

LMS Solutions Guide

LMS Test.Lab Rotating Machinery

LMS Test.Lab Rotating Machinery

Mastering the Complexity of Vibro-Acoustic Testing



Vibro-acoustic troubleshooting and product refinement demand a comprehensive array of tools: waterfall mappings to globally characterize the problem; order tracking for an in-depth investigation; time data to experience the sound; a complete set of processing functions and specialized modules to help assimilate and visualize the vast amounts of data that are generated. Whether you are measuring on an engine dyno, in a vehicle on the proving ground or in the field near a large turbine, LMS Test.Lab is always the perfect choice.

Measurement capabilities you could not imagine before

Because so much is happening at once, LMS Test.Lab measures everything in parallel – you'll be tracking signatures against engine speed, recording temperature, pressure and other speed references, computing orders using high-speed digital filters, throughputting raw time data to disk and even monitoring sound fields using real-time 1/3 octaves. Users miss nothing and so there is no need to repeat a test just to see the data in a different format. On-line displays keep them up to date with measurement progress.

Flexible data processing in real-time

With LMS Test.Lab the concept of post-processing is obsolete - it calculates everything during the acquisition run without loss of data and without slowing down the measurement. You can compare incoming measurements against a reference curve, a running average of run-ups, or previously stored results. Immediately after the run, users can flip through a series of waterfalls, snap between spectral, octave, and order ratio formats, toggle the color map through a stunning range of user-definable presentation styles, re-process the raw time data to change rpm increments, and much more. LMS Test.Lab is faster and more flexible than you have ever experienced!

System Setup

It's all about productivity and test integrity.

General

Just click on a user-defined icon in the Windows Desktop to launch Test.Lab and automatically load a specific test template (e.g. engine 5 WOT run-up) which can also be specific to an operator - instructions to follow, color schemes, trace styles, font size and so on...

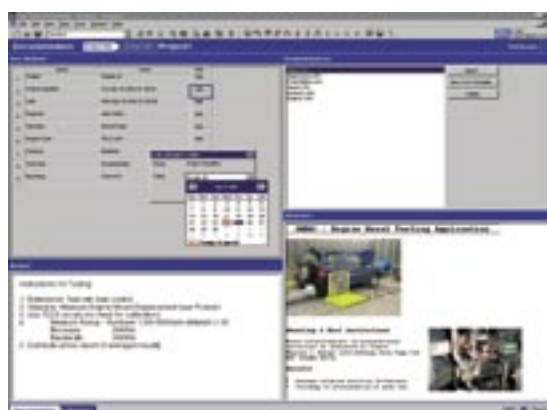
The operator then follows the workflow defined by the supervisor: overall guidelines; channel set-up, calibration, tracking and acquisition set-up, on-line processing, measure and post-processing. Because all the information is automatically loaded, only a minimum of intervention is required.

Channel data

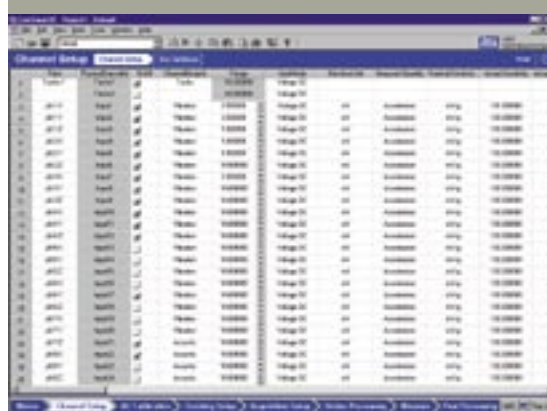
- Check or upload transducer calibrations, point-ids etc. from any ODBC database or read it directly from Smart Transducers (TEDS)
- Automatic detection of which channel(s) is being calibrated
- Automatic selection of channels to be calibrated by given calibrator type (i.e. mic or accel)
- Channel mapping to avoid re-cabling the set-up
- Configurable layout panel
- Channel grouping, categorizes channels in terms of vibration, acoustics, static and others which will be processed in the same manner on-line.

Acquisition & Tracking

- Interactive cursor-driven tacho level setting
- Two tachos for gearbox and turbo analyses
- Derived tacho, e.g. from rpm to speed conversion
- Overview multiple channels, pan, zoom and overview into interesting details
- Immediate interactivity - change bandwidth and you see the results, enable a channel and the LED on the front-end turns green - and if there is a cabling error it will go red.



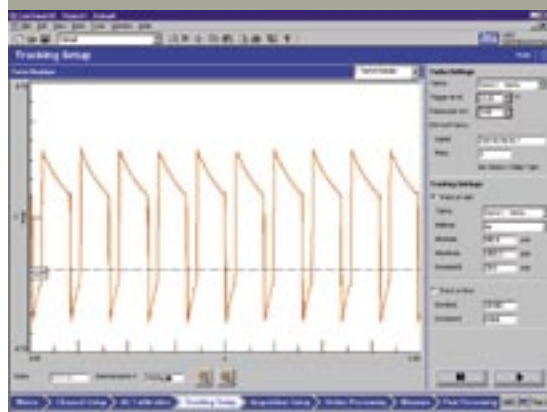
The operator can see what to do at a glance.



Transducer values are easily entered - or just load them from a database.



Automatically detect which transducer(s) are connected.



Tacho conditioning is very interactive.

Signature Acquisition and Processing, delivering a process-centric approach

Real-time processing

A wide choice of on-line display options and layouts means that the operator can see anything that is important - when it is wanted. These include the usual range of spectra, colormaps and rpm-related traces - and also reference curves, derived channels, on-line indicators...

Processing priority is given to those results that are required 'on-line', which means faster display updating when it most matters. Data buffering means that, no matter how quick the run-up, data will be acquired and processed at the specified rpm interval.

