



Brüel & Kjær and LDS – The Perfect Match





Brüel & Kjær and LDS

The Perfect Match



Brüel & Kjær is a world leading manufacturer and supplier of sound and vibration solutions. We help our customers solve their sound and vibration problems – from measuring traffic noise and vibration in car engines to evaluating building acoustics and performing quality control.



This combined business adds capability in offering complete excitation solutions from a single source, providing our customers with a greater platform and expanded team to service their needs and requirements.



LDS experience and product portfolio of Electro Dynamic Shakers, Vibration Slip Tables, Fixtures and Amplifiers, Laser and Comet vibration controllers together with Focus II and Photon+ will complement the Brüel & Kjær product range.

Aerospace

For any aircraft, helicopter, space vehicle or ballistic device, reliability is the number one priority. By using our vibration test systems, dynamic signal analyzers, and high-speed data acquisition systems, a product's reliability and integrity can be proved.



ESA's VEGA launcher upper stage being tested on the LDS QUAD Shaker System, the European Space Research and Technology Centre (ESTEC), The Netherlands. (Image courtesy of ESA, 2009)

Satellite Testing

Getting the Mars Rover over 48 million miles to the red planet was only half the mission. The second was landing it in one piece. NASA knew if the Spirit Rover was going to make it to the Gusev Crater on Mars, a special set of tests would be required and with LDS's experience in satellite test equipment, we were the obvious choice.

NVH Structural & Modal Testing

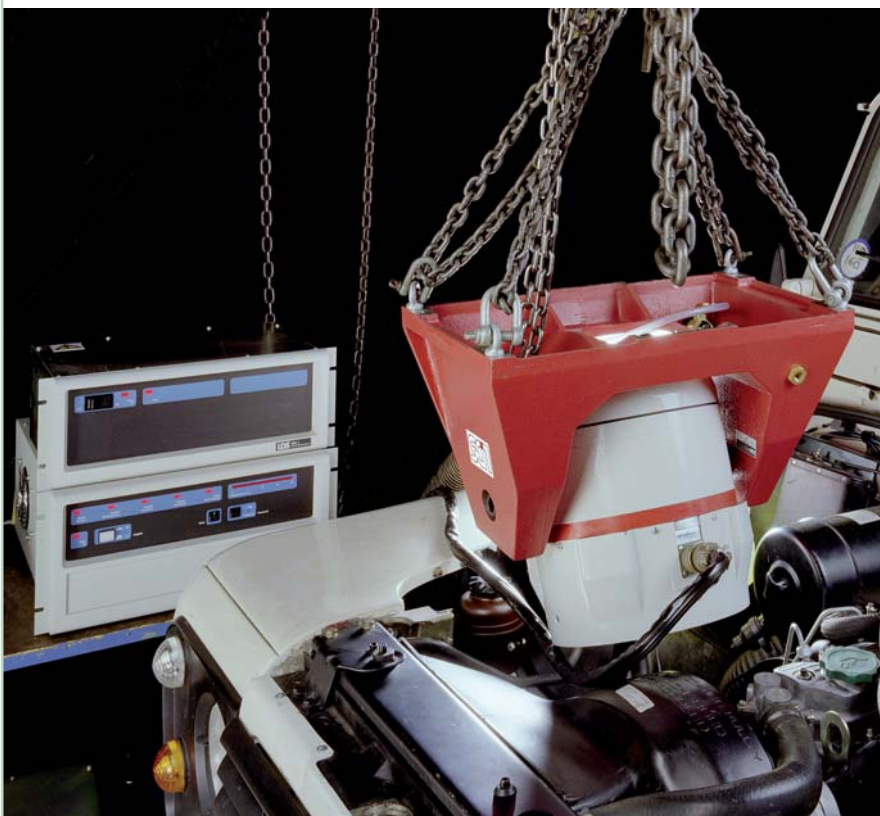
LDS products provide solutions for a wide variety of noise, vibration, and harshness test requirements. Field test applications include in-vehicle, structural and modal, rotating machinery diagnosis. LDS also offers complete solutions, from data acquisition to shakers and controllers, for "field to lab" testing such as road test simulation.

Ballistics & Missile Testing

With once in a lifetime tests you need to guarantee that you capture the event. For over 35 years, LDS has been a market leader in high resolution, and high speed transient capture. With our rugged hardware and intuitive software, we can capture data from a test that cannot be repeated.

Automotive

Manufacturers of cars, motorcycles, trucks, buses and rail vehicles all face similar requirements for improving performance durability and safety. Here at LDS, we provide a range of solutions to meet your needs.



Squeak & Rattle

Our