in sweeps** allows defining the **maximum number of sweeps** from 300 to 30000. The **maximum number of sweeps** is how many sweeps may be collected until the test stops automatically. Testing continues until the **maximum number of sweeps** has been collected unless the stop criterion for the test has been met.

3. Selecting **Include TE criteria as stop criteria** results in the system measuring the frequency range for no longer than needed to meet the TE criteria as setup on the next tab.
4. Checking **Enable Pass/Refer** results in the system labeling an overall test as either a **Pass** or **Refer** based on user defined **TE criteria**. If the measurement is stopped before completion of the test, **Incomplete** will appear on the label. When **Enable Pass/Refer** is checked, the following disclaimer window will appear. You must press Accept to continue creating a pass/refer protocol. Ensure that the screening protocol is valid for the test population and meets the desired sensitivity and specificity.

5. The **Minimum number of bands required for a pass** must also be set. The overall Pass or Refer result will depend whether the minimum number of individual frequency bands reached the TE criteria. The overall result may also depend on whether all mandatory bands have reached the TE criteria as well.

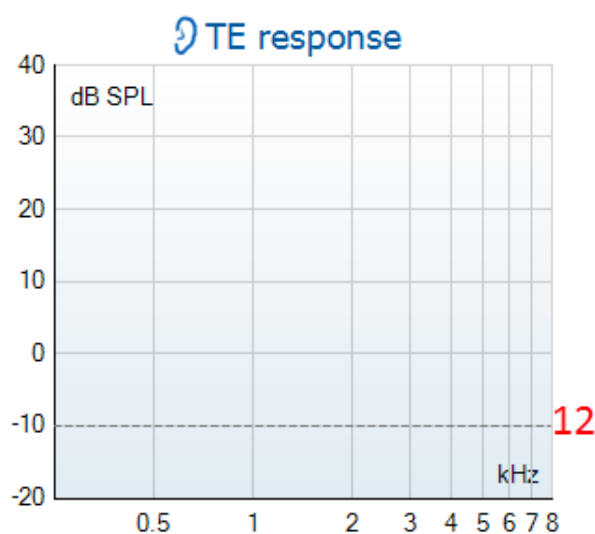


TE criteria

Under the **TE criteria tab** both pass and stop criteria are defined for each individual added frequency band. **Include TE criteria as stop criteria** and **Enable Pass/Refer** from the **Stop criteria tab** use the settings here to determine whether a frequency band meets the stop criteria, passes or refers. Note that all criterion in the row for the selected frequency band must be met in order for it stop, pass or refer. Each individual criteria on its own is not sufficient.

6. To change more than one frequency band's settings at the same time, use the **checkboxes** beside the required frequencies. Check the **select all** box next to **Frequency** to select or de-select all frequency bands in the list.
7. The **Frequency** column displays the frequency bands included for testing.
8. **Min SNR** is the minimum signal to noise ratio that must be reached to meet the stop criteria. The signal to noise ratio (in dB) is the difference between the TEOAE level and the noise level.
9. **Mandatory** defines which frequency bands are mandatory for the test to stop/pass.

10. At **Min. sweeps**, the minimum number of sweeps to be recorded during the test is defined. This can be set between 50 and 5000. It is recommended to collect a minimum of 80 sweeps to ensure enough good data can be analyzed to form a conclusion.
11. At **Min. total OAE**, the minimum total OAE to be recorded during the test can be defined. This can be set between Off, 0 and +30.
12. **Min. TE level** is the minimum level (in dB SPL) that an OAE must be measured at for it to meet the stop criteria. The min. TE level is displayed on the advanced graph by way of a dotted line. Setting a valid min. TE level ensures that low level artifact responses are not accepted as being an OAE response. This can be set between -10 and +5 dB SPL.





3.5.3.1 Recording window

The **Recording window** tab indicates and allows you to set the recording window and waveform reproducibility window.

Stop criteria TE criteria **Recording window** Display

Recording window

☒ 4 - 12.5 ms

☐ 4 - 23 ms (4 - 20 ms for Eclipse)

Stimulus rate
80.0 /sec

- The **recording window** range defines the time range from which the OAE is analyzed following the presentation of each click stimulus. It is possible to use a short or long recording window
 - **4 – 12.5 ms, short recording window (default)**
 - **4 – 23 ms, long recording window**
The starting time for the recording window is 4 ms to ensure that analysis of the OAE is not done during presentation of the stimulus or the artifact that follows
- The **stimulus rate** used for testing is updated automatically based on the length of the recording window used. The stimulus rate is the number of clicks presented to the ear per second

3.5.3.2 Display

Under the **Display** tab, options are available for setting how the results will be displayed on the test screen.

Stop criteria TE criteria Recording window **Display**

Ears 17

☐ Binaural view

☒ **Monaural view**

☒ Summary view

View TE 18

☒ Show SNR labels

☒ **Advanced view**

☐ Basic view

Additional views 19

☒ Stimuli & probe check

☒ Response waveform

- Under **Ears**, you can select:
 - **Monaural view** – displays one ear at a time on the test screen
 - **Binaural view** – displays both ears on the test screen
 - **Summary view** – displays the test summary and point summary tables on the test screen. This option is only available when **monaural view** is selected
- Under **View TE**, it is possible to select how the test results are displayed in the TE response graph.
 - **Show SNR labels** option is available when **Advanced view** is selected. **SNR labels** are displayed in the top right-hand portion of the frequency band
 - **Advanced view** displays the noise and OAE for each frequency band. Noise is displayed in gray and the OAE is displayed in the color of the selected ear (red/blue)
 - **Basic view** displays the progress over time for each frequency band measured. When a frequency band becomes completely filled and changes to green, it has reached the stop criterion set in the protocol. Those bars that do not meet the stop criterion will remain in the color of the selected ear (red or blue)
- Additional views** allows for displaying the **stimuli & probe check** and/or the **response waveform** on the test screen. Note that these options are only available when **Advanced view** is selected.



