

SIEMENS



Siemens PLM Software

LMS solutions for durability testing

[siemens.com/plm/lms](https://www.siemens.com/plm/lms)

Profound expertise in durability engineering

Consumers are increasingly demanding these days. Automotive, transportation and heavy equipment customers expect a wide choice in models, increased fuel economy, great design, ultimate comfort, extended mileage and a long product life span. The mindset governing this wish list does not allow for compromise on either durability or safety.

Despite the growing use of simulation, durability engineering departments are facing an ever-growing and challenging volume of testing work. Innovative tools are needed for both (road) load data acquisition and processing.

Siemens PLM Software offers full hybrid engineering expertise to increase test efficiency and productivity. These products include a full durability testing solution for automotive, transportation and heavy equipment industries. With a complete hardware and software solution dedicated to (road) load data acquisition and (road) load data processing, Siemens PLM Software allows you to maximize testing productivity on all levels.

The LMS SCADAS™ Recorder and LMS Test.Lab™ Durability software suite are the ideal companions for accurate load data acquisition for diverse markets. LMS™ Tecware software complements this portfolio with an integrated approach to durability data processing, allowing you flexible target setting as well as precise and accelerated test schedule definition.



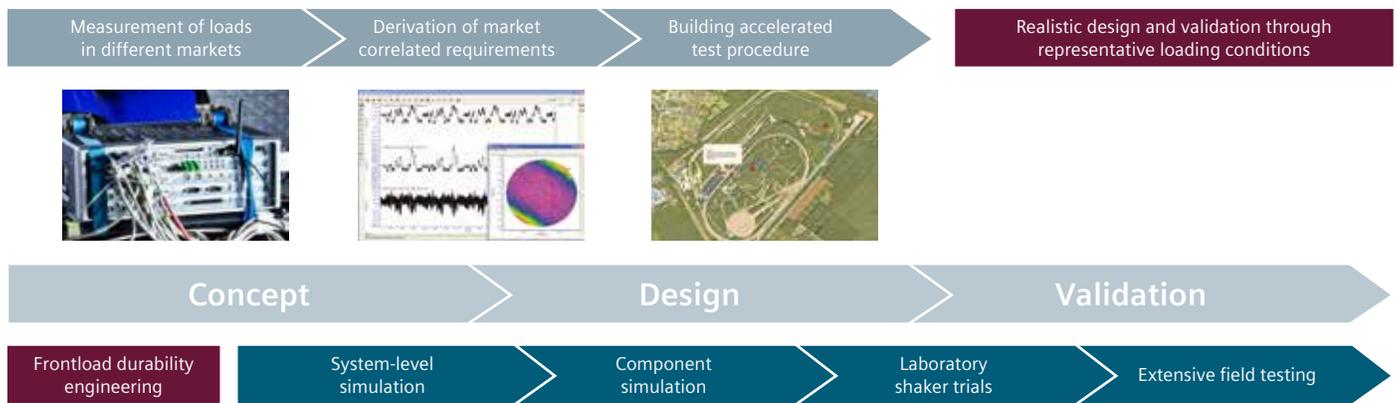


Unrivaled expertise in hybrid engineering

Siemens PLM Software has the right products to make those critical, go-the-distance improvements and thus ensure a more (cost-)effective durability engineering process.

We provide you with expertise at the concept, design and validation stages of your product development cycle along with a unique portfolio of testing solutions, embedded simulation techniques and engineering services.

LMS testing solutions provide you with a profound understanding of operational loads. An accurate definition of targets and test procedures enables you to design actionable, customer-correlated test schedules. In the end, a streamlined engineering process is bound to add refinement to your vehicle and heavy equipment design.



Road load data acquisition

Measure anywhere, anything, with confidence, right first time

“Our engineers are very happy with the insight delivered by this information. Over time, this improved insight will help define standard profiles to reproduce realistic tests in the lab.”

Jan Vestergaard Madsen
Head of the Design
Department
Kverneland Group



Understanding the loads your vehicles and equipment will undergo during their lifetimes is critical in successful durability engineering. Accurate (road) load data acquisition (RLDA), however, can be challenging and time-consuming.

With a complete hardware and software solution dedicated to (road) load data acquisition, Siemens PLM Software enables you to maximize testing productivity:

- Acquire reliable data under extreme conditions and avoid needless test reruns
- Measure more in less time and accelerate a seamless delivery of results
- Rely on less equipment, which is compact, easy to install and easy to transport
- Solutions are tailored for cost-sensitive applications and easily expandable for all your testing needs
- Technician-friendly applications require minimum training, thus ensuring a rapid ROI

The RLDA solution comprises three vital components:

- The LMS SCADAS Recorder offers maximum measurement power in one rugged box. The embedded universal signal conditioning enables easy setup of a large variety of tests, whatever your needs.
- LMS Test.Lab Durability Acquisition is a complete, integrated software solution for (road) load data acquisition. With its unique workflow-based interface, it sets new standards for ease-of-use, productivity and data consistency.
- On-the-spot data validation with the LMS Smart™ Control 7" tablet and application prevents errors and annoying test reruns.

