LMS Test.Lab Vibration Control
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Complete solutions for vibration and shock testing
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LMS Test.Lab Vibration Control offers a complete 4 to 8 channel solution for closed loop vibration control testing. The LMS Test.Lab system helps test engineers easily certify and homologate their products, ensuring they can cope with external excitation and vibration conditions. These can range from normal to very extreme conditions, and also include rough transportation circumstances.

LMS Test.Lab Vibration Control combines optimal ease of use with the performance and the reliability of an advanced system. The system offers accurate closed-loop shaker control and a maximum of built-in safety mechanisms which minimize the risks of damaging costly test items. User guidance and secure automation capabilities deliver maximum productivity and enable testing teams to meet critical deadlines.

The LMS Test.Lab software is specially designed to work with the LMS SCADAS III controller hardware system that incorporates 24-bit ADC and DAC technology. This tight integration delivers an optimal loop speed and guarantees maximum safety.

LMS Test.Lab Vibration Control at a glance:

- Control and analysis software for sine, tracked sine dwell, random and shock vibration testing
- Integrating common industry standards and supporting user specific test definitions
- 4 to 8 input channels with embedded signal conditioning, 24 bit DSP technology and 105 dB signal to noise ratio
- Safe, accurate and fast closed-loop shaker control up to 20 kHz
- Fully compatible with electro-dynamic shakers and hydraulic actuators
- Expandable with extensive analysis and advanced control features
Qualifying products for real-life operating conditions

LMS Test.Lab Vibration Control helps test engineers qualify whether a product will withstand normal to extreme operating or transportation conditions. LMS Test.Lab offers a complete and fully integrated solution to reproduce vibration environments, supporting basic functional testing up to complex life cycle testing. The system can easily be extended with advanced analysis tools to further support engineers in product development.

LMS Test.Lab Vibration Control supports qualification testing through closed-loop shaker control, using 4 to 8 simultaneous ICP or voltage channels for control or measurement. With a focus on qualifying components, the LMS Test.Lab system is designed for long-duration durability testing including online damage monitoring and trend analysis.

Supporting common standards – offering maximum flexibility

The LMS Test.Lab Vibration Control system supports random, swept sine, tracked sine dwell, shock and combined test modes. LMS Test. Lab Vibration Control integrates all common industry standards for vibration and shock testing. In addition, the system offers a high degree of flexibility in vibration test definition to support non-standard test specifications, allowing the usage of more complex test profiles derived from field data using test tailoring. This provides a safe, accurate and fast reproduction of the target reference spectra on a shaker installation, using up to 8 control/measurement channels.

LMS Test.Lab Vibration Control is an entry-level vibration control solution with high-end performance:

- Maximum productivity and flexibility to qualify products faster
- Optimal ease of use and built-in user guidance guarantee a short learning curve
- Extensive safety routines and fail-safe hardware provide full protection of test objects
- Secure automated testing to cover lengthy and complex testing campaigns
- Extensive analysis capabilities to efficiently interpret test results
**LMS Test.Lab Vibration Control**

**Convenience, productivity and safety**

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**Smart test routines for optimal productivity**

Smart test routines and the intuitive user interface of LMS Test.Lab Vibration Control deliver optimal productivity throughout the testing cycle. Users directly launch predefined standard test campaigns from their desktop, without having to worry about specific parameter settings. The test procedures embed all the details on the actual test setup and can be complemented with digital images. All test results are automatically annotated with consistent header information and stored in a searchable database, together with full information on the test setup and the complete test logging.

- Predefined test procedures
- Searchable databases for data and reports
- File-explorer based data navigator
- Test procedures embed test details and setup information

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**Vibration control made easy**

The LMS Test.Lab system guides users in the definition of standard and more complex test profiles, which eliminates possible errors before starting the actual test. The system also supports the definition of schedules for complex endurance programs, including loops and the execution of external applications. For trend analysis, automatic measurements can easily be programmed and scattered during each level of the test. An embedded digital scope assists the operator in troubleshooting the measurement setup and quickly diagnosing possible problems.