3.6 General setup

The General setup is accessed by going to **Menu | Setup | General setup...**

Here, the following options are available to setup:

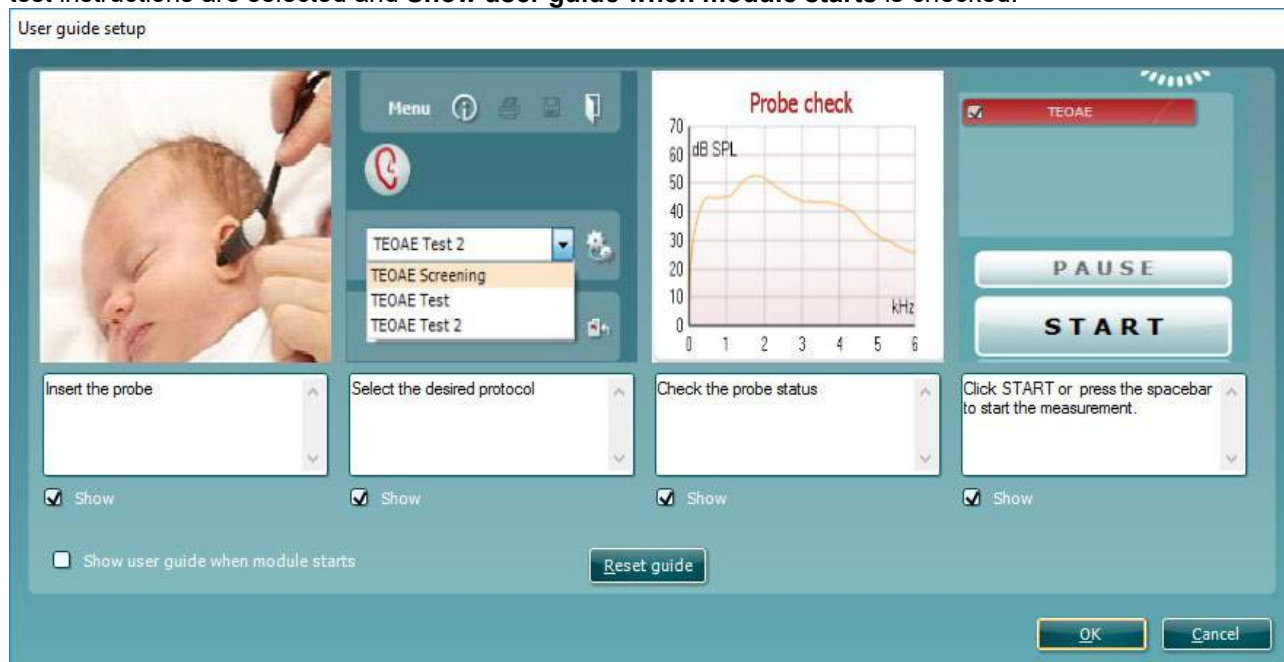
- 1 **Selected TEOAE norm data** allows you to select the norm data category you wish to display on the screen (Newborn, Male, Female, None). The Lower limit and Upper limit of the norm data can also be selected
- 2 **Startup ear** allows you to select which ear the program will always start on as default. The selected startup ear applies to all modules
- 3 The **Print button** can be set up to automatically print to PDF
 - Check the **PDF print enabled** box to set the print icon to print to PDF functionality
 - Check the **Open after print** box to open the PDF document after printing
 - Select the **File location** to where the PDF document should be saved
- 4 Select **PDF filename configuration** to define the name of the file. Selecting the button will open another window to set the fields defining the name of the PDF file
Use the arrow keys to add fields to the file name. The adjustable delimiter will separate the different fields from one another.



3.6.1 User guide

The User Guide setup is accessed by going to **Menu | Setup | User guide setup**

The default setup for the User Guide has preselected guidance pictures and text. All four guide pictures and test instructions are selected and **Show user guide when module starts** is checked.



The following options are available:

1. Right clicking on a **Picture** allows you to add a new picture to assist with guidance. A Microsoft window will open allowing you to select pictures stored elsewhere on your PC. Navigate to and select the desired image and then click Open. The picture will be replaced with your chosen one.
2. The **Text** can be edited the text in the text box by simply placing the cursor in the white box with your mouse.
3. There are four available guidance pictures with text. Uncheck **Show** on the ones you do not want shown when the User guide is displayed.
4. Uncheck **Show user guide when module starts** if you do not want the User Guide to appear on the screen each time the module starts.
5. **Reset guide** allows you to reset the guide pictures and text to the default settings as when the software was installed
6. Pressing **OK** will accept any changes made and will close down the User Guide setup
7. **Cancel** will close down the User Guide setup without saving any changes made.

3.6.2 Temporary setup

The **Temporary setup** can be accessed in two ways and allows you to make temporary changes to the protocol currently shown in the protocol drop down list.

- Go to **Menu | Setup | Temporary setup**
- Click on the Temporary setup icon  on the control panel

When a temporary change has been made to a protocol, the protocol name will then appear with an asterisk next to it. If data is measured before you enter temporary setup you are prompted to save or discard the data. In temporary setup the same options are available as in the normal protocol settings.



3.7 PC shortcuts

For quick operation from the keyboard the following hotkeys are available:

- L - switch to left ear
- R - switch to right ear
- Space - start or stop
- A - select or deselect all tests of a protocol
- T - go into temporary settings
- Ctrl S - save and new
- Ctrl P - print
- Ctrl N - delete all data and start new measurement
- Page up - go one up in saved sessions
- Page down - go one down in saved sessions
- Arrow up - go one test up within the protocol
- Arrow down - go one test down within the protocol



4 Protocol management

The following is a common description for protocol management within the DPOAE or TEOAE tab.

4.1 Renaming a protocol

To rename a protocol you need to enter the **Protocol setup** menu.

- Select **Menu | Setup | Protocol setup...**
- Select the protocol that you want to rename from the **Selected protocol** drop down menu
- Type in the new name
- Press **OK**
- Press **Yes** in the dialog box to confirm you want to rename the protocol. If you chose a new name that already existed in the protocol list you will be asked to go through step 2 to 5 again in order to rename your protocol

Note: You cannot rename factory protocols.

4.2 Deleting a protocol

To delete a protocol you need to enter the **Protocol setup** menu.

- Select **Menu | Setup | Protocol setup...**
- Select the protocol to delete from the **Selected protocol** drop down menu
- Press **Delete**
- Press **Yes** in the dialog box to confirm you want to delete the protocol

4.3 Exporting a protocol

To export a protocol you need to enter the **Protocol Setup** menu.

- Select **Menu | Setup | Protocol setup...**
- Select the protocol to export from **Selected protocol** drop down menu
- Press **Export**
- When prompted, select Yes or No for saving the file as read-only? **Exporting a protocol as read-only results in the protocol being protected against any setting changes when imported back into the IA OAE Suite**
- Browse to the location where you want to store your protocol. Name the file and press **Save**

4.4 Importing a protocol

To import a protocol you need to enter the **Protocol Setup** menu.

- Select **Menu | Setup | Protocol setup...**
- Press **Import**
- Browse to the location where you stored your protocol files. Select the protocol you want to import.
- Press **Open**

Note: If the imported protocol was originally saved as a read-only file, you will not be able to change any of the protocol settings.

