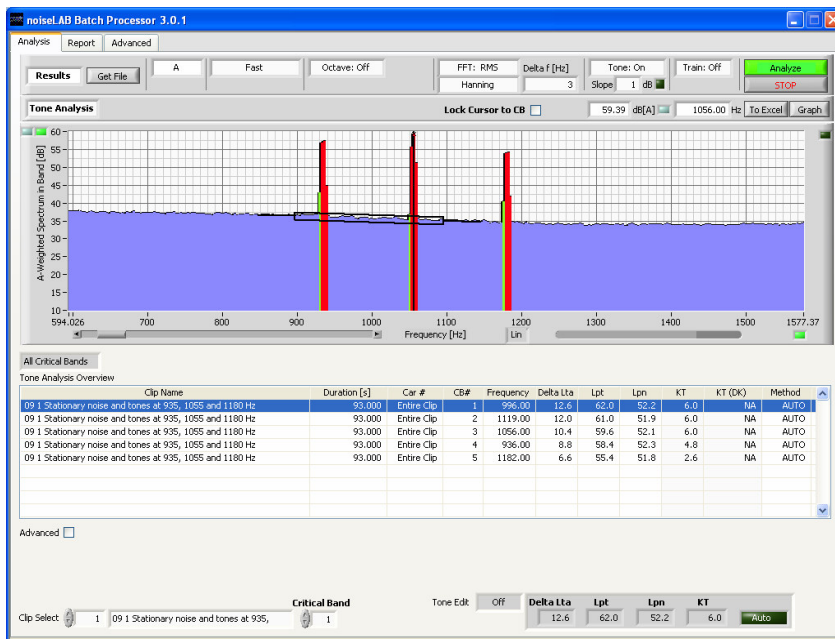# noiseLAB

Noise Analysis Software with tone analysis and batch processing

Truly Portable, Truly Affordable

Specifications Version 3.0

Features / Benefits

- *Integrated Recording, Analysis, and Post-processing of most noise related parameters.*

  Simplicity in data handling and documentation.

- *Up to 4 channels/24-bit recording laptop based sound recording.*

  No need for dedicated recorders, your laptop does it all! Saves cost and weight.

- *Wide range of measurement parameters:*

- Sound Level and Statistical analysis.

With just one mouse click, measure Sound Levels, Leq, LE, and L_N values for each clip and all clips combined.

- 1/1, 1/3, 1/6, 1/12, and 1/24 octave.

- FFT Analysis: up to 100 000 lines.

- Automatic 1/3 octave pass-by.

- Automatic Tone Analysis to ISO 1996-2

- TaktMax (3 s and 5 s)

- Infra-sound G and A (LF) Weighting

- *Fully documented, traceable data and documentation*

  Noise surveys made with noiseLAB readily comply with documentation and data integrity requirements for accredited noise reports.

- *Integration of user comments, digital photographs, site documentation, and meteorological conditions*

  No need for handwritten notes, sketches, and loose documentation..

- *Import of data from .wav-files, DAT, and hard disk recorders and sound level meters.*

- *Up to 8 channels 24 bit data recording on desktop PC*

  High-performance, high resolution recording with full alias protection.

- *Advanced Batch Processing*

  Processing multiple of Clips of data with any or all measurement functions.

- *Automatic "Train" Processing*

  Sub—divide a Clip into "Cars" of user-defined length and perform batch processing on these.

- *Integrated report generation to Microsoft Word, Excel, and Web: One tool feeds multiple sources.*

User-Focused Design

noiseLAB is simple. At a time when products get more and more complex, noiseLAB focuses on simplicity. Easy-to-learn, easy-to-use.

noiseLAB focuses on results. A fully documented noise report in an integrated system that provides both calibrated measurements and automatic report data output.

noiseLAB focuses on your work flow. Designed by noise professionals with years of field experience, noiseLAB gets the results done in a rapid, professional way. noiseLAB captures the entire process including calibration, documentation of meteorological conditions, integration with site data and digital photographs, time-stamped and fully documented noise recordings and processed results. Push one button and out comes your finished data.

Five Easy Steps:

1. **Configure and Calibrate**: Set up and calibrate your hardware, document your measurement set-up, and you're ready to go.

2. **Record**: Record up to 8 channels, and monitor signal levels. Mark events of interest.

3. **Edit**: While viewing or listening to your recordings, edit your data to create sound clips for subsequent analysis.

4. **Analyze**: Apply analysis to one or more clips at a time. A choice of Sound Level/Statistics, 1/N Octave, or FFT, infrasound or Tone Analysis.

