Nor850

- Distributed multi-channel measurement system
- Reporting in acordance with various Standards

General Analyser   **Building Acoustics**   **Sound Power**

Appliance Noise   **Sound Intensity**

The Nor850 measurement system is the state-of-the-art acoustical analyser from Norsonic. Using the experiences and accumulated knowhow from the previous generations of analysers such as Nor811, Nor823, Nor830 and Nor840, Norsonic is offering a unique multi-channel system.

The software Nor850 Suite is connecting a variable number of individual measuring units to create the optimal system that suits any measurement task. In addition, it offers dedicated user-friendly software packages for the following applications:

Nor850 is a distributed multi-channel measurement system

Nor850 Measurement Modules

Nor850-MF1

The Nor850-MF1 rack is designed to contain up to 10 measurement channels. Each channel module has the same features and specifications as the Nor140, but can only be remotely controlled from the Nor850 Suite via LAN interface. For wireless connection, a router is attached to the LAN connector. The rack is powered by 115/230 Vac or by 12Vdc.

The Nor850-MF1 rack is delivered with a selectable number of measurement channels, and may be upgraded with additional channels as the needs grow. Multiple racks may be used in the same system alternatively in a mix with Nor140 or Nor150 Sound Level Meters as additional frontends. Optionally, selected channels may be fitted with signal generator outputs.

Nor140

The Nor140 Sound Level Meter is connected to the Nor850 measurement system through the USB interface. Minimum optional requirements is that the Nor140 is running version 4.x firmware and equipped with options 1, 3 and 6 (i.e. 1/3-octave filters and profile measurement feature).

Nor150

The Nor150 Sound Level Analysers may be used as a Nor850 frontend – in either single or dual channel mode. The connection is done via LAN, or with WLAN using the WiFi dongle on the Nor150. The Nor150 must be equipped with the optional 1/3-octave filters.

Software features for all modes

Individual units for each measuring channel offer a very high degree of operating flexibility. It allows the user to operate a multichannel system one day – or many individual measuring units another day!

The multichannel system Nor850 is expanding as the needs grow. Start with the new Nor150 SLM, or two units of the standardized Nor140 SLM's, and increase step-by-step by adding additional SLM units – or mix with Nor850-MF1 Racks containing 1-10 measuring channels.

By connecting a number of individual measuring units through various communication channels – including both LAN and USB – the user may create the optimal multichannel system for any task. Wireless communication through WLAN is available.
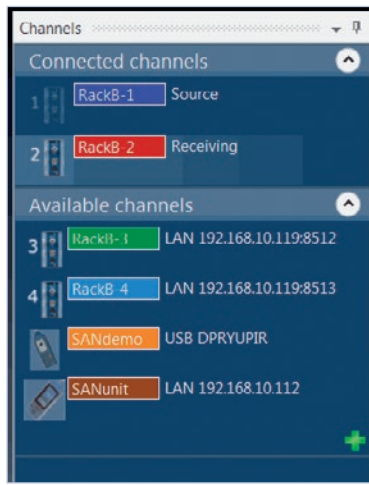
Various measurement channels are displayed in the list as 'available' or 'connected'

Each individual measuring unit may be homologated by independent verification laboratories that means even the entire multichannel system may be homologated!

Advanced multi channel calibration

Daily microphone calibration of multichannel in a laboratory may be a time consuming activity if the microphones are placed far away from the controlling PC. It would normally require two persons to be involved – one at the controlling PC and one moving around with the microphone calibrator from mic to mic. With the Nor850 system, however, only one person is needed for this job. The Nor850 offers two alternative features that overcome this problem:

- Acoustic feedback: Walk around with the microphone calibrator from mic to mic - put the calibrator on - and get a low-level acoustic feedback from the noise excitation loudspeaker for each mic.
- SmartPhone display: Connect a WiFi router to your Nor850 Rack and get the feedback display on your SmartPhone for the calibration process as you walk around with the microphone calibrator from mic to mic.

Independent of which feature that is in use, the Nor850 automatically detects which mic that has the calibrator connected. Hence, the operator may move from mic to mic without thinking which is next?

Sensor database

In the heart of the Nor850 Suite there is a sensor database containing all possible information for each measurement transducers (microphones, preamplifiers, accelerometers, etc.) including serial numbers, product name, producer, calibration history, verification laboratories, date of last verification and date for next verification, correction data, and more. Should the date for next verification of any sensor be overdue, a warning will pop-up on the screen. The database may also include similar data for calibrators and reference sound sources.
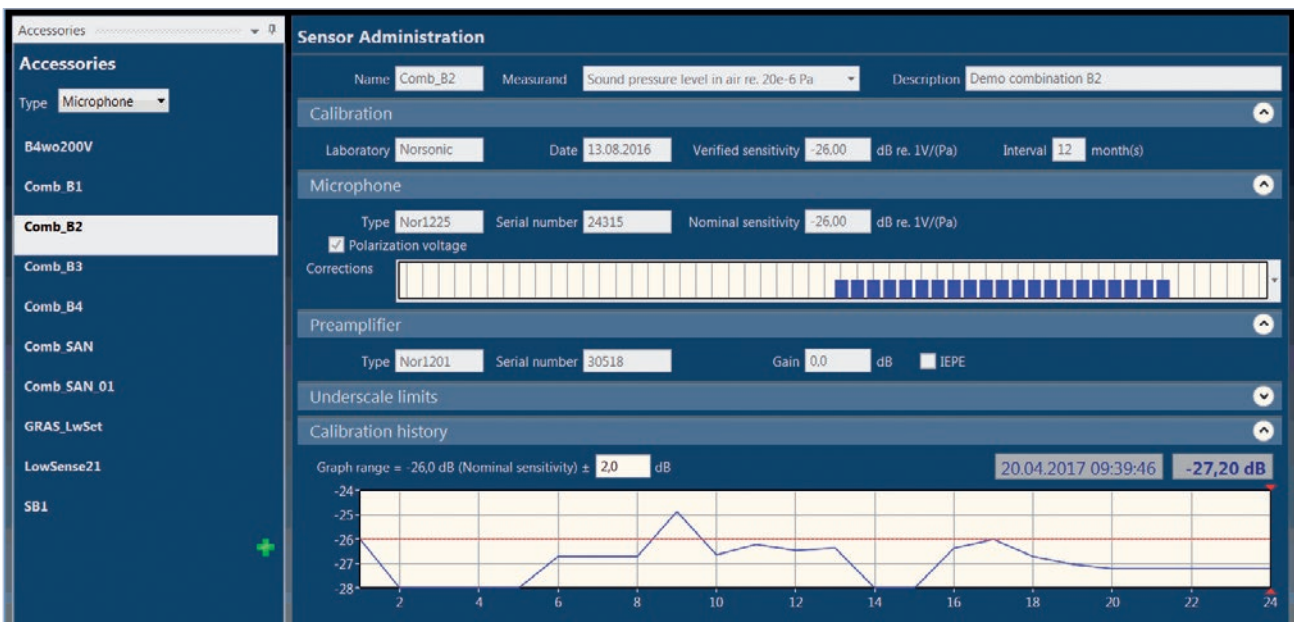
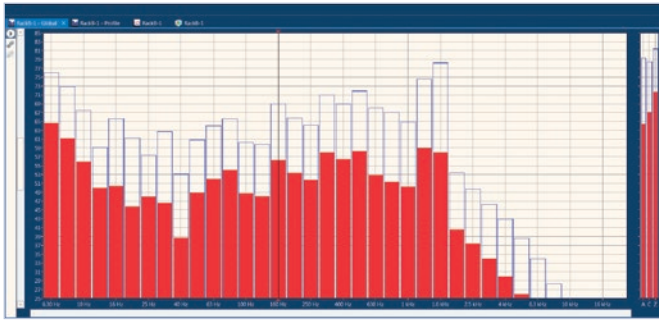*Various sensors are administrated in the connected sensor database*

General Analyser Mode

With the General Mode of the Nor850 system, the operator has full control of all connected measurement channels. The measurement setups are done in parallel with equal settings for all channels, and the start and stop of the measurement are synchronized.
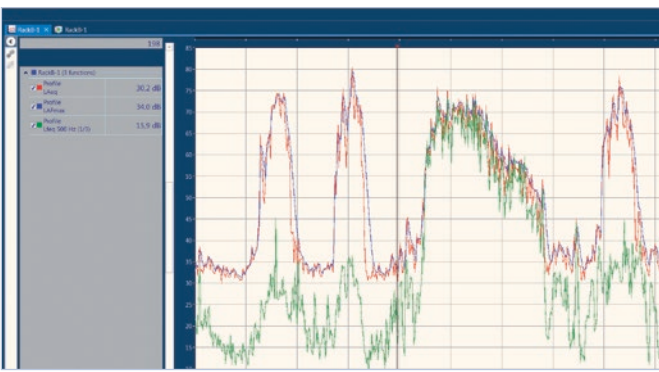
Measurement results are presented in either level vs. frequency graphs or in level vs. time histograms.

Multiple windows may be opened simultaneously, and each window may contain one or more measurement channels. And selected windows may be viewed on possible extra monitors connected to the PC in use. Hence, the General mode of the Nor850 offer full freedom for the user both in the measurement control and in the result presentation!

The General Mode allows the user to make multispecter measurements in all channels simultaneously with any settings for frequency range and measurement functions. The profiles have user-defined period lengths from a few msec to several minutes, and two parallel profiles are available with independent period-lengths and independent measurement functions.