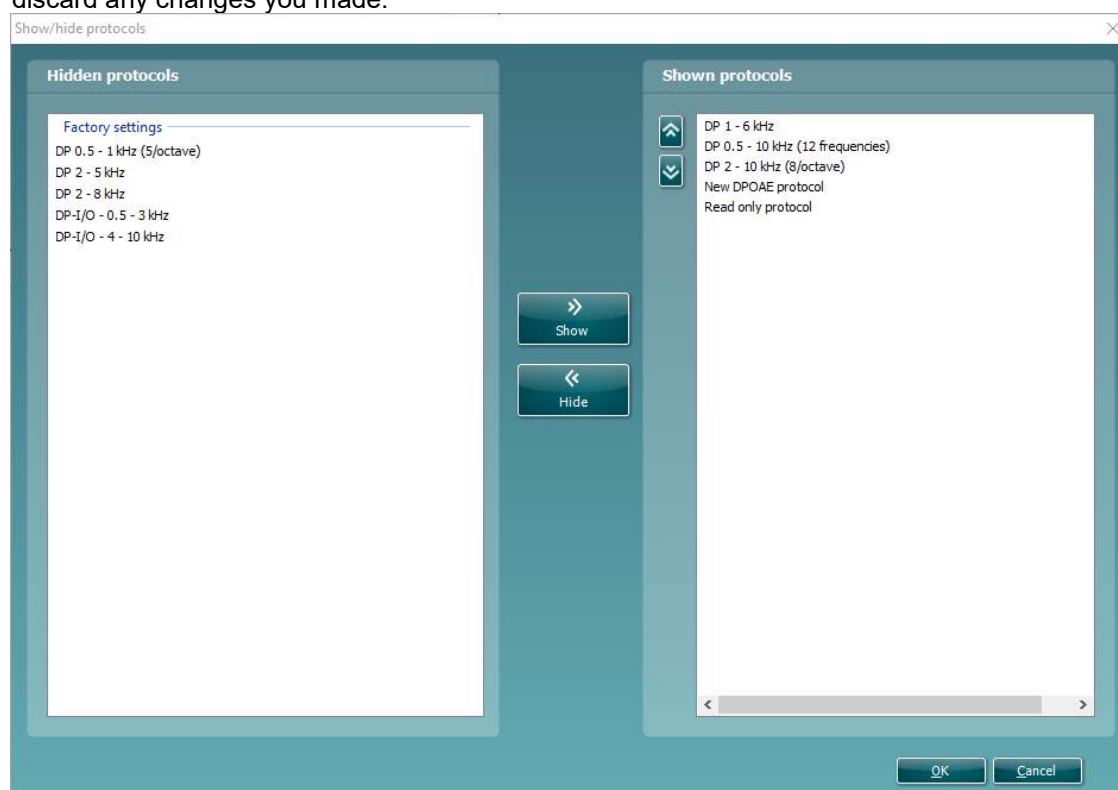


4.5 Show/hide protocols in IA OAE Suite (DP/TE)

The software allows you to select which protocols are visible in the protocol selection dropdown menu on the test screen. Go to the **Show/hide protocols** window to select the protocols that will be available for use from the test screen.

In the DPOAE and TEOAE modules, show/hide protocols works as follows:

1. Select **Menu | Setup | Show/hide protocols**
2. Select protocols from the **Hidden protocols** window and press the **Show** button to move them to the **Shown protocols** window.
3. Select a protocol in the **Shown protocols** window. Use the arrow keys to rearrange the order of the protocols. This is the order in which they will be displayed in the protocol selection dropdown menu on the test screen.
4. To hide protocols, select the protocols to be hidden from the **Shown protocols** window and press the **Hide** button. The selected protocols are moved back to the **Hidden protocols** window.
5. Press **OK** to save your selection and close the window. Press **Cancel** to close the window and discard any changes you made.

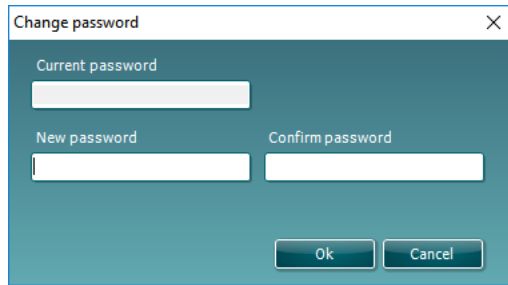


4.6 Password protection

Activating the password restricts users from entering the protocol setup and user guide setup throughout the entire IA OAE Suite.

To activate password protection for the first time:

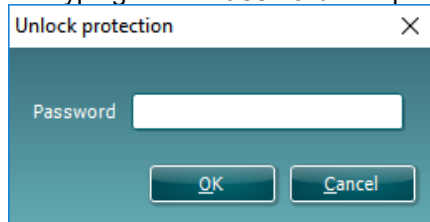
- Go to and select **Menu | Setup | Password protection**
- Leave the current password blank. The default password is empty
- Type in your **New password**
- Retype your password as confirmation
- Press **OK**



A dialog box titled "Change password" with a close button (X) in the top right corner. It contains three text input fields: "Current password", "New password", and "Confirm password". At the bottom, there are two buttons: "Ok" and "Cancel".

Deactivating the password protection temporarily (until the Suite is closed or the password is changed) is done by

- Going to and selecting **Menu | Setup | Unlock protection**
- Typing in the **Password** and pressing **OK**



A dialog box titled "Unlock protection" with a close button (X) in the top right corner. It contains a single text input field labeled "Password". At the bottom, there are two buttons: "OK" and "Cancel".

To permanently disable the Password Protection:

- Go to and select **Menu | Setup | Password protection**
- Type in your password in the **Current password** field
- Leave the **New password** and **Confirm password** fields blank
- **Password protection** is now turned off