Anywhere – truly rugged in extreme conditions

The LMS SCADAS Recorder is a powerful, compact and lightweight data acquisition front-end unit, bundled into a fully rugged and ultra-portable package. You can use it as an autonomous recorder, as a smart recorder with a wireless tablet connection or connected to a PC – on public roads and proving grounds.



Anything – embedded signal conditioning for all sensors

Flexible, universal signal conditioning is embedded in the LMS SCADAS Universal Durability Module, allowing you to easily set up a variety of tests, whatever your needs. Its versatility greatly reduces the amount of required equipment, which reflects on the bottom line.



Right first time – raising the bar on productivity

LMS Test.Lab Durability Acquisition is a complete, integrated software solution for (road) load data acquisition. With its unique workflow-based interface, it sets new standards for ease-of-use, productivity and data consistency. You have control of the complete data acquisition process from a single software platform.



With confidence – instant data validation on the track

With LMS Smart Control, users can instantly validate recorded data quality during and after each measurement run, right onsite. On-the-spot, trackside data validation guarantees high-quality data and eliminates the need for costly test campaign reruns.



LMS SCADAS Recorder

Measure anywhere, even in extreme conditions

Your durability data acquisition equipment needs to be rugged and robust to resist water, dust, dirt, shocks and jolts associated with real-life testing scenarios on public roads and proving grounds. Autonomous recording with on-the-spot validation is a must. The LMS SCADAS Recorder offers you a reliable, dedicated solution for complex, long and repetitive acquisitions that require large data-set storage.



Designed for the extreme

Durability measurements start with quality cables and connectors for no-compromise data acquisition security. The LEMO connectors on the LMS SCADAS Recorder ensure vibration-resistant cable connections. The LMS SCADAS Recorder

itself is a rugged instrument with full MIL-STD-810F compliancy. Its robust design stands up to the most diverse external conditions, shocks and vibrations. The LMS SCADAS Recorder is also available in a sealed version to resist dust and water.



PC-less data recording

The LMS SCADAS Recorder operates autonomously. It is particularly suited for challenging test applications, where using PC-based data acquisition is impractical. With direct 24-bit streaming, the recorder stores the acquired data on high performance, fast, read/write, solid-state CompactFlash memory cards. The acquired data is immediately available for onsite validation or further analysis back at the lab.

Expandable for high-channel count

The LMS SCADAS Recorder is completely expandable, making it the ideal companion for multiple, in-field test setups, ranging from a simple 16-channel run to a complex, multi-frame, high-channel count, single-synchronized measurement. For high-channel counts, where the channels are divided over multiple, separated testing units, the system supports a daisy-chained master/slave configuration. Fully synchronized data is automatically collected in one measurement file. You can easily lash the frames together using 50m optical cable (rather than costly transducer cabling), giving you much higher quality measurements.

The LMS SCADAS Recorder at a glance

- PC-free smart and secure data recording
- Compact and easy to install
- MIL-STD-810F, withstanding up to 7.7 grms vibrations and 60 gpk shocks
- Dust and water-splash protection: IP32 or IP54 ingress protection
- Rugged LEMO connector: MIL-STD-810F, for at least 5,000 mating cycles
- Operating temperature: -20°C to +55°C
- No moving parts or fans: reduced risk of in-field breakdowns
- Low power consumption: less than 1W per channel
- Flexible power supply: internal battery, vehicle DC battery or AC power supply
- Flexible setups: accessible, front-panel connection points

LMS SCADAS Universal Durability Module

Measure anything with flexibility and precision

Dedicated to durability engineering, the LMS SCADAS Universal Durability Module contains flexible, built-in, universal signal conditioning. Up to 72 direct sensor measurements can be recorded in one unit, allowing you to easily set up a variety of tests, whatever your needs.



Maximum measurement power

The LMS SCADAS Universal Durability Module supports 8 channels and enables you to perform virtually any load data measurement:

- Strain gauges in full-, half- and quarter-bridge configurations
- Conditioners for carrier frequency support for strain gauges and LVDT or RVDT sensors
- Load cells, pressure transducers and potentiometers
- Capacitive, piezoresistive or MEMS-based accelerometers
- ICP and TEDS IEEE 1451.4 conditioning
- 15 V active sensors
- 4-20 mA transmitters



For simpler or reduced test setups, you can use the LMS SCADAS Voltage/Bridge and LMS SCADAS Voltage/Bridge/ICP Durability Module.

Focus on flexibility

The LMS SCADAS Recorder comes complete with a built-in GPS receiver for instant absolute time, speed and position data acquisition. An embedded CAN interface is available for direct access to high- and low-speed vehicle bus data.

Your typical durability configuration will consist of an LMS SCADAS system stocked with LMS SCADAS Universal Durability Modules, with a free slot used for specific application tuning.