5. **Create the Report**: With a single mouse click you create files for Word, Excel, and the Web.

How noiseLAB saves you time

Typical noise analysis is based on a sound level meter or tape recorder for use in the field.

Data was brought home and processed on the PC. To create a full report, you had to manually key in the data and documentation after the measurements were done.

With noiseLAB, your laptop is your integrated recording and analysis system. You enter all documentation and calibration information while in the field, saving time and preventing subsequent mistakes.

noiseLAB reduces mistakes

The most frequent mistakes in noise analysis are related to documentation and calibration. Simple, but serious mistakes such as attenuator changes that are not documented are virtually eliminated when noiseLAB is used as a fully integrated system.

Calibration management tracks your data from calibration tone through all analysis functions. No risk of manual, undocumented errors.

noiseLAB can give better accuracy

Compared to a classic sound level meter, noiseLAB gives you full control over which signals to include. Since you make a high quality recording of the noise, you can precisely edit your data to create Clips which *only* include the desired noise, and eliminates unwanted sound, thus giving a more correct measurement.
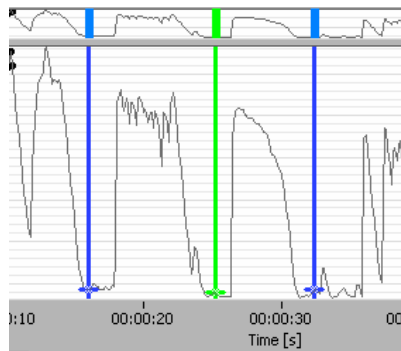
noiseLAB: No regrets

With noiseLAB, you have a high-dynamic range recording of the original signal. You can always go back and make totally new calculations on the same data.

Assume you made a classic Leq measurement, and a few weeks later the client asks you about infra-sound or tones in the data. You only need to go back to the original recording! No need to go back in the field and make a new measurement.

Batch Processing: Simple yet powerful

Complex noise surveys may include hundreds of individual sound clips. Now with noiseLAB 3.0 you can process them all in one simple operation.

First, edit your Recording to create the individual sound Clips. Give the Clips clear, meaningful names which can be used directly in the final report.

Next, Select the Clips you want to Analyze:
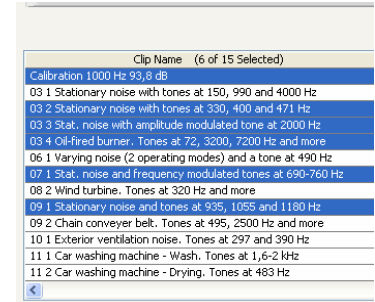
Finally, select the one or all of four classes of measurements:

1. Sound Level/Statistical Analysis
2. 1/N octave (1/1 to 1/24)
3. FFT Spectrum
4. Tone Analysis.

Note for each category, there are only a few simple additional parameters to set. (Fig. 1 on the next page)
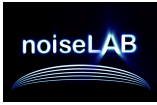
noiseLAB

Results	Get File		Linear	Fast	Octave: RMS		FFT: RMS	Delta f [Hz]		Tone: On		Train: Off	Analyze
					1/3 Oct	4 Hz - 20 kHz	Hanning	3	Slope	1 dB			STOP

Fig. 1: Simplicity in Setting up your Measurements

(Linear Spectrum in Band [dB] vs Frequency [Hz] graph)

1/N Octave Result

Clip Name	Duration [s]	Car #	Filter Settled	G (infra)	A (LF)	Lin	4.0	5.0	6.3	8.0	10.0	12.5	16.0	20.0	25.0
Calibration 1000 Hz 93,8 dB	20.000	Entire Clip	True	-8.99	-24.60	93.83	-29.6	-30.2	-30.7	-25.9	-26.0	-23.9	-23.1	-21.2	-20.8
03 2 Stationary noise with tones at 330, 400	237.250	Entire Clip	True	87.40	51.88	81.97	37.9	41.2	41.3	39.4	48.0	63.8	72.9	76.2	75.9
03 3 Stat. noise with amplitude modulated to	237.500	Entire Clip	True	72.59	45.30	69.95	22.1	25.7	30.0	30.5	35.3	46.8	57.2	61.4	61.7
03 4 Oil-fired burner. Tones at 72, 3200, 720	237.625	Entire Clip	True	88.28	63.45	87.33	31.5	34.9	34.7	31.8	35.9	45.0	61.7	78.9	72.4
07 1 Stat. noise and frequency modulated to	178.125	Entire Clip	True	15.49	49.53	67.02	-4.9	-5.6	-5.5	-4.9	-3.7	-1.2	1.9	3.0	4.7
09 1 Stationary noise and tones at 935, 1055	93.000	Entire Clip	True	69.63	55.91	74.64	17.3	22.4	29.1	40.7	49.2	52.2	55.3	58.1	57.9

Fig. 2: Typical Octave analysis results based on above set-up.