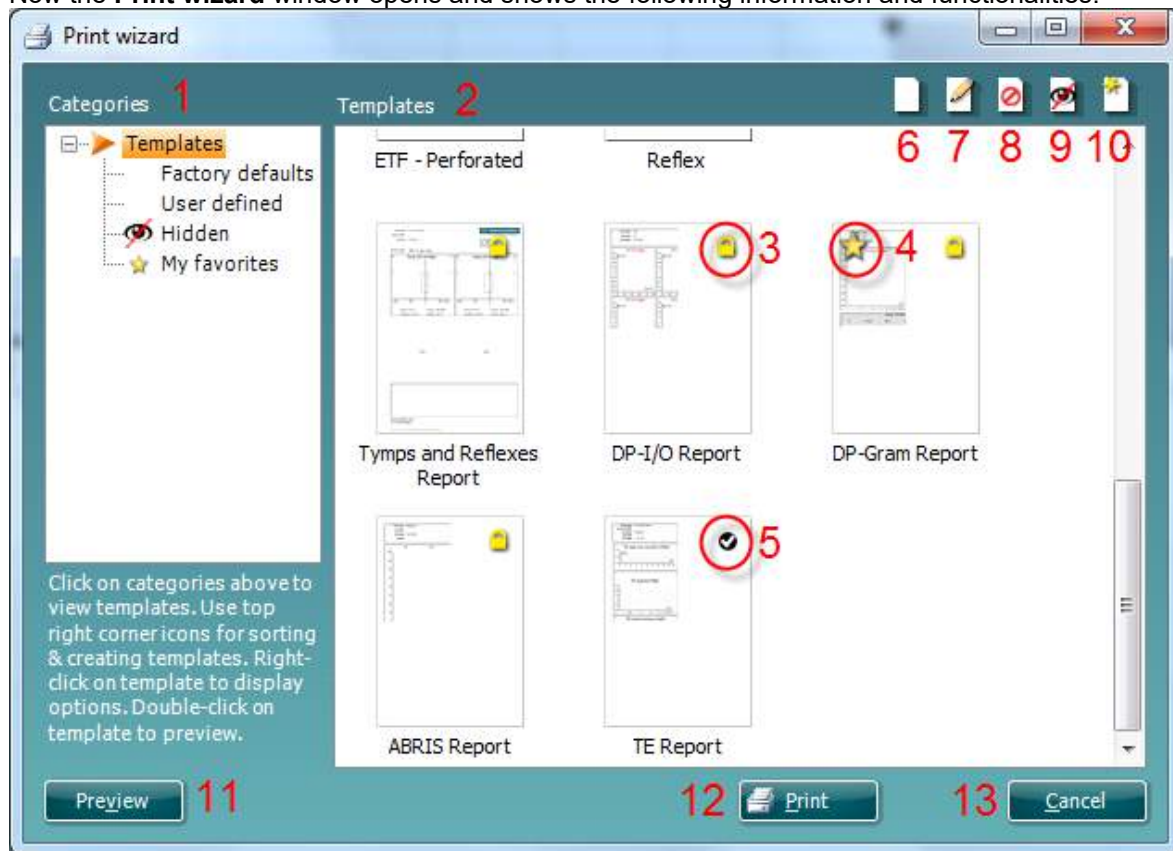
5 Printing and making reports

5.1 The Print Wizard

You have the option to create customized print templates which can be linked to individual protocols for quick printing. The Print wizard can be reached in two ways.

- If you want to make a template for general use, or select an existing one for printing: Go to **Menu | Print | Print wizard...** in any of the IA OAE Suite tabs (DPOAE, TEOAE)
- If you want to make a template or select an existing one to link to a specific protocol: Go to Module tab (DPOAE, TEOAE) relating to the specific protocol and select **Menu | Setup | Protocol setup**. Select the specific protocol from the drop down menu and select **Print wizard** at the bottom of the window

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

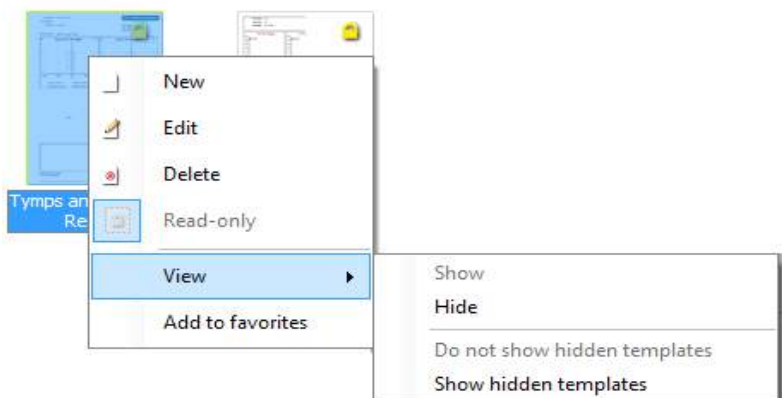


1. Underneath **Categories** you can select
 - **Templates** to show all available templates
 - **Factory defaults** to show only standard templates
 - **User defined** to show only custom templates
 - **Hidden** to show hidden templates
 - **My favorites** to show only templates marked as a favorite
2. Available templates from the selected category are shown in the **Templates** viewing area.
3. Factory default templates are recognized by the lock icon. They ensure that you always have a standard template and do not need to create a customized one. However, they cannot be edited according to personal preferences without resaving with 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 that is attached to the selected protocol when entering the print wizard via the **Protocol setup** window is recognized by 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. The template can now be quickly found when **My Favorites** is selected under **Categories**. To remove a template marked with a star from My Favorites, select the template and press the **My Favorites** button.
11. Select one of the templates and press the **Preview** button to print preview the template on screen.
12. Depending how you reached the Print wizard, you will have the option to press
 - **Print** for using the selected template for printing or press
 - **Select** for dedicating the selected template to the protocol from which you got into 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:

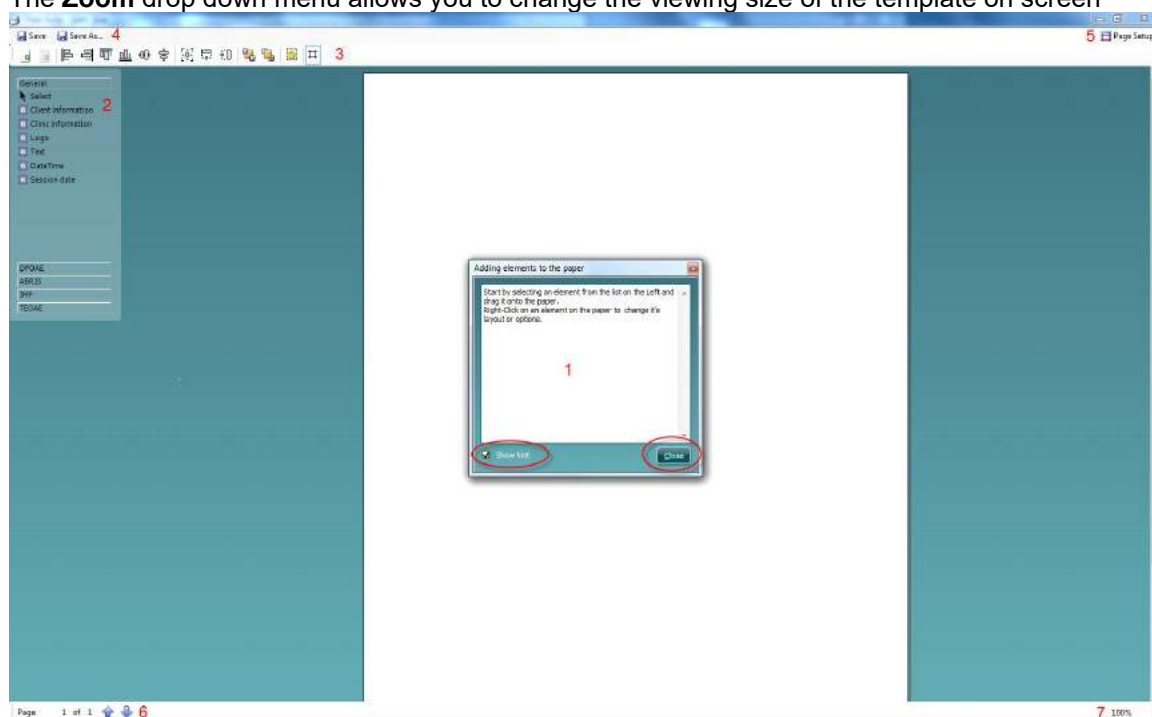




5.2 Designing a customized print template

After clicking on the **New Template** (or **Edit Template**) button the design window shows as below.