If required, record the raw time data together with the data processed on-line. Just in case somebody asks for some other details

Post-processing

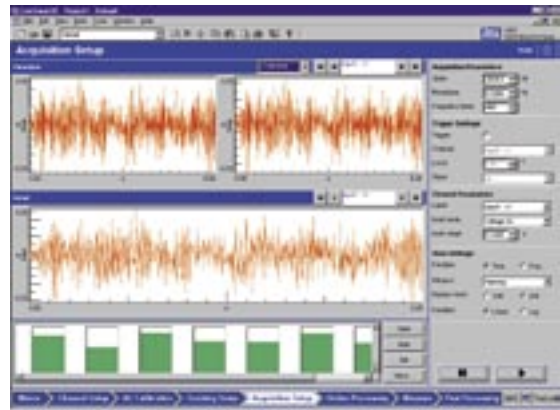
Now you're ready to quickly manipulate, process, and re-format the readings in any way you like. You can generate a wide range of graphs: from rpm-time diagrams, through interactive cursor sections, through summation diagrams in the frequency and/or order domains. Toggle between linear, weighted and user defined functions and formats. Drag and drop data into waterfalls, snap between spectral, octave, and order ratio formats; flip over the frequency/speed axes; toggle the color map through a stunning range of user-definable presentation styles...

Reporting

Right after the measurement, or additional post-processing, you can create your report or presentation in MS Word or MS PowerPoint. When the graphics are embedded as "active" pictures, the reader can activate those graphics, add cursors, change axes limits and formats, etc... No need of cumbersome iterations to have the report in a slightly different way or to get details of a peak or overall level. When needed, a paper or electronic plot of all processed data can be scheduled automatically after the measurement.

Application extensions...

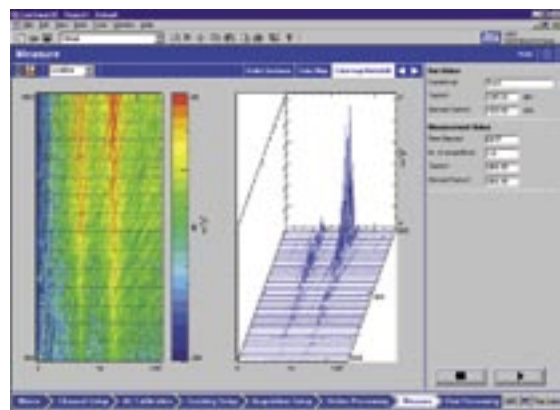
Each workbook can be extended with additional capabilities, loaded as "add-in". The workflow can thus be adapted to specific tasks such as :



Use the Acquisition Setup worksheet to set acquisition parameters and preview all the signals in time or frequency domain.



Then, define the on-line processing functions, such as order sections, frequency sections, but also many additional functions such as derived channels.



Finally, visualize the data during the acquisition with multiple displays, defined as part of the measurement procedures or modifiable during the measurement.

LMS Test.Lab 16 Channel Harmonic Analysis

Versatile system for analysis of rotating machinery harmonics in operation

The LMS Test.Lab 16 Channel Harmonic Analysis system offers online and offline order analysis based on narrow-band waterfall spectra and color-maps, measured on rotating equipment in operating conditions. Data acquisition is conducted on a portable LMS SCADAS 305 front-end with two embedded tacho inputs, supporting 16 channels for ICP® and Voltage signals (including quasi-static parameters), which can be expanded to 20 channels.

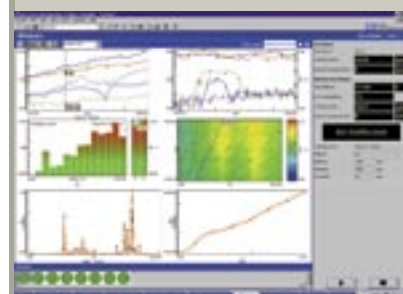
With the Signature Testing workbook, spectral data and orders can be measured and processed repeatedly in accordance with custom procedures, making use of pre-defined templates with specified display layouts and measurement settings.

This solution supports acquisition during run-ups, run-downs or sequences of both, at user defined time or rpm intervals. Derived tacho channels enable online monitoring of secondary quantities, such as rotational speed on another axis or vehicle speed. The many online processing and visualization formats include broadband RMS-levels, waterfalls and order-, frequency- and octave sections. With online derived channels, the engineer can add virtual channels by recombining the signals measured on physical channels using both basic and advanced mathematical operations. The multiple sample rates permit the amount of saved data to be reduced by acquiring the vibration channels at a lower sampling rate, while keeping the high sample rate for the acoustic channels. Online reference curves can be used as design targets to validate the current design or can be applied to check the repeatability of multiple runs.

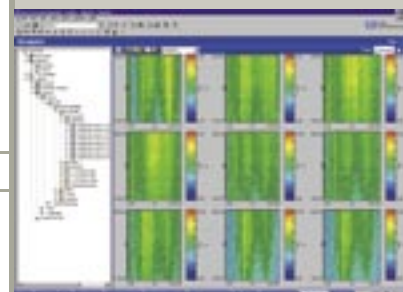
Offline post-processing offers a list of functions for global problem characterization and for gaining a deeper insight into the physical processes.



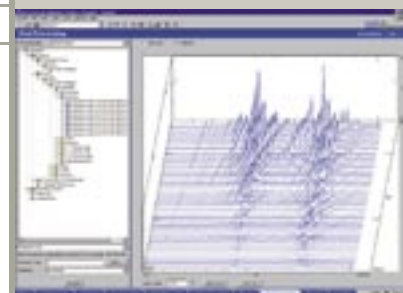
Noise and vibration engineers perform benchmarking, troubleshooting and design verification on test benches or in operating conditions.



On line status information about processing functions help the operator to monitor measurement progress and take corrective actions if needed.



