INSTRUCTION MANUAL

Software version 1.5

nor850

Software

Norsonic

nor850

Software

Nor850 User Guide – Software version 1.5

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If you wish to communicate with us, please feel welcome.

Our address is:

Norsonic AS, P.O. Box 24, N-3421 Lierskogen, Norway

Find us on the web: www.norsonic.com

Tel: +47 3285 8900,

Fax: +47 3285 2208

e-mail: info@norsonic.no

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Startup

Power up the measurement modules (Nor850 multichannel racks and/or Nor140 units) and make sure they are all connected to the PC via LAN or USB interfaces.

Start the program by double-clicking the 'Nor850' icon normally placed on the desktop of the PC. Alternatively, start the program from the C:/ProgramFiles/Norsonic/Nor850/ folder. The startup window will appear showing the available measurement modes in the current installation.

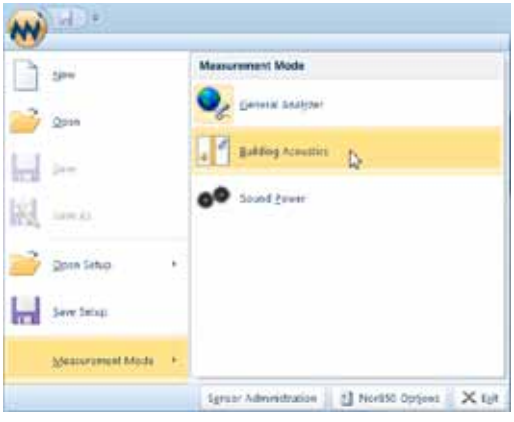
PLEASE NOTE:
After installation of the software, and before making any attempt to measure or calibrate, it is essential for the operation that all required microphones, preamplifiers etc. are entered into the ***Sensor Administration*** database as described in section 3 of this manual.

Selecting Measurement mode

The version 1.5 of the Nor850 software offers three measurement modes: ***General Analyzer*** and the optional ***Building Acoustics*** and ***Sound Power***. Click on the desired mode, and the startup display of the selected mode will be displayed on the screen.

Switching Measurement Mode

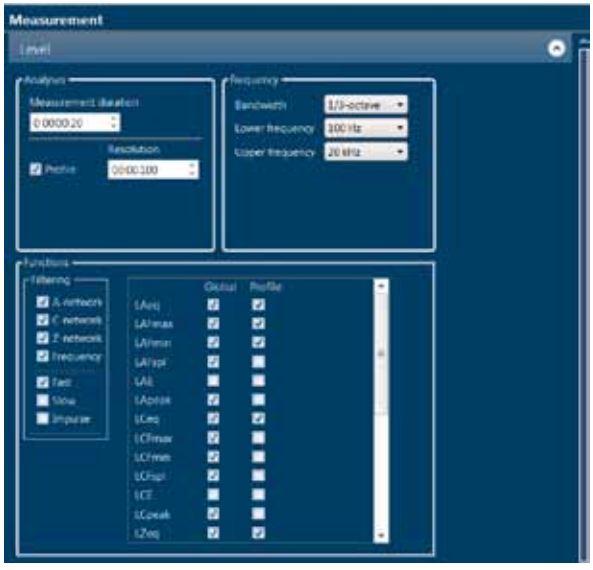
Switching from one measurement mode to another is possible by clicking on the ***Nor850*** button, selecting ***Measurement Mode*** in the menu list and then clicking on the desired measurement mode. The startup display of the selected mode will then be displayed on the screen.



General analyzer mode

Measurement setup

The actual functions and parameters for the measurement are all set in the ***Measurement menu***. Click on the 'Measurement' tab in the task bar and select ***Measurement setup***.
The ***Measurement menu*** contains two sub areas, ***Level*** and ***Audio recording***:



The ***Level*** area contains the following parameters:

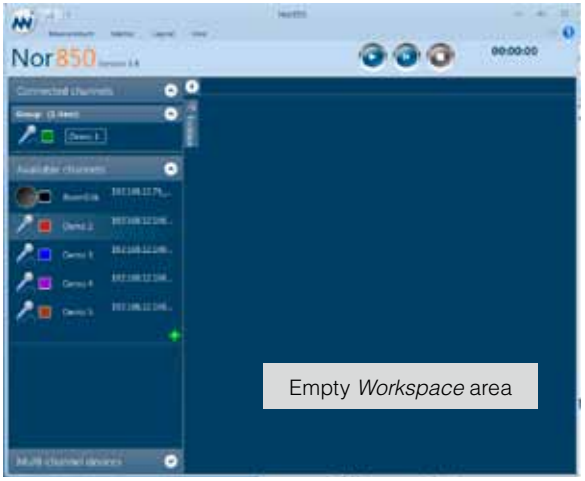
- 'Measurement duration' sets the time before the measurement automatically stops. Measurements can be stopped before by clicking the 'Stop' button.
- The 'Profile' checkbox sets whether the function level profile will be measured or not. ***Profile*** means measuring the selected function at regular time intervals, and logging it to a graph, while ***Global*** means measuring the average (or peak/max/min) over the whole measurement period, which gives a single number as a result.
- 'Resolution' is the sampling interval when the ***Profile*** measurement is enabled.
- 'Bandwidth' is the spectrum resolution, 1/1- or 1/3-octave.
- 'Lower'/'Upper frequency' is the frequency limits for the spectrum measurements.
- 'Filtering' selects which weighting functions, in addition to which short-time averaging functions, will be measured.
- The last box contains two columns, 'Global' and 'Profile'. The checked boxes for the functions (L_{Aeq}, L_{AFmax}, L_{AFmin}, etc) will be measured.

Note that if a measurement is done when a function is not checked in the measurement setup menu, this function will not be recorded, and it is not possible to recover it at a later time!

The 'Audio Recording' area contains the 'Sampling rate' and 'Format' fields, where 12kHz/48kHz sampling rates and 8/16/24 bits resolutions are possible. The 'Gain field' adjusts the digital gain of the recording.

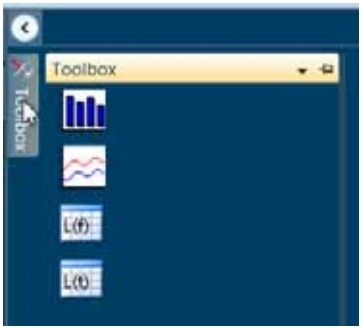
Available measurement channels

The first time the Nor850 system is started, the screen will show an empty Workspace area with the ***Available channels*** list to the left. Later, the ***Workspace*** area will contain the selected display windows from the previous use.



Display Windows

The various ***Display Windows*** are selected from the ***Toolbox*** menu available upon clicking the ***Toolbox icon***.

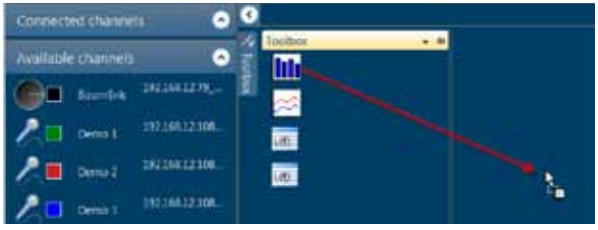


There are 4 different formats available:

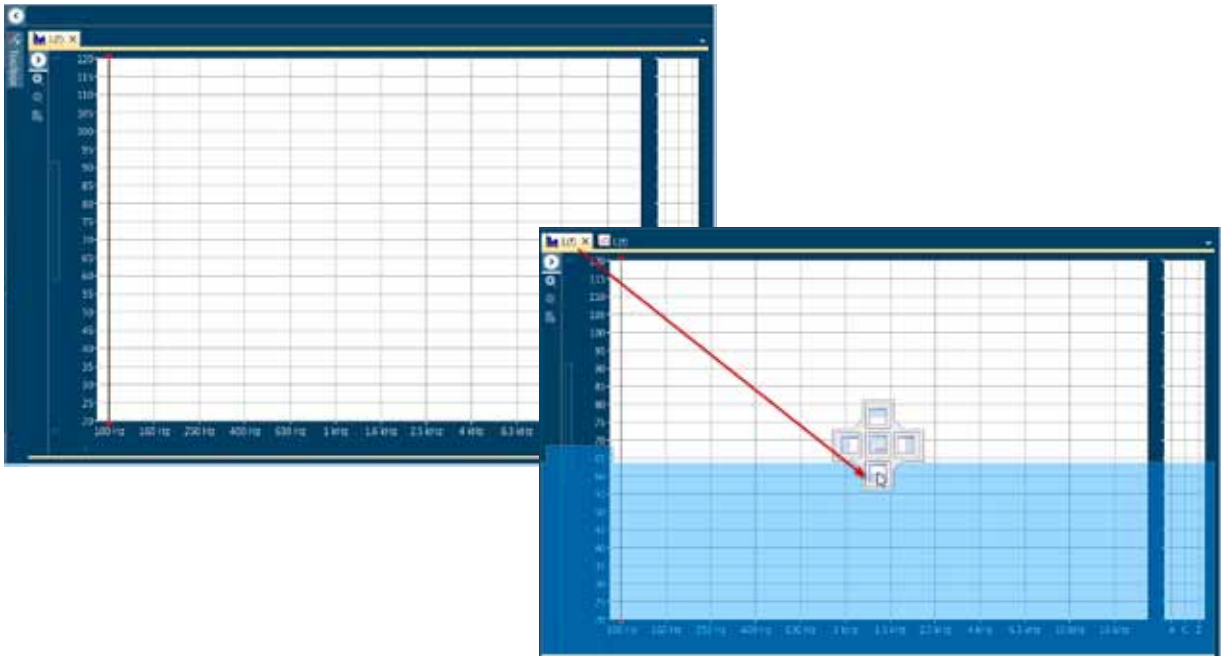
- Level versus Frequency Window, 'L(f)'
- Level versus Time Window, 'L(t)'
- Level versus Frequency Numerical Table, 'NumL(f)'
- Level versus Time Numerical Table, 'NumL(t)'

Click on the desired format and drag the selected window icon into the ***Workspace*** area:

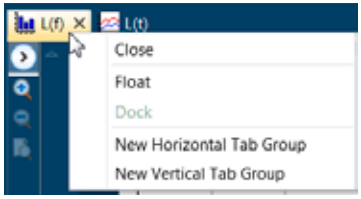
The selected window will then appear in the free space, or at the top of the existing previously selected display windows.



Each of the windows has a tab in the upper left corner showing the window format. With a right click on this tab, the user may choose to move the window to the horizontal or vertical, or let the window float on the PC screen. The floating is particularly useful when using a PC with multiple screens.



Alternatively, the user may click on the tab and drag the window onto the transparent guide that appears. By putting the window to the right or left, to the upper or lower, or to the middle, the selected window will appear respectively within the ***Workspace.***



For multiple display windows measurement setups, it is advisable to save the final window configuration as a ***Setup*** for later use. Thereby the user does not need to go through this window setup procedure again each time the same measurement task shall be used. The ***Save Setup*** feature is found in the menu list displayed upon clicking the ***Application*** button in the upper left corner of the screen.

Activating channels

All measurement channels found on the PC's Local Area Network (LAN) and USB interfaces are displayed in the ***Available channels*** list on the left hand side of the screen. Should additional PCs running the Nor850 software be connected to the same LAN, all measurement channels connected through the LAN interface will be listed in the same way on the other PCs.

Logically, each measurement channel can only be controlled by one specific PC. Hence, those measurement channels used in the actual measurement task must be ***activated*** by the PC in control. This is done by simply clicking on the selected available channels and dragging them into the ***Connected channels*** area at the upper left side of the screen. More channels can be selected simultaneously by holding down the Ctrl key while clicking the channels. Alternatively, right-click on the desired channels and select the Activate feature in the displayed menu. The graphical icons for the selected measurement channels will then be moved into the ***Connected channels*** area and removed from the ***Available channels*** area on all PCs connected to the LAN system. Hence, these channels area only available for the PC which has activated them.

In the General Analyzer mode, all activated measurement channels will be used in the measurement independently of the selected ***Display*** Windows.

Displaying the measurements

In order to view the running and final measurement results, the activated measurement channels must be ***connected*** to the desired Display Window. This is simply done by clicking on the desired activated channels and dragging them into the desired Display Window. One or more measurement channels may be dragged into each window.

The real-time SPL frequency spectrum or time profile will now be displayed in the Display Window connected to the channels.