1. Upon 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 it to appear next time.
2. This list shows the elements which can be dragged onto the paper. When **General** is selected, the general elements are listed. Template elements for each module will be listed when selecting the relevant module name, for example **DPOAE** or **TEOAE**. The handling and options for all 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 below in a separate 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 are 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 setup the 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 screen



5.2.1 Taskbar



1. **Add page.** Allows you to add an extra page to an existing template.
2. **Remove page.** Allows you to remove an extra page that has been added to the template. You will be prompted to confirm removal before it takes effect.
3. **Align left.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their left borders.
4. **Align right.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their right borders.



5. **Align top.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their top borders.
6. **Align bottom.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their bottom borders.
7. **Align horizontal.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their horizontal central axis.
8. **Align vertical.** If you select two or more elements (by holding down the shift button on the keyboard) this button will align the selected elements on their vertical central axis.
9. **Make equal size.** If you select two or more elements (by holding down the shift button on the keyboard) this button will make all element sizes equal to the element that was placed on the page first.
10. **Same width.** If you select two or more elements (by holding down the shift button on the keyboard) this button will make all element 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 (by holding down the shift button on the keyboard) this button will make all element 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 other taskbar functions is used on a locked element it will automatically unlock.
15. **Display margins** toggles between showing/hiding the print margins as a broken line.



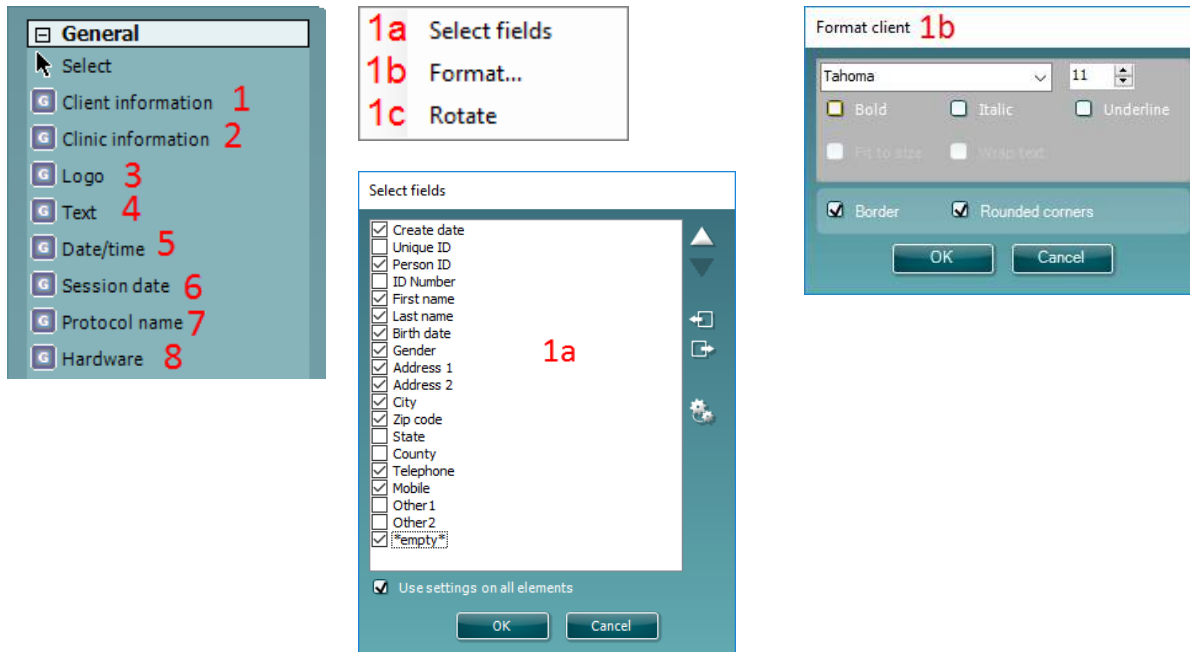
5.3 Design elements

Template elements are added to the template page 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 following elements are available for the **DPOAE** and **TEOAE** and modules. 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.

5.4 General elements



1. Client information

- a) **Select fields** opens the **Select fields** window where you select which items are to be shown in the client 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 sec and then left clicking on the name.

Pressing  will remove user created fields when selected. Press  to restore the manufacturers' default fields.

The **Create date** item cannot be changed as it will always shows the date and time that the patient was created in the database.

- 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** rotates the element by 90 degrees in a clockwise direction.

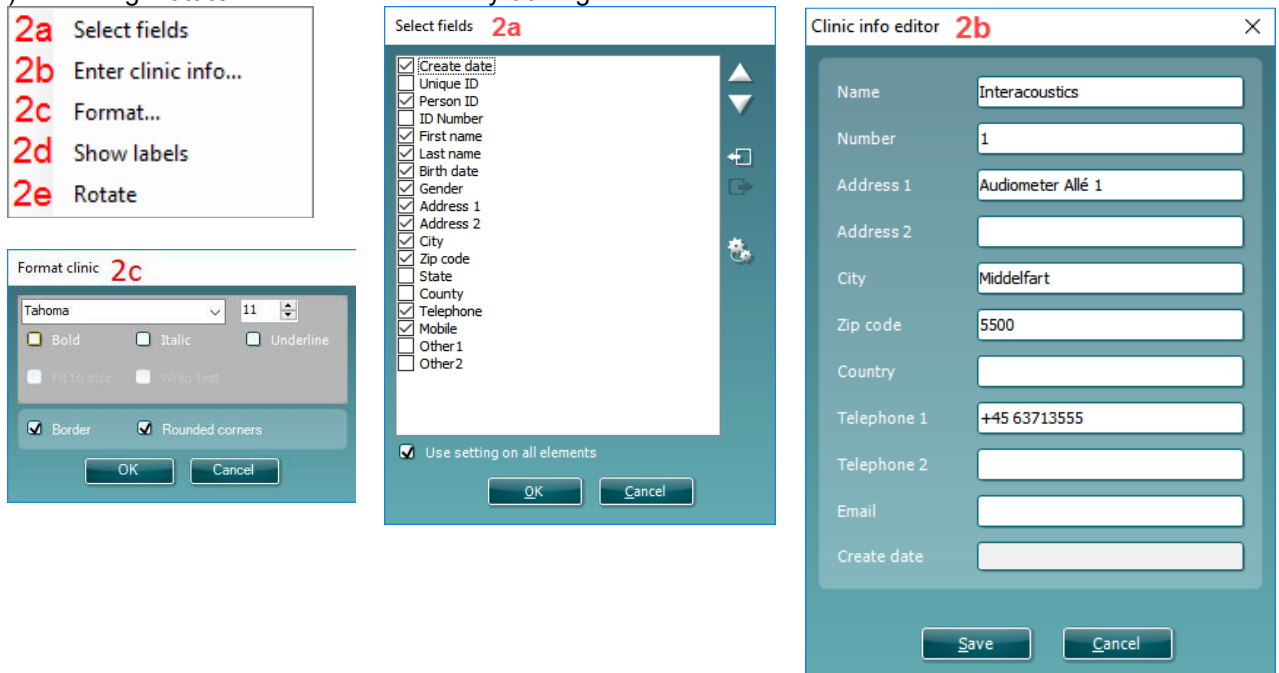
2. Clinic information

- a) **Select fields** pops up the **Select fields** window where you 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 sec and then left clicking on the name.