Visualization of several channels allow identification of critical speeds or structural resonances.

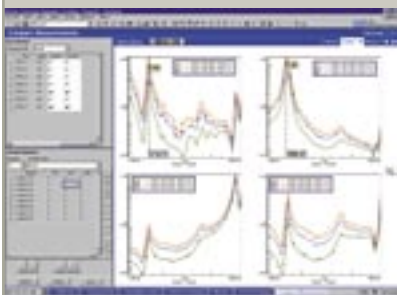


Order analysis can be done on-line, during acquisition or off-line based on waterfall data.

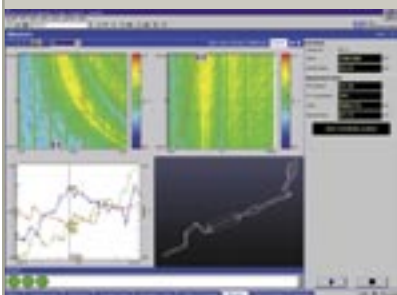
Features	Benefits
<ul style="list-style-type: none"> • Online monitoring of multiple parallel measurement functions: spectra, waterfalls and color maps, octave displays and order sections • Online and offline order analysis with reference to measured or derived tacho channels • Online check against reference curves • Online monitoring of a variety of measurement status indicators (ADC levels, rpm readouts, rpm time traces, rpm levels) 	<ul style="list-style-type: none"> • Offers fast diagnosis capability based on accurate and complete data set • Reduces errors and accelerates productivity • Improves the process with online feedback on progress and measurement quality • Presents fast standard reporting by "single button" operation
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tacho, AC/DC power and SCSI interface • 4 x PQA - 4 channel Programmable V/ICP® Signal Conditioner • 4 x SP92-B - 4 channel 24-bit DSP Signal Processor Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Desktop • SCADAS 305 Driver • Signature Testing Workbook 	<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • V12A - replaces SP92-B and PQA for up to 60 channels <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Audio Replay & Filtering • Run Data Averaging & Comparison Organizer • Operational Deflection Shapes • Time Recording during Signature Testing • Signal Calculator • Throughput Validation & Processing Host • Signature Throughput Processing • Batch Reporting - Organizer • Geometry Workbook



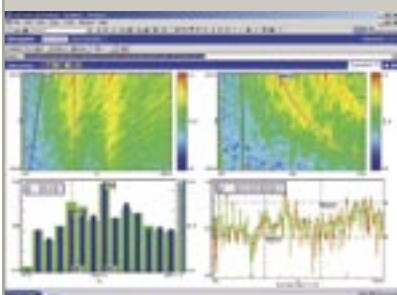
Multiple tacho inputs allow to track vibration with respect to several rotation speeds, such as in aero-engines or transmission systems.



Compare measurements, make averages and scroll through channels: LMS Test.Lab does the data handling while you concentrate on the results.



Combine the convenience of narrow-band spectra with the accuracy of synchronously sampled orders and store raw time data for future re-analysis.



Simultaneous acoustic and vibration measurements, even with different sampling rates, give increased insight about global vibro-acoustic behavior.

LMS Test.Lab 32 Channel Order Analysis

System for extensive harmonic analysis of rotating machinery in operation

The LMS Test.Lab 32 channel Order Analysis system provides a solution for advanced harmonic analysis on rotating equipment in operating conditions. Order sections are obtained from data sampled synchronously with rpm, giving leakage-free, razor-sharp order cuts, while additional online processing is available starting from narrowband fixed frequency sampled waterfall spectra. Raw time data are recorded in parallel for offline processing. The data acquisition is performed using a LMS SCADAS 310 front-end with 2 tacho inputs, supporting 32 channels for ICP® and Voltage signals, including quasi-static parameters.

With the Order Tracking During Signature Acquisition workbook, the user can simultaneously acquire narrowband spectra and synchronously sampled orders during run-ups, run-downs or sequences of both, referenced to multiple physical tacho signals. Derived tacho enables online monitoring of secondary quantities, such as the rotational speed on another axis. With online derived channels, the engineer can add virtual channels by recombining the signals measured on physical channels using both basic and advanced mathematical operations. The multiple sample rates permit the amount of saved data to be reduced by acquiring vibration channels and acoustic channels at different sampling rates. Online reference curves can be used as design targets to validate the current design, or can be applied to check the repeatability of multiple runs.

The time histories for all channels can be validated immediately after the measurement and are directly written to the PC hard disc with a throughput performance that is independent of channel count. The Signature Throughput Processing workbook provides for any processing function needed to gain deeper insight into the physical processes, analyzing individual recordings or batches of time histories from multiple measurements.

Features	Benefits
<ul style="list-style-type: none"> • Simultaneous measurement of leakage-free, synchronously sampled order sections and fixed sampled spectra • Online monitoring of spectra, waterfalls and color maps, octave displays and order sections, and a variety of measurement status indicators (ADC levels, rpm readouts, rpm time traces, rpm levels) • Simultaneous recording of raw time data • Online check against reference curves 	<ul style="list-style-type: none"> • Maximal data consistency and measurement productivity, providing online high precision order analysis while acquiring narrowband waterfall data and time recordings • Productive batch processing of throughput data from multiple measurements • Fast and convenient standard reporting
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • LMS SCADAS 310 - Master frame with 10 slots, AC power and SCSI interface • 1 x PDT - Programmable dual Tacho input Module for Analog and TTL signals • 8 x POA - 4 channel Programmable V/ICP® Signal Conditioner • 8 x SP92-B - 4 channel 24-bit DSP Signal Processor Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Desktop • LMS SCADAS 310 Driver • Order Tracking during Signature Acquisition Workbook • Time Recording during Signature Testing • Throughput Validation & Processing Host • Signature Throughput Processing • Signature Data Post-Processing Workbook 	<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • PDT dual Tacho input module • QTV Quad Torsional Vibration module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Audio Replay & Filtering • Run Data Averaging & Comparison Organizer • Operational Deflection Shapes • Psycho-Acoustic Metrics • Signal Calculator • Batch Reporting - Organizer • Geometry Workbook • LMS SCADAS III Multiple Tacho Support

LMS Test.Lab 12 Channel Mobile Time Data Processing and Recording

Mobile system for operational benchmarking of rotating machinery

The LMS Test.Lab 12 Channel Mobile Time Data Processing & Recording system provides a mobile solution for operational benchmarking of rotating machinery. It stores raw time data histories for offline processing, while providing comprehensive online analysis functionality. The data acquisition is conducted using a portable LMS SCADAS 305 front-end with two embedded tachometer inputs, supporting 12 channels for ICP® and Voltage signals, including quasi-static parameters.