Level vs. frequency graph

Level vs. time graph

General mode setup menu

Multiple window screen including spectogram view

The results are presented in user-defined windows with both level vs. frequency and level vs. time views as well as tables. The content in the various windows may be all, or just a subset of the measured functions. The colours in the windows may be varying based on channels or based on measurement functions, and the bargraphs may be set to full fill colours or only framed colour. Cursor positions in various windows may be synchronized and linked ensuring that the windows show results from the same source at the same time-spot. Hence, the operator may find the optimal presentation method for any measurement task and number of channels!
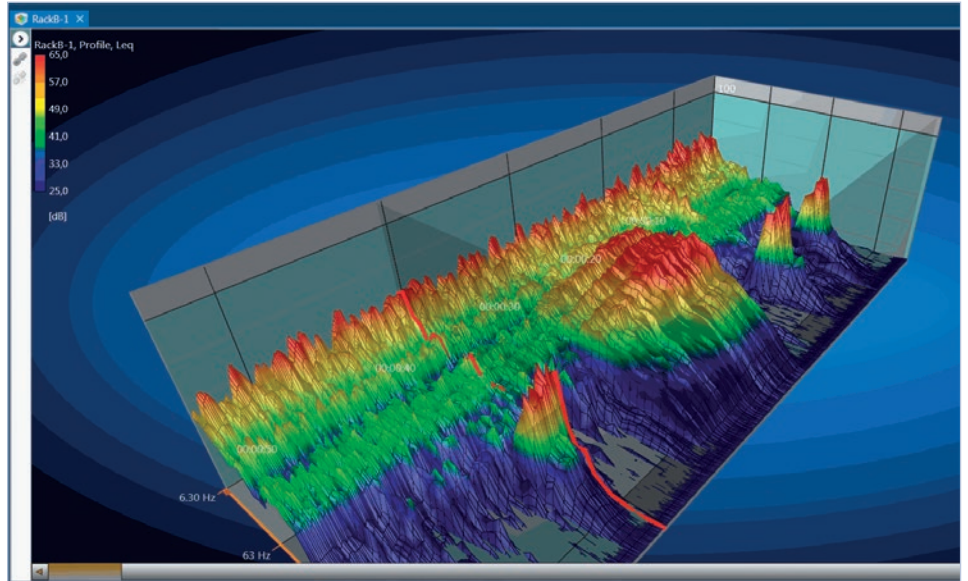
3D view of a mltispectrum measurement

Additionally, special views for 3D or Spectro-gram presentations are available – even for real-time presentation of the running measurements!

Quality control

Quality control measurements are easily made using the two reference spectra possibilities. Each reference spectre may be used as a lower or upper boundary. Previous measurement may be used as reference spectra, but the operator are also free to enter and edit the spectra manually. Selected frequency bands may be removed from the spectra should the quality control task only require limited bands. In addition, a 'Go/NoGo' sign is presented on the screen for fast response to the operator about each QC measurement.
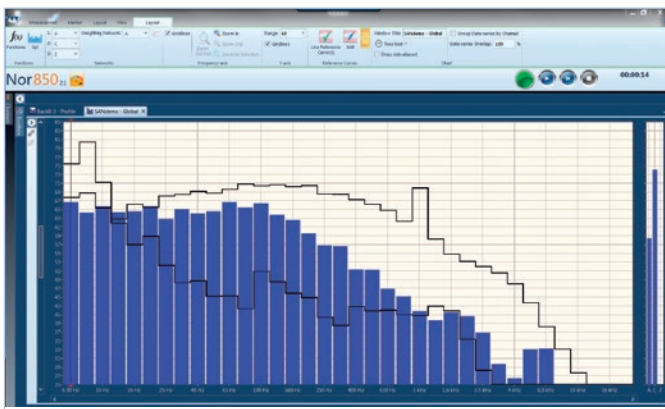
QC measurement view

Audio recording

The Nor850 Suite offers an environmental software extension that enables the user to make audio recordings in selected channels. The operator starts and stops each recording during the measurement, and a marker along the time-line shows the operator the actual start, length and end of each recording. The recording format is selectable to 8, 16 or 24 bits resolution with either 12 or 48 kHz sampling. By double-clicking on the marker, each recording is re-played on any loudspeaker connected to the PC.

Measurement markers

During the measurement, the operator may insert marker along the time-line in the profile windows. Markers may be set as single markers on one specific measurement period, or as toggle markers with specific start- and end-points. Each marker has its dedicated name and colour, and to ensure correct setting along the time-line a fixed pre-set time may be used. Up to 10 markers are pre-definable in a dedicated marker-bar menu.
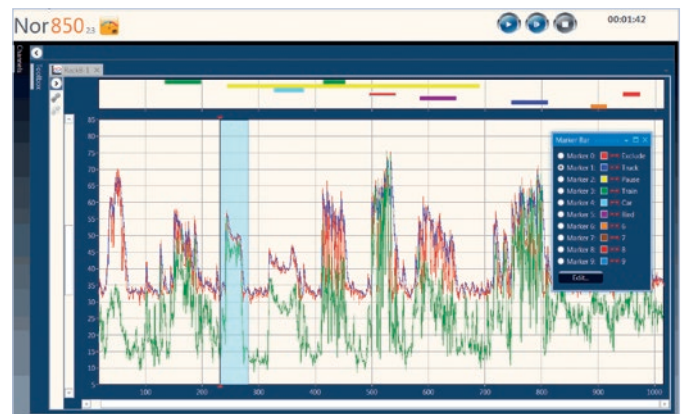
Measurement markers along the upper time-axis

Building Acoustic Mode

The basic Building Acoustics application package includes all required features for performing sound insulation tests in the field. Both the traditional ISO 140 Standards as well as the new ISO 16283 Standards are included, plus national varieties of these. The ASTM Standards E336, E90 as well as the E413 are also included.

In the extended Building Acoustics package the more advanced laboratory test such as ISO 10140 as well as ASTM E1007, E492 and E989 are included together with absorption coefficient testing in accordance with ISO 354 and ASTM C423.

The software includes calculation of sound insulation indices with predefined printed reports as well as parameter input in both metric and US formats.

Pre-selection for the measurements

Before the actual measurements is started, the operator need to make some pre-selection in the Rating menu. This include selection of the desired measurement Standard, and entry of various measurement properties such as room volume, specimen area, temperature etc.

Standard selection and measurement room parameters are entered into the Rating menu
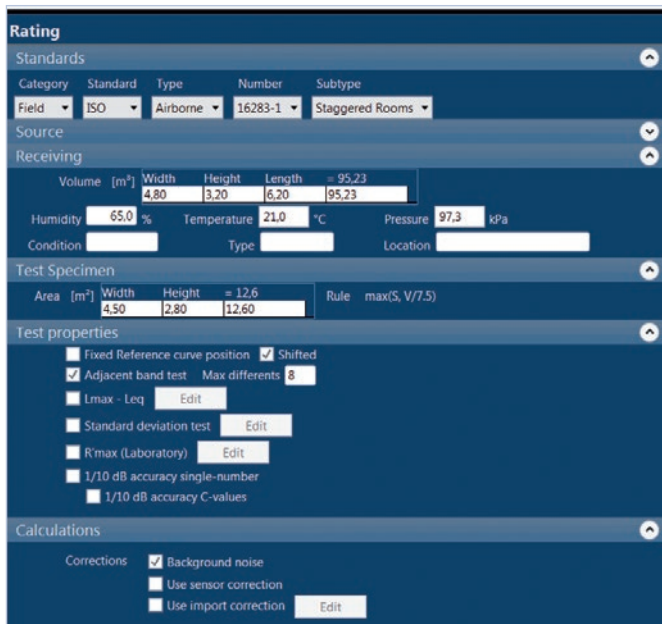
The selected Standard will normally set all measurement parameters correctly, but the operator may edit these in the Measurement menu.

Depending on the selected Standard, the tabular window in the lower part of the display will be organized automatically with separate sections for level measurements in source and receiving room, background levels and reverberation time measurements.
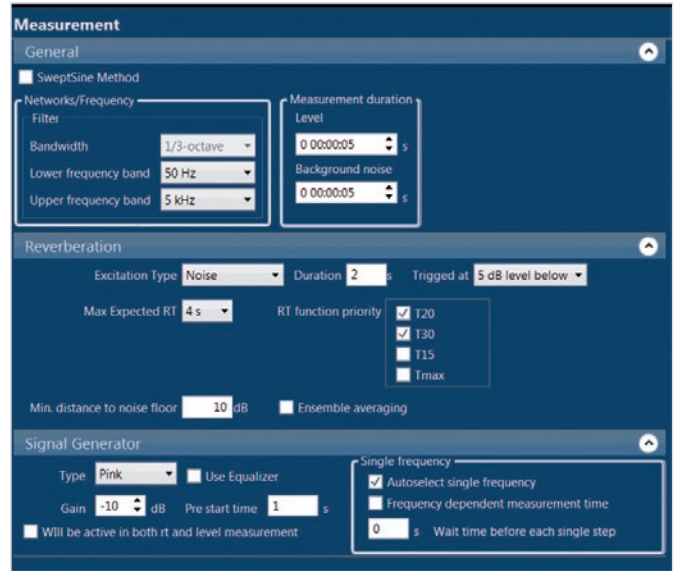
Measurement parameters are adjusted in the Measurement menu

Finally, the connected channels are dragged & dropped into the various measurement rooms.

Signal Generator

The signal generator offers white or pink noise on all measurement channel outputs that are activated. Signal generator outputs are available on all Nor140 and Nor150 units connected to the Nor850 Suite, and on those measurement channels in the Nor850-MF1 rack units with signal generator option. Hence, use of multiple un-correlated loudspeakers in the source room is possible.
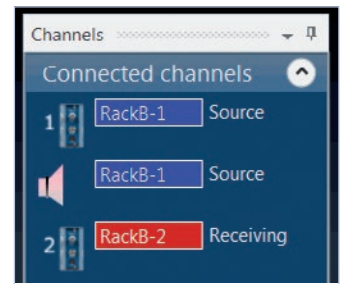
Signal generator outputs may be activated for the individual measurement channels

The output signal from the signal generators are maximum 1 Vrms, but may be reduced to -40 dB in 1 dB steps. The output signal is turned on automatically when the measurement is running, and turned off automatically at the measurement end. On demand, it may be controlled manually. For reverberation time measurements, the signal is turned off automatically after the selected excitation time. For noise excitation in larger rooms, the excitation signal may even be turned on automatically a few seconds before the actual measurement is started.

The signal generator may in special situation produce band-filtered noise for one frequency band at the time. This is very useful in those situations when the white or pink noise do not produce sufficient noise level in the receiving room (due to high background noise or high sound insulation), or, when making 50 - 80Hz low-frequency corner measurements in smaller rooms as required with the ISO 16283-1 Standard.