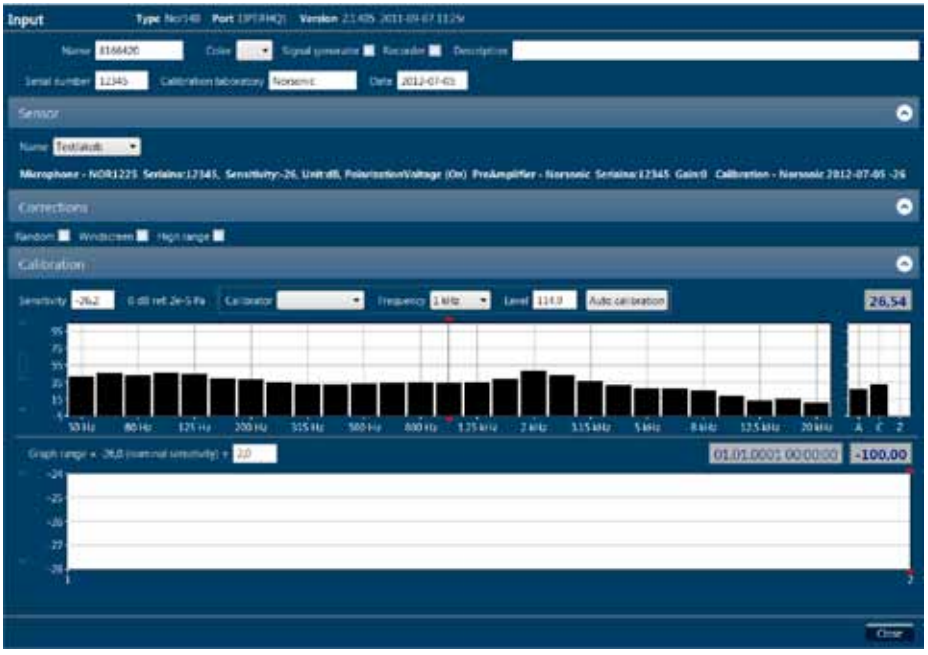
It is also possible to click and drag any of the ***Available channels*** directly into a selected Display Window. Thereby, the selected channels will automatically appear in the ***Connected channels*** area.

The input menu

For each activated channel, there is a configuration menu which is opened either by double-clicking the channel icon, or right-clicking it and selecting 'View configuration'.

The input menu contains:

- Information about the instrument (type, connected port and software version)
- User-defined information (name, serial number, calibration laboratory/date and description)
- Check-boxes for activating the recording function and signal generator
- A drop-down menu for selecting the connected Sensor, and the most important information about the selected Sensor
- Check-boxes for selecting whether Random incidence, Windscreen or High range corrections should be applied'
- The calibration menu

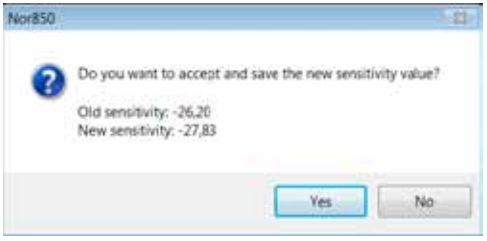


Calibrating the sensor

In the last part of the Input menu, you will find the menu for calibrating the sensor. It is important that a new sensor is correctly calibrated.

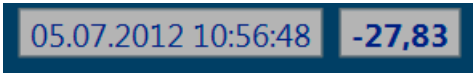
Normally, the previous calibration value will be shown in the 'Sensitivity' field. However, if a sensor is to be calibrated for the first time, one may need to pre-set the sensitivity before calibrating (normally -26,0dB for a 50mV/Pa microphone). This is because the calibration will only work if the measured calibrating level is within +/- 2dB of the previously stored sensitivity.

Select a calibrator sensor from the drop-down menu. If a calibrator sensor is not available, a new sensor will have to be defined in the Sensor Administration. Select the calibrator frequency, calibrator level and click 'Auto calibration'. Connect and switch on the calibrator. The Nor850 system will now continuously monitor the channel input and when it senses the calibrator tone, it will automatically calibrate the sensor.



A pop-up window will ask the user to accept the new sensitivity value, and the 'Sensitivity' field and calibration history will be updated.

The calibration history is shown in the Input menu (as well as in the Sensor Administration). The red line shows the laboratory verified sensitivity and the blue line shows the user calibration history. Click various points in the calibration history to view the previous sensitivity values as well as the date of calibration:



Multi-channel calibration

A practical option in the Nor850 software is the multi-channel calibration. Click the 'Nor850' button and select 'Multi-Channel':

The multi-channel calibration window will appear:

To do the calibration, choose calibrator sensor, frequency and level. Click 'Start' to initiate calibration. A bar indicating that the calibration process has started will be shown to the right for each channel. Walk around and connect the calibrator to the different microphones. Wait for a few seconds and the Nor850 will automatically calibrate the microphone you have connected. When you return to the PC, a green tick mark will appear to the left of the channel name, and the graph will show the calibration history instead of the SPL frequency spectrum. Press 'Stop & Save' to accept all calibrated values. Alternatively, press 'Stop' to cancel the calibration.

If the calibration of a sensor has not completed (i.e. the time bar is still showing and no green tick has appeared), there could be several reasons. Either the microphone has not been properly connected to the calibrator or the calibrator has not been connected for a long enough time. It could also be that the level has not reached +/- 2dB of the previous calibration value which indicates that something is wrong with the sensor or the sensor has been replaced with a different one. Reconnect the calibrator and inspect the instantaneous level.

A nice feature with the multi-channel calibration is the web server which serves a web site containing the

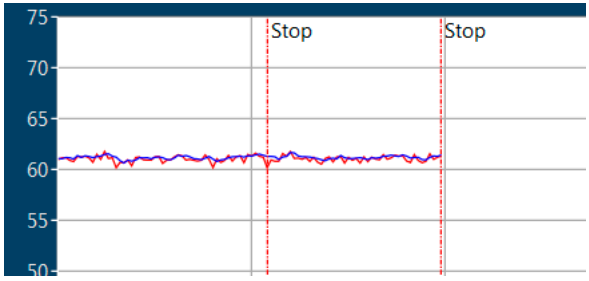
most relevant information about the calibration procedure. To access it, open a web browser and enter the URL which is shown at the bottom of the multi-channel calibration window in Nor850.

The SPL of non-calibrated channels is shown at the top, and the channels will appear at the bottom when they are calibrated, showing the verified, max/min and current calibration values.

Making measurements

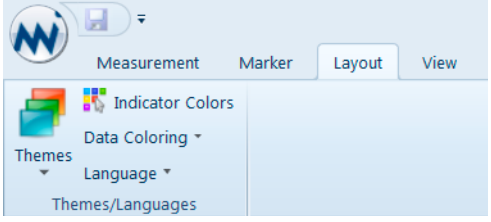
To make a measurement, simply click the 'Start' button in the top right corner of the screen. Measurements can be stopped with the stop button to the right and continued with the continue button in the middle. The elapsed time is displayed to the right of the buttons.

When a measurement is stopped, a ***stop marker*** will be displayed in the L(t) windows. Continuing and stopping the measurement will add more stop markers.



Graphical function design, colors, themes and languages

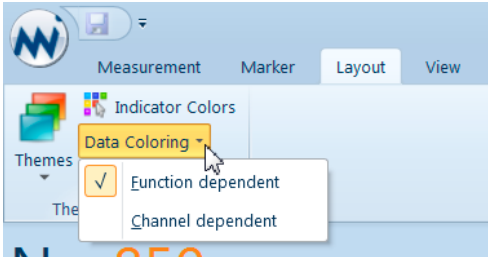
To change the colors, themes and languages for the Nor850 system, click the ***Layout*** tab in the top left hand corner of the screen:



To choose between the two main themes, 'Blue' and 'Black', click the ***Themes*** button and select a theme.

The Nor850 system has a set of color codes assigned to different warnings and messages. These colors can be changed by clicking the ***Layout*** tab in the top left hand corner of the screen. Then click the ***Indicator colors*** button. A new window will appear which shows the colors selected for the different messages. It is possible to assign new colors from a pre-defined set by clicking the down arrow to the right of the color, or assign user-defined colors by clicking ***Advanced***.

In, addition, the Nor850 system has two main preset choices for the color scheme used for the displayed measurements: *Channel dependent* or *Function dependent*. To choose the preset, click the *Data coloring* button in the Layout menu.



When the *Function dependent* color scheme is selected, all measurement functions of the same kind (i.e. Leq or Lmax, etc) will appear with the same color for all activated channels. Hence it will be easy to distinguish between Leq and Lmax from the same channel, or to rapidly compare the same function within multiple display windows.

When the *Channel dependent* color scheme is selected, each activated channel will use the same preselected color on all measurement functions for this particular channel. Hence, it is easy to distinguish measurement results from one channel to another channel even when both are displayed in the same window.

Finally, it is possible to select language by clicking the *Language* button (only English is supported in version 1.5).

L(t) Properties

To open the L(t) Display Properties menu, right-click the Display Window and choose *Properties.* A new window appears:

The 'Functions' tab shows which functions are available (in the 'Available functions' box) and displayed in the L(t) graph (in the 'Selected functions' box). It is

possible to change which functions are shown by clicking a function and using the Add/Remove buttons. (The functions which are not measured are grayed out and marked with an 'X'. Adding these channels will thus not yield any results without enabling the function in the ***Measurement*** menu.) Here it is possible to choose the graphical display ('Step-line' or 'Line') of each measurement function. It is also possible to assign custom colors to the functions. Note that this overrides the ***Data coloring*** selection done in the ***Layout*** menu.

Under the 'Axes' tab it is possible to change the properties of the X- and Y-axis display. The ***Time Unit*** selection box sets whether the X-axis is numbered with Absolute time, Relative time or sample Periods. The ***Range*** defines the distance from the minimum to the maximum displayed Y axis value (i.e. -20 to 80dB at Range 100). The X- and Y-axis grid lines can be toggled on and off by checking checking the ***Grid-lines*** boxes.

All of these L(t) properties can be altered at any time.

L(f) Properties

The L(f) Properties are basically the same as the L(t) Properties, but with a few more options. The graphical display can be set to 'Rectangle', 'Framed rectangle', 'Step-line' or 'Line'. In addition, it is possible to display the channel bar graphs next to each other by checking the 'Group data-series by channel' box. The channel bars may also be set to overlap with a given percentage.

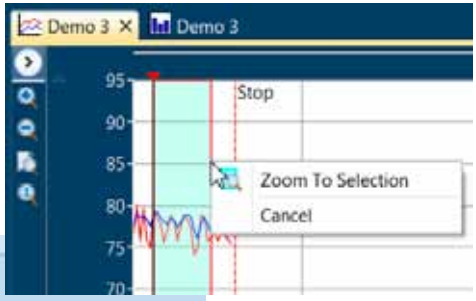
The additional ‘Networks’ box under the ‘Axes’ tab defines which weighting networks (A, B, C, D, L or Z) which should be displayed in the right part of the Display Window.

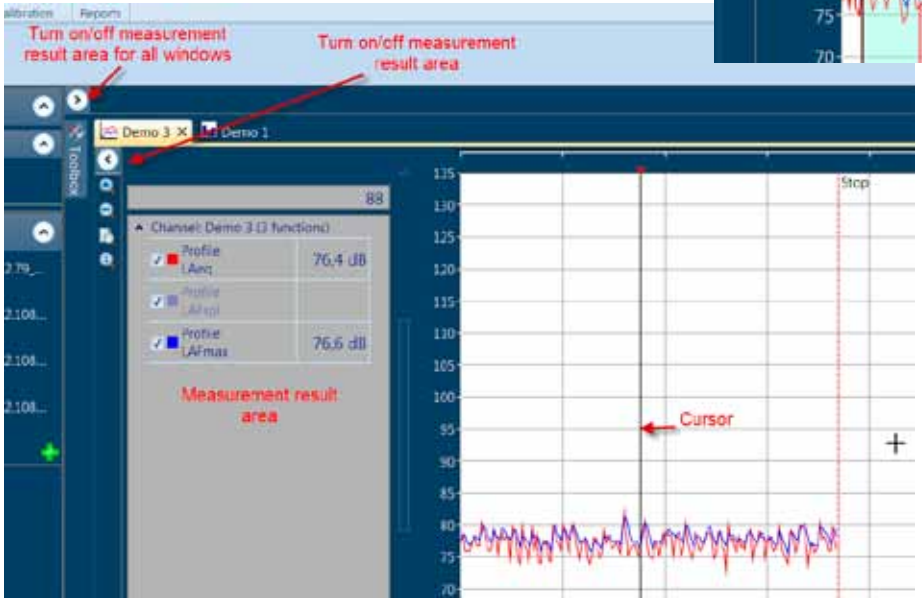
Cursor position measurement values

Both the L(f) and the L(t) graphical window contain a cursor that can be moved to specific positions along the frequency or time axis. Simply click on the desired position, or use the left/right arrow to select the specific cursor position. To view the exact position of the cursor as well as the measurement values of all selected functions, click the arrow on the left hand side of the window, and a table showing the cursor position and function values.