The Signature Throughput workbook writes the time histories for all channels directly to the PC hard disc. The resulting TDF-data files have no size limitations and contain all dynamic and static channels, rpm-time traces for all tachometer channels and overload information for each individual channel. The many online processing and visualization formats include waterfalls and order-, frequency- and octave sections. The data acquisition can be controlled remotely through a push-button box and enlarged status displays facilitate monitoring during measurement. The time data can be validated immediately after the measurement, allowing the engineer to gain a quick overview on the whole measurement or to zoom in on details.

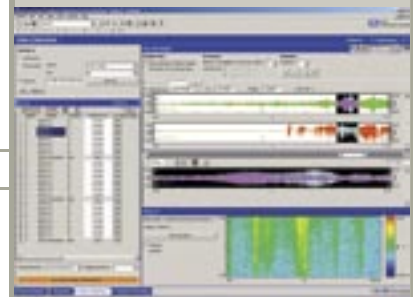
With the Signal Calculator, the engineer can expand the measurement with virtual time histories by recombining physical measurement channels using basic and advanced mathematical operations. These time histories are calculated automatically upon completion of the measurement and stored together with the measurement channels in the same TDF-data file, so they can be processed simultaneously during the offline throughput processing. With dedicated data validation and selection, data from different measurement runs can be organized and combined for batch processing.



The portable LMS SCADAS 305, brings on-line processing capabilities for higher confidence during measurement.



The scope function allows to verify the setup before acquiring data.



Time data can be validated immediately after the measurement, giving you a quick overview, and allowing you to zoom in on details.

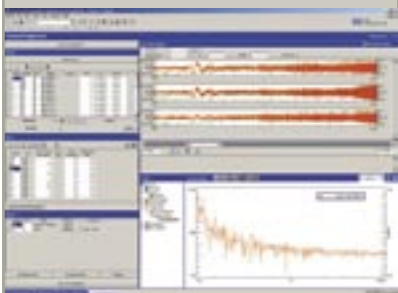


Virtual channels can be defined as mathematical operations on physical channels.

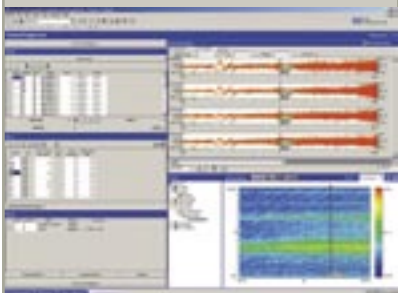
Features	Benefits
<ul style="list-style-type: none"> Throughput performance independent of channel count Online monitoring of spectra, waterfalls and color maps, octave displays and order sections, and a variety of measurement status indicators (ADC levels, rpm readouts, rpm time traces, rpm levels) Virtual time histories calculated from physical measurement channels Batch throughput processing to process multiple measurement runs simultaneously 	<ul style="list-style-type: none"> Ensures effective and reliable operational benchmarking Integrates advanced time data analysis in the measurement process Includes easy-to-use automated processing of multiple recordings Presents fast standard reporting with "single button" operation
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tachometer, AC/DC power and SCSI interface 3 x PQA - 4 channel Programmable V/ICP® Signal Conditioner 3 x SP92-B - 4 channel 24-bit DSP Signal Processor Module 1 x RC01 - Remote Control Unit <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> Desktop LMS SCADAS 305 Driver Signature Throughput Workbook Signal Calculator 	<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> V12A - replaces SP92-B and PQA for up to 60 channels <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> Run Data Averaging & Comparison Organizer Psycho-acoustic metrics Audio Replay & Filtering Signature Data Post-Processing Workbook Batch Reporting - Organizer



Measure acoustic and acceleration signals on the road or roller bench and calculate on-line metrics related to the human perception of noise.



Replay signals using play lists of different recordings and switch instantaneously between them to hear the difference.



On-line filtering of orders or fixed frequency while replaying helps to find the origin of annoying sounds.



Using templates makes measurements in different conditions simple and consistent for comparison.

LMS Test.Lab 16 Channel Sound Quality

Versatile system for operational benchmarking and sound evaluation

The LMS Test.Lab 16 Channel Sound Diagnostics system provides a flexible solution for operational testing and psycho-acoustic sound evaluation in a variety of test environments, including road, test track and roller bench. High bandwidth time data is acquired, yielding a comprehensive set of sound metrics, on-line or off-line. The data acquisition is performed using a portable LMS SCADAS 305 front-end with two embedded tacho inputs, supporting 16 channels for ICP® and Voltage signals, of which four channels accept polarization microphones.

The Signature Throughput workbook writes the time histories for all channels directly to the PC hard disc. The resulting TDF-data files contain all dynamic and static channels, rpm-time traces for all tacho channels and overload information for each channel. The many online processing and visualization formats include waterfalls and order-, frequency- and octave sections. The data acquisition can be controlled remotely through a push-button box and enlarged status displays facilitate monitoring during measurement. The time data can be validated immediately after the measurement, allowing the engineer to gain a quick overview on the whole measurement or to zoom in on details.