Sound Level Overview

Clip Name	Duration [s]	Car#	Leq	Max SL	Min SL	Peak	Impulse	Leq 3s	Leq 5s	L1	L5	L10	L50	L90	L95	L99
Calibration 1000 Hz 93,8 dB	20.000	Entire Clip	93.80	93.80	47.81	96.81	93.81	93.80	93.80	93.80	93.79	93.78	93.70	93.62	93.61	92.67
03 2 Stationary noise with tones at 330, 400	237.250	Entire Clip	81.96	89.76	35.51	98.81	93.51	85.60	86.07	85.64	84.33	83.70	81.49	79.44	78.94	78.07
03 3 Stat. noise with amplitude modulated ton	237.500	Entire Clip	69.95	75.33	13.72	84.39	77.94	72.72	73.18	72.70	71.67	71.18	69.62	68.31	68.00	67.49
03 4 Oil-fired burner. Tones at 72, 3200, 7200	237.625	Entire Clip	87.45	91.07	40.39	99.56	92.09	89.33	89.56	89.39	88.77	88.45	87.26	86.02	85.65	85.03
07 1 Stat. noise and frequency modulated tor	178.125	Entire Clip	69.05	70.75	16.78	82.45	72.27	70.07	70.15	69.91	69.58	69.42	68.92	68.44	68.33	68.09
09 1 Stationary noise and tones at 935, 1055	93.000	Entire Clip	74.60	76.89	21.94	88.06	77.95	75.73	75.78	76.17	75.77	75.49	74.31	73.62	73.45	73.10

Fig. 3: Typical family of Sound Level measurements

Recording ←——————————————————————————————————————→

Clips ←————————————————————→ ←————————————————————→

Cars ←→←→←→←→←→←→←→←→←→ ←→←→←→←→←→←→←→←→←→

Make a recording, edit it to create one or more Clips, and define the Car Duration. Make any analysis desired.
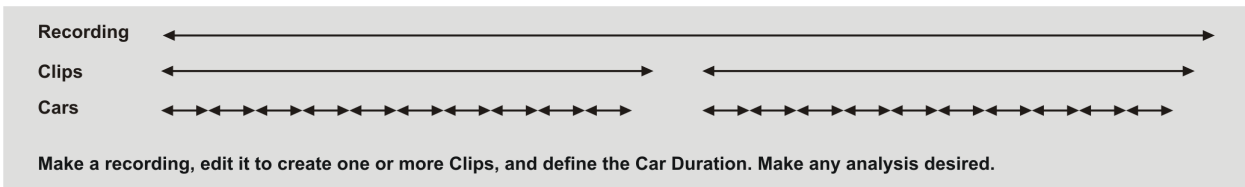
Overview of Train Analysis

But noiseLAB computes a lot of extra functions behind the scenes for you. For 1/3 Octave analysis, it also calculates the Infra-sound G and A Filtered LF values (Fig. 2 above), and for Sound Level it also calculates the Maximum and Minimum, Peak, and Impulse sound level along with the TaktMax (3 and 5 s) and statistical parameters L1 to L99 (Fig. 3 above).

Note that all of these measurements can be made on as many Clips as you desire, and you can perform them in parallel! Which means you can perform Sound Level, 1/N Octave, FFT, and Tone Analysis, all at the same time!

Result storage is just as easy. Simply hit the "To Excel" button, and the entire table of data is stored. You can check off whether you want it for each or all of the classes of measurements, and how you want the data organized.

The same applies to Graphs. Simply hit the "Graph" button and a JPEG file of the current graph is saved to disk.

And if you need a sequence of plots, such as when plotting the sound level as a function of time, you use the "Train Analysis" to automatically create multiple plots of a user-defined
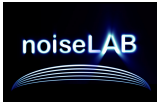
length. For example, if you have one hour of data, you can automatically break it into 60 second "Train Cars", and then automatically plot each of the sixty resulting graphs, with just one click of the mouse!

Finally, a simple "One Page Tone Report" saves both the graph and tabular data, along with measurement documentation on a single sheet suitable for Word or the Web.

"Train Analysis" is also useful for looking a time varying signals where the frequency of the signal changes. Simply choose your "Car Duration", and Automatically plot all the FFT spectra of all the cars with just one mouse click. Or if you prefer, you can do the same thing using 1/N octave analysis, and tone analysis, all at the same time!