Level measurements

By use of the drop-down menu to the left of the start-key, the operator has full freedom to choose the kind of measurement that is performed. Level, background and reverberation time measurement may be taken in any order as the measurements will all be placed in correct part of the tabular display automatically.

When performing level measurements, the operator may additionally choose to assign each measurement to any loudspeaker position as required in the latest ISO Standards.

Control panel allows the operator to choose between loudspeaker positions, measurement type (level, reverberation time or background level) as well as Start, Stop and Continue of the measurement process

During the running measurement phase, the full frequency spectrum is displayed for the current sound pressure, the Leq and the Lmax levels. In addition, the upper right part of the screen show the time profile of the measurement in order to spot any kind of exterior noise events that could influence the
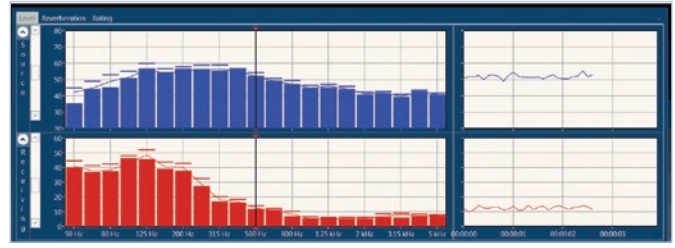
During the measurements, the frequency spectrums, as well as the level vs. time data are shown in the display.

measurement values negatively. As soon as the measurement is ended, the operator may evaluate all the data before accepting the measurement.

As soon as the microphone is moved to a new position, the measurement is repeated the same way. For each new measurement, a new row with data is entered into the tabular window which also calculate the average levels. On demand, the table will additionally present the standard deviation. When multiple measurement channels are used, the corresponding number of new results are entered into the table for each measurement.

After each measurement, the operator may accept or discard the last measurement

All measurement are automatically stored in the correct sub-area of the tabular window. Warnings are identified by alternative blue background colors.

Reverberation time calculations

Reverberation time measurement are performed using either noise excitation or impulse excitation. The Nor850 calculates T15, T20 and T30 simultaneously for all frequency bands plus the Tmax for noise excitation and the 'Early Decay Time' (EDT) for impulse excitation. Except for the EDT, RT calculations starts 5 dB below the top and then over the pre-selected ranges. All parameters are normalized to 60 dB decay time for the presented results.

Reverberation times are displayed both as calculated RT-values vs. frequency and as reverberation decays.

For absorption measurements in accordance with the ASTM C423 Standard, the special reverberation procedure is also available.

Multiple reverberation time measurement are arithmetically averaged in the tabular part of the display including calculation of the standard deviations. On demand, the special ensemble averaging procedure may be used where all decays are averaged before the calculation of the final reverberation time value.

Single frequency measurements

In-situ building acoustics measurement may sometimes cause problems due to insufficient S/N ratio, either for the level measurements in the receiving room or for reverberation time measurements at lower frequencies. The Nor850 offer a single frequency measurement feature where the signal generator energy is focused into one frequency band at the time. Hence, a S/N improvement of 15-20 dB is achieved. After defining the frequency bands with such S/N problems – manually or automatically - the Nor850 will automatically scan through these bands after performing the broadband measurement for all bands.
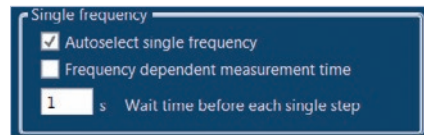
Signal to noise ratio may be improved by using single frequency bandpass noise for individual frequency bands.

SweptSine technique

SweptSine measurement technique is very useful for building acoustic as it allow transmission loss testing under difficult background noise conditions for receiving room level and reverberation time. The ISO 18233 Standard opens up for using this technique for performing tests in accordance with ISO 16283 and ISO 10140. By using the Nor150 SLM as frontend, SweptSine technique is available for Nor850 users.

The operator may choose to alternate between normal noise excitation and SweptSine excitation. Thereby it is possible to use SweptSine only for level measurement, only for reverberation time measurements, or for both.

The SweptSine feature in the Nor850 has a flexible setup where various sweep length may be selected depending on the measurement task. For the reverberation time measurements, all the normal functions are calculated in parallel (T15, T20, T30 and EDT) as well as the special parameters SNR (Signal to Noise Ratio), PNR (Peak to Noise Ratio) and C (Curvature). For multiple measurements, the ensemble averaging of the measured impulse responses is available for reverberation time calculations.

Reverberation time based on SweptSine technique allow the inspection of the impulse response together with the backward integrated decay in the upper right window. Calculated RT functions are found in the expanded tabular window.

Rating calculations
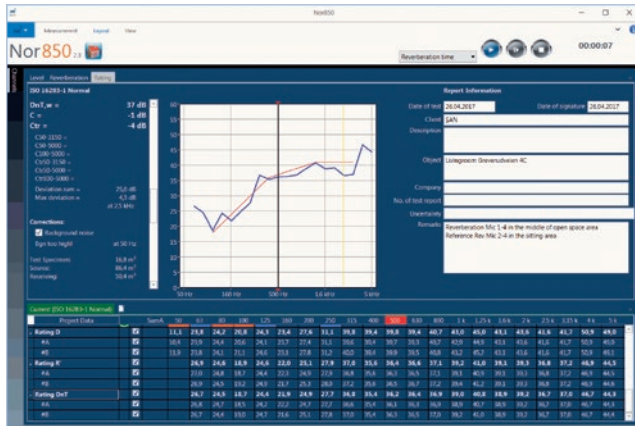
When all required measurement are available, the Rating window displays the final result both graphically and numerically

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Right: The Nor850 calculates the final sound insulation rating based on the pre-selected Standard as soon as all required measurement values are available. If the selected Standard has multiple rating options such as both R and DnT for airborne insulation, these are all calculated simultaneously in the tabular view. The graph, however, do only contain one selected rating. A simple click in the tabular part change the graph to any other rating.In the upper right part of the screen, the operator may key-in more detailed descriptions about the actual project such as room surface, product details, etc. All these will then be part of the final report which easily is produced by a click on the excel-report key. This excel report may automatically contain company logo and descriptions that are pre-entered by the operator.
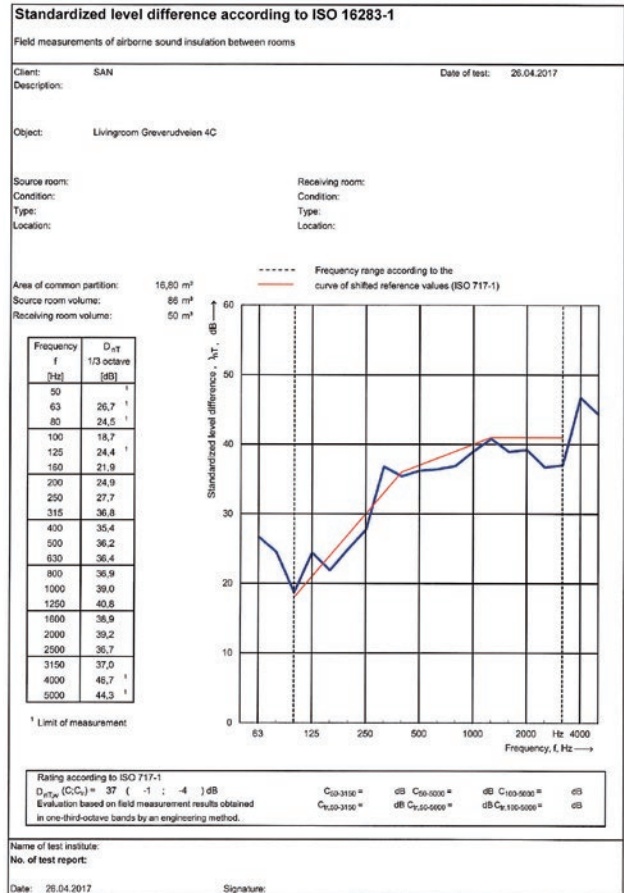
Measurement security

The Nor850 measurement system has a wide range of build-in test properties, or warning-features, which helps the operator to become aware of possible measurement problems. These test properties may be turn on and off depending of the actual situation. All activated test properties not fulfilling the pre-set value, will be displayed with a special background colour in the tabular part of the display, and the corresponding 'Smiley' will turn neutral or sad depending of how serious the possible warning are.

In the building acoustics mode, the user may activate one or more of the following test property features:

- Background noise too close to receiving room level
- Adjacent bands with too high level difference
- Too large difference between Leq and Lmax for source or receiving room level
- Too short calculated reverberation time compared to filter centre frequency
- Too high standard deviation for multiple measurements
- Measurement results too close to the Rmax value for the actual laboratory

By moving the cursor to the actual value with a warning colour, a tooltip message will appear on the screen telling which of the above test properties that has failed. And on demand, this particular measurement or microphone position may be re-measured to obtain better results.

For each measurement, an overall 'smiley' indicates the status. The alternative background color for each frequency band indicate a warning (light blue) or an error (orange).

Scheduler

In many laboratories, the same kind of measurements are repeated through the full day. Hence, to avoid operator failures, or simply to save time for the operators, a pre-defined Scheduler may be activated. Using this, all the measurements such as level measurements in both source and receiving rooms, reverberation time measurements and background noise measurement are all performed automatically in one long sequence.