Pressing  will remove user created fields when selected. Press  to restore the manufacturers' default fields.

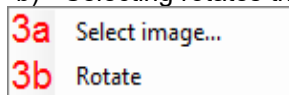


- b) **Enter clinic info...** opens the **Clinic info editor** window (Noah 4 only). Here you can type and save the clinic information specifically for the selected print template. The **Create date** item cannot be changed as it will always show the current date and time. When using in conjunction with the OtoAccess® database, you will be advised to define the clinic information via the database
- c) **Format...** Here you can change the the font, font size and formatting, and the appearance (borders) of the **Clinic information** area.
- d) By selecting **Show labels**, the **Clinic information** fields can be toggled on and off.
- e) Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction.



3. Logo

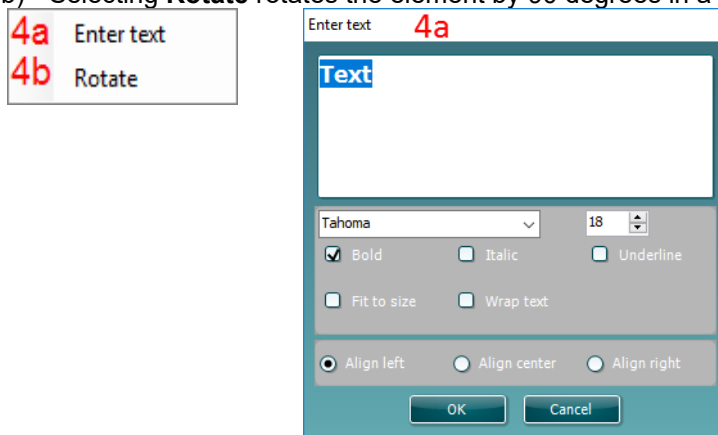
- a) **Select image** opens a window from where you can browse to find the image stored on your PC that you want to include in the template.
- b) Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction.



4. Text

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

- a) **Enter text** opens the **Enter Text** window. Here you can type in freetext and choose the font type, size and formatting.
- b) Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction.

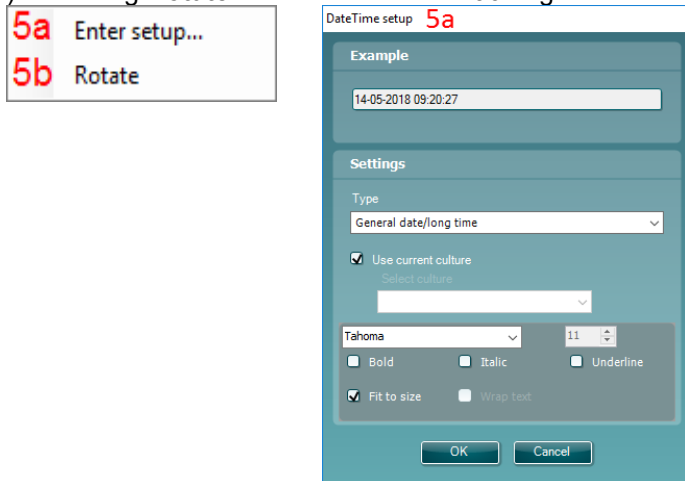




5. Date time

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

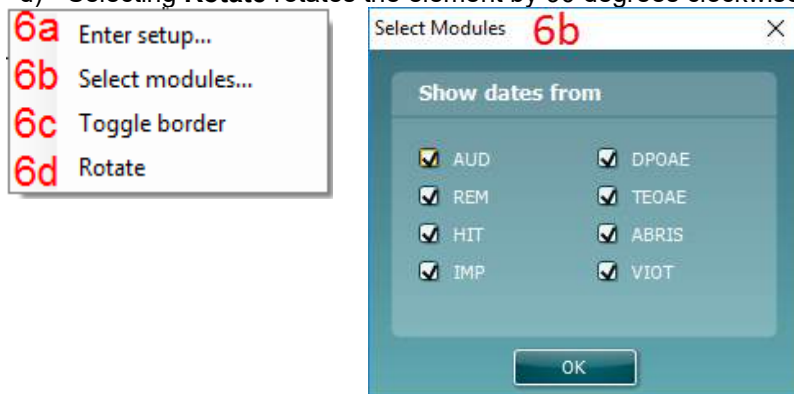
- Enter setup...** opens the **Date Time setup** window. Here you choose the format in which the date and/or time appears in the template. You can also choose the font type, size and formatting.
- Selecting **Rotate** rotates the element 90 degrees in a clockwise direction.



6. Session date

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

- 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.
- Select modules** gives the opportunity to define which modules' session dates will be shown. On the print out you can combine measurements from the IA OAE Suite and other Interacoustics Suites (Callisto, Affinity, Equinox, Titan & Diagnostic suite).
- Toggle border** allows you to disable or enable the border around the **Session date** element
- Selecting **Rotate** rotates the element by 90 degrees clockwise.



7. Protocol name

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

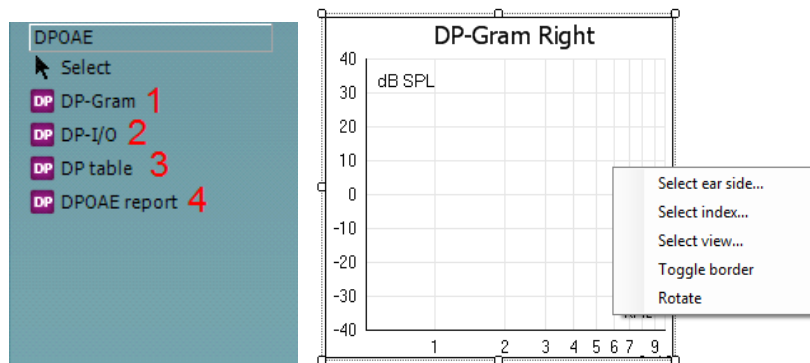
- Select modules** gives the opportunity to define which modules' protocol names will be shown. On the print out you can combine measurements from IA OAE Suite and other Interacoustics Suites (Callisto, Affinity, Equinox, Titan & Diagnostic suite).
- Toggle border** allows you to disable or enable the border around the **Session date** element
- Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction.



5.4.1.1 DPOAE elements

Add DPOAE elements to the template page using the select, drag and drop function with the mouse.