- Expert system for optimal user guidance during test processes
- Digital scope to troubleshoot possible problems
- Ready for all common industry standards
- No need for tedious post-processing thanks to online processing and automated trend analysis

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**Full test object protection**

LMS Test.Lab includes a fully automated SelfCheck procedure, which verifies the control loop for integrity and safety before running the actual test. The SelfCheck procedure starts with measuring the background noise on all channels, after which it injects a low-level shaped random into the loop. It then automatically ramps up the amplitude in user-defined stages until a specified signal-to-noise ratio is met, or until the drive reaches a specified limit. Finally, LMS Test.Lab measures the system response using a compensated spectrum, and prevents the initiation of the test in case of error detection.

- Fail-safe test verification through a fully automated SelfCheck procedure, including peak and overload prediction
- Full protection against operation beyond shaker limits
- Measurement chain validation for each individual measurement channel
- Prevention of test initiation without proper control feedback
**Safe and accurate vibration control**

The LMS SCADAS III controller hardware has been designed with safety as a primary objective. The entire measurement chain is continuously monitored during testing for open or short circuits. Overload checks are carried out on several places in the signal paths, including upfront, full bandwidth checks on the anti-alias filters. Dedicated hardware circuits guarantee smooth shutdown of the output signals, even in case of power failure, to protect the structure under test. During closed-loop control RMS and line-by-line abort checking, the system performs single or multipoint control, drive limitation, sigma clipping, continuous open channel and overload checks. Fast loop times ensure a safe and reliable control loop with 100% test object protection.

- Fast, accurate and reliable control loops
- Fail-safe hardware with smooth shutdown guaranteed, communication time-outs, continuous overload monitoring
- Fail-safe software developed according to ISO 9001 standards with extensive quality control

**Secure automated testing**

The test sequencing scheduler in LMS Test.Lab increases safety and productivity in case of product tests that require complex and extensive test profiles. Swept sine, random, shock and combined modes tests can be automatically sequenced, repeated and synchronized with external equipment. Alarms are permanently checked to properly interrupt the vibration control test and the external equipment when required. The measured data and run logging are automatically saved in the LMS Test.Lab project database. E-mail or SMS messages can automatically be sent to keep the operator up-to-date on the progress of the test.

- Efficient long duration test monitoring
- Sine, random, shock control, combined modes sequencing
- Vibration test synchronization with external equipment like climatic chambers

**Flexible analysis and effective communication**

In addition to the online processing capabilities, LMS Test.Lab Vibration Control offers analysis tools for the most demanding testing campaigns. With the help of intuitive data navigation, user attribute-based search, comprehensive analysis functions and powerful displays, users can quickly visualize and interpret data, and analyze test results. LMS Test.Lab automatically generates reports with a single mouse click, which eliminates the extensive effort to document the entire test campaign. Full compatibility with Microsoft Office and embedded support of OLE/ActiveX technologies turns static reports into dynamic information files. Readers can dynamically adapt axis scaling, add cursors and change legends to create their own customized view on the test results. LMS Test.Lab Vibration Control enables testing teams to move beyond the simple “passed or failed” test result, and to effectively visualize, analyze, report and share their work with others.

- Comprehensive analysis functions provide full insight into test results
- Automated and customizable report generation for test setup, SelfCheck, run logging and test data
- Embedded ActiveX support animates static reports
LMS Test.Lab Vibration Control - Standard

LMS Test.Lab Vibration Control - Standard offers a complete solution for the certification and homologation of products and components, to ensure they can cope with external excitation and vibration conditions (normal operations, extreme operations, transport). It includes the LMS SCADAS 302VB front-end with 4 channels for control and measurement, the LMS Test.Lab Desktop - Standard and all LMS Test.Lab Vibration Control applications.