There is also an overall closing/opening arrow for all windows which is found in the upper left corner of the Workspace area.

To zoom in the Display Windows, use the +/- magnifying glasses at the left hand of the window. There is also a ‘Zoom out full’ and ‘1:1’ button for quick zooming. To view a specific part of the measurement, click&drag to choose a part of the measurement, and click ‘Zoom to selection’.





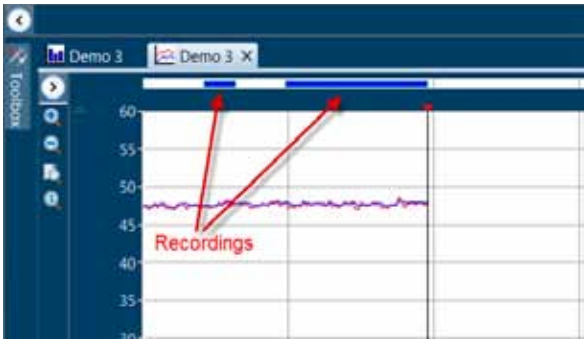
Audio Recording

In the General Analyzer mode, it is possible to record from the connected Nor140/Nor850 MF1 channels while measuring, for later analysis. The available recording time depends on the sampling rate / bit resolution and the available space on the device's SD card. Note that since the device uses a FAT32 file system, the maximum file size is limited to 4GB (in addition the WAV format is limited to this size), which corresponds to roughly 12 hours recording time at 48kHz/16bit.

To make a recording, a channel must be activated for recording. This is done by right-clicking an activated channel and clicking 'Activate recording':

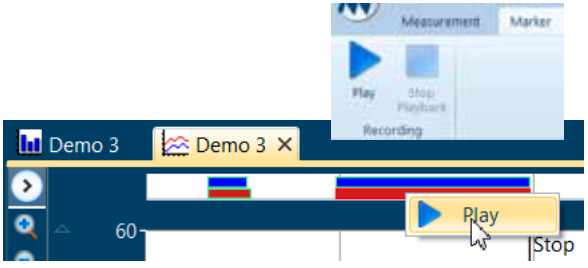
All recording-activated channels will appear with a film roll along with the microphone icon:.

To start recording audio, Open an L(t) window and add the channels you want to record, and start the measurement. A recording can then be started/stopped by pressing the Alt+R keys. Multiple recordings can be done during one single measurement (for example, during a traffic measurement, the recording can be manually started when a car is passing and stopped when there is no traffic).



The recordings will appear as solid lines at the top of the Display Window, colored by the channel color. It is thus possible to record multiple channels simultaneously.

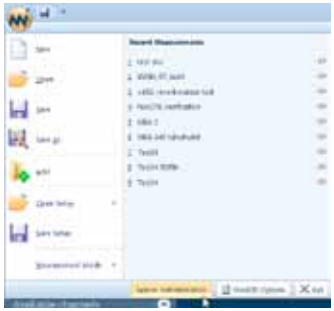
To listen to a recording, right-click the solid line and click 'Play', or click it and use the Space Bar key to start/stop the recording. In addition, the recording can be started/stopped in the 'Marker' menu at the top left corner of the screen.



The recorded WAV-files can be found in the \Nor850\data\Project_Name\Recording folder on your hard drive.

Sensor Administration

The ‘Sensor Administration’ (in short SA) menu is found by clicking on the Norsonic logo in the upper left corner:
The SA is a small database that contains all sensors that the users have available including calibration and verification data. These sensors are available in the Input menu for each measurement channel by selecting the given name for each sensor.



On the left hand side of the SA menu, the user will find a list of all sensors currently entered into the system.

This listed is sorted according to the type of sensor which divide the sensors in the following groups:

- Microphone
- Line
- Nor1214
- IEPE
- Calibrator
- RSS

Calibrators and RSS (Reference Sound Sources) are of course not real “sensors”, but from a practical point-of-view it is very handsome to put these into the same database.

Each sensor type has its dedicated menu containing the most important properties for this kind of sensor. For all kinds the top of the menu contain the user defined name and an addition text string which may be used for a more detailed description. The rest of the menu is dependent on the type of sensor, and the user may quickly view the current data by clicking on the different existing sensor in the list along the left hand side.

New sensors are entered by selecting the desired type and then clicking on the green + sign on the left hand side. This will open an ‘empty’ sensor menu in which the operators key-in all relevant data. When all data are entered, simply click the ‘OK’ key in the lower right corner, and the new sensor is added to the list of sensors along the left side.

All data entry fields are then normally locked from modification. However, existing sensors may be modified, deleted or partly copied by a right mouse-click onto any of the existing sensor names along the left hand side. When copying data for an existing sensor, a new name is always required. This feature is handsome when entering a new microphone/preamplifier combination using an existing preamplifier with another microphone capsule, or, entering another correction response characteristic for an existing combination.

Microphone sensor

The microphone sensor menu contains the following data. All calibration and verification data are valid for the combination of the entered microphone cartridge and preamplifier:

Calibration:

- 'Laboratory' is used for the verification laboratory used at the latest periodic verification
- 'Date' is used for the date of the latest periodic verification
- 'Verified sensitivity' is used for the measured sensitivity of the latest periodic verification
- '0 dB ref' is the setting of the reference for the given sensitivity
- 'Interval' is the selection for how many months the current verification is valid. After this period, the system will give a warning if the selected sensor is out of date.

Microphone:

- 'Type' is the producer and model of the microphone cartridge
- 'Serial number' is the given serial number on the microphone cartridge

- 'Nominal sensitivity' is used for the nominal sensitivity given by the producer
- 'Polarization voltage' is used to indicate whether this microphone is depending on 200V polarization voltage or not (i.e. pre-polarized microphones). If selected 'On' the polarization voltage in the Nor140 unit or Nor850-1 Module will be turned on automatically upon selecting this sensor in the Input menu.
- 'Correction' is containing correction response or frequency linearity information about this microphone. This correction is NOT added to the measurement result unless selected in the appropriate measurement mode (such as 'diffuse field correction' in the Building Acoustic mode). To enter the given correction response, click on the down arrow on the right hand side of the graph and enter the correct value for each frequency band.

Preamplifier:

- 'Type' is the producer and model of the preamplifier
- 'Serial number' is the given serial number on the preamplifier
- 'Gain' is the actual internal gain for the preamplifier (typically 0,1 – 0,2 dB). This value is added in the calculation of sensitivity for each performed calibration.

Calibration history:

- 'Graph range' is the selected +/- range with reference to the given nominal sensitivity
- The mouse may be used to click on any part of the displayed graph along the x-axis in order to view the date, time and sensitivity for any previous calibration in the upper right part of the graph

Line sensor

The line sensor is used when a line source is connected to the channel:

The line sensor menu is not much different from the microphone sensor menu, except from the 'Verified Sensitivity', 'Polarization Voltage' and Preamplifier fields, which are obviously not needed for the line sensor.

Nor1214 sensor

The Nor1214 sensor menu is essentially the same as the microphone sensor menu. However, we have a new field called 'Orientation'. This can be set to either Horizontal orVertical, depending on the applied frequency compensation.

IEPE sensor

The IEPE sensor menu is also essentially the same as the microphone sensor menu. Since this sensor is for IEPE microphones, polarization voltage is not an option, and preamplifier data does not have to be entered.

Calibrator sensor

The calibrator sensor menu contains the following data:

Calibration:

- 'Laboratory' is used for the verification laboratory used at the latest periodic verification
- 'Date' is used for the date of the latest periodic verification
- 'Verified level' is used for the measured level of the latest periodic verification
- '0 dB ref' is the setting of the reference for the given sensitivity
- 'Interval' is the selection for how many months the current verification is valid. After this period, the system will give a warning if the selected sensor is out of date.

Calibrator:

- 'Type' is the producer and model of the calibrator
- 'Serial number' is the given serial number on the calibrator
- 'Nominal level' is used for the nominal sound pressure level given by the producer
- 'Frequency' is the frequency which the Nor850 system will calibrate for. '1kHz', '250Hz', 'A', 'C', 'Z' are possible options.
- 'Correction' is containing correction response or frequency linearity information about this calibrator.

RSS sensor

The RSS sensor menu contains the following data:

Calibration:

- 'Laboratory' is used for the verification laboratory used at the latest periodic verification
- 'Date' is used for the date of the latest periodic verification
- 'Verified LwA' is used for the measured sound power level of the latest periodic verification
- '0 dB ref' is the setting of the reference for the given sensitivity
- 'Interval' is the selection for how many months the current verification is valid. After this period, the system will give a warning if the selected sensor is out of date.

RSS:

- 'Type' is the producer and model of the RSS
- 'Serial number' is the given serial number on the RSS
- 'Nominal LwA' is used for the nominal sensitivity given by the producer
- 'Correction' is containing the Lw values of the RSS for 1/3-octave frequency bands.

Building Acoustic Application Mode

The Building Acoustic application mode is selected either by clicking the 'Building Acoustics' button on the opening screen, or, by selecting the Measurement Mode menu found by clicking on the Norsonic logo in the upper left corner.

As soon as the application software is loaded, the 'Rating' menu containing the settings for the actual sound insulation calculation is presented.

Rating menu

This 'Rating' menu contains several sub-sections for setting the different propertis of the upcoming sound insulation calculation, or, for pre-entering text descriptions for the final test report document. Some of these are mandatory for the selected Standard which is inicated by a red line around the actual property box until a legal value is entered. The line then turns light blue. The different sub-sections may be closed by clicking the up/down arrow in the right part of the sub-section header.

Standard:

- 'Category' is used for selection among the predefined Standard categories ***Field, Laboratory*** or ***Others***
- 'Standard' is used for selecting the different Standard group such as ISO, ASTM or other national groups
- 'Type' is the selection of ***Airborne, Impact, Façade*** or similar.
- 'Number' is used for the selection of possible multiple Standard numbers within the set Category, Standard and Type
- 'Subtype' is used when required in cases such as selecting between ***Rooms*** or ***Element*** version of the ISO 140-4

Source:

- 'Volume' is the actual volume in the source room given in m3
- 'Humidity' is the humidity in the source room measured in %
- 'Temperature' is the air temperature measured in ˚C
- 'Pressure' is the air pressure measured in kPa
- 'Condition' may be used for describing the condition of the source room
- 'Type' may be used for describing the actual type of source room
- 'Location' may be used for describing the location of the source room

Receiving:

- 'Volume' is the actual volume of the receiving room given in m^3. For the receiving room, this value is calculated based on entered values for ***width, height*** and ***length*** of the actual room. If the room is non-square, and the final volume is known, the user may simply enter '1' for ***width*** and ***height*** and the actual volume as ***length t***o get the correct volume for the calculations. Alternatively, use the down-arrow on the keyboard to get additional calculation lines which then will produce the final volume based on several sub-volumes. Entering a negative value into one of these lines will make it possible to subtract the volume of construction beams etc. The additional line may be removed again by deleting all values in the line.

- 'Humidity' is the humidity in the receiving room measured in %
- 'Temperature' is the air temperature measured in ˚C
- 'Pressure' is the air pressure measured in kPa
- 'Condition' may be used for describing the condition of the receiving room
- 'Type' may be used for describing the actual type of receiving room
- 'Location' may be used for describing the location of the receiving room

Test Specimen:

- 'Area' is the actual area in the test specimen given in m^3. This value is calculated based on entered values for ***width*** and ***height*** of the actual test specimen. For non-square objects, additional calculation lines may be added as described for the receiving room volume.
- On the right hand side of this sub-section, any special calculation rules for the area used in the calculations are indicated. One example is the use of the maximum value of either entered Test Specimen area S or the entered Receiving Room volume divided by 7,5.