The Nor850 may contain a long list of various pre-defined Schedules of which the operator must select the appropriate one for todays job. Then press the Start key, and just wait for all results to be ready for final review.
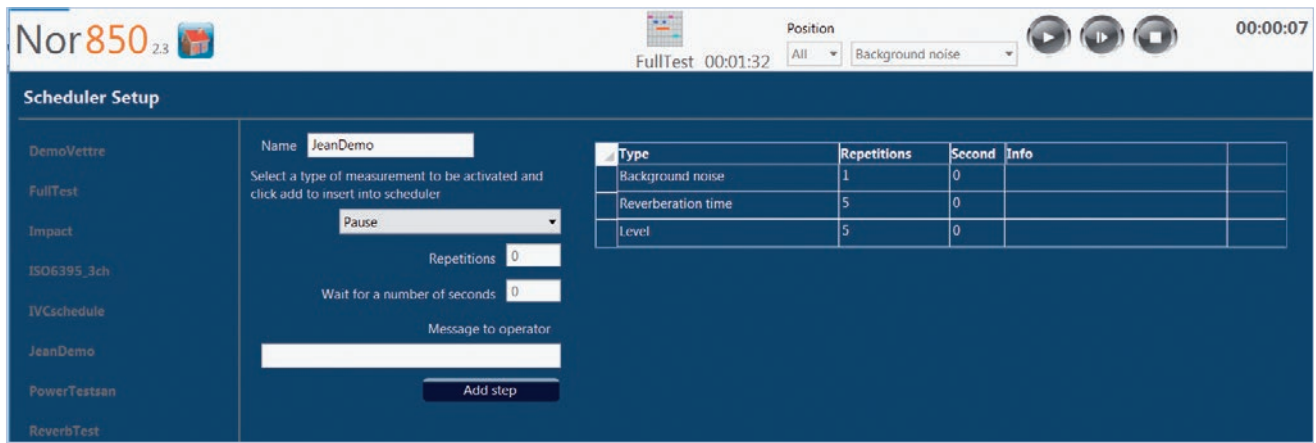
Scheduler menu

Multiple projects

The user may open several Nor850 project simultaneously. This is useful when comparing older measurements with newer measurements, or when making calculations of various national and international Standards based on the same set of measurement data.

For easy comparisons, the Multi Rating view offer graphically view of multiple measurement results.

Re-use of measurement data

Old measurement project from previous Norsonic analysers may be imported and compared with new measurements using the multi-project feature. Measurement results are re-used in new projects by easy drag&drop functionality.

Multi-rating display

Among the various display views in the Nor850, there is also a special multi-rating view for comparing multiple measurements or ratings in the same diagram. Hence, comparison of the sound insulation rating before and after a construction change, or, comparison of measurements of various products is easily available.

Supported Standards

The Building Acoustic mode in the Nor850 Suite offers a wide range of pre-programmed Standards for airborne and impact sound insulation as well as sound absorption. The basic ISO-140 and its replaced versions ISO-16283 and ISO-10140 as well as the equivalent ASTM Standards E336, E90, E413, E1007, E492 and E989 are all available. In addition, many national equivalents from UK, Germany, Switzerland, France and Sweden are found when opening the Rating menu. The full list of implemented Standards is given in the table on page 21 - 22. Please note, however, that this list is dynamic and new Standards are expanding the list as they become available.

Building Acoustic accessory control

The Nor850 Suite additionally offer features for automatic control of Rotating Microphone Booms, Tapping Machines as well as relay-control of moving loudspeaker systems.

Laboratory setup configurations
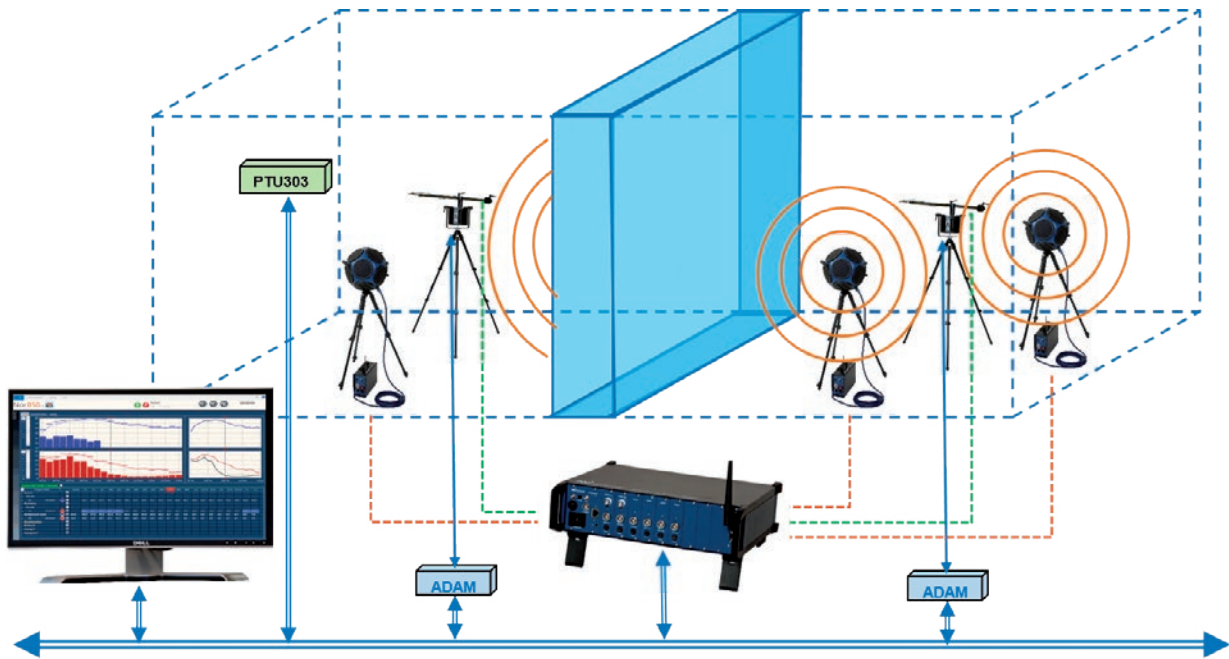
All the available Building Acoustic features within the Nor850 allow a wide range of possibilities for fulfilling the possible needs and requirement of various laboratory configurations:

- Multiple microphones or rotating microphone booms
- Multiple loudspeakers with individual signal generator or a movable single loudspeaker on a controllable slide
- Remote on/off switching of tapping machines based on Nor850 software
- Automated read-in of test chamber temperature, humity and air pressure

- Manually operated test sequences, or automated measurements based on a pre-programmed Scheduler
- Larger laboratories with several measurement chambers for parallel testing controlled from multiple PC via overall LAN network

The figure above shows a typical setup for airborne testing with microphone booms, two parallel loudspeaker system for level measurements and one dedicated loudspeaker system for reverberation time measurements.

Sound Power Mode

The basic Sound Power application package includes all features required for making sound power test in accordance with the various Standards in the ISO 3740 series.

The extended Sound Power application package contains required features for making more special tests such as dual-chamber testing of heat-pumps, dynamic testing of earth moving machinery, sound power calculated at various engine rpm speeds, and similar.

Pre-selection of the sound power procedure

In the Rating menu for the Nor850 Sound Power mode, the initial operator selection deals with required accuracy and test method. The accuracy must be defined as 'Precision', 'Engineering' or 'Survey', and the test method as 'Direct' or 'Comparison'. Dependant of these choices, the software will display a drop-down menu containing the available Standards within the ISO 3740-series.
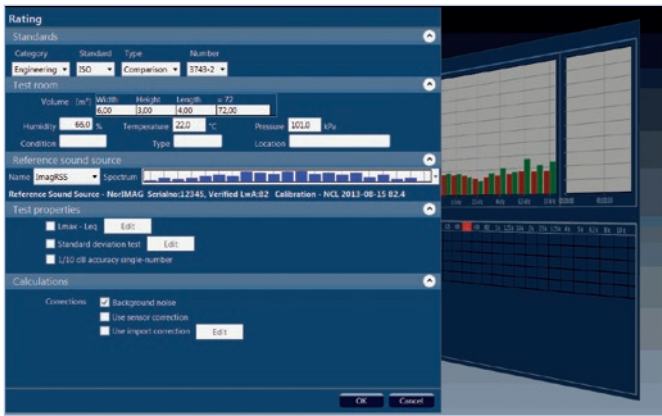
Test room properties and sound power calculation method are selected in the Rating menu.

Comparison method

The comparison method require the use of a known sound power source – normally called a 'Reference Sound Source' (RSS). This unit is tested once every year in an accredited laboratory in order to establish the exact radiated reference sound power level.

The 'comparison' principle test procedure is to measure the known RSS in the test room followed by the same measurement on the test object. The level difference between these two tests can then be added to the known sound power level of the reference sound source, and thereby the final sound power level of the object is found.

Direct method

The direct method do not require two different objects to be measured as it in principle is made under controlled free field situations where the final sound power level is calculated based on the size of the hemisphere or parallelepiped in use.

In order to make control of the free-field situation, additional measurements of either the reverberation time or a reference sound source may still be required in order to find the 'environmental correction factor' (K2). If the 'K2' is known from earlier tests, however, the corresponding correction for the upcoming sound power test may be keyed-in manually.

Pre-test setup menu

Depending of the selected Standard, various parameters are needed for the final sound power calculation. The setup-menu will change its content accordingly asking for mandatory properties such as test room volume, test-box sizes, reference sound source level etc. In addition, the user may enter temperature, humidity, pressure, product data a.o. for use in the final test report.

Handling of the Reference Sound Source

All relevant data about the RSS units are taken care of by the Nor850 'Sensor Database'. After every annual accredited verification, the correct data are saved here including the date for the next verification. Inside the sound power rating menu, the user only need to select the correct RSS and all relevant data are then available for the final sound power calculations.
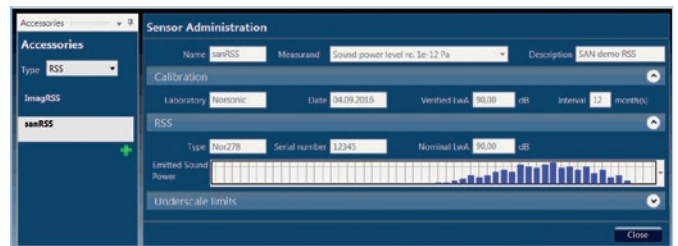
Reference Sound Source properties are entered into a special section of the 'Sensor Administration Database'.

Connecting the measurement channels

Sound power testing may in the simplest configuration be done by a single microphone in a reverberant room. Then only one measurement channel is required.