LMS Test.Lab includes reliable, efficient and robust control algorithms and delivers a safe, accurate and fast reproduction of the target test profiles on electro-dynamic shaker or hydraulic actuator installations. The Test.Lab controller is configurable to support single and averaged, minimum, maximum or weighted multi-point control strategies from 0.025Hz up to 20kHz control bandwidth.

During closed-loop control, the system combines monitoring functions, simultaneous acquisition, processing and visualization of all control and measurement channels with immediate feedback on test progress and control quality. For long duration testing, users can activate an automated trend analysis, including a comparison with previous measurements, without interrupting the test sequence.

The test setup is simplified with a consistent mapping between common industry standards and the LMS Test.Lab Vibration Control – Standard test parameter definition. The ergonomic control panel shows all critical information at any time and offers a wide choice of online display options and clear abort and overload messages. At all times, test operators are presented the required information to make the right decision.

**Features**
- Swept sine control
- Tracked sine dwell
- Random control
- Shock control (classical pulse, measured pulse and shock response analysis)
- Control bandwidth up to 20 kHz
- Single and averaged, minimum, maximum or weighted multi-point control strategy
- Real-time calculation and online visualization
- Supports all common industry standards
- Non-standard user specific test profiles
- Integrated Digital Scope and SelfCheck
- Automated reporting

**Benefits**
- Novice users can get started with minimal training
- Built-in user guidance increases efficiency and minimizes errors
- Full protection of the tested objects
- Extensive analysis capabilities to efficiently interpret test results
- Smooth reporting to easily share results
LMS Test.Lab Vibration Control - Advanced

LMS Test.Lab Vibration Control - Advanced consists of all the modules of LMS Test.Lab Vibration Control - Standard, supplemented with the LMS Test.Lab Desktop - Advanced and LMS Test.Lab Test Sequencing modules.

LMS Test.Lab Vibration Control Advanced complements the standard solution with a test sequencing scheduler for secured automated testing. This scheduler allows the fully secured automation of unattended long-duration qualification tests with multi-type vibration control. It can mix all the test modes (swept sine, random and shock), do loops, pause commands and a variety of automated pre-test options. In addition, it is possible to automatically run a MS Windows program as part of the schedule, for example to keep the operator up to date on the progress of the test sequence via e-mail or SMS. Through the digital I/O based remote control, the system can control other equipment in the lab and synchronize vibration testing with e.g. functional or climatic testing.

The advanced solution also offers a set of customization capabilities to adapt the LMS Test.Lab user environment and tune the workflow of the testing process. Users create their dedicated test procedures by locking specific parameters to fixed values. The workflow tuning also extends the usage of the system from vibration qualification testing to more advanced noise and vibration refinement tests. Dedicated noise and vibration analysis add-ins are easily activated and become an integral part of the LMS Test.Lab vibration qualification workflow. 3D visualization of measurement results for structural analysis or access to any other LMS Test.Lab analysis module is only one click away. This eliminates tedious data exports to more advanced analysis applications.

Features

- Scheduler for swept sine, random and shock test modes
- Remote communication
- Communication with external equipment
- Test status report via e-mail or SMS
- Parameter locking
- Workflow tuning

Benefits

- Secure automation of long duration test schedules
- Control peripheral equipment during the vibration test
- Customize the vibration qualification testing workflow to specific procedures
- Extend vibration qualification test to advanced refinement analyses
LMS Test.Lab Mission Synthesis helps define test specifications for single axis random and swept sine vibration testing from measured load data. Resulting test specifications are equal in damage and are accelerated for faster run times. Test tailoring methods as described in industry standards such as GAM EG-13, MIL-STD 810F and NATO AECTP 200 are used for this purpose. Multiple acceleration loading environments (defined in either time or frequency domain) are analyzed for fatigue potential by calculating MRS (maximum response spectrum) and FDS (fatigue damage spectrum).