In addition to the results for each car, noiseLAB also computes the result for all cars together. You don't even have to ask for it.

Train Analysis is also useful when you have to create complex time profiles such as looking at the evolution of 1 minute L_{eq} values over long periods. With user-defined car lengths, you have full flexibility. You can even process the same data multiple times with different cars lengths and re-combine the data in Excel.

- **Tone Analysis: Automated analysis of audibility based on psychoacoustics**

The tone analysis algorithms in noiseLAB 3.0 were developed over many years of psycho-acoustic research at DELTA, and are now part of the ISO 1996-2 standard.

The core concept is based on finding the audibility of a tone or group of tones in a critical band. Since a spectrum may contain multiple tones in many different critical bands, noiseLAB automatically identifies those which are most audible.

The process, in simplified form is the following:

- Find the tones in the spectrum (based on steepness and relative bandwidth).
- Find the critical band(s) encompassing one or more tones.

- Find the background noise in each critical band.
- Compute the ratio of the tone(s) to background noise and correct for psycho-acoustic masking effects.
- Compute the Tonal Audibility and the associated Correction Factor.
- Sort the data to find the "worst" tones.

noiseLAB performs all these complex calculations automatically and outputs the results in a simple, easy to understand graph and table. For advanced users, manual tone computation is also possible.

noiseLAB: Four Editions

noiseLAB is available in three different editions:

- **noiseLAB Standard**
  A-, C-, and Linear weighted sound level measurements (Fast and Peak), including Leq, statistical values (L_N on Fast values) as well as editing capabilities. Automatic calculation of above parameters of individual edited clips or collections of clips. Up to 60 minutes of 2-channel recording.

- **noiseLAB Advanced**
  All above features plus 1/1 and 1/3 octave analysis, up to 10,000 line FFT analysis, tone detection and batch processing. Up to 4 channels and 4 hours of real-time audio recording.

- **noiseLAB Professional**
  All above features plus 1/6, 1/12, and 1/24 octave analysis, FFT analysis with up to 100,000 lines FFT. Up to 8 channels and 8 hours recording. Train Analysis plus Manual Tone Analysis.

Basic PC Configuration

PC running Windows XP (Home or Professional) with Microsoft Office 2003 or Office 2007.

Minimum of 1.5 GHz Intel Compatible CPU, 512 MByte memory, 10 GByte free harddisk space. 1024 x 768 (or better) color display

One of the following digitizers:

- A Type 1 sound level meter with compatible .wav format recording capability.
- A hard disk recording with a type 1 microphone (Analog or digital .wav)
- National Instruments 4474 4-channel digitizer (for use with desktop PC with one free PCI slot)
- National Instruments 4472 8-channel digitizer (for use with desktop PC with one free PCI slot)
- National Instruments USB-9233: 4- channel 24-bit digitizer with built in IEPE powering. Instrumentation microphones (Type 1) with suitable preamplifier can be used with any of the above digitizers.

noiseLAB: Common Functions for All Editions

- **Conformance**: IEC 61672-2 Sound Level meters Type 1and IEC 61260 Octave Filters Class 1 with matching hardware and microphone. Certified with above National Instruments Hardware.

- **Calibration**
  – User, site, microphone/
  preamp ID, Level and time calibration
  – Site notes/Meteorological notes
  – Noise event notes
 – Import of up to 4 photo files (jpeg)

  Recording/Editing
  – Up to 100 recordings per project

  – Non-destructive editing up to 1000 clips per project. Automatic user-defined Clip naming.

  – Selective post-processing on individual clips or collection of clips

- **Project Definition and Management**

  – Data traceability from calibration through recording and editing that ensures the integrity of the measurement, post-processing, report generation chain.

- **Probe Function (Real time)**

  – Sound level (A and Lin), oscilloscope, octave, 1/3 octave analyzer, FFT spectrum analyzer
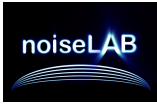
Ordering Information

noiseLAB is sold worldwide by distributors. See: www.noiseLAB.dk

Options for noiseLAB include one year maintenance contracts which guarantee all updates released during one year.

Return policy: noiseLAB may be returned within 30 days of purchase for any reason.

noiseLAB license contract permits one instance on one office and one field computer which cannot be used simultaneously. A product key code is provided for each license.

noiseLAB is only supported on Windows XP Home and Professional Edition. To obtain adequate real-time data recording performance, the PC must be configured according to DELTA guidelines, which may include turning off firewalls, virus checker, and other background processes. Since DELTA can make no guarantee of adequate performance on all variations of personal computers, it provides a 30-day return policy with full refund.