Report:

- 'Reference curve position' tick-boxes may be selected to ***Fixed*** and/or ***Shifted***. This allow the user to draw the red reference curve according to the pre-set fixed position in the selected Standard, and/or, according to the calculated position for the final sound insulation index.
- '6 dB rule' tick-box is used for activating the check of the neighboring frequency bands differences for the average level in the source room. The smiley faces on the left hand side of the tabular view may then show a neutral face when this check is active.
- 'Lmax – Leq' tick-box is used for activating the check of maximum differences between the Lmax and the Leq values for the different measurement positions. This is handy for evaluation of any possible short-term external noise during the measurement duration. The user may specify the maximum differences for each frequency band by opening the sub-menu by clicking 'Edit'. The smiley faces on the left hand side of the tabular view may then show a neutral face when this check is active.
- '1/10 dB Accuracy' tick-box is used for making the final sound insulation index calculation in 1/10 dB step instead of the normal 1 dB step. This is handy when making small adjustment to the test object that cannot be measured with 1 dB final resolution.
- The seven text field areas named 'Client', 'Date of test', 'Description', 'Object', 'Company', 'No. of test report' and 'Date of signature' are all for free text entry by the user. These texts will then automatically appear in the final Excel Report.

Calculations:

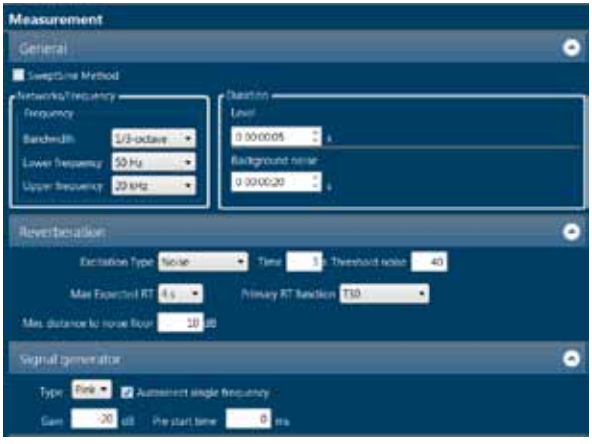
- 'Corrections' is used for activating corrections to the measured values in the final calculations. By activating the tick-box named 'Background noise', the receiving room average values will be corrected for the measured background noise level when measured. The selected Standard is automatically giving the details for such corrections.

When all required and desired properties are entered, a click on the 'OK' key initiates the Nor850 system for the desired sound insulation calculations in accordance with the selected Standard.

The 'Rating' menu can also be found by clicking the 'Measurement' button in the upper left corner:

Measurement menu

As soon as the details in the Rating menu are entered, the Nor850 system is ready for the measurements. However, the user may choose to adjust different parameters for the measurements by opening the 'Measurement' menu. Select the Measurement/Measurement in the upper menu bar.



The Measurement menu contains the following features and settings for the measurements of level and reverberation time:

General:

- '***SweptSine*** method' tick-box is used for activating the sweeping sine measurement technique. Use of this technique is different from the traditional method, and described in a separate section.
- 'Bandwidth' enables the user to switch between 1/3- and 1/1-octave measurements. Please note that for all currently supported building acoustic testing Standards in the Nor850 system, only the 1/3-octaves are selectable.
- 'Lower frequency' is used for selecting the lowest frequency band to be measured. In the BA mode, the minimum is 50 Hz for 1/3-octaves.
- 'Upper frequency' is used for selecting the highest frequency band to be measured. In the BA mode, the maximum is 20 kHz for 1/3-octaves.
- 'Duration Level' is used for pre-setting the measurement duration for the source and/or receiving room level measurements. Most Standards require 16s for measurements down to 50Hz and 6s for measurements down to 100Hz.
- 'Duration Background noise' is used for pre-setting the measurement duration for the background noise in the receiving room.
- When the SweptSine method is selected, the user can choose between a pre-defined measurement duration of either 60s, 336s or 672s, depending of the background noise conditions. In addition, the signal-to-noise requirement is to be specified in dB.

Reverberation:

- 'Excitation Type' is used for selecting the actual method for detecting the correct decay. Noise is used for operation with the external noise generator, and ***Impulse*** is used for operation with an external impulsive noise. When several measurement channels are connected simultaneously, the Nor850 system will automatically operate such multi-channel systems with activated signal generators in some channels and non-activated signal generators in others. Note that when the ***SweptSine*** method is se-

lected, this is the only choice for the reverberation excitation type.

- 'Time' is setting the duration of the active noise excitation before the decays are measured.
- 'Threshold noise' is setting the minimum threshold level before the decay measurements are triggered.
- 'Max expected RT' is setting the maximum reverberation time to be measured. In reality, this setting controls the period length of each sample along the decay. The available settings of ***4s, 8s, 16s*** and ***32s*** are corresponding to sample periods of 5ms, 10ms, 20ms and 40ms respectively.
- 'Primary RT function' is used for selecting between the reverberation time functions ***EDT, T_{15}, T_{20}*** *or* ***T_{30}***. All functions are presenting the result as the time for the theoretical 60dB decay time, but the calculation ranges are individual for each function. ***EDT*** starts at 0 dB below the excitation level and end -10 dB below. All the other functions start at -5 dB below the excitation level, but ends at -20, -25 and -35 dB respectively.
- 'Min distance to noise floor' is setting the minimum difference between the lower calculation range for the selected RT function and the background noise level. The background noise level for the RT calculation is handled individually for each frequency band, and is set identical to the horizontal part of the decay measurement after the decays have decreased below the RT calculation range.
- When the ***SweptSine*** method is selected, a box called 'Very short RT' can be checked. This can be used if the expected reverberation time is shorter than 1,5 seconds in all frequency bands. When this option is selected, the measurement duration will be a little shorter.

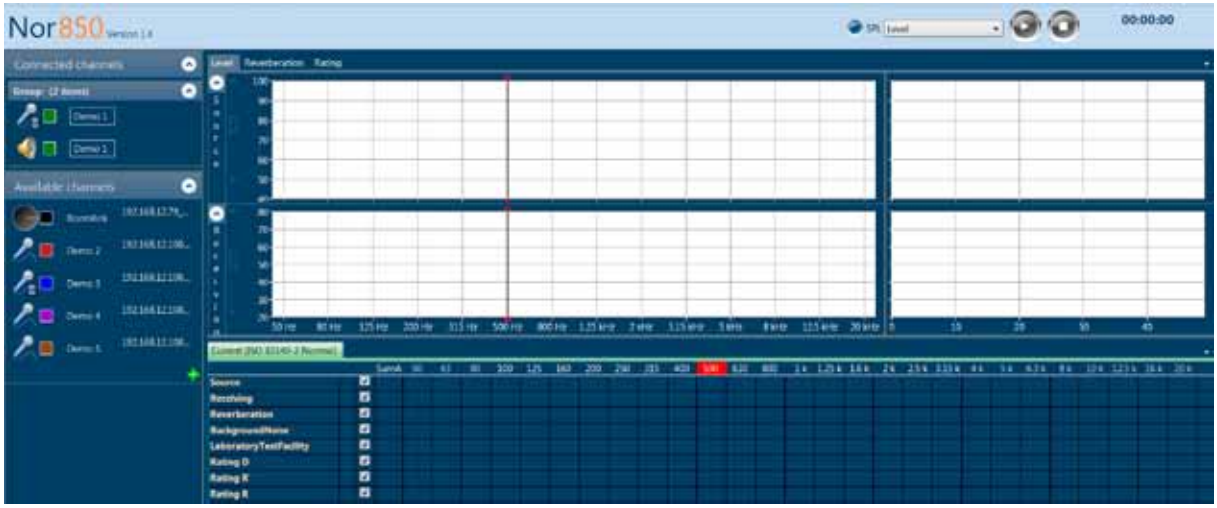
Noise:

- 'Type' is used to select between ***White noise*** or ***Pink noise***, or alternatively ***SweptSine*** when in ***SweptSine*** mode. All connected measurement channels with activated signal generator will get the same type of noise.
- By ticking the 'Autoselect single frequency' option, the Nor850 system will automatically select the single frequency bands where the receiving room level is less than 10dB higher than the background noise level. The user can then choose to measure these bands with 1/3-octave band-limited noise. Note that the autoselect function will only work if background noise measurements are performed first.
- 'Gain' is used to set the output signal level in the range from 0 to -50 dB, where 0dB corresponds to 1 Vrms. All activated signal generators will get the same output gain setting.
- 'Pre start time' is used to start the signal generator before the measurement is initiated. This is used to build up the sound level to a steady state before starting the measurement.

When all required and desired properties are entered, a click on the 'OK' key initiates the Nor850 system for the desired sound insulation measurement setup desired by the operator.

Normal measurement display view

As soon as the user has selected all proper settings in the Rating and Measurement menus, the Nor850 system is ready to perform the Building Acoustics tests. The PC screen now shows a display with 3 - 4 main sections:



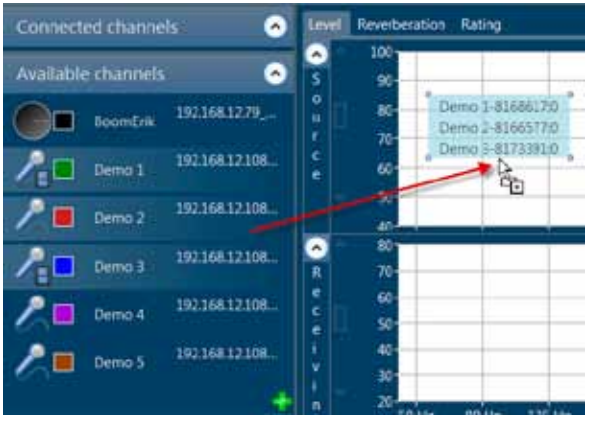
- To the very left, all connected and/or available measurement channels are listed
- The lower mid and right part shows a table view containing all measurement and calculation values
- The upper mid and right parts contain different views depending on the actual measurement mode or selected tab. The possible tabs are found in the upper left corner of the mid-section. The various contents of this section are normally as follows:
  - 'Level' contains the spectrum of the source room (upper part) and receiving room (lower part) in the mid-section and the corresponding level vs time during the measurement duration for the selected cursor frequency in the corresponding right-sections. For background and impact level measurements, the lower part is normally stretched onto the upper part as only the receiving room information is desired.
  - 'Reverberation' contains the calculated RT spectrum as a function of frequency in the mid-section, and the corresponding level vs time decay for the selected cursor frequency in the corresponding right-sections.

– 'Rating' contains the graphical view of the measured sound insulation including the reference curve and the calculated index in the entire upper mid- and right-sections. In this tab it is also possible to enable/disable the background noise correction by toggling the 'Background noise' checkbox. Thus the user can see how much the background noise is influencing the measurements.

- On the very top section, the operator finds the measurement mode selector, the Start/Stop push buttons as well as the measurement duration indicator. The measurement mode selector is used to select which kind of measurement to perform when hitting the Start button. Normally the selection is ***Level, Background noise*** or ***Reverberation time***, but these will alter with the preselected Standard.

Activating the available measurement channels

In order for the Nor850 measurement system to operate correctly, the channels in use must be placed either in the source room or in the receiving room. This is done by click&drag on any of the available channels onto the source or receiving room area in the upper mid-section of the display. As soon as the connection is well established, this channel will be found under the 'Connected channels' in the upper left part of the display. For a multiple channel system, the user may put as many channels as desired into both the source and the receiving room.



Alternatively, the user may first ***activate*** any available channel into the 'Connected channels' area, and then place the activated channel into the source or receiving room by click&drag. The activation of the channels is either done by click&drag, or, by right-click and selecting the ***Activate*** command in the dialogue box.

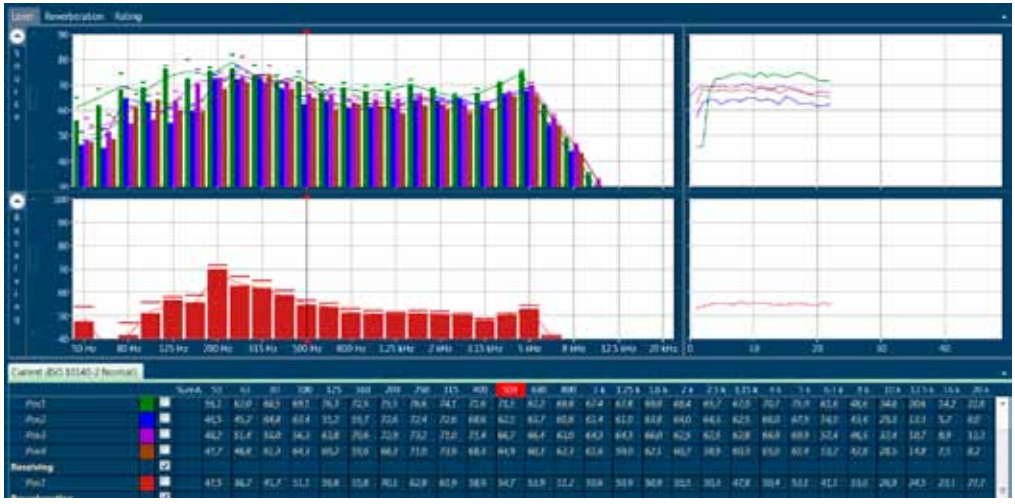
Activating the signal generator of a measurement channel

To activate the signal generator of any of the measurement channels, the desired channel must first be activated in the Nor850 system. The users must then right-click on this connected channel and select the 'Add signal generator' in the display dialogue menu, or select the 'View Configuration' and tick-on the Signal Generator in the Configuration menu. Alternatively, the channel Configuration menu can be opened by double-clicking the channel. The 'Connected channels' list will contain extra rows for each of the activated signal generators.