The following elements are available to create a DPOAE report and are described in detail below. Right clicking on element will list options for customization such as Select ear side, Select index, Toggle border and Rotate.



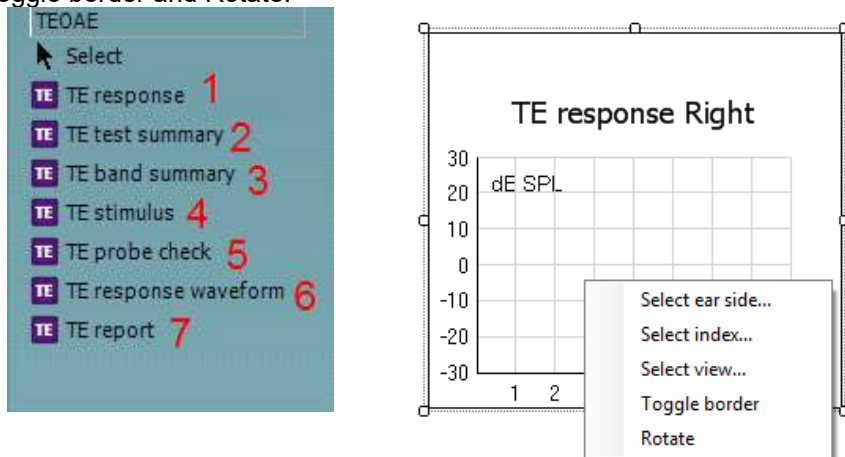
1. **DP-Gram.** This element contains the DP-Gram measurement.
 - **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
 - **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one DP-gram test, the first one contains dataset 1, the second dataset 2, etc.
 - **Select view...** opens a window in which you can choose which graph type will be displayed – bar view or graph view
 - **Toggle borders** allow you to disable or enable the border around the **DP-Gram** element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction
2. **DP-I/O.** This element contains the DP-I/O measurement. Right clicking on the element shows the following same options as for item.
 - **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
 - **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one DP-gram test, the first one contains dataset 1, the second dataset 2, etc.
 - **Toggle borders** allow you to disable or enable the border around the **DP I/O** element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction
3. **DP-Table.** This element contains details about each data point of the DPOAE measurements.
 - **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
 - **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one DP-gram test, the first one contains dataset 1, the second dataset 2, etc
 - **Toggle borders** allows you to disable or enable the border around the **DP-Table** element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction
4. **DPOAE report.** This element contains the report which is created in the report editor.
 - **Toggle borders** allows you to disable or enable the border around the **DP report** element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction



5.4.1.2 TEOAE elements

Add TEOAE elements to the template page using the select, drag and drop function with the mouse.

The following elements are available to create a TEOAE report and are described in detail below. Right clicking on element will list options for customization such as Select ear side, Select index, Select view, Toggle border and Rotate.



1. **TE response.** This element contains the TE response graph.

- **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
- **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
- **Select view...** opens a window in which you can choose which graph type will be displayed – basic, advanced or FFT view
- **Toggle border** allows you to disable or enable the border around the element
- Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction

2. **TE test summary.** This element displays the TE test summary table.

- **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
- **Select results...** opens a window in which can choose which result items should be displayed in the table
- **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
- **Toggle border** allows you to disable or enable the border around the element
- Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction

3. **TE band summary.** This element displays the TE band summary table.

- **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
- **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
- **Toggle border** allows you to disable or enable the border around the element
- Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction

4. **TE stimulus.** This element displays the TE stimulus graph.

- **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
- **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
- **Toggle border** allows you to disable or enable the border around the element
- Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction



5. **TE probe check.** This element displays the probe check graph.
 - **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
 - **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
 - **Toggle border** allows you to disable or enable the border around the element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction
6. **TE response waveform.** This element displays the TE response waveform.
 - **Select ear side...** opens a window in which you choose if the graph shows the right or left ear
 - **Select index...** opens a window in which you choose which dataset should be displayed. If a protocol exists with more than one TE test, the first one contains dataset 1, the second dataset 2, etc.
 - **Toggle border** allows you to disable or enable the border around the element
 - Selecting **Rotate** rotates the element by 90 degrees in a clockwise direction
7. **TE report.** This element contains the report which is created in the report editor. Right clicking on the element allows you to **toggle** the **border** or **rotate** the element.



5.5 Creating reports

The IA OAE Suite allows electronically generated reporting through the **Report editor**. This allows reports to be saved in the specific module for each test session and they can be retrieved at any time. The contents of the report can also be added to the print template, which gives you the opportunity to have all the relevant test information in one customized printout. The report function also includes the possibility to make **Report templates** which gives you the option to have different templates e.g. for different client groups or for use by different clinicians.

To open the **Report editor** in order to write a report for the current patient where measurements have been obtained, press the  icon on the control panel on the left hand side of the screen.

5.5.1 Using the report editor with saved sessions

5.5.1.1 Noah 4

When a session is saved into Noah 4, there is a limited time window where reports can be added or edited. Changes or edits can only be made on the same date as the session was saved.

When a session is imported into Noah 4 from the hand held unit, the report can only be changed on the same date as the test was imported.