In free-field or semi free-field, conditions, however, multiple microphone positions are required. Hence, the Nor850 offer the use of up to 32 measurement channels simultaneously. Alternatively, to measure repeatably and moving the microphone to a new position in-between.

Whatever microphone configuration selected, the measurement channels in use are easily activated by a drag&drop feature.
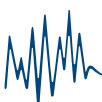
Running the sound power measurement

The drop-down menu in the upper right part of the screen is used to define what is going to be measured. Make the choice between 'Background', Reference Sound Source' and ' Surface', and press the start arrow key to run the measurement.

All measurement channels are viewed simultaneously during the measurements.

As soon as the pre-set measurement duration is ended, the measured data is presented. Should previous measurement already be made, the last measurement will be compared with these for easy judgement about the quality of the last sequence. If everything seems correct, simply press the 'Accept' key, or press the 'Cancel' key and repeat the last measurement.

After measuring all microphone positions for all measurement modes, the tabular part of the screen is filled up with the required data to calculate the final sound power level.

A simple click on the lower row named 'Sound Power Lw' displays the complete calculated sound power graph.

At the end of each measurement, the operator may evaluate the results before accepting or discarding the measurement.

Should a printed report be required, a push on the excel-report key will present a suitable report to be forwarded to your printer.
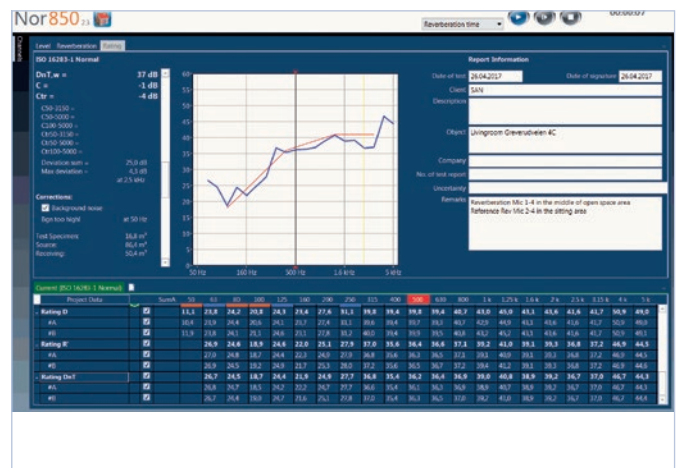
When all required measurement are available, the Rating window displays the final sound power result both graphically and numerically

The operator may evaluate all measurements for level, background and reference sound source in one single window.

Scheduler control

The entire test procedure may be controlled by the optional user defined Scheduler for easy test repetitions.
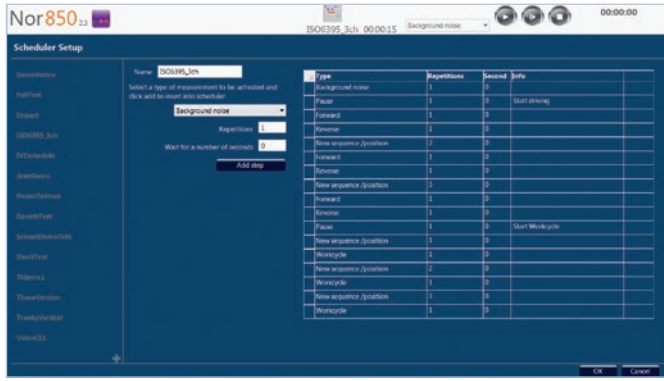
Scheduler setup

Workstation position

In all the available Standard selections within the Sound Power measurement mode, the Nor850 has an additional measurement register called «Workstation position». By placing one of the connected microphone measurement channels on the operator place, the noise level on this particular position will be measured simultaneously with the sound power level of the entire machine. Both LeqA and LpeakC are measured, so correct labeling of both machine sound power and operator sound pressure level is available in one single test.

Sound power versus RPM

The optional Nor850 advanced sound power mode offers a possibility to measure the sound power level as a function of the RPM level of the machine. By connecting an ADAM DC-input unit to a +/- 10V DC signal which vary with the RPM level of the machine under test, a special report window showing the calculated sound power level as a function of RPM is available.

Twin chamber sound power testing

Simultaneously ISO 3744 sound power testing in two measurement chambers is possible with the Nor850 system. This is handy for products like heat pump solutions based on two separate units – one for use inside the house and one for use outside. The sound power test is made with various climate conditions for the individual units although the units are connected together due to the combined operation.

When the climate conditions in both chambers are correct, the Nor850 perform the measurement for both units simultaneously, and calculate the final sound power level on both units.
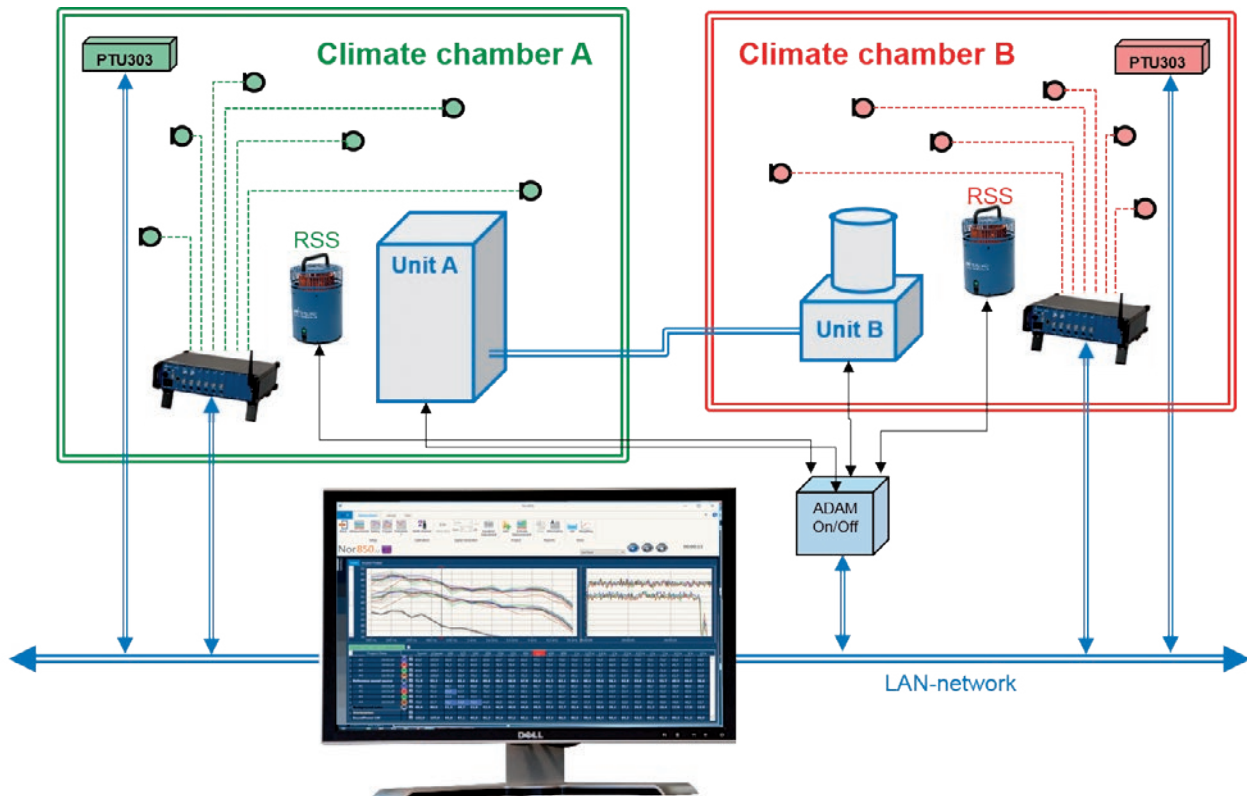
Dynamic test of earth moving machinery
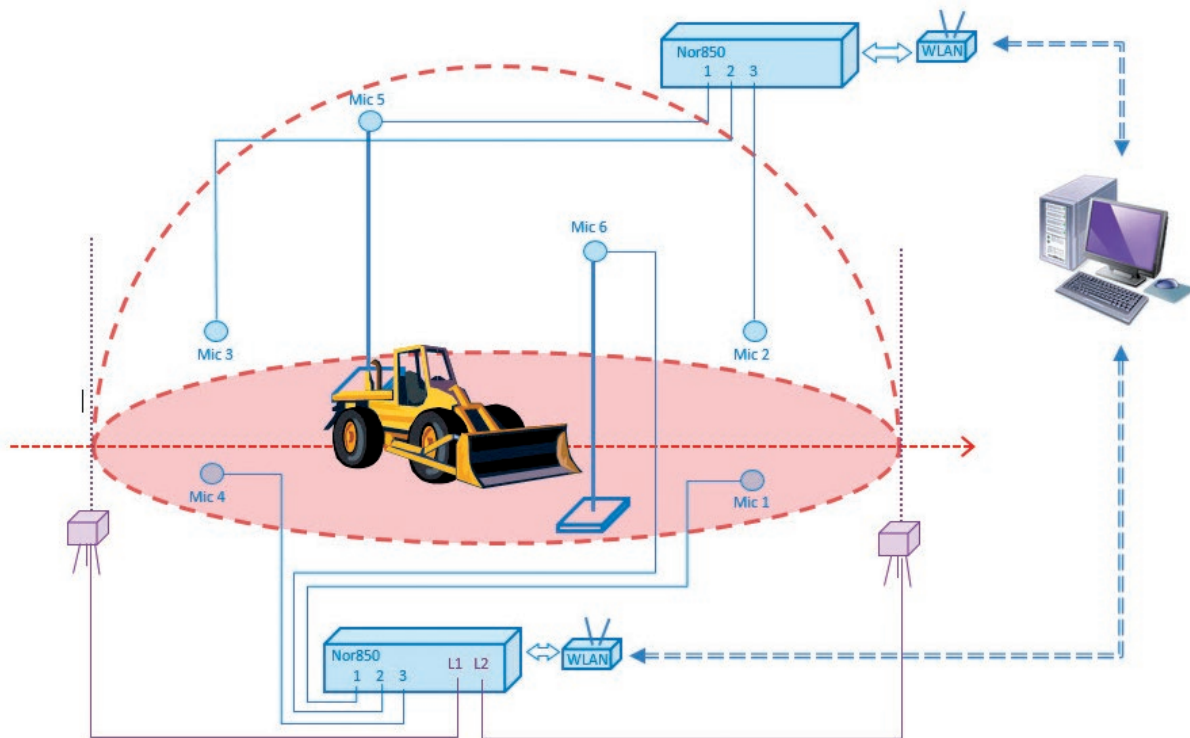
Sound Power tests of earth moving machinery is made with reference to the ISO 6395 Standard. This calls for a larger outdoor place at which the rather large machinery perform the required operations in a free-field environment over a reflective ground. Typical operations vary with the various machinery, but forward and backward driving at constant speed plus workcycle loading/unloading operations are common.