The Sound Diagnosis workbook allows the engineer to evaluate the human perception of the recorded sound through a large range of global and tracked psycho-acoustic metrics on user defined segments of the recorded time histories. After spectral analysis, the main origin of the sound characteristics can be diagnosed starting from any type of display. While listening, an unlimited number of filters can be applied interactively. Data from different measurement runs can be organized and combined for batch processing. The selection and processing parameters from any interactive sound diagnosis session can be saved as template procedure to speed-up future analysis.

Features	Benefits
<ul style="list-style-type: none"> • Online monitoring of spectra, waterfalls and color maps, octave displays and order sections, and a variety of measurement status indicators (ADC levels, rpm readouts, rpm time traces, rpm levels) • Large range of online and offline global and tracked sound metrics • Flexible segment selection for detailed analysis • Built-in polarization microphone power supply and signal conditioning • Quick and easy tabular reporting of sound metrics in MS-Office 	<ul style="list-style-type: none"> • Ensures effective and reliable operational benchmarking for sound qualification • Allows on the spot psycho-acoustic sound evaluation during mobile data recording • Fast and productive in-depth Sound Diagnosis through interactive filtering • Quick standard tabular reporting with "single button" operation
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tacho, AC/DC power and SCSI interface • 3 x PQA - 4 channel Programmable V/ICP® Signal Conditioner • 1 x PQMA - 4 channel Programmable V/ICP®/MIC Conditioner • 4 x SP92-B - 4 channel 24-bit DSP Signal Processor Module • 1 x RC01 - Remote Control Unit <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Desktop • LMS SCADAS 305 Driver • Signature Throughput Workbook • Sound Diagnosis 	<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • 1 x QDA Quad Digital Audio Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Run Data Averaging & Comparison Organizer • Signal Calculator • Signature Data Post-Processing Workbook • Batch Reporting - Organizer • Psycho Acoustic Metrics

LMS Test.Lab 8 Channel Synchronous Torsional Vibration Analysis

Mobile system for torsional vibration analysis

The LMS Test.Lab Torsional Vibration Analysis System provides a mobile solution for highly accurate torsional vibration analysis of rotating machinery with single or multiple shafts. The order sections can be extracted from fixed sampled frequency spectra as well as from data sampled synchronously with rpm, giving leakage-free, razor-sharp order cuts. The data acquisition is performed using a portable LMS SCADAS 305 front-end with two embedded tacho inputs, supporting four dedicated torsional vibration channels.

Four additional channels for regular ICP® and Voltage signals guarantee data consistency with traditional NVH data. The fast and accurate tacho conditioning, combined with the powerful real time processing power of the QTV module, translates the streams of tacho pulses into highly accurate angular velocity and displacement time histories up to a high bandwidth.

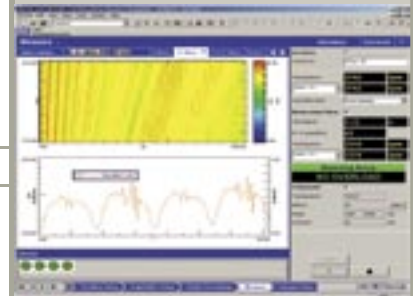
With the Order Tracking during Signature Acquisition workbook, the user can simultaneously acquire narrowband spectra and synchronously sampled order spectra during run-ups, run-downs or sequences of both, referenced to multiple physical tacho channels. Derived tacho enables online monitoring of secondary quantities, such as the rotational speed on other axis or the speed of the vehicle. The many online processing and visualization formats include waterfalls, color-maps and order-, frequency- and octave representations of the torsional vibrations. With the Signal Calculator, the engineer can expand the measurement with virtual time histories, by recombining physical measurement channels using basic and advanced mathematical operations to measure e.g. relative angular displacement. These time histories are calculated automatically upon completion of the measurement and stored together with the measurement channels in the same TDF-data file, so they can be processed simultaneously during the offline throughput processing. Data from different measurement runs can easily be organized for batch processing.



Transmissions systems such as belts, gearboxes and drivelines are subjected to torsional vibrations causing high noise and vibration levels.



Fixed and synchronous sampling on torsional vibration signals support analysis in the time/frequency or in the angular/order domain.



Pulse trains from shaft encoders or gear tooth picks are converted to rotational speed variations and processed with other vibration channels.



Use the time signal calculator for removing average rpm or to derive shaft torsion.

Features	Benefits
<ul style="list-style-type: none"> • High precision and high bandwidth torsional vibration measurements • Simultaneous calculation of leakage-free, synchronously-sampled order sections and fixed sampled order sections • Simultaneous and synchronized acquisition of torsional vibration signals and generic noise and vibration signals • Online monitoring of angular velocity irregularities, spectra, waterfalls and color maps, octave displays and order sections, and a variety of measurement status indicators 	<ul style="list-style-type: none"> • Allows high precision torsional vibration analysis based on synchronous order data while acquiring narrowband waterfall data • Effective measurement setup guaranteeing fully consistent measurement of noise, vibration and torsional signals in a single system • Provides wide range of spectral and time domain analysis tools on torsional vibration signals
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tacho, AC/DC power and SCSI interface • 1 x PQA - 4 channel Programmable V/ICP® Signal Conditioner • 1 x SP92-B - 4 channel 24-bit DSP Signal Processor Module • 1 x QTV - Quad Torsional Vibration Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Desktop • LMS SCADAS 305 Driver • Order Tracking during Signature Acquisition Workbook • Time Recording during Signature Testing • Signal Calculator • Throughput Validation & Processing Host • Signature Throughput Processing • Signature Data Post-Processing Workbook 	<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • 1 x QTV - Quad Torsional Vibration Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Run Data Averaging & Comparison Organizer • Operational Deflection Shapes Workbook • Batch Reporting - Organizer • Geometry Workbook



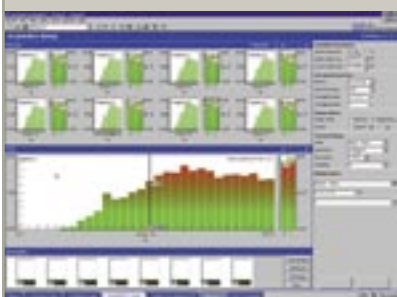
Measure and evaluate the product's acoustic performance with multiple microphones connected to a light and portable acquisition system.