Pricing

A free demo version of noiseLAB Demo is available for download at noiseLAB.dk.

The following Editions are available for purchase:

noiseLAB Standard:

noiseLAB Advanced:

noiseLAB Professional:

Please contact your local distributor for price and delivery information. Distributors are listed at www.noiselab.dk, or you may send an email to noiseLAB@delta.dk.

An educational edition of noiseLAB is available for bona fide educational institutions.

DELTA:
World Class Acoustics since 1941

Microsoft Office 2003, Word, Excel registered trademarks of the respective companies. noiseLAB is a registered trademark of DELTA.

All specifications and pricing are subject to change without notice.

Specifications: Version 3.0 18 September, 2007

noiseLAB Detailed Specifications

- **Batch Processing**: The number of clips and number of train cars is only limited by the available computer system memory. Other factors that have a significant impact are the frequency resolution for FFT Analysis, the total duration of all clips when Sound Level is Selected. Analysis speed is impacted primarily by the total length of signals analyzed, as well as the number of different measurements selected. Particularly 1/24 octave analysis and tone analysis can have a significant impact of processing speed. The batch processor requires data input in the form of noiseLAB Project files (.nlp) with associated sound recordings which have been edited to create one or more clips. Spectra may also be imported for tone analysis (see below).

- **Analysis General Characteristics**: The following analyses are performed on selected Clips, Cars, and sum of Cars. When train analysis is Off, the analyses are computed for the entire train. All measurements are computed using the selected Frequency Weighting (A, B, C, or Lin). Overload information is logged for each channel at 125 ms intervals.

- **Sound Level Analysis**: Simultaneous analysis of Sound Level Maximum, Minimum (125 ms interval), Peak,Impulse, Leq as a function of time with 125 ms sampling interval. TaktMax is computed simultaneously with both 3 s and 5 s intervals. L_N (N=1,5,10,50,90,95,99) is computed for the entire car

and sum of cars or the entire clip(s). Sound Level is computed based on Fast, Slow or user-selectable time exponential constant from 1 ms to 60 s in steps of 1 ms. Time scale selectable with 125 ms or ~1 ms resolution (Short Time function only)

- **FFT Analysis**: Frequency Line spacing from 0,2 Hz to 50 Hz in noiseLAB Classic, and from 1 Hz to 100 Hz in Batch Processor. Actual line spacing is shown with 6 decimals accuracy. Time Domain Window: None, Hanning, Hamming, Blackman-Harris, Blackman, Exact Blackman, 4-term Blackman-Harris, 7-term Blackman-Harris, Flat Top, Low Sidelobe. Overlap: 50%. Averaging: Linear RMS over the selected analysis period. When analysis is performed on multiple cars, each car is analyzed from start to end without overlap into the preceding or following car. For Sum of Cars, the spectrum is computed for as the sum of the spectra of the individual cars. For Clips, the Analysis is a sliding window over the entire Clip.

- **1/N Octave Analysis**: Selectable 1/1, 1/3, 1/6, 1/12, 1/24 octave analysis with linear integration. Filter settled status shown. noiseLAB Classic: Linear RMS integration or Max Spectrum with selectable time constant (1 ms to 10 s in steps of 1 ms). Pass-by: The 1/N octave spectrum at the time of A weighted Fast maximum value. Batch Processor only: Select lower frequency limit of 1, 4 or 20 Hz. Upper frequency: ap-

proximately 20 kHz depending on sampling frequency.

- **Tone Analysis**: According to ISO 1996-2. Computes tone characteristics for up to 50 Critical Bands per spectrum. Automatic determination of Critical Band, number of tones, individual tone level Lpti, total tone level Lpt, Tone Bandwidth as % of Critical Band, Perceived Noise Level Lpn, and tone correction KT for each critical band. Selectable Tone Slope criteria, Lpn curve fitting width in % of Critical Band. Manual curve fitting (Slope and Offset) for determination of Lpn (Professional Edition only). Automatic sorting of list of Critical bands by Lta. The tone analysis speed will be significantly impacted by the number of tones in the spectrum. The spectrum frequency range used for tone analysis may be restricted to improve performance. The following tone parameters may be changed without requiring new spectrum analysis, but only a new tone analysis: Frequency range, tone slope criteria, and regression fitting width.

- **Import of spectra**: Up to 250 FFT spectra in tab-delimited spreadsheet .txt file column format may be imported for subsequent tone analysis. Maximum number of lines in each spectrum is limited by Excel (65000 lines). Start frequency and line spacing must be specified. Spectra may also be output by the Batch Processor for subsequent import.