Six microphone position is required on the theoretical hemisphere with a 16 meters radius. That mean two microphones must be placed on 11,2 meters high stands. Alternatively, only three microphones are used which only cover one side of the vehicle. In such cases, the vehicle must be turned around to test the other side in a separate measurement. For a wheel loader, the Standard calls for three times forward driving, three times backward driving and finally three times workcycle.

The results are averaged in accordance with the specific method given for wheel loaders. Other kind of earth moving machinery may have other methods, but the Nor850 handles these according to the selected machinery handles these automatically.

The Nor850 MF-1 multichannel rack may be equipped with two light barrier triggers in order to start and stop both the forward and backward driving automatically. Combined with the measurement Scheduler feature, the operator then setup the test facility, perform the driving, and then evaluate the results without help from a second person.

Should a test of the operator sound pressure level be required, an extra measurement channel connect via a WLAN router, and set to register the "Workstation position", will perform this ISO 6396 measurement simultaneously.

Appliance Noise Mode

Water below atmospheric pressure create vapor at lower temperature. Large pressure differences appear across small volumes of turbulent water. Here bubbles are created, and they collapse then they reach a region of higher pressure. This creates a disturbing amount of acoustic noise distributed thru the tubes. Standardized measurements are needed to compare the noise emitted from different products. The Appliance Noise application package includes the requires features to perform a full laboratory test of the ISO 3822 Noise emission from appliances and equipment used in water supply installations.

The Norsonic Nor850 multi channels noise analyzer is the perfect sound power measurement tool for use both in R&D and on production line for any industry or testlab dealing with water appliances. It has the following characteristic for water appliance noise measurement:

- Highly configurable
- Easy setup
- Intuitive and efficient interface
- Test Scheduler for automated processes
- Customized report generator
- Flexible but still easy use
- For both experts and freshmen

Measurement hardware setup

The measurement hardware setup is simple. You should setup both the measurement system and the water appliance operation system. One of the typical measurement configuration is illustrated in the figure on page 17.

Test sequence

According to the installation noise standard ISO 3822, the related test sequence is

- 1/1 or 1/3 octave analysis (100Hz - 5KHz)
- A standardized calibrated "bend" for base line measurements
- Plural test modes in combination
  - fully opened & most noisy position
  - warm, cold and 50/50 mix
  - water pressure 3 and/or 5 bar
- 3 samples pr. model
- 3 measurements pr. test mode
- Results in an averaged Sound

Test properties

In order to obtain comparable measurements in different laboratories, the noise produced by the appliance is always compared with the noise produced by an Installation Noise Standard (called: INS). The INS is mounted at the end of the test pipe instead of the appliance. And since there is usually a twin outlet, hot/cold or left/right, customer can specify on which outlet he mounts the INS. If customer selects Left and Right, the values of the left and the right will be averaged to one value. Some laboratories have an extra (single) pipe for control purposes. The INS can be mounted for control purposes on this pipe as well.

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 Appliance noise test measurements. The PC screen now shows a display with 3 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 contains 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.

Measurements results are displayed in a tabular view

Evaluating the final results in the Rating display

The Rating display contains the measured resulting level with/without correction for background noise. The final rating includes averaged levels for each test appliance sample under various pressures, along with averaged levels for each test condition under various pressures. It will also indicate the Rating index for that appliance type under various pressures. 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.

In the upper-right side of 'Rating' tab, you can fill in Report Information such as 'Date of Test', 'Client Name', 'Description', etc; these information can also be filled by select

Measurement/ Information in the menu bar before performing the building acoustic test.

After saving the measurements, you may produce the final excel report of the appliance noise test, select the Measurement/ Excel Reports feature in the menu bar. In the excel report draft, you can still edit and modify the text of the file.

Making Flushing valve measurements

When selecting the Flushing valve type in the rating menu there will be two standards available, ISO 3822 and EN 12541. The only difference is the required water flow pressure. It is 3 and 5 bar for the ISO standard while the EN standard requires 2.5 and 4 bar. The measurement resolution for the L(t) profile is automatically set to 10 ms.

If ordered seperately, the option Nor850/DC lets you measure water flow pressure, water flow rate and water temperature for monitoring and documentation purposes. This is done by logging DC-voltages from an ADAM device connected via LAN. The device has inputs for voltage signals in the range of ±10 V or current signals in the range of 4-20 mA.
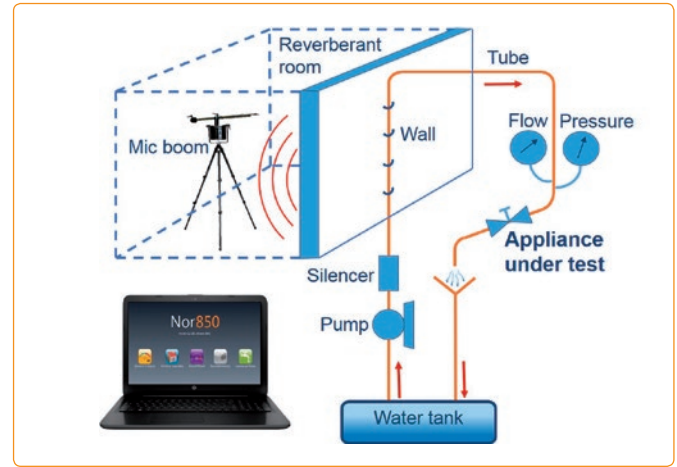
Typical setup of a Appliance Noise test lab

Auxillary test and control possibilities

The Nor850 is basically designed for measuring sound using dedicated application packages. As many of these tests include requirements for other test parameters such as temperature, wind, humidity, pressure, flow, or control of various equipment used in the test procedure such as moving loudspeakers, switching on/off reference sound sources, etc., the system has various possibilities for these purposes.

Measuring humidity, temperature and air pressure

The option Nor850/HTP allows connection of the Vaisala unit type PRO 303which measures humidity, temperature and air pressure. It is connected via LAN, and the measured values are automatically used as input parameters to the final Nor850 reports for Building Acoustics and Sound Power.

Once connected and setup correctly, the Vaisala unit appear in the channel window in the left side of the Nor850 screen.

Controlling relay-switches

Through the option Nor850/Relay and the ADAM-6066 device, various switches may be controlled simultaneously with the on-going measurement. Such switches are useful to control the on/off power to a reference sound source, a warning light or a tapping machine, or to control the start-stop-return of a moving loudspeaker in a test lab.

Once connected and setup correctly, the Relay-channels appear in the channel window in the left side of the Nor850 screen.

Measuring DC values

The option Nor850/DC allows logging of RPM-level water flow and pressure, water flow rate and water temperature for monitoring and documentation purposes. This is done by logging DC-voltages from an ADAM-6017 device connected via LAN. The device has inputs for voltage signals in the range of ±10 V or current signals in the range of 4-20 mA. Each input line has a jumper to select the type of input signal.

Each DC input channel needs to be setup for a minimum and maximum value corresponding to the input signal, plus the corresponding user-defined unit such as temperature, flow, etc. The calibration chart of the transducer should tell what values to use for "Min Value" and "Max Value".

Once connected and setup correctly, the DC-channels appear in the channel window in the left side of the Nor850 screen.

Controlling the Nor265 Microphone Boom

Through the option Nor850/265 and the MOXA Nport 5110 device, the microphone boom is controlled during the measurement cycles. It may be pre-programmed for sweep or fixed point movements with return to start posision after the test. Individual control setups are possible for level and reverberation measurements.

Once connected and setup correctly, the Nor265 connection appear in the channel window in the left side of the Nor850 screen.

Nor850 Reporting System

The user-friendly and innovative calculation and reporting features in the Nor850 may be used as individual modules for post-processing of individual measurement files. This feature is available for the building acoustics and sound power modes. In addition, a dedicated reporting module for sound intensity measurement is available.

Customers may enhance their Nor850 Reporting system to a full-blooded Nor850 Measurement system at any time.

Building Acoustics reporting

Measurements taken manually by use of the Norsonic sound level meters Nor140 or Nor150 and stored in the PC, are imported easily into the reporting modules. Level, reverberation or background measurement files are included into the respective table folders by simple drag&drop technique. Even complete building acoustics files containing all data in one file may be imported.

The full range of Standards for building acoustics such as the in-situ ISO 16283, laboratory ISO 10140 and the national version such as American ASTM Standards, are selectable. Calculation properties as well as informative text for the excel reports are inserted and edited for the final calculation of the sound insulation indices or sound power value.

More details are shown in the Building Acoustic section on pages 6 - 11 of this brochure.
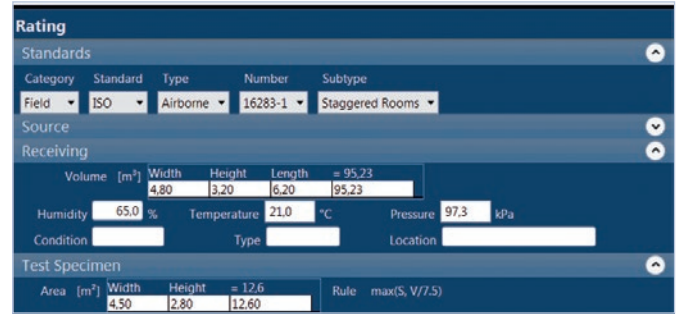
Building Acoustic Rating property menu

Building Acoustic results are available as both graphical and numerical Excel-spreadsheet printouts

Sound Power reporting

As described above for the Building Acoustic mode, existing measurement files in a PC may be imported into the Nor850 for calculation of the final Sound Power results. The Sound Power calculations is done using the range of pre-defined Standards in the ISO-3740 series.