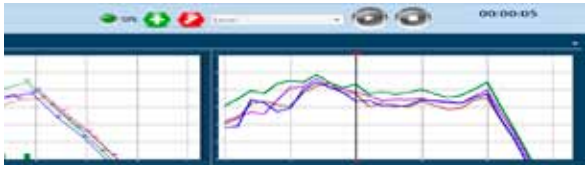
When channels with activated signal generator are placed in the source or receiving rooms, the operation of the signal generators will automatically follow the selected measurement mode. That means produce excitation signal in the source room channels during level measurements and excitation signal in the receiving room channels during reverberation time measurements.

Making the Level measurements

Set the measurement mode selector to level, and push the Start key in the upper right corner. The display will then show the frequency spectrum of the source and/or receiving room in the upper mid-section and the level vs time of the selected cursor frequency in the upper right-section. In the frequency spectrum, the SPL values are shown as filled bar graphs, the L_{eq} values as a line, and the L_{max} values as a step-line.



When the preset measurement duration is ended, or the Stop key is pushed, the upper right-section will change to present the last measured spectrum (thick lines) together with the possible previously measured microphone positions. In addition, a thick black line will indicate the average level of the previously measured positions. To the left of the measurement mode selector, the display now presents 'Accept' and 'Cancel' keys for the acceptance or cancellation of the last performed measurement.



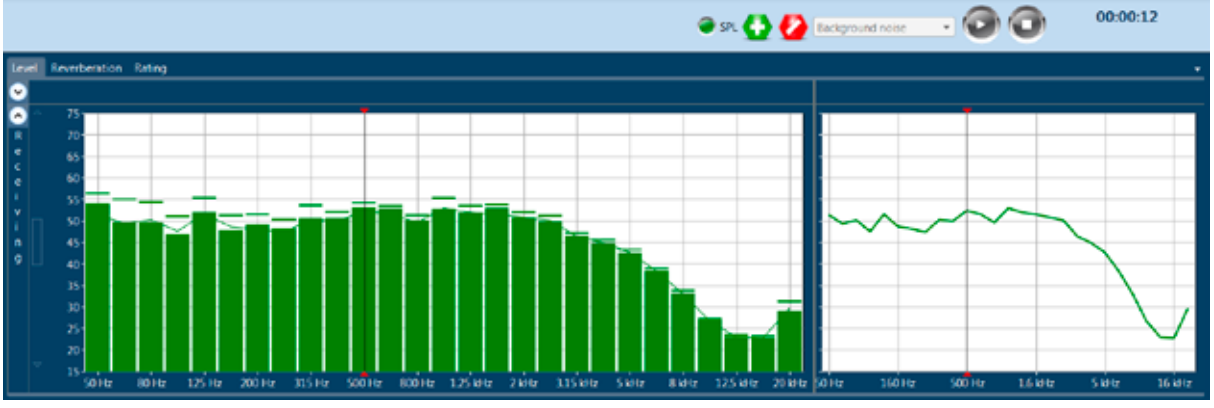
In the tabular section, the measured values are presented in a yellow color. Upon accepting the measurement, these values are turned into white and put into the calculation of the average level. Cancellation of the measurement will remove all the last measured values from the memory.

Additional level measurement positions may now be measured by a new click on the Start key.

Making the Background noise measurements

Set the measurement mode selector to Background noise, and push the Start key in the upper right corner. The display will then show the frequency spectrum of the receiving room in the same way as for the level measurements. In the right-section, the measured background noise will be presented together with the average normal level measurement in order to evaluate the difference between the measured receiving levels and the background noise levels.

The background noise measurements must be accepted or cancelled in the same way as the level measurements. Additional background noise measurement positions may now be measured by a new click on the Start key.

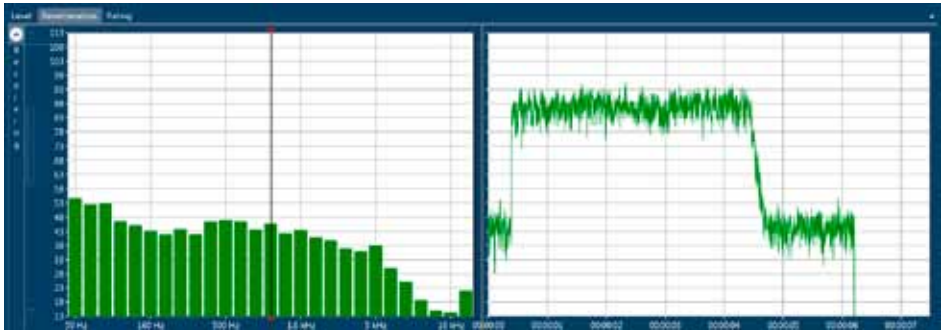


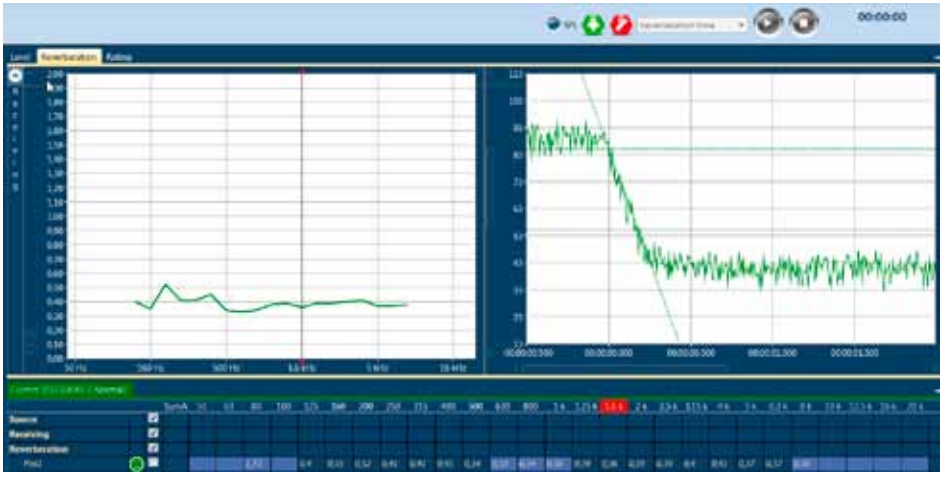
Making the Reverberation time measurements

Set the measurement mode selector to Reverberation time, and press the Start key. The Nor850 system will now automatically use the noise generator connected to the receiving room instead of the noise generator connected to the source room.

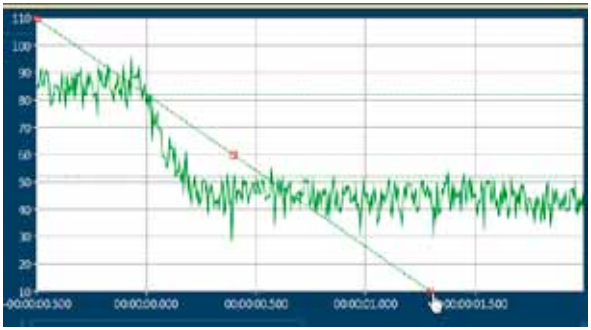
During the measurement, the upper mid-section will show the SPL frequency spectrum, while the upper right-section will show the level vs time of the noise level.

As soon as the reverberation time measurements is ended, the display will turn to show the calculated reverberation times as a function of frequency in the mid-section and the decay with the calculated decay-line and indicator lines for the T_{30}/ T_{20}/ T_{15}/EDT decay calculation ranges for the in the right-section. The user should now accept or cancel the last measurement in the same manner as for the previous measurements.





It is possible to manually change the resulting RT curve if the curve fitting does not work properly. This can be done by holding down the 'Alt' key and clicking the curve:



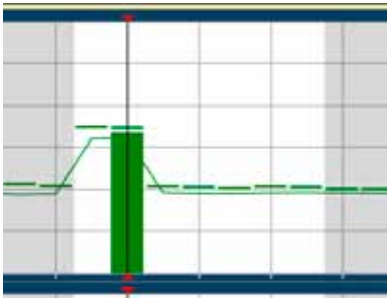
To change the slope of the curve, click&drag the lower or upper red square. The RT value in the table below will change accordingly.

Single frequency measurements

For the level and reverberation time measurements, the signal-to-noise ratio might be to low even if the loudspeaker is operating at full power. The Nor850 system can in such cases measure with 1/1- or 1/3-octave band limited noise instead of pink or white noise. Thus the frequency bands with low signal-to-noise ratio can be measured sequentially. This results in approximately 15dB of increased signal level in the selected frequency bands.

To do single frequency measurements, first make a normal level or reverberation time measurement. Before accepting the measurement, hold down the Ctrl key and click the desired frequency bands to be measured in the spectrum window. Alternatively, click&drag to select multiple frequencies (and hold down the Ctrl key to select multiple groups of frequencies):

Then, right-click in the spectrum window and select 'Set selected as single frequency', and click the Accept button to do the measurements. The Nor850 system will now measure the selected frequency bands automatically, according to the standard. The SPL, L_{max} and L_{eq} will be shown for the single frequency while measuring.



The single frequency selection will now be stored and automatically performed for the following measurements, since the same measurement settings must be used for all other measurement positions.

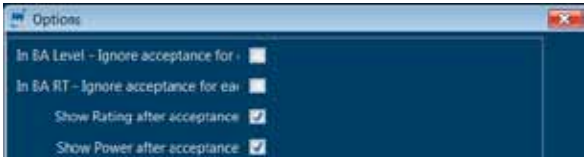
The single frequency measurement procedure is the same when measuring reverberation time.

Evaluating the final results in the Rating display

To evaluate the final calculated rating, select the rating display by clicking the 'Rating' tab in the upper left part of the mid-section.

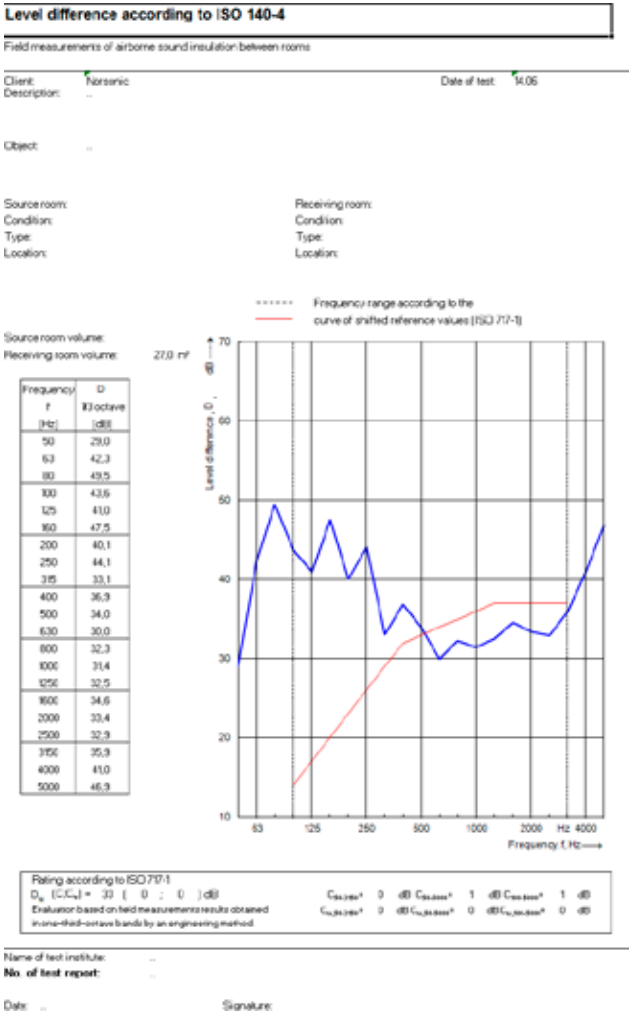
Alternatively, turn on the automatic rating view selector to allow the system to switch automatically to the rating view each time new measurements are accepted. The 'Show Rating after acceptance' switch is found in the 'Nor850 Options' menu available after clicking the Norsonic logo in the upper left corner.