On-line psycho-acoustic metrics give immediate information related to human sound perception.



Embedded DSP power allows to measure and process all channels online to ANSI compliant 1/1 or 1/3 octave data.



Create fully annotated plots, using corporate standard formats, with just one mouse click.

LMS Test.Lab 12 Channel Real-Time Octave Testing

Mobile system for product noise evaluation

The LMS Test.Lab Real-Time Octave Testing System provides a mobile solution for the noise evaluation of rotating machinery against predefined targets or legislative standards. The data acquisition is performed using a portable LMS SCADAS 305 front-end with two embedded tacho inputs, supporting 12 channels for polarization microphones or generic ICP® and Voltage signals.

With the Real-time Octave Testing workbook, acquisition and analysis of multi-channel 1/1 or 1/3 ANSI compliant octave data is made easy. It provides linear and exponential averaging methods for acquiring octave data in stationary or transient operating conditions, against specified time or rpm intervals, and for monitoring dynamic, static and operational parameters. It allows the online acquisition and visualization of the most important functions such as octave cuts, OA_Levels, etc. Calculations from physical measured channels using mathematical operations provide the online derived mathematical channels. The Psycho-Acoustic Metrics add-in obtains metrics related to the human perception of noise, like articulation index, loudness or sharpness, online. The varied post-processing functions assist in global problem characterization and gaining a deeper insight into the physical processes.

Features	Benefits
<ul style="list-style-type: none"> • Online monitoring of octave sections and overall levels, and a variety of measurement status indicators (ADC levels, rpm readouts, rpm time traces, rpm levels) • Psycho-Acoustic metrics available online and during post-processing • Derived channels as a calculation on physical measurement channels 	<ul style="list-style-type: none"> • Allows effective and reliable noise evaluation according to required standards • Provides online feedback on the progress and the quality of the measurement • Reduces errors and accelerates productivity • Presents fast standard reporting, with "single button" operation
Solution Pack Content	Solution Pack Options
<p>LMS SCADAS III Hardware</p> <ul style="list-style-type: none"> • LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tacho, AC/DC power and SCSI interface • 3 x PQMA - 4 channel Programmable V/ICP®/MIC Conditioner • 3 x SP92-D - 4 channel 24-bit DSP Signal Processor Module <p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Desktop • LMS SCADAS 305 Driver • Real-Time Octave Testing Workbook • Psycho-Acoustic Metrics 	<p>LMS Test.Lab Software</p> <ul style="list-style-type: none"> • Run Data Averaging & Comparison Organizer • Time Recording during Real-time Octave Testing • Throughput Validation & Processing Host • Signature Throughput Processing • Batch Reporting - Organizer

LMS Test.Lab Rotating Machinery – Options

LMS SCADAS III Hardware

QDA Quad Digital Audio Module

Supporting AES/EBU and SPDIF data formats, the QDA is a dedicated audio interface module, specifically designed for artificial heads. The QDA accepts 16- or 24-bit data and all standard audio sample rates. HMS data is retrieved from the audio stream and separately sent to the host. Because the QDA resamples the input data to the standard LMS SCADAS III internal sample rates, the output data of QDA is fully compatible with data from other modules. Therefore, digital audio measurements can be done in parallel (synchronous) with other vibration or sound measurements.

- Support of AES/EBU and SPDIF input data at all standard sample rates
- Support of HMS data
- Synchronization of digital audio streams with other inputs
- All processing functions, including filtering, order tracking and 1/3rd octave are available

QTV Quad Torsional Vibration Module

The QTV is a four-channel tachometer input module, designed for the acquisition and analysis of torsional vibration phenomena. Through the use of high bandwidth ADCs and dedicated embedded processing, the QTV is able to detect and represent high frequency tachometer variations with a precision that exceeds that of conventional (counter based) solutions. QTV dynamic RPM data is acquired with 24-bit precision and is perfectly synchronous with all other input channels present in the LMS SCADAS III system. The LMS SCADAS III QTV module offers a dedicated solution for highly accurate torsion analysis of rotating objects.

- Input range $\pm 62.5\text{mV}$ to $\pm 25\text{V}$
- Maximum tachometer frequency 50kHz
- Acquisition synchronous with all other input channels in SCADAS III
- Frequency independent resolution

PDT Programmable Dual Tacho Module

The tachometer module allows order tracking as well as spectral/octave acquisitions against rpm. Tachometer signals up to 15kHz and 1024 pulses per rev are supported, while auto-ranging inputs and programmable signal conditioning ensure that even 'industrial quality' analog tachometer signals with noise and changing amplitudes give stable readings.

- Auto ranging differential input
- Bias voltage compensation from -5V to $+5\text{V}$
- 40ns. tachometer counter resolution
- Tachometer preview with 16-bit ADC
- Double and missing pulse compensation
- rpm smoothing filter

V12A - 12 channel programmable V/ICP®/TEDS signal conditioner

The V12 is a twelve-channel voltage and ICP® conditioning and data acquisition module that triples your conventional channel count in a SCADAS III frame. Because of its high channel density, the V12 is ideally suited for connecting triaxial accelerometers. AC, DC and ICP® coupling is supported, as well as reading out smart sensors. The V12 is a one-board solution, incorporating 24 bits ADC's with a maximum sample rate of 51.2kHz. A high performance on-board DSP allows real time embedded processing such as decimation, order tracking and 1/3rd octave filtering.