Multi-rating view for comparing purposes

Sound Power Rating calculation property menu
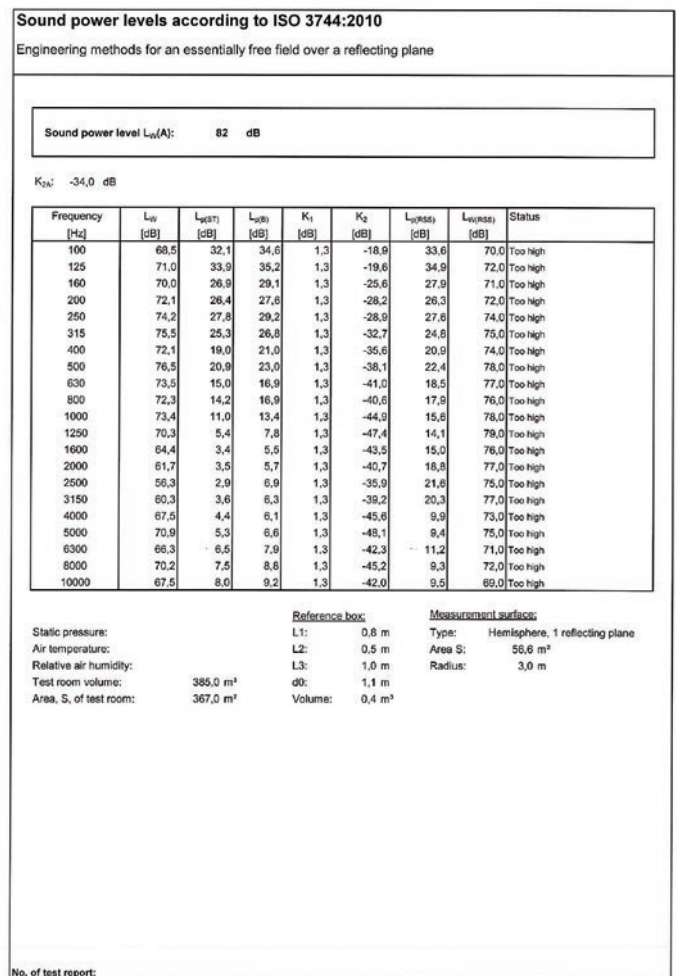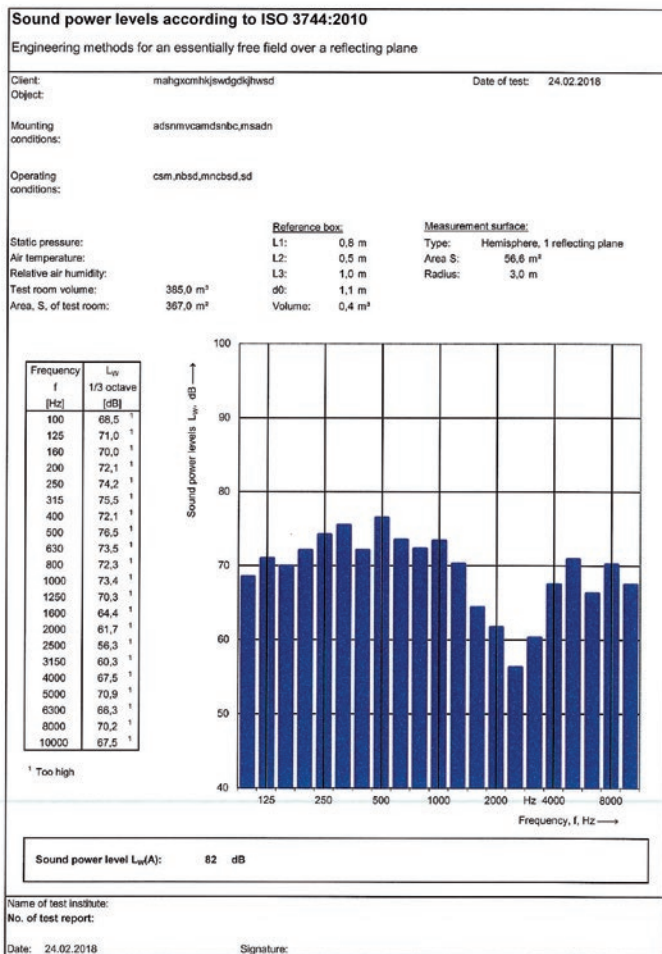
Sound Power results are available as both graphical and numerical Excel-spreadsheet printouts

Sound Intensity reporting

In the Nor850 software you can change all settings the same way as in the Nor150. However, copying and analysing the measurements is easier on a larger screen. The Nor850 software provides intuitive visual tools for editing.

Copy segments or surfaces, view intermediate results of a subset of segments, exclude segments, surfaces or bands. If desired, the measurement may be up/downgraded between Survey/Engineering, and the weighted frequency range may be changed.

Nor850 displays all the information as the Nor150, including the Scope Selector and all functions. In addition, the results are mapped onto a 2D/3D surface for noise mapping.

A typical application may be the case where limited time did not allow for a full definition of segments before measurement. All measurements can be made on a single surface where the areas are not defined. By opening up two measurement projects in Nor850, you define a new total measurement surface and copy/paste each measured segment into correct locations in the new project.

Measured reulsts are available in various windows containing graphs, tables, navigation pane etc.

Nor850 with Sound Intensity option includes report generation for the ISO 9614 part 1 and part 2 Standards. Fill in the essential information about the measurement, and generate the measurement report.
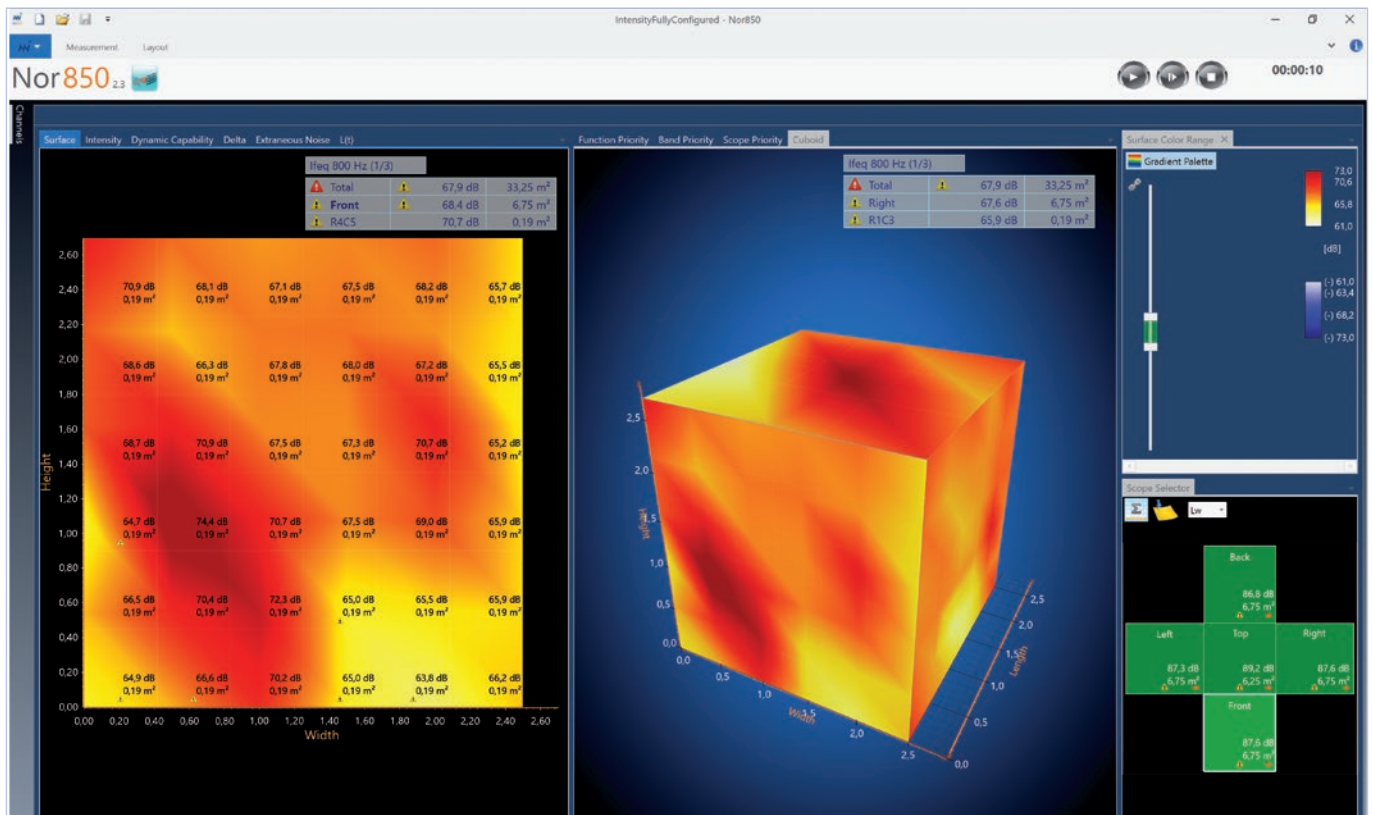
Measured results displayed as 2D surface and 3D surface together, along with the Scope Selector (navigator) and colour range adjustment pane.