Application expansion options are:

- Digital wheel force transducers (WF12): a digital interface to the Kistler RoadDyn 2000 Wheel Force Transducer system, supporting synchronous acquisition of wheel force signals
- Vehicle bus (CN4 or FR4): supports high- and low-speed CAN bus (ISO 11898), including J1989, and the FlexRay vehicle bus standard
- Temperature (T8 or TCK8): thermocouples, galvanic isolation and onboard linearization for B, E, J, K, N, R, S and T thermocouples
- Analog output (A016): lets you connect conditioned data signals to test rig controllers for laboratory test development
- Video (CIM2): documents dynamic load measurements with synchronized video recordings for a crystal-clear view of the measurement environment at each moment of the acquisition

Guaranteed high-quality data

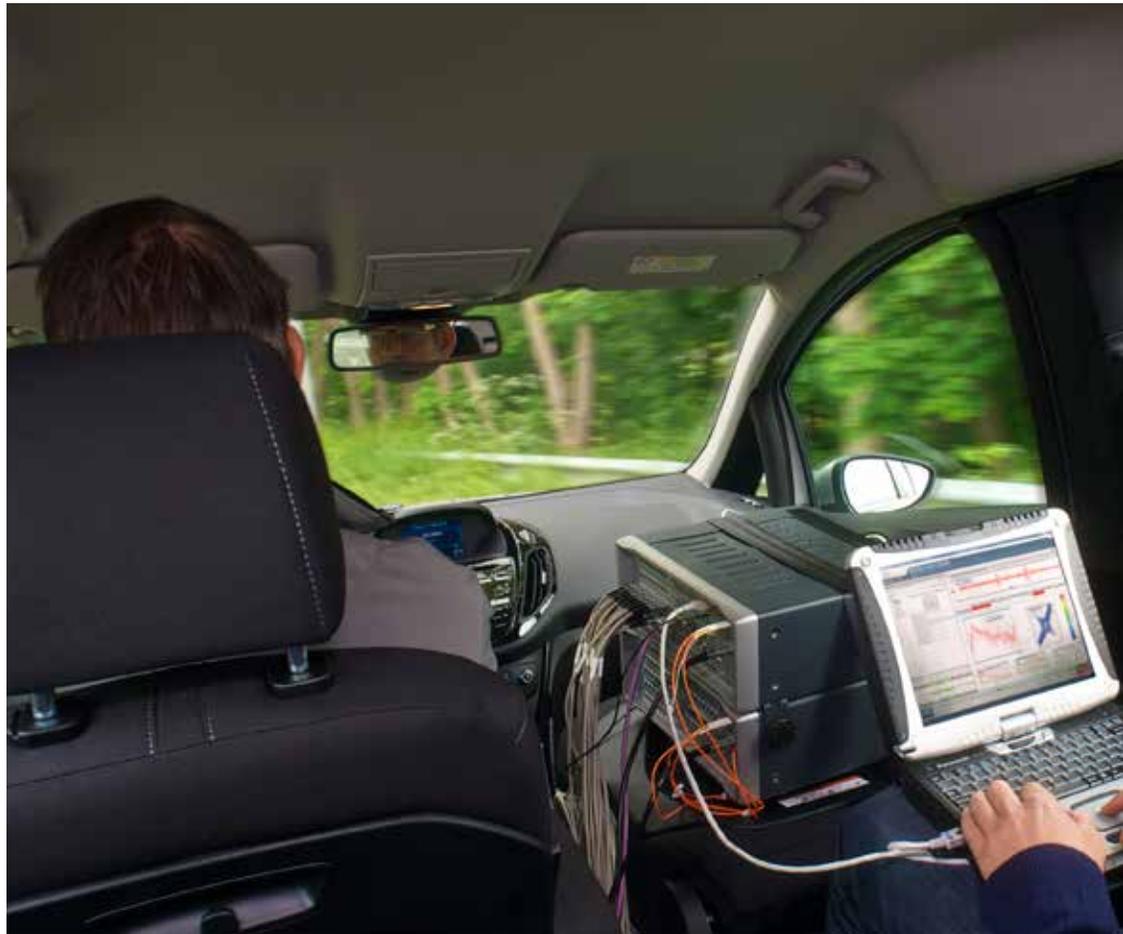
24-bit, high-sampled data, converted via sigma-delta AD converters, ensures high-quality data from any signal. A number of verification methods ensure measurement integrity, including overload detection, bridge cable and ICP cable checks.

The LMS SCADAS Universal Durability Module supports automatic sensor identification based on the TEDS IEEE 1451.1 'Plug&Play Smart Sensors' standard, resulting in a faster test preparation and higher data quality due to reduced setup errors.

LMS Test.Lab Durability Acquisition

Measure it right first time and seamlessly deliver load data

LMS Test.Lab Durability Acquisition is an integrated, end-to-end solution for (road) load data acquisition. From a single software platform, you have complete control of the full load data acquisition process. LMS Test.Lab Durability Acquisition combines universal, multi-channel data acquisition with a full suite of channel setup, measurement, validation, reporting and data sharing tools.



Raising the bar on productivity

With its unique workflow-based interface, LMS Test.Lab Durability Acquisition sets new standards for ease-of-use, productivity and data consistency. The LMS Test.Lab Durability Acquisition user interface is designed to guide you seamlessly, from start to end, through the entire durability acquisition process. The application is built

around three basic steps that make up a typical RLDA process: set up channels, measure and validate, and report and share. LMS Test.Lab is tightly integrated with LMS SCADAS data acquisition hardware. This allows you to execute durability acquisition processes more confidently, in less time and with fewer errors.