The Rating display contains the measured resulting level difference after correction for the reverberation time, background noise, etc. The final rating index is shown in the left part of the upper section. Should the selected Standard allow more indices, the required index is selected by a click on the desired line in the lower part of the tabular display.



The calculated index may be viewed with or without background noise correction. Simply activate the function by a click in the 'Background noise' tick-box in the left part of the upper-section.

In order to produce the final excel report of the sound insulation test, select the Measurement/Excel Reports feature in the menu bar.



Level difference according to ISO 140-4

Field measurements of airborne sound insulation between rooms

Client: Norsonic
Description: ..
Date of test: 14.06

Object: ..

Source room:
Condition:
Type:
Location:

Receiving room:
Condition:
Type:
Location:

Source room volume:
Receiving room volume: 27,0 m³

Frequency f [Hz]	D 1/3 octave [dB]
50	29,0
63	42,3
80	49,5
100	43,6
125	41,0
160	47,5
200	40,1
250	44,1
315	33,1
400	36,9
500	34,0
630	30,0
800	32,3
1000	31,4
1250	32,5
1600	34,6
2000	33,4
2500	32,9
3150	35,9
4000	41,0
5000	46,9

Frequency range according to the curve of shifted reference values (ISO 717-1)

Level difference, D, dB

70
60
50
40
30
20
10

63 125 250 500 1000 2000 Hz 4000

Frequency f, Hz

Rating according to ISO 717-1

D_n (C;C_{tr}) = 33 (0 ; 0) dB

Evaluation based on field measurements results obtained in one-third-octave bands by an engineering method

$C_{100-3150}$ 0 dB $C_{50-5000}$ 1 dB $C_{50-5000}$ 1 dB
$C_{tr,100-3150}$ 0 dB $C_{tr,50-5000}$ 0 dB $C_{tr,50-5000}$ 0 dB

Name of test institute: ..
No. of test report: ..

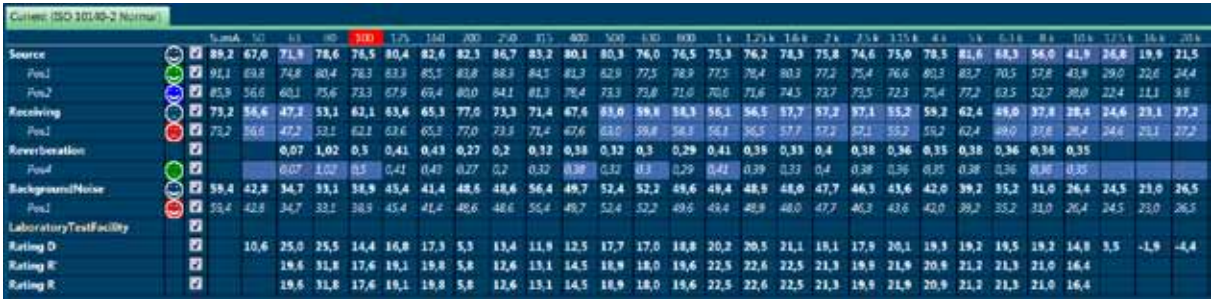
Date: ..

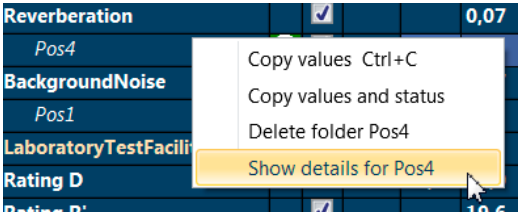
Signature:

Detailed analysis of the tabular result display

To evaluate the details of the measured data, the tabular view in the lower part of the screen is giving the user many possibilities. The table is organized in accordance with the selected Standard in a kind of folder system where the ***Source, Receiving, Background Noise*** and ***Reverberation*** time measurements represent the folders. In addition, the calculated ratings are found in the rows below the main folders.

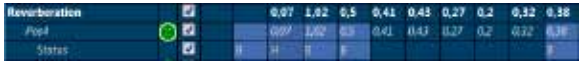
Double-clicking on any of the folders will change the content of the upper part display. Generally, a double-click on the Source or Receiving folder will change the upper part to show all the measurement made in level mode. Double-clicking the Background Noise folder will show the background noise measurements with the additional results from the receiving room. Please note that the thick black line represents the average result from all the individual measurement positions. Finally, double-clicking the Reverberation folder will initiate the view of the reverberation time as a function of frequency plus the decay of all the measurements at the frequency cursor position.





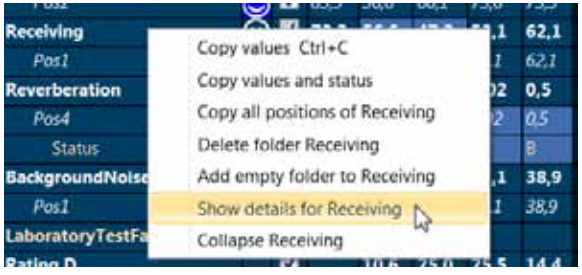
For viewing one single measurement position, a double-click on the required position will present only this single measurement result. It is additionally possible to view the status of each measurement by making a right-click and select the ‘Show details for Pos X’ command.

For a best possible evaluation of the average results, a right-click on the folder names opens a dialogue box in which the user may activate extra rows showing the details for the folder with the number of averaged positions as well as the calculated standard deviation from this averaging process.

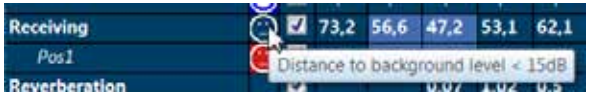


The right-click dialogue boxes additionally give the possibility to delete or copy the measurement positions.

Depending of the quality of the measurements, the table view additionally contains different color background in the various cells. Generally, the orange color represents an error such as too short reverberation time for the actual frequency band, and the blue colors represent various warnings such as high background noise or too high Lmax – Leq differences.



Along the left hand side of the table view, small smiley indicates the overall status for each measurement position. If no warning or errors are detected for any frequency band, the smiley smiles! Depending on possible warnings or errors, the smileys shows a neutral face or a negative face. To get information about the reason behind the non-smiling smileys, simply put the mouse on the top and read the tool-tip which appears.



The tool-tip feature is also available on the top of any table cell for detailed information about the status for this particular frequency band at this particular measurement position.

The user may key-in new values manually by double-clicking in the required cell and enter the desired value from the keyboard. This will then be logged as a hand-made value in the status row.

Sound Power Application Mode

The Sound Power application mode is selected either by clicking the 'Sound Power' button on the opening screen, or by selecting the 'Sound Power' Measurement Mode menu found by clicking on the Norsonic logo in the upper left corner.

As soon as the application software is loaded, the 'Rating' menu containing the settings for the actual sound power measurement is presented.

Rating menu

This 'Rating' menu contains several sub-sections for setting the different propertis of the upcoming sound power measurement, and for pre-entering text descriptions for the final test report document. Some of these are mandatory for the selected Standard which is inicated by a red line around the actual property box until a legal value is entered. The line then turns light blue. The different sub-sections may be closed by clicking the up/down arrow in the right part of the sub-section header.

Standards:

- 'Category' is used for selection among the pre-defined Standard accuracy grades ***Precision, Engineering*** or ***Survey.***
- 'Standard' is used for selecting the different Standardization groups. In Sound Power mode, only ISO Standards are available.
- 'Type' is the selection of ***Direct or Comparison***, which indicated whether the sound power is to be measured directly or with a reference sound source (RSS).
- 'Number' is used for the selection of possible multiple Standard numbers within the set Category and Type.
- 'Surface', when using a Direct type measurement, defines the measurement surface which is used to measure the source, such as ***Hemisphere*** or ***Cylindrical***.
- 'K2Correction' is the type of K2 correction factor which will be used for the calculations. ***RSS, Reverberation*** or ***User input*** are the possible choices.

Test Box:

- When using ***Engineering*** or ***Survey*** grade, the Test Box tab defines the dimensions of the object which is to be measured. Here one simply enters the length, width and height of the object. 'd0' is the characteristic source dimension which is the distance from the origin of the co-ordinate system to the farthest corner of the reference box.

Test Room:

- 'Volume' is the actual volume of the measurement room given in m3. This value is calculated based on entered values for ***width, height*** and ***length*** of the actual room. If the room is non-square, and the final volume is known, the user may simply enter '1' for width and height and the actual volume as length to get the correct volume for the calculations. Alternatively, use the down-arrow on the keyboard to get additional calculation lines which then will produce the final volume based on several sub-volumes. Entering a negative value into one of these lines will make it possible to subtract the volume of construction beams etc. The additional line may be removed again by deleting all values in the line.

- 'Humidity' is the humidity measured in %
- 'Temperature' is the air temperature measured in ˚C
- 'Pressure' is the air pressure measured in kPa
- 'Condition' may be used for describing the condition of the measurement room
- 'Type' may be used for describing the actual type of measurement room
- 'Location' may be used for describing the location of the measurement room

Surface Parameters:

- This tab shows the measurement and object surfaces as defined in the 'Standards' tab. A figure shows the shape of the surface and distances which must be entered.
- Depending on the choice of surface, the user must enter either the distance from the measured object to the surface or the radius of a hemispherical surface or the radius and height of a cylindrical surface.
- Note that the value '0' is not accepted for a parallelepiped surface, because this indicates that the microphone is placed directly at the object surface.
- The measurement surface area is automatically calculated.

Reference Sound Source:

- When the Comparison type measurement is chosen, or the RSS is used for the K2 correction factor, the user needs to choose one of the reference sound sources from the drop-down list. The nominal A-weighted level, as well as the spectrum correction values are displayed for the chosen RSS.
- New RSS sensors can be added in the Sensor Administration menu.

User input:

- If the K2 correction value has been set to User Input, the user needs to enter the K2 correction values manually in this field. Both the A-weighted and 1/3-octave spectrum values have to be entered.

Report:

- The eight text field areas named 'Client', 'Date of test', Mounting condition', 'Operation condition', 'Object', 'Company', 'No. of test report' and 'Date of signature' are all for free text entry by the user. These texts will then automatically appear in the final Excel Report.

Calculations:

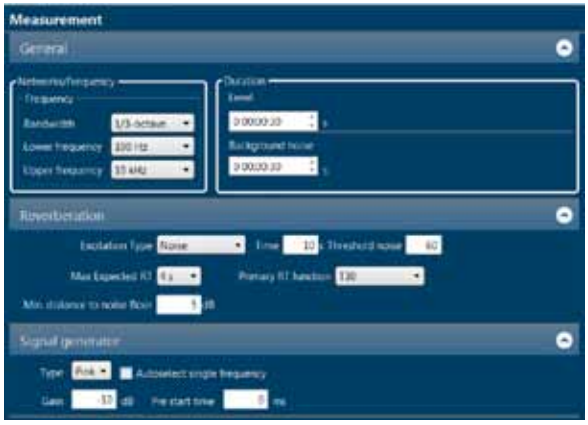
- 'Corrections' is used for activating corrections to the measured values in the final calculations. By activating the tick-box named 'Background noise', the sound power values will be corrected for the measured background noise level when measured. The selected Standard is automatically giving the details for such corrections.

When all required and desired properties are entered, a click on the 'OK' key initiates the Nor850 system for the desired sound power measurements in accordance with the selected Standard.

The Rating menu can also be found by clicking the 'Measurement' button in the upper left corner:

Measurement menu

As soon as the details in the Rating menu are entered, the Nor850 system is ready for the measurements. However, the user may choose to adjust different parameters for the measurements by opening the 'Measurement' menu. Select the Measurement/Measurement in the upper menu bar.



The Measurement menu contains the following features and settings for the measurements of level and reverberation time:

General:

- 'Bandwidth' enables the user to switch between 1/3- and 1/1-octave measurements. Please note that for all currently supported sound power measurement Standards in the Nor850 system, only the 1/3-octaves are selectable.
- 'Lower frequency' is used for selecting the lowest frequency band to be measured. In the Sound Power mode, the minimum is 50 Hz for 1/3-octaves.
- 'Upper frequency' is used for selecting the highest frequency band to be measured. In the Sound Power mode, the maximum is 20 kHz for 1/3-octaves.
- 'Duration Level' is used for pre-setting the measurement duration for the level measurements.
- 'Duration Background noise' is used for pre-setting the measurement duration for the background noise in the measurement room.