- Input range $\pm 1\text{V}$ to $\pm 10\text{V}$
- 4mA ICP® supply
- TEDS support

LMS Test.Lab Software

Run Data Averaging & Comparison Organizer

This worksheet provides a comprehensive view on all available 2D data (order sections, frequency sections, octave spectra or octave sections, ...) and is designed to compare and average results from various tests very quickly, for validation and/or processing. Selected data are immediately displayed via powerful display filling modes in user defined screen layouts. Embedded navigation supports fast scrolling across functions or measurement points. Individual measurements are included or excluded from automatic average and envelope calculations by tick-box selection. Averages and envelopes can be stored in project database.

Audio Replay & Filtering

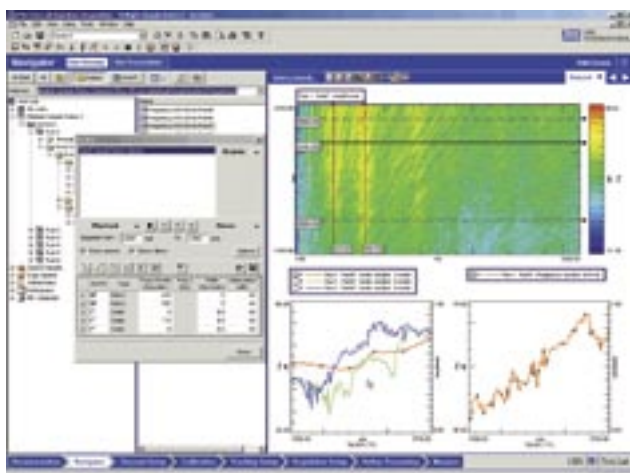
This option enables user-intuitive audio replay using the available PC audio facilities and allows interactive real-time filtering during replay. Replay sessions can conveniently be initialized from multiple LMS Test.Lab displays and the original time traces are automatically retrieved. It allows engineers to closely integrate subjective noise evaluation into the standard measurement process.

Psycho-Acoustic Metrics

Allows the online and off-line calculation of a number of indices related to the human perception of noise, such as Articulation Index, Loudness and Sharpness. The indices are derived from 1/n octave data measured by any of the acquisition workbooks.

Batch Reporting - Organizer

Facilitates organized printing of large quantities of data according to multiple pre-defined plot formats, created in Microsoft Office applications, including Active Pictures. Absolute scale-printing to printer and electronic documents is supported.



Audio replay sessions can conveniently be initialized from multiple LMS Test.Lab displays and the original time traces are automatically retrieved.



With the Psycho-Acoustic add-in, LMS Test.Lab derives indices related to the human perceptions of Noise and Vibration against a variety of international and de facto standards.

Time Recording during Signature Testing

This option enables recording of raw time histories while performing tracked measurements and online narrow band analysis (waterfall, orders, spectra,..). The throughput data is directly written to the host PC disc in LMS TDF format, without affecting the online measurement performance.

Signal Calculator

Measured time recordings can be expanded with virtual time histories by recombining physical measurement channels using basic and advanced mathematical operations. These time histories can be calculated automatically upon completion of the measurement and stored together with the measurement channels in the same TDF-data file, so they can be processed simultaneously during the offline throughput processing. With dedicated data validation and selection, data from different measurement runs can be organized and combined for batch processing.

Throughput Validation & Processing Host

This worksheet offers a convenient Strip Chart Display overview of time histories, including zoom-in, immediately after completing a measurement using the parallel throughput functionality, without leaving the data acquisition workbook. It also provides Processing Data Set definition functionality, organizing and combining recordings from different measurements for batch processing. A Quick Spectral Map provides insight in spectral contents of the displayed time histories to guide the selection of appropriate processing parameters.

Signature Throughput Processing

Signature Throughput Processing enables efficient processing of multiple throughput files with a common set of processing parameters. Tracking channels (e.g. tacho) can be used to control the selection of segments of time data to be processed. The module supports trial processing on limited number of channels and batch processing, including auto-saving of results which can be interrupted at any time. It also includes a convenient preview of processing results with auto switch of display depending on type of results.

Signature Data Post-Processing

Completes the on-line analysis functionality by providing various post-processing functions on measured narrow band waterfall data resulting from run-ups or run-downs against specified time or rpm intervals. It contains a comprehensive list of functions for a global problem characterization and for any further processing necessary for gaining a deeper insight into the physical processes.

Time Recording during Real Time Octave Testing

This option enables recording of raw time histories while performing Real Time Octave measurements. The throughput data is directly written to the host PC disc in LMS TDF format, without affecting the online measurement performance.

Operational Deflection Shapes

The user can investigate deformation shapes using order and frequency sections (for instance obtained in LMS Test.Lab Structures), or using FRF or Cross-Power information for stationary conditions (as can be obtained in the LMS Test.Lab Modal Impact workbook). The user can select a data range in which the animation will automatically scroll, with the possibility to pause and restart the animation at all times. The workbook includes also facilities to only animate at peaks of the function, look for maxima between 2 cursors and much more. Deflection shapes can be calculated at specific cursor values (or automatically calculated within a cursor-defined band) and saved in the project.