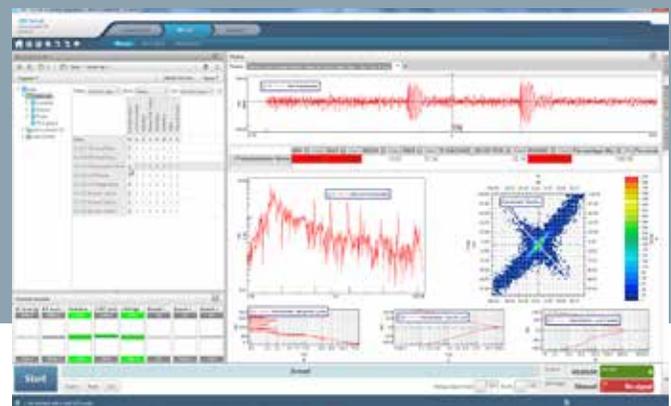
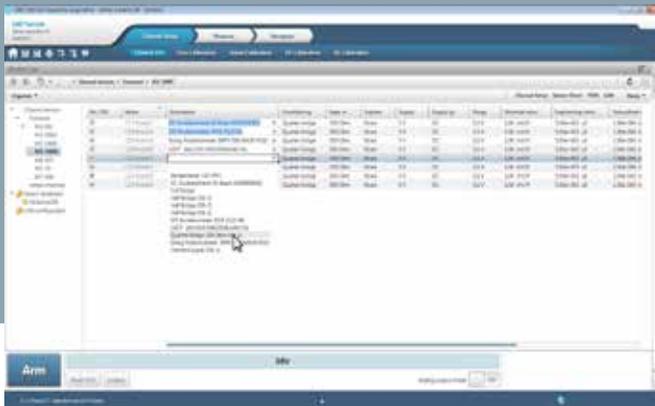
LMS Test.Lab Durability Acquisition is designed to make testing more efficient and more convenient. It is the ideal tool for future-focused durability testing departments – offering the right balance between ease-of-use and functional flexibility.

Customized user experience reduces learning curve and increases uptime

What's more, it's easy to tune the application to your own needs. Mark your favorite projects or parameters to have quick access to them. Use custom views for tables and graphs, showing only the parameters that are relevant to you. Burdened by lengthy training courses and complex manuals? Not needed. Thanks to the LMS Test.Lab Durability Acquisition user-friendly interface, you will be operational in no time.

LMS Test.Lab Durability Acquisition at a glance

- Designed to guide you seamlessly, from start to end, through the entire durability acquisition process
- Fast and accurate, semi-automatic measurement setups
- Measure and validate in real time, avoiding costly test reruns
- Transform data into actionable and easy-to-share reports
- Annotate and organize your tests systematically
- Tailored user experience limits training and results in faster uptime



Fast and accurate, semi-automatic measurement setups
 LMS Test.Lab Durability Acquisition is specifically tuned for handling challenging test setups. A seamless integration with LMS SCADAS data acquisition hardware results in accelerated measurement setups and correctly formatted results. No external sensor-conditioning or third-party applications are required; a single software solution supports all the signal conditioning provided by LMS SCADAS front-ends.

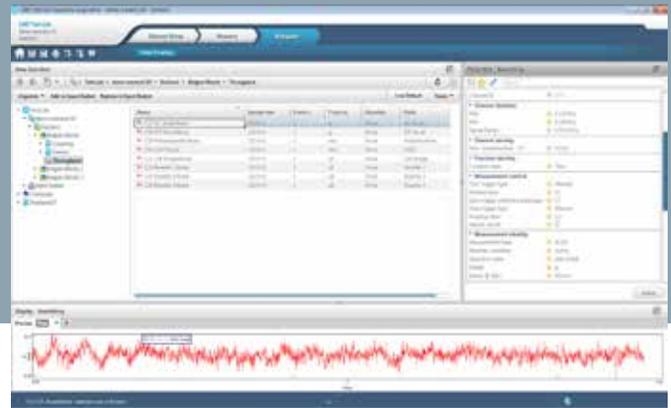
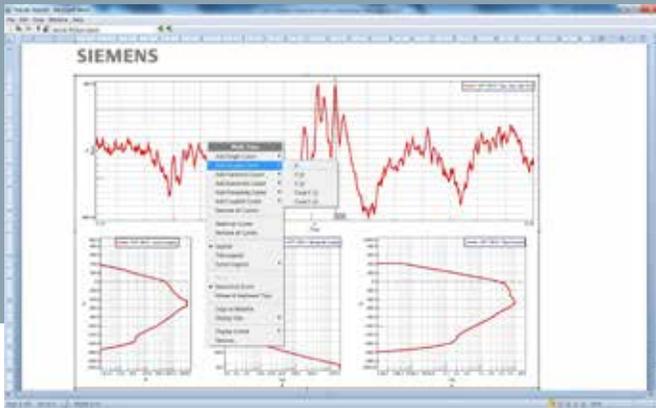
With LMS Test.Lab Durability Acquisition, you can specify the channel list for any measurement setup at the click of a button. All you have to do is select the right sensor from a drop-down box, and the software will automatically configure the right parameters. The system automatically looks up transducer calibrations from any ODBC database. Alternatively, you can copy and paste parameters directly from Microsoft® Office Excel. Smart TEDS transducers are also supported.