Reverberation:

- 'Excitation Type' is used for selecting the actual method for detecting the correct decay. ***Noise*** is used for operation with the external noise generator, and ***Impulse*** is used for operation with an external impulsive noise. When several measurement channels are connected simultaneously, the Nor850 system will automatically operate such multi-channel systems with activated signal generators in some channels and non-activated signal generators in others.
- 'Time' is setting the duration of the active noise excitation before the decays are measured.
- 'Threshold noise' is setting the minimum threshold level before the decay measurements are triggered.
- 'Max expected RT' is setting the maximum reverberation time to be measured. In reality, this setting controls the period length of each sample along the decay. The available settings of ***4s, 8s, 16s*** and ***32s*** are corresponding to sample periods of 5ms, 10ms, 20ms and 40ms respectively.
- 'Primary RT function' is used for selecting between the reverberation time functions ***EDT, T_{15}, T_{20}*** or ***T_{30}***.

All functions are presenting the result as the time for the theoretical 60dB decay time, but the calculation ranges are individual for each function. ***EDT*** starts at 0 dB below the excitation level and end -10 dB below. All the other functions start at -5 dB below the excitation level, but ends at -20, -25 and -35 dB respectively.

- 'Min distance to noise floor' is setting the minimum difference between the lower calculation range for the selected RT function and the background noise level. The background noise level for the RT calculation is handled individually for each frequency band, and is set identical to the horizontal part of the decay measurement after the decays have decreased below the RT calculation range.

Noise:

- 'Type' is used to select between ***White*** noise or ***Pink*** noise. All connected measurement channels with activated signal generator will get the same type of signal.
- By ticking the 'Autoselect single frequency' option, the Nor850 system will automatically select the single frequency bands where the source level is less than 10dB higher than the background noise level. The user can then choose to measure these bands with 1/3-octave band-limited noise. The single frequency option will explained more thoroughly later in this document. Note that the autoselect function will only work if background noise measurements are performed first.
- 'Gain' is used to set the output signal level in the range from 0 to -50 dB, where 0dB corresponds to 1 V_{rms}. All activated signal generators will get the same output gain setting.

When all required and desired properties are entered, a click on the 'OK' key initiates the Nor850 system for the desired sound power measurement setup desired by the operator.

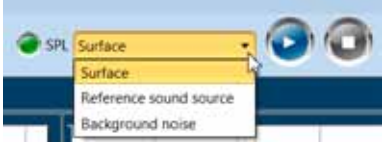
Normal measurement display view

As soon as the user has selected all proper settings in the Rating and Measurement menus, the Nor850 system is ready to perform the Sound Power measurements. The PC screen now shows a display with 3 - 4 main sections:

- To the very left, all ***connected*** and/or ***available*** measurement channels are listed
- The lower mid and right part shows a table view containing all measurement and calculation values
- The upper mid and right part contain different views depending on the actual measurement mode or selected tab. The possible tabs are found in the upper left corner of the mid-section. The various contents of this section are normally as follows:
  - 'Level' contains the spectrum of the measured surface, RSS or background levels in the mid-section and the corresponding level vs time during the measurement duration for the selected cursor frequency in the corresponding right-sections.

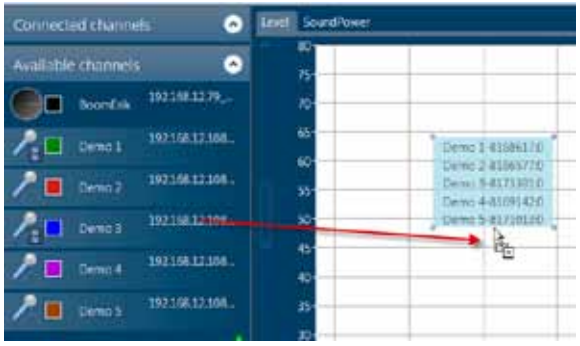
– 'Reverberation' contains the calculated RT spectrum as a function of frequency in the mid-section, and the corresponding level vs time decay for the selected cursor frequency in the corresponding right-sections.
– 'SoundPower' contains the graphical view of the measured sound power spectrum including the calculated total A-weighted sound power level. Here, the user will get a warning if the K1 and/or K2 factor is too high. In this tab it is also possible to enable/disable the background noise correction by toggling the 'Background noise' checkbox. Thus the user can see how much the background noise is influencing the measurements. The C1 and C2 correction factors are also displayed.

- On the very top section, the operator finds the measurement mode selector, the Start/Stop push buttons as well as the measurement duration indicator. The measurement mode selector is used to select which kind of measurement to perform when hitting the Start button. Normally the selection is ***Surface, Background noise, Reference Sound Source*** or ***Reverberation time***, but these will alter with the pre-selected Standard.

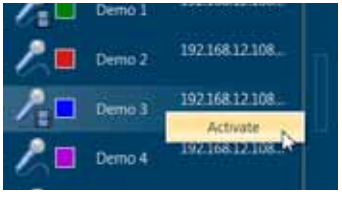


Activating the available measurement channels

In order for the Nor850 measurement system to operate correctly, the channels in use must be placed in the measurement room. This is done by click&drag on any of the available channels onto the test room area in the upper mid-section of the display. As soon as the connection is well established, this channel will be found under the 'Connected channels' in the upper left part of the display. For a multiple channel system, the user may put as many channels as desired into the room.

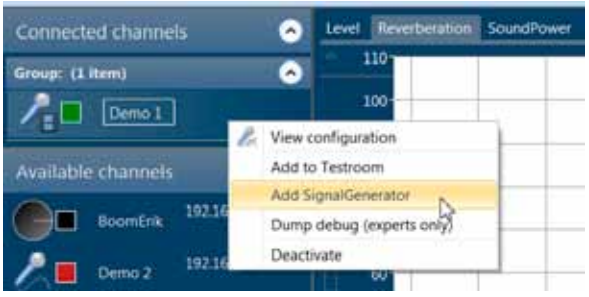


Alternatively, the user may first activate any available channel into the 'Connected channels' area, and then place the activated channel into the measurement room by click&drag. The activation of the channels is either done by click&drag, or, by right-click and selecting the Activate command in the dialogue box.



Activating the signal generator of a measurement channel

To activate the signal generator of any of the measurement channels, the desired channel must first be activated in the Nor850 system. The users must then right-click on this connected channel and select the 'Add signal generator' in the display dialogue menu, or select the 'View Configuration' and tick-on the Signal Generator in the Configuration menu. Alternatively, the channel Configuration menu can be opened by double-clicking the channel. The 'Connected channels' list will contain extra rows for each of the activated signal generators.

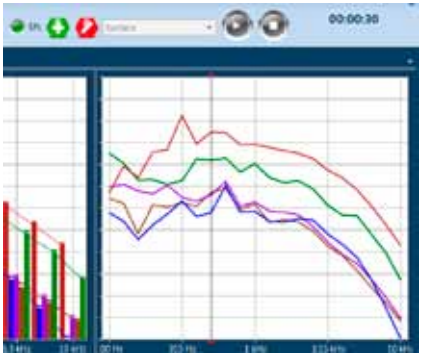


When channels with activated signal generator are placed in the measurement room, the operation of the signal generators will automatically follow the selected measurement mode. This means that the signal generator will only be active (and thus visible in the channel list) during reverberation time measurements.

Making the surface level measurements

To measure the measurement surface levels, set the measurement mode selector to surface, and push the Start key in the upper right corner. The display will then show the frequency spectrum of the measured SPL in the upper mid-section and the level vs time of the selected cursor frequency in the upper right-section. In the frequency spectrum, the SPL values are shown as filled bar graphs, the L_{eq} values as a line, and the L_{max} values as a step-line.

When the preset measurement duration is ended, or the Stop key is pushed, the upper right-section will change to present the last measured spectrum (thick lines) together with the possible previously measured microphone positions. In addition, a thick black line will indicate the average level of the previously measured positions. To the left of the measurement mode selector, the display now presents 'Accept' and 'Cancel' keys for the acceptance or cancellation of the last performed measurement.



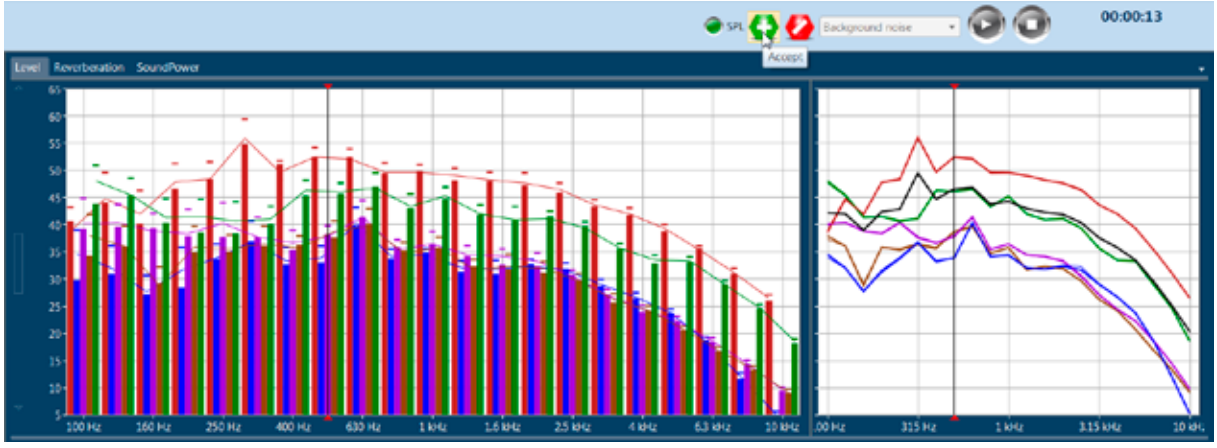
In the tabular section, the measured values are presented in a yellow color. Upon accepting the measurement, these values are turned into white and put into the calculation of the average level. Cancellation of the measurement will remove all the last measured values from the memory.

Additional surface measurement positions may now be measured by a new click on the Start key.

Making the Background noise and RSS level measurements

The background noise and RSS level measurements works exactly the same way as the surface level measurements. Set the measurement mode selector to Background noise or Reference Sound Source, and push the Start key in the upper right corner. The display will then show the frequency spectrum of the measured levels in the same way as for the surface measurements. In the right-section, the measured background noise will be presented together with the average surface/RSS level measurement in order to evaluate the difference between the measured surface/RSS levels and the background noise levels.

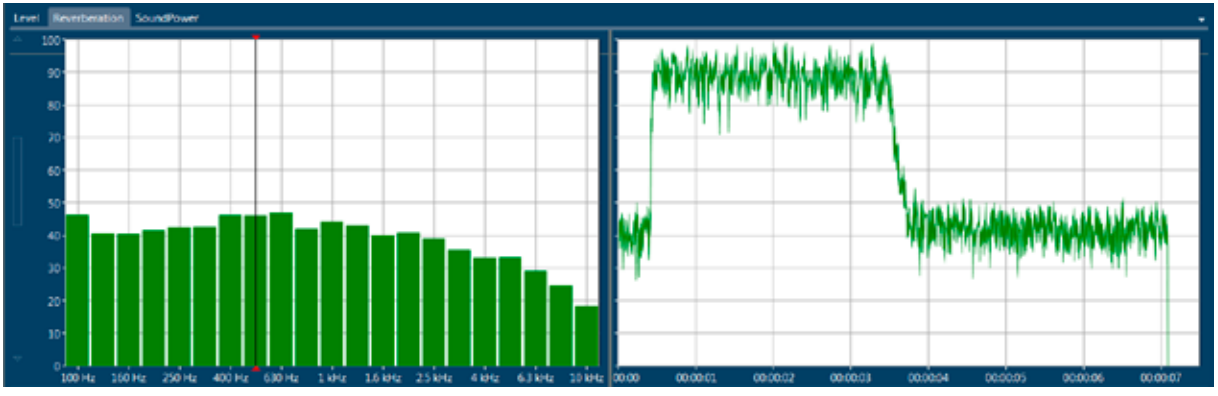
The background noise/RSS measurements must be accepted or cancelled in the same way as the surface measurements. Additional measurement positions may now be measured by a new click on the Start key.



Making the Reverberation time measurements

Set the measurement mode selector to Reverberation time, and press the Start key. The Nor850 system will now automatically use the noise generator connected to the measurement room.