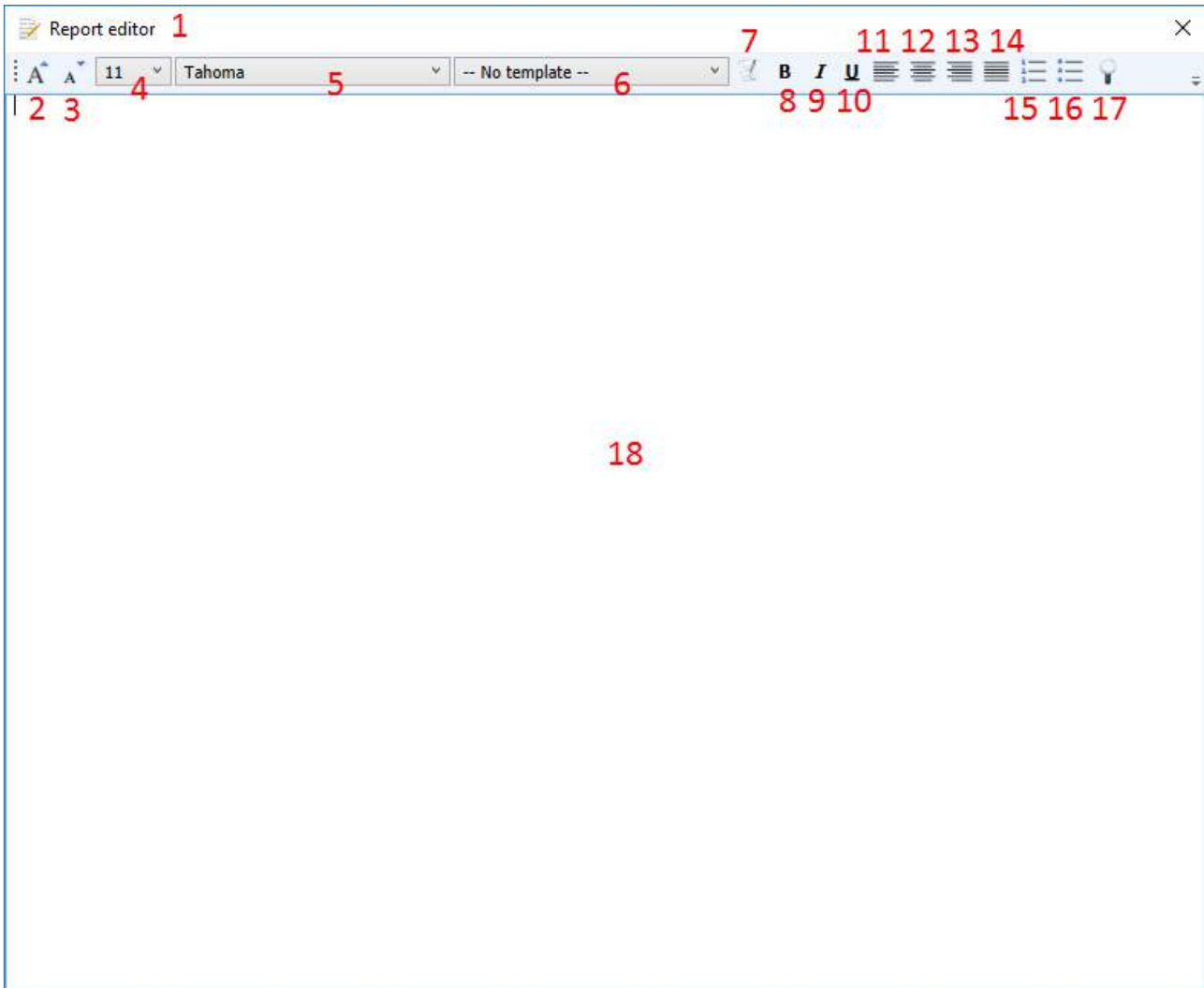
5.5.1.2 OtoAccess®

Reports for historic sessions saved in OtoAccess® can be edited at any time and the updated information entered into the report will be saved.

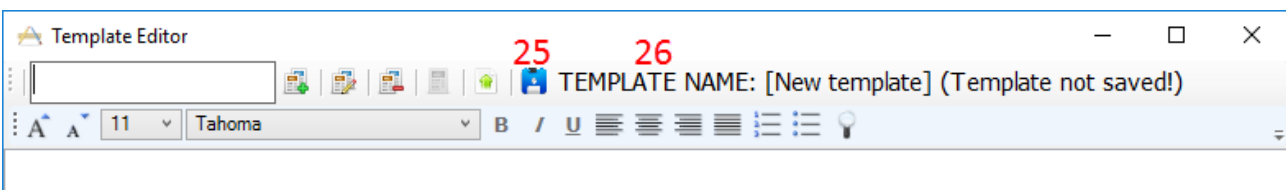
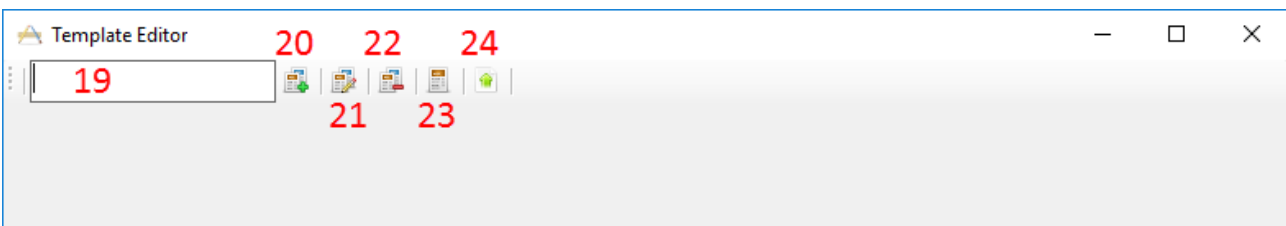
5.5.2 Operation of the report editor

The follow information and operations are found in the **Report editor**:

- 1 When **Report editor** is displayed in the top bar, new reports or templates can be made. When viewing a historic saved report, (Read only) will also be visible
- 2 **Increase font size** allows you to increase the font size in steps
- 3 **Decrease font size** allows you to decrease the font size in steps
- 4 Change the currently selected **Font size**
- 5 Change the currently selected **Font type**
- 6 **Template** allows you to select a saved template and insert it into the current report
- 7 **Template editor** allows you to access a screen for creating, saving, editing, deleting, importing and exporting templates
- 8 Change the currently selected font to **Bold**
- 9 Change the currently selected font to **Italic**
- 10 Add an **Underline** to the currently selected font
- 11 Change the alignment of the selection to **Align left**
- 12 Change the alignment of the selection to **Center**
- 13 Change the alignment of the selection to **Align right**
- 14 Change the alignment of the selection to **Justify**
- 15 Insert **Numbering**
- 16 Insert **Bullets**
- 17 **Import image** allows you to insert an image or picture saved on your PC
- 18 Indicates the area in which the **report** can be written



On selecting template editor, a new screen will appear to allow for template editing. The toolbar options are described below:



- 19 Type the **template name** here
- 20 **Add new template** after the template name has been entered
- 21 **Edit template** displays a list of saved templates for editing. Select the desired template from the list to make edits



- 22 Delete template** displays a list of saved templates for deleting. Select the desired template from the list to delete it
- 23 Set as default template** will set the open template on screen as the default template to display when the report editor is opened for the first time during a session
- 24 Import/Export template** allows templates to be imported from a location on your PC or exported for use on another PC
- 25** The **Save** icon becomes visible once a template has been added
- 26** The **template name** is displayed. If it has not been saved, **(Template not saved!)** will appear beside the template name





6 Troubleshooting

Problem	Explanation	Solution
USB connection with Lyra fails	- USB connection incorrect to the PC or to the Lyra - Lyra allows only connection to one instance of IA OAE Suite	- Check USB connection - Check if Lyra is switched on - If problem still occurs: disconnect Lyra, restart IA OAE Suite and the database you are using and connect Lyra again - If the problem remains, request help from an authorized technician or call Hotline support or help
Unhandled exception during IA OAE Suite	Although Lyra is thoroughly tested, you could have encountered an unknown software problem	- After an unhandled exception it is advised to disconnect Lyra, reconnect Lyra and restart IA OAE Suite and the database you are using - If your problem occurs more often Interacoustics would very much appreciate if you report the problem and the situation from which it occurs
IA OAE Suite states that no probe is connected	A disconnection has occurred between the probe cable and the device	Contact your authorized technical for assistance
Other		- Please contact an authorized technician for support