Since LMS Test.Lab Durability Acquisition gives you real-time signal checks on all channels, you can set up your sensors with no risk of error and start your measurement with confidence. Thanks to customizable templates, you can create company-specific test procedures for repeatable and comparable measurements.

Measure and validate in real time, avoiding costly test reruns

Data monitoring and online test visualization ensure data reliability and provide you with direct information on what is happening. LMS Test.Lab Durability Acquisition calculates everything during the acquisition run, without data loss or slowing down measurements. Incoming results can be compared against reference curves or previously stored datasets. Immediately after the run, you can browse via a pivot table through a series of rainflows, power spectral densities, statistics, GPS data or simply rough throughput data.

Temperature, pressure, strains, speed references – since so much is happening at once, LMS Test.Lab Durability Acquisition measures everything in parallel. Online displays keep you up to date about measurement progress. During the data acquisition itself, the choice of what and how to monitor is up to you. Do you prefer rainflows, statistics or time-at-level? Or maybe you want reference curves, derived channels or online indicators? Select your own view with LMS Test.Lab Durability Acquisition.



Transform data into actionable and shareable reports

Sharing test results between departments is indispensable in developing a quality product. LMS Test.Lab Durability Acquisition keeps you from losing vital information in the process. Test reports are easily distributed across different departments, as you create and share 'active' reports with a click of the button. Instead of producing static bitmaps, all measurement data is fully embedded into the charts. This allows you to focus on actual data acquisition while others can format or edit graphs in Microsoft Office Word or Microsoft Office PowerPoint in whatever way they see fit. In addition, you can export your data in a wide range of binary data formats (MTS RPC3, IST RigSys, nCode DAC, NI DIAdem, Google KML, ASAM/ODS ATFX among other formats).

Systematically annotate and organize your tests

With both LMS Test.Lab Durability Acquisition and LMS Smart Control, you can accelerate the delivery of critical test results by organizing and annotating your tests consistently in an orderly fashion. That way you make sure your colleagues from simulation or testing departments will find the numbers they need, when they need them.

When you work with vast amounts of data, traceability is key in maintaining an efficient development cycle. LMS Test.Lab Durability Acquisition enables you to add key information to raw data – such as operator details, test object descriptions or testing conditions – relating measurement results to product structure. Better documentation means your data will retain its value long after the testing phase has been completed.

LMS Smart Control

Measure in confidence and validate your data on-the-spot

The LMS SCADAS Recorder and the LMS Smart Control are particularly suited for challenging test applications, where using PC-based data acquisition is unsafe or impractical. LMS Smart Control is a wireless, icon-based, touchscreen application that runs on a 7" Android tablet. It is compact, smart and ideal for mobile usage. You can cycle through test setups, start and stop measurements, monitor data in real time and validate measurements on-the-spot, avoiding lengthy test reruns.





Instant data validation

During the data recording process, LMS Smart Control provides instant graphical and tabular feedback per channel. The LMS SCADAS Universal Durability Modules onboard digital signal processor stores a condensed overview of time series and overall statistics while real-time data is being collected. This allows data to be checked without having to wait for it to be uploaded.

A one-person operation

- Bluetooth® communication: no cables or wires
- Wireless control of measurement: start, stop and balancing
- Icon-based graphics on a high-resolution 7" display: easy to see while driving
- Direct feedback: alarm notifications, real-time digital displays and full-color measurement status

Road load data processing

Enhance testing productivity with LMS Tecware advanced durability data processing

“Measurement campaigns on proving ground and in the field are also performed together with the LMS Engineering teams and a Daimler test engineer. The LMS Tecware tool has become integral to everyday use. High quality test results are key.”

Dr. Christof M. Weber
Senior Manager Daimler
Trucks Durability Testing
Daimler AG



A critical factor for successful durability engineering is gaining a precise understanding of the loads that products will undergo during their anticipated lifetimes. The availability of realistic load data is essential for this virtual and physical product validation and optimization process. After all, whether generated through extensive field testing, laboratory testing or numerical simulation, the last thing you want to do is spend months interpreting results.

Fast and intuitive

LMS Tecware is a modular suite of solutions for durability load data processing. Co-developed with leading transportation OEMs, it streamlines the process of consolidating load data by analyzing durability-specific characteristics. Fast and intuitive time data validation allows you to prepare data for reliable simulations, proving ground and test rig campaigns – without requiring any cryptic commands or writing complex programs.