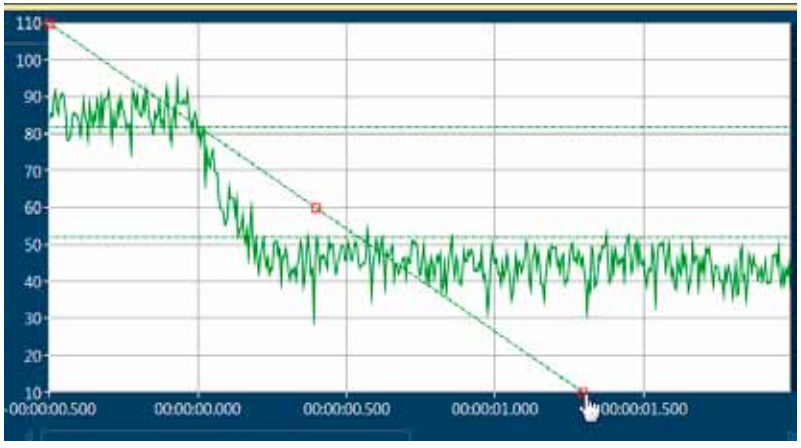
During the measurement, the upper mid-section will show the SPL frequency spectrum, while the upper right-section will show the level vs time of the noise level.



As soon as the reverberation time measurements is ended, the display will turn to show the calculated reverberation times as a function of frequency in the mid-section and the decay with the calculated decay-line and indicator lines for the T_{30}/ T_{20}/ T_{15}/EDT decay calculation ranges for the in the right-section. The user should now accept or cancel the last measurement in the same manner as for the previous measurements.

It is possible to manually change the resulting RT curve if the curve fitting does not work properly. This can be done by holding down the 'Alt' key and clicking the curve:

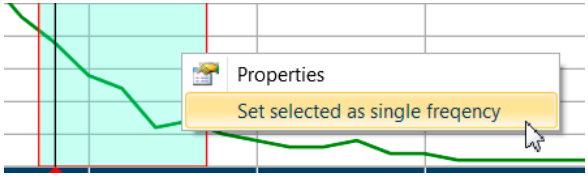
To change the slope of the curve, click&drag the lower or upper red square. The RT value in the table below will change accordingly.

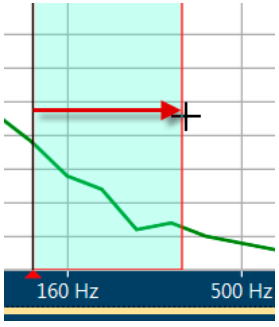


Single frequency measurements

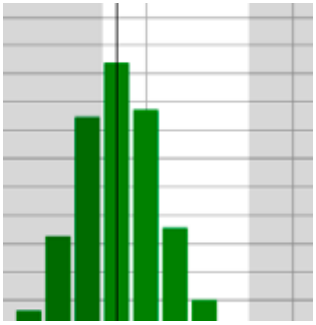
For the reverberation time measurements, the signal-to-noise ratio might be to low even if the loudspeaker is operating at full power. The Nor850 system can in such cases measure with 1/1- or 1/3-octave band limited noise instead of pink or white noise. Thus the frequency bands with low signal-to-noise ratio can be measured sequentially. This results in approximately 15dB of increased signal level in the selected frequency bands.

To do single frequency measurements, first make a normal reverberation time measurement. Before accepting the measurement, hold down the Ctrl key and click the desired frequency bands to be measured in the spectrum window. Alternatively, click&drag to select multiple frequencies (and hold down the Ctrl key to select multiple groups of frequencies):





Then, right-click in the spectrum window and select 'Set selected as single frequency', and click the Accept button to do the measurements. The Nor850 system will now measure the selected frequency bands automatically, according to the standard. The SPL will be shown for all frequencies while measuring.

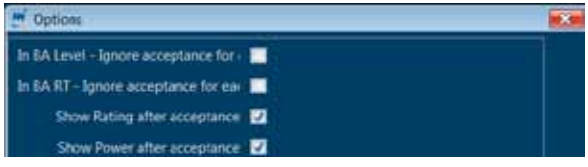


The single frequency selection will now be stored and automatically performed for the following measurements, since the same measurement settings will probably be needed for all other measurement positions.

Evaluating the final results in the SoundPower display

To evaluate the finally calculated rating, select the rating display by clicking the 'SoundPower' tab in the upper left part of the mid-section.

Alternatively, turn on the automatic sound power view selector to allow the system to switch automatically to the rating view each time new measurements are accepted. The 'Show Power after acceptance' switch is found in the 'Nor850 Options' menu available after clicking the Norsonic logo in the upper left corner.



The SoundPower display contains the measured resulting Sound Power spectrum after correction for the reverberation time, background noise, etc. The final A-weighted level is shown in the left part of the upper section

The calculated sound power may be viewed with or without background noise correction. Simply activate the function by a click in the 'Background noise' tick-box in the left part of the upper-section.

In order to produce the final excel report of the sound power measurement, select the Measurement/Excel Reports feature in the menu bar.

Sound power levels according to ISO 3741:2010

Precision methods for reverberation test rooms - Direct method

Client: Date of test:
Object:

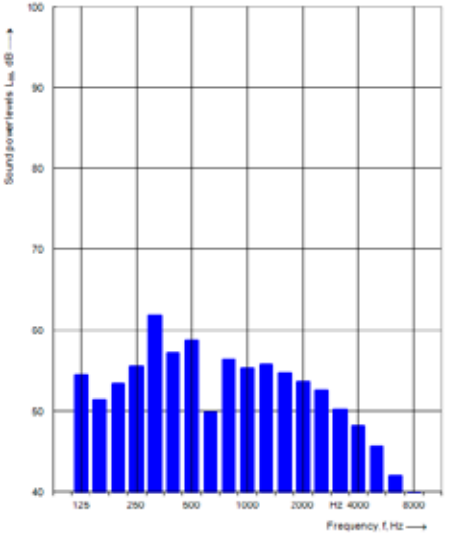
Mounting conditions:

Operating conditions:

Static pressure:
Air temperature:
Relative air humidity:
Test room volume: 210,0 m³
Area, S, of test room: 842,0 m²

Frequency f [Hz]	L_w 1/1 octave [dB]
100	*
125	54,5 *
160	51,4 *
200	53,4 *
250	55,5 *
315	61,8
400	57,2 *
500	58,7 *
630	49,9 *
800	56,4 *
1000	55,3 *
1250	55,7 *
1600	54,7
2000	53,7 *
2500	52,5 *
3150	50,2
4000	48,1
5000	45,6 *
6300	41,9
8000	37,7 *
10000	

* Too high



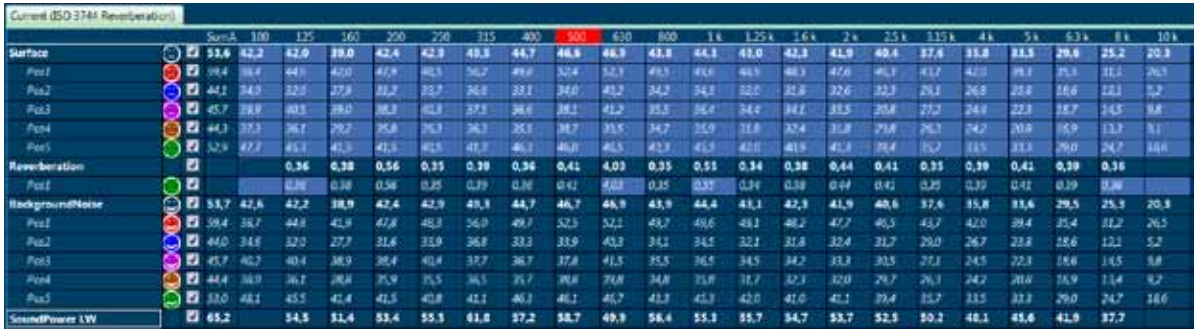
Sound power level L_w(A): 65,2 dB

Name of test institute:
No. of test report:

Date: Signature:

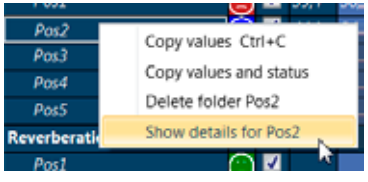
Detailed analysis of the tabular result display

To evaluate the details of the measured data, the tabular view in the lower part of the screen is giving the user many possibilities. The table is organized in accordance with the selected Standard in a kind of folder system where the ***Surface, ReferenceSoundSource, BackgroundNoise*** and ***ReverberationTime*** measurements represent the folders. In addition, the calculated sound power levels are found in the row below the main folders.

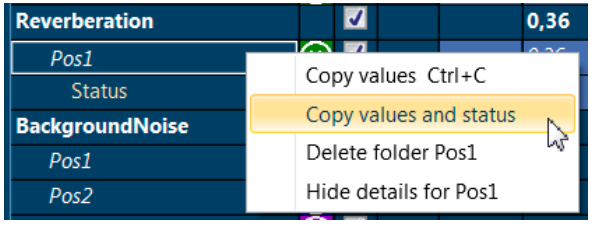


Double-clicking on any of the folders will change the content of the upper part display. Generally, a double-click on the Surface folder will change the upper part to show all the measurement made in surface mode. Double clicking the RSS folder (when using a standard with an RSS) will show the surface and RSS measurements together. Double clicking the Background Noise folder will show the surface, RSS and background noise measurements. Please note that the thick black line represents the average result from all the individual measurement positions. Finally, double-clicking the Reverberation folder (when using a standard with reverberation time) will initiate the view of the reverberation time as a function of frequency plus the decay of all the measurements at the frequency cursor position.

For viewing one single measurement position, a double-click on the required position will present only this single measurement result. It is additionally possible to view the status of each measurement by making a right-click and select the 'Show details for Pos X' command.



For a best possible evaluation of the average results, a right-click on the folder names opens a dialogue box in which the user may activate extra rows showing the details for the folder with the number of averaged positions as well as the calculated standard deviation from this averaging process.
The right-click dialogue boxes additionally give the possibility to delete or copy the measurement positions.



Depending of the quality of the measurements, the table view additionally contains different color background in the various cells. Generally, the orange color represents an error such as too short reverberation time for the actual frequency band, and the blue colors represent various warnings.

Along the left hand side of the table view, small smiley indicates the overall status for each measurement position. If no warning or errors are detected for any frequency band, the smiley smiles! Depending on possible warnings or errors, the smileys shows a neutral face or a negative face. To get information about the reason behind the non-smiling smileys, simply put the mouse on the top and read the tool-tip which appears.

The tool-tip feature is also available on the top of any table cell for detailed information about the status for this particular frequency band at this particular measurement position.

The user may key-in new values manually by double-clicking in the required cell and enter the desired value from the keyboard. This will then be logged as a handmade value in the status row.

Norsonic

Declaration of Conformity

We, Norsonic AS, Gunnersbråtan 2, N-3408 Tranby, Norway, declare under our sole responsibility that the product:

Nor850 MF-1

equipped with any combination of:

Nor850-1, Nor850-1/SG, Nor850-1/TTL, Nor850-1/RPM, Nor850 I/O.

to which this declaration relates, is in conformity with the following standards or other normative documents

Standards:	IEC61672-1 Class 1	ANSI S 1.4 1983 type 1
	IEC 60651 Type 1	ANSI S 1.43 1997 class 1
	IEC 60804 Type 1	ANSI S1.11-2004 class1
	IEC 61260 class 1	EN 61010-1: February 2001

following the provisions of the EMC-Directive.

This product has been manufactured in compliance with the provisions of the relevant internal Norsonic production standards. All our products are tested individually before they leave the factory. Calibrated equipment – traceable to national and international standards – has been used to carry out these tests.

During the RF emission, RF immunity and AC povwer frequency test the following was connected: USB cable (1m), microphone preamplifier Nor1209, microphone Nor1225, extension cable Nor1408A. Setup: Measurement duration 1h, General analyser mode.

The orientation of the instrument in the magnetic field had no influence. During the ESD test the SPL value may show some fluctuations from the ESD pulse. Power supply: Mains 220 VAC.

This Declaration of Conformity does not affect our warranty obligations.

Tranby, October 2011

Dagfinn Jahr
Quality Manager

The declaration of conformity is given according to EN 45014 and ISO/IEC Guide 22.

Norsonic AS, P.O. Box 24, N-3421 Lierskogen, Norway

Norsonic

P.O. Box 24
N-3421 Lierskogen
Norway
Tel: +47 3285 8900
Fax: +47 3285 2208
info@norsonic.com
www.norsonic.com

Norsonic AS supplies a complete range of instrumentation for acoustics – from sound calibrators, microphones and preamplifiers; via small handheld sound level meters to advanced, yet portable, real time analysers, but also spectrum shapers, building acoustics analysers and complete community, industry and airport noise monitoring systems. Contact your local representative or the factory for information on our complete range of instrumentation.