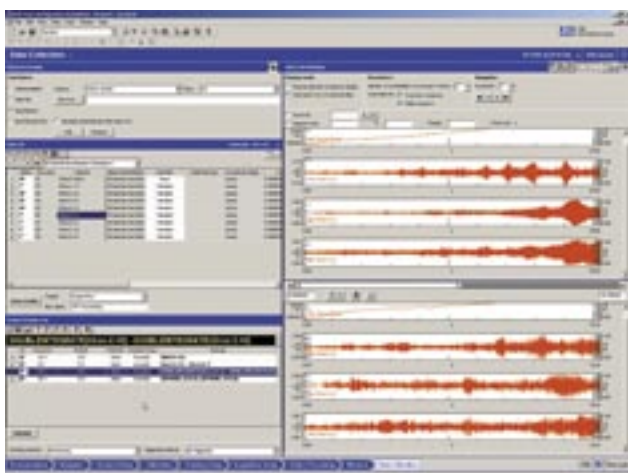
Geometry workbook

The LMS Test.Lab Geometry workbook is designed to build a geometrical definition of test structures, that can be used to visualize measurement and analysis results in a 3-dimensional view. The workbook allows to build a structure as an assembly of separate components, and to use different axis systems (Cartesian, cylindrical or spherical) for each component. Point coordinates can be defined in the global axis system or in the local axis system of a component, reducing the complexity of making a geometry definition for real-life structures. Next to the definition of points, the user can easily add lines and surfaces between points in order to come to a realistic representation of the test structure.

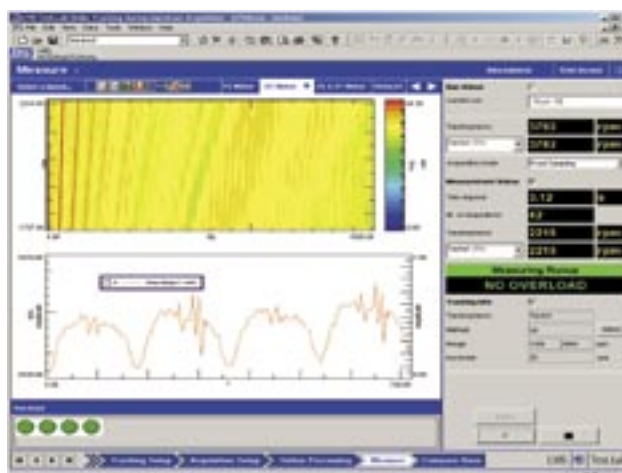
LMS SCADAS III Multiple Tacho Support

The LMS Test.Lab SCADAS III Multiple Tacho Support Driver enables the use of multiple PDT modules in the Test.Lab acquisition workbooks.

- Visualizes all system hardware settings in GUI
- Preview of tacho time signals
- Interactive setting of tacho parameters for each tacho channel individually
- Enables for narrow band acquisition the calculation of Order Sections relative to all tacho channels, online or via post-processing
- Enables documentation of measured data with rpm-information from more than 2 tacho channels



Recombining measurement channels, using basic and advanced mathematics, results in virtual time histories. Both real and virtual time histories enlarge insights into the characteristics of the rotating structure.



Structure borne noise, induced by torsional vibration phenomena are adequately identified through LMS Test.Lab and the QTV hardware module.

LMS Test.Lab Rotating Machinery Overview

	16 Channel Harmonic Analysis TL-SIG-HA	32 Channel Order Analysis TL-SIG-FSOA	12 Channel Mobile Time Data Processing and Recording TL-GPR-TDAP	16 Channel Mobile Testing & Sound Quality TL-GPR-SQ	8 Channel Torsional Vibration Analysis TL-SIG-TVA	12 Channel Real-time Octave Testing TL-AC-RTO
LMS SCADAS III Hardware						
LMS SCADAS 305 SCSI - Master frame with 5 slots, 2 tacho, AC/DC power and SCSI interface	1		1	1	1	1
LMS SCADAS 310 - Master frame with 10 slots, AC power and SCSI interface		1				
PDT - Programmable dual Tacho input Module for Analog and TTL signals		1(O/1)				
SP92 - 4 channel 24-bit DSP Signal Processor Module	4(B)	8(B)	3(B)	4(B)	1(B)	3(D)
PQA - 4 channel Programmable V/ICP® Signal Conditioner	4	8	3	3	1	
PQMA - 4 channel Programmable V/ICP®/MIC Conditioner				1		3
QTV - Quad Torsional Vibration Module		O			1(O/1)	
RC01 - Remote Control Unit			1	1		
QDA - Quad Digital Audio Module				O		
V12A - 12 channel Programmable V/ICP®/TEDS Conditioner	O		O			
LMS Test.Lab Software						
LMS Test.Lab Desktop	•	•	•	•	•	•
LMS Test.Lab SCADAS 305 Driver	•		•	•	•	•
LMS Test.Lab SCADAS 310 Driver		•				
LMS Test.Lab Signature Testing	•					
LMS Test.Lab Order Tracking during Signature Acquisition Workbook		•			•	
LMS Test.Lab Signature Data Post-Processing Workbook		•	O	O	•	
LMS Test.Lab Signature Throughput Workbook			•	•		
LMS Test.Lab Time Recording during Signature Testing	O	•			•	
LMS Test.Lab Throughput Validation & Processing Host	O	•			•	O
LMS Test.Lab Signature Throughput Processing	O	•			•	O
LMS Test.Lab Signal Calculator	O	O	•	O	•	
LMS Test.Lab Sound Diagnosis				•		
LMS Test.Lab Real-Time Octave Testing Workbook						•
LMS Test.Lab Psycho-Acoustic Metrics		O	O	•		•
LMS Test.Lab Run Data Averaging & Comparison Organizer	O	O	O	O	O	O
LMS Test.Lab Batch Reporting - Organizer	O	O	O	O	O	O
LMS Test.Lab Audio Replay & Filtering	O	O	O			
LMS Test.Lab Time Recording during Real Time Octave Testing						O
LMS Test.Lab Operational Deflection Shapes Workbook	O	O			O	
LMS Test.Lab Geometry Workbook	O	O			O	
LMS Test.Lab SCADAS III Multiple Tacho Support		O				

• = standard
O = optional

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