LMS Test.Lab Shock Response Synthesis synthesizes a time waveform that corresponds to a user defined shock response using a series of superimposed wavelets. The synthesis module is seamlessly integrated in the shock control workbook.

LMS Test.Lab Sine Notching and LMS Test.Lab Random Response Limiting enable users to effectively protect test items against over-testing. While the average control signal level will match its reference spectrum, the response at particular points of the tested object may be very different, due to the resonances of the device under test. The vibration level at any channel (control or measurement) is limited by an auxiliary reference profile for maximum protection of the test item.

Combined Modes

The LMS Test.Lab Sine on Random (SoR) module offers the possibility to define a background noise level combined with up to ten fixed and sweeping sine tones. LMS Test.Lab Random on Random (RoR) option offers the user the possibility to define a background noise level combined with an unlimited number of fixed and sweeping narrow-band signals. Both options in combination with LMS Test.Lab Random Control allow the definition of complex profiles, typically called Sine on Random on Random (SoRoR).

LMS Test.Lab Single Axis Waveform Replication gets field data to the shaker in fewer steps and extends current testing techniques from classical sine, tracked sine, random and shock control to long-duration time waveform replication. The easy-to-use, native MS Windows software requires little training and helps operators automate very long duration tests with full security. The workflow-based user interface of LMS Test.Lab assists the user throughout the complete test.
Remote Control

The 20 button remote control unit connects to the host computer through USB and supports the LMS Test.Lab Vibration Control commands for operator control. It provides a convenient way to control levels, sweep direction and progress, shock firing, etc.

Expand the LMS SCADAS 302VB to 8 measurement channels

The LMS SCADAS 302VB is delivered with 4 channels (SP92-B and POA). It has one free slot which can be used to expand to an 8-channel system. For higher channel count systems the SC302VB frame can be replaced by the LMS SCADAS 310WV (up to 36 measurement channels) or the LMS SCADAS 316 (up to 60 measurement channels).

DAC Shutdown Control Unit

The DAC Shutdown Control Unit offers remote shutdown control. It is designed as a hardware backup of the software controlled shutdown. The use of a removable key prevents unauthorized enabling after a shutdown procedure. In addition, the DSCU includes two BNC connectors with normally open and normally closed contacts for connecting external safety devices. The DSCU is connected to the LMS SCADAS III frame via three-pole LEMO connectors and a 10-meter long cable.

LMS Test.Lab Geometry and LMS Test.Lab ODS & Time Animation

LMS Test.Lab Geometry is designed to build a geometrical definition of test structures, which can be used to visualize measurement and analysis results in a 3D view. Deformation shapes of the structure can be investigated starting from frequency spectra, or FRF or crosspower information for stationary conditions or starting from time recordings using LMS Test.Lab Operational Deflection Shapes and Time Animation.

LMS Test.Lab Time Recording during Sine and Tracked Sine Dwell

This module enables the recording of continuous time histories parallel to online analysis based on fixed sampled spectra, without jeopardizing the performance of the control loop. The recorded throughput data are directly written to LMS TDF (Time Data Format) on a PC hard disc.
LMS is an engineering innovation partner for companies in the automotive, aerospace and other advanced manufacturing industries. With 30 years of experience, LMS helps customers get better products to market faster and turn superior process efficiency into key competitive advantages.

With a unique combination of 1D and 3D simulation software, testing systems and engineering services, LMS tunes into mission critical engineering attributes, ranging from system dynamics, structural integrity and sound quality to durability, safety and power consumption. With multi-domain solutions for thermal, fluid dynamics, electrical and mechanical system behavior, LMS can address the complex engineering challenges associated with intelligent system design.

Thanks to our technology and dedicated people, LMS has become the partner of choice of more than 5,000 leading manufacturing companies worldwide. LMS is certified to ISO9001:2008 quality standards and operates through a network of subsidiaries and representatives in key locations around the world. For more information on LMS, visit www.lmsintl.com.