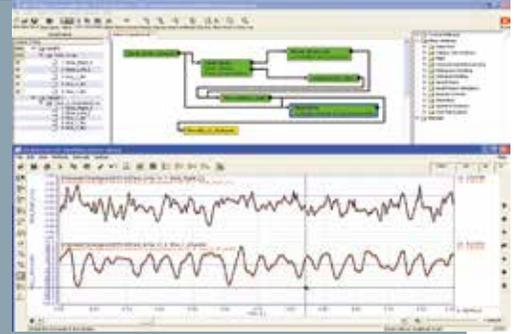
LMS Tecware increases the return out of testing facilities and ensures a rapid ROI. It offers you more accurate insights into the durability performance of new product designs throughout the development process.

LMS Tecware maximizes testing productivity by:

- Delivering more engineering insights from acquired data
- Increasing the volume of analytical work, but without losing the fatigue content
- Minimizing errors through automated processing
- Standardizing company-wide analysis procedures
- Designing customer-correlated test schedules

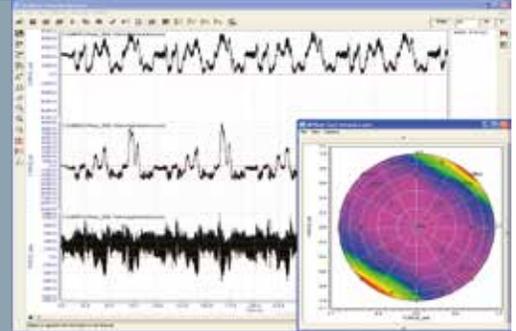
Consolidate vast amounts of acquired load data

LMS Tecware helps you efficiently validate gigabytes of raw mobile data. A multitude of measurements – strain, load, displacement, acceleration, RPM, pressure, temperature, CAN, GPS, wheel force transducer data, among other measurements – are consolidated, either interactively or fully automated.



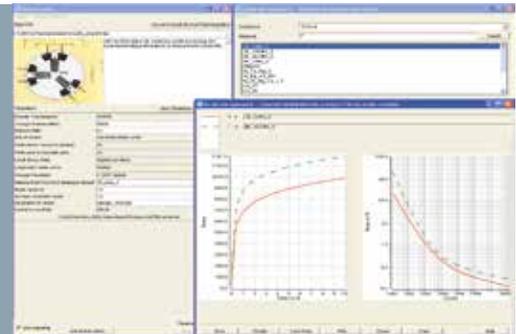
Precise understanding of applied loads

Compare essential, durability-related aspects to select representative loading scenarios. An extensive range of dedicated, durability-specific data interpretation methods helps you efficiently qualify and quantify load data durability potential.



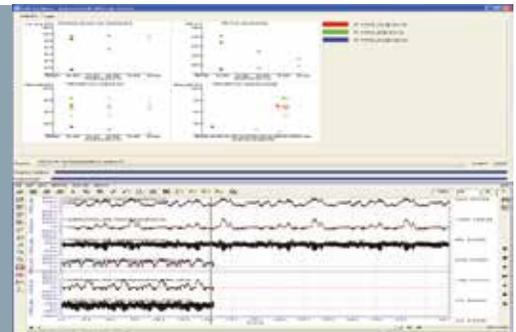
In-depth fatigue analysis

LMS Tecware accurately estimates the fatigue life of a component, based on measured strain histories, individual tensors and cyclic material properties. It enables a wide range of design sensitivity studies, such as the variability of loading, materials and surface conditions.



Faster durability test scenarios

LMS Tecware removes nondamaging events from long duration measurements to accelerate durability tests or simulations. This enables you to test more variants in the same amount of time – an optimal compromise between reduced testing time and preserved damage potential.



Customer-correlated durability test schedules

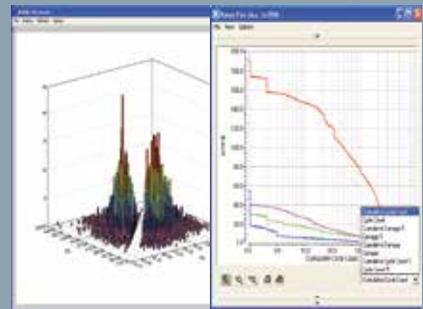
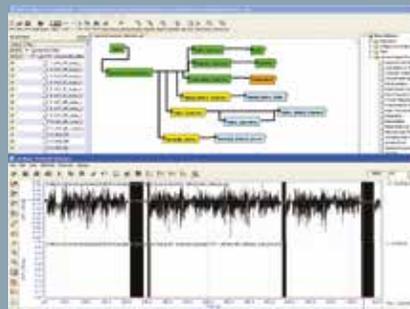
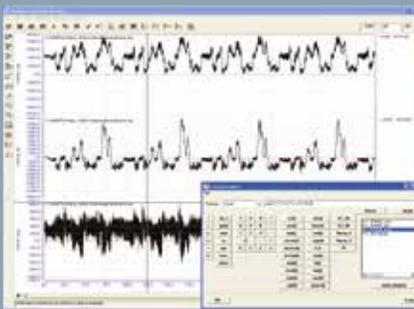
LMS Tecware calculates, via an optimization procedure, the optimal mix of test track sections that match the target customer usage with respect to mechanical fatigue. This results in condensed and realistic durability testing scenarios.



LMS Tecware

Streamlining data processing, accelerating durability engineering

LMS Tecware provides everything you need for the fast, easy and intuitive validation of raw time signals: statistics, multi-channel time signal viewing, a pocket calculator for mathematical operations, a broad set of interactive editing tools, resampling, filtering and much more. The software supports all common data formats and is specifically designed to handle vast amounts of data.



Fast, easy and intuitive time data validation

LMS Tecware provides everything you need for the fast, easy and intuitive validation of raw time signals: statistics, multi-channel time signal viewing, a pocket calculator for mathematical operations, a broad set of interactive editing tools, resampling, filtering and much more. The software supports all common data formats and is specifically designed to handle vast amounts of data.

- Fast, intuitive and easy-to-use time data, for viewing and editing
- Compatible with all common data formats
- No file conversion, no waste of time or disk space
- Handling vast amounts of time data

Automated anomaly detection and correction

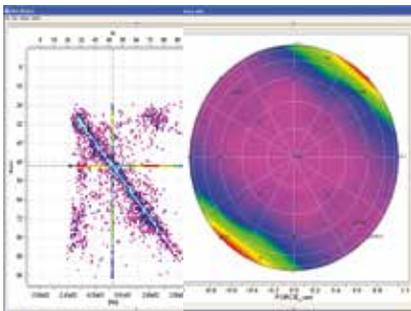
Since the interactive inspection and validation of each individual signal would take far too long, LMS Tecware automatically locates any anomaly in the acquired load data. A Microsoft Office Excel report summarizes all potential anomalies resulting from power failures, spikes, offsets, drifts and overloads. As a result, users only need to focus on a limited subset of data channels and time events, which dramatically accelerates the data validation process.

- Efficient data consolidation with automated anomaly detection and clean-up
- Repeatable and consistent results, ready for further analysis

Gain a precise understanding of durability loads

The extensive range of dedicated, durability-specific data analysis methods – based on statistics, rainflow counting and frequency analysis – helps engineers efficiently qualify and quantify the load data durability potential. A wide range of embedded display capabilities helps users quickly assess the durability impact of various road surfaces, compare the loads collected using multiple sensors or correlate test and simulation results.

- Complete tool kit for durability load data analysis and synthesis
- On-the-fly interactive usage as well as streamlined analysis
- Compliant with SAE, AFNOR and DIN standards



Get more out of your data

LMS Tecware incorporates innovative technologies, co-developed and validated with leading transportation OEMs, that help you get more out of your data. Optimize your components' fatigue performance by running in-depth, fatigue life analyses on measured strain histories. Perform dedicated rainflow analysis on shafts or gears using rotating rainflow counting.

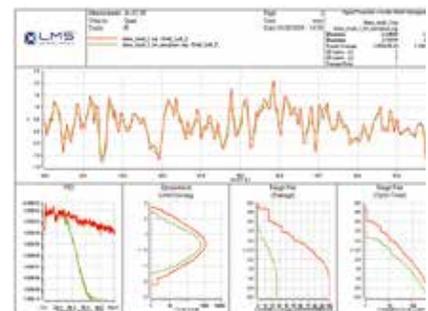
- Get more out of your data – in-depth fatigue analysis, insight into multi-axial loading conditions and rotating component analysis
- Optimize your components' fatigue performance
- Innovative technology co-developed and validated with leading transportation OEMs



Streamlined analysis to increase testing productivity

By streamlining the analysis, a greater amount of work can be performed in the same time span. Repetitive tasks can be executed automatically, operator errors are eliminated and company processes standardized. The LMS Tecware ProcessBuilder is a dedicated graphical environment for defining, optimizing and executing an unlimited number of analytical tasks. Procedures set up in LMS Tecware ProcessBuilder can be executed around the clock without any user interaction.

- A greater amount of analytical work gets done in the same time span
- Designed for nonexperts
- Consistent, error-free results
- Standardize on company-wide analysis procedures



Powerful reporting

Besides template-based standard reporting, LMS Tecware provides the possibility to organize report content and layout in line with personal preferences and company guidelines. LMS Tecware automatically generates reports directly as web pages or exported to Microsoft Office Word, Excel or PowerPoint. Reports can consist of any combination of time histories, rainflow matrices, frequency information, statistics and fatigue predictions.

- Clear reports with all engineering insights to support decision-making
- Immediate results in standard Microsoft Office templates
- Easy-to-use, template-based
- Configurable to company guidelines

LMS SCADAS Recorder

	SCR202	SCR205	SCR209	SCR207
	SCADAS Recorder 02	SCADAS Recorder 05	SCADAS Recorder 09	SCADAS Recorder 07
	Optimal flexibility in 16 channels	Mobile measurement power	High-channel density mobile unit	Designed for the extreme
				
Number of channels	8 to 16 channels	8 to 40 channels	8 to 72 channels	8 to 56 channels
Operation modes				
Autonomous recording	●	●	●	●
Data storage	CompactFlash (CF), FAT32 or exFAT file system			
PC-free	●	●	●	●
Smart recording	●	●	●	●
Wireless connection	BlueTooth			
LMS Smart Control on 7" Android tablet	○	○	○	○
Mobile frontend	●	●	●	●
Real-time data streaming to PC	●	●	●	●
Transfer rate	16 Msamples/sec			
Ethernet interface	1 Gbit			
Parallel recording to CompactFlash and PC	●	●	●	●
Scalable channel count				
Number of free slots	2	5	9	7
Max number of channels per frame	16	40	72	54
Embedded tacho inputs	2	2	2	2
Embedded CAN-bus	1	1	1	1
Embedded GPS (position, speed, absolute time, 4Hz update rate)	1	1	1	1
Power supply: flexible and low-power				
Power consumption	25W	40W	65W	65W
External power mode	Auto ranging AC using external mains adapter, Auto ranging DC input from 9VDC to 42VDC			
Internal battery mode	Rechargeable Li-ion battery; rating 21.6V-1.6Ah		Dual rechargeable Li-ion battery	
Internal battery operation time	90 min	60 min	64 min	40 min
Compact and easy to install				
Dimensions (WxHxD) mm	216x76x271	345x92x300	345x142x300	345x142x300
Weight (full configuration)	5.3 kg	6.2kg	10.5 kg	9.6 kg
Rugged design				
Operating temperature	Operating: -20°C to +55°C, Storage: -20°C to +70°C			
Relative humidity	Up to 95% noncondensing			
Vibration protection	MIL-STD-810F [20-2000Hz (random): 7.7grms]			
Shock protection	MIL-STD-810F [60gpk applying an 11ms sawtooth shock pulse; 3 shocks per direction]			
Ingress protection	IP32 (protected against >2.5 mm particles, dripping-water when tilted up to 15 degrees)		IP54 (dust and water-splash)	
Channel expansion using slave frame				
Channel expansion via slave frame	○	○	○	○ (max 1)
Max number of channels per slave frame	24 (SCM03S) or 48 (SCM06S) or 80 (SCM10S)			64 (SCD08S)

Legend: ● included, ○ option

LMS SCADAS

Universal Durability Modules

SCD-DB8a	SCD-DB8b	SCD-DB8c	Options
8-channel V/Bridge	8-channel V/Bridge/ICP	8-channel Universal	
Tailored solution for voltage and bridge	Expanding V/Bridge with ICP and TEDS	Unrivalled flexibility and performance	
			

Base characteristics					
Number of channels	Individually configurable	8	8	8	
Rugged connector	Push-pull latching mechanism with guaranteed 5000 mating cycles	7-pins LEMO.0B			
Adapter cables	Included	LEMO to pigtail	LEMO to pigtail LEMO to BNC	LEMO to pigtail LEMO to BNC	
Maximum sampling frequency	24-bit $\Sigma\Delta$ AD converter	51.2 kHz	51.2 kHz	51.2 kHz	102.4kHz (DB8-II) 204.8kHz (VB8-II)
Alias free bandwidth		5 kHz (-3dB)	5 kHz (-3dB)	5 kHz (-3dB) 640Hz (-3dB) for AC-LVDT, AC-Bridge	5 kHz (DB8-II) 92kHz (VB8-II)
Onboard processing					
Sensor interface	TEDS IEEE 1451.4 (Class 1/2)	-	●	●	
Cable/sensor check	Strain/bridge (open loop, short circuit, current beyond limit)	●	●	●	
	ICP (open loop, short circuit)	-	●	●	
Overload detection	Analog (at the input) , digital (after ADC)	●	●	●	
Feedback		Transmitted to host	Transmitted to host	Frontpanel LED	
Embedded signal conditioning					
Strain gauges	Quarter bridge 120 Ω	●	●	●	
	Quarter bridge 350 Ω	●	●	●	
	Half bridge	●	●	●	
	Full bridge	●	●	●	
	DC supply	●	●	●	
	AC supply (carrier frequency)	-	-	●	
Accelerometer	Piezoresistive	●	●	●	
	Capacitive	●	●	●	
	MEMS	●	●	●	
	Piezo-electric (ICP)	-	●	●	
	Piezo-electric (charge)	-	-	-	VC8-E
Displacement	Potentiometer / stringpot	●	●	●	
	LVDT / RVDT (inductive displacement/rotation)			●	
Force	Load cell (bridge-type sensor)	●	●	●	
Voltage	+/-10V (differential, single ended)	●	●	●	
Active sensor	Sensor with excitation 10V	●	●	●	
	Sensor with excitation 15V	-	-	●	
Current	Transmitter 4-20mA	-	-	●	Requires adapter cable
Temperature	Thermocouple T8 (K, T, B, E, J, N, R and S type) or TCK8 (K type)				T8 or TCK8
Wheel force	Digital (Kistler RoaDyn® 2000)				WF12
Analog out	Voltage (+/-10V, differential)				AO16
Vehicle bus	CAN 2.0B and J1939				CN4
	FlexRay				FR4
Video	HD quality (720p), 30 fps				CIM2

Legend: ● included, ○ option

About Siemens PLM Software

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