Supported standards for Building Acoustic

Building Acoustic	**Field (Nor850/BA-1)**	Airborne		ISO 140-4 ISO 10052 ISO 16283-1 ISO 16283-1 (incl. Corner) ISO 18233 (SweptSine) ASTM E336 BS EN ISO 140-4 BS EN ISO 140-4 (BB93)	BS EN ISO 16283-1 (BB93) DIN 4109-4 (Hall Room) DIN 4109-11 SIA 181 SIA 181 (Low Frequency) SS 25267 SS 25267 (2015)
			Staggered room	ISO 16283-1 DIN 4109-4	
			Rating as ISO/DIS 16717	ISO 16283-1 ISO 16283-1 (incl. Corner)	
		Facade		ISO 140-5 ISO 10052 ISO 16283-3 ISO 16283-3 (ncl. Corner)	DIN 4109-4 SIA 181
		Impact		ISO 140-7 ISO 10052 ISO 16283-2 (incl. Corner) ISO 16283-2 (for Rubber Ball) ASTM E1007	BS EN ISO 140-7 BS EN ISO 140-7 (BB93) BS EN ISO 16283-2 (BB93) SIA 181 SS 25267 SS 25267 (2015)
			Airborne correction	ISO 140-7 ISO 16283-2 DIN 4109-4	
			Rating as ISO/DIS 16717	ISO 16283-2 ISO 16283-2 (incl. Corner)	
		Misc.	Reverberation	DIN EN ISO 3382 DIN 52216	
	Laboratory (Nor850/BA-2)	Absorption		ISO 354, ISO 354 (with Area) ISO 11654 ASTM C423	BS EN ISO 354 BS EN ISO 354 (with Area) BS EN ISO 11654
			Performance	EN 1793-1 (2012) EN 1793-1 (2017)	
		Airborne		ISO 140-3 ISO 140-9 ISO 140-10 ISO 140-16 ISO 10140- ISO 10140-2	ASTM E90 BS EN ISO 10140-1 BS EN ISO 10140-2 BS EN ISO 10848-2
			Small Element	ISO 10140-2, BS EN ISO 10140-2	
			Small Opening	ISO 10140-2 BS EN ISO 10140-2	
			Total Loss Factor	ISO 140-3 ISO 10140-4	
		Impact		ISO 140-6 ISO 140-8 ISO 140-11 ISO 10140-3 ISO 10140-3 (for Rubber Ball)	ISO 10848-2 ASTM E492 BS EN ISO 10140-3 BS EN ISO 10848-2
			Airborne Correction	ISO 140-6 ISO 10140-3	
			Heavyw.Airborne Corr	ISO 10140-1	
			Lightw.Airbonre Corr.	ISO 10140-1 EN BS ISO 10140-1	
			Heavyweight	ISO 10140-1 BS EN ISO 10140-1	
			Lightweight	ISO 10140-1	
			Performance	EN 1793-2	

Additional standards may be included on customer request

Supported standards for Sound Power, Sound Intensity and Appliance Noise

Sound Power	**Basic (Nor850/LW-1)**	Engineering grade	Comparison method	ISO 3743-1, ISO 3743-2, ISO 3747
			Direct method	ISO 3743-2, ISO 3744 (with Parallelepiped, Hemisphere or Cylinder based on 1, 2 or 3 reflective planes)
		Precision grade	Comparison method	ISO 3741
			Direct method	ISO 3741, ISO 3745 (Hemisphere or Sphere)
		Survey grade	Comparison method	ISO 3747
			Direct method	ISO 3746 (with Parallelepiped, Hemisphere or Cylinder based on 1, 2 or 3 reflective planes)
	Advanced (Nor850/LW-2)	A and B parallel chambers	Comparison method	ISO 3743-1
			Direct method	ISO 3744 (with Parallelepiped, Hemisphere or Cylinder based on 1, 2 or 3 reflective planes)
		Dynamic test of earth-moving machinery		ISO 6395 ('Loaders' and 'Landfill Compactors')
Sound Intensity	**(Nor850/SI)**	Sound Power based on Sound Intensity technique		ISO 9614-1 ISO 9614-2
Appliance Noise	**(Nor850/APL)**	Noise emission from appliances		ISO 3822 General Flow Adjuster, Half Steps Flow Adjuster, Flushing Valve, Mixing Valve or Shower Head

Additional standards may be included on customer request.

Ordering information

Nor850/Suite	Basic system software for maximum 2 measurement channel analysis containing general features such as overall administration, save/load, general properties, sensor administration, etc. This Frame module is required for running any Nor850/xx-M application measurement module. (Must be ordered separately!). Requires PC with Windows7 operating system.
Nor850/GEN-M	General multichannel measurement system software including measurement features for 1/1- and 1/3-octave filtering as well as time pro-filing. To be used with measurement frontends Nor850-MF1, and/or a number of Nor140 instruments containing minimum options 1, 3 and 6, and/or a number of Nor150 instruments containing minimum option 3. Requires Nor850/Suite basic system software.
Nor850/ENV-1	Environmental software containing features for true audio recording of the measurement signal as well as online user-defined marker entry. Requires Nor850/Suite basic software with option Nor850/GEN-M.
Nor850/BA-M	Building Acoustic measurement software including required features for transmission loss testing such as level, background and reverberation time measurements in accordance with ISO 140/16283/10140 & similar national Standards. Includes feature for swept-sine excitation. Requires Nor850/Suite system software.
Nor850/BA-1	Building Acoustic calculation software with required features for calculating in-situ sound insulation as described in ISO 140-4, -5 and -7, ISO 16283 as well as ISO 717-1 and -2 (and similar national Standards). Requires Nor850/Suite basic system software..
Nor850/BA-2	Extended Building Acoustic calculation software with required features for laboratory testing of sound insulation (as described in ISO 354, ISO 10140 and similar national Standards). Requires Nor850/Suite basic software with options Nor850/BA-M and Nor850/BA-1.
Nor850/LW-M	Sound Power measurement software including required features for measuring surface-, reference- and background level as well as reverberation time in accordance with the ISO 3740 series of Standards. Requires Nor850/Suite basic system software.
Nor850/LW-1	Sound Power calculation software mode with required features for calculating sound power as described in the ISO 3741, 3743-1, 3743-2, 3744, 3745 and 3747 Standards. Requires Nor850/Suite system software.
Nor850/LW-2	Extended Sound Power calculation software with required features for advanced testing of sound power in accordance with dedicated application oriented Standards and/or in special test facilities. Requires Nor850/Suite basic software with options Nor850/LW-M and Nor850/LW-1..
Nor850/SI	Sound Intensity calculation and reporting software module with 3D color plot. Works with Nor150 sound Intensity files. Requires Nor850/Suite basic software
Nor850/APL	Appliance Noise calculation software with required features for a full laboratory testing of appliance noise and equipment used in water supply in accordance to ISO 3822 including read in of all additional required parameters such as water flow and pressure. Requires Nor850/Suite basic software.
Nor850/DC	Logging of DC-voltages from ADAM-6017 device (inluded) connected via LAN. Requires Nor850/Suite basic software with option /BA-M or LW-M.
Nor850/TTL	Control of TTL-switches on ADAM-6066 device (included) connected via LAN. Requires Nor850/Suite basic software with option /BA-M or LW-M.
Nor850/HTP	Automated reading of humidity, temperature and air pressure via LAN from Vaisala type PTU303 (not included). Requires Nor850/Suite basic software with option /BA-1 or LW-1.
Nor850/Boom	Control of Nor265 Microphone Boom units connected via RS-232/LAN adapter MOXA Nport 5110 (included). Requires Nor850/Suite basic software with option /BA-M or LW-M.
Nor850/Scheduler	User definable test Scheduler for use with BA and LW measurements. Requires Nor850/Suite basic software with option /BA-M or LW-M.
Nor850/Ext3-4	Multichannel system software extension for 3-4 measurement channels (requires Nor850/Suite and minimum one Nor850/xx application software).
Nor850/Ext5-8	Multichannel system software extension for 5-8 measurement channels (requires Nor850/Suite, /Ext3-4 and minimum one Nor850/xx application software).
Nor850/Ext9-16	Multichannel system software extension for 9-16 measurement channels (requires Nor850/Suite, /Ext3-4, /Ext5-8 and minimum one Nor850/xx application software).
Nor850/Ext17-32	Multichannel system software extension for 17-32 measurement channels (requires Nor850/Suite, /Ext3-4, /Ext5-8, Ext9-16 and minimum one Nor850/xx application software).
Nor850/LIC2	Software licence extension for use of 2nd PC within the same measurement system. Calculate price based on the total sum of software prices in the system.
Nor850/LIC3+	Software licence extension for use of 3rd PC within the same measurement system. Calculate price based on the total sum of software prices in the system. Additional PC in system possible by additional purchase of LIC3+ option.
Nor850/V2	Upgrade from V1.x to V2.x. Upgrade fee for all purchased Nor850/software products.
Nor850/Maint1	Opt. Maintenance: Annual maintenance fee to ensure free upgrade to the next released software versions.
Nor850/Maint3	Opt. Maintenance: Annual maintenance fee to ensure free upgrade to the next released software versions. Contract for minimum 3 years.
Nor850-MF1	MainFrame rack holding up to 10 Modules. Communicate with PC through LAN or USB interfaces. Runs on 12Vdc and 115/230 Vac.
Nor850-1	Measurement Module for use in Nor850-MF1 with single channel measurement features. 7-pin Lemo socket for signal input and 3,5mm Jack plug for AC output.
Nor850-1 SG	Measurement Module for use in Nor850-MF1 with single channel measurement features and signal generator output. 7-pin Lemo socket for signal input, BNC socket for signal generator and 3,5mm Jack plug for AC output.
Nor850 LB	Light Barrier trigger module for use in Nor850-MF1 with two trigger inputs. This module contains power for the two individual light barrier units that are included in the module price.

Build the Nor850 system to fulfill any need

The Nor850 offers a great flexibility both in use and in configuration. What ever measurement task or reporting job, the user may pick from a wide range of optional available features. The figure below illustrates how the optional system is built-up.

All orders must start with the basic box named "Nor850 Suite". For only reporting features, the available applications packages are shown above this basic box. The advanced boxes require that the basic reporting option for the same application is ordered as well.

For measurement applications, the available applications are shown below the basic box, but also for these measurement boxes it is required that the basic reporting option for the same application is ordered as well.

Each Nor850 system may contain as many of these optional boxes as desired. In addition, the special auxiliary features (shown as grey boxes) may be added on demand. More details are found in the ordering information table.

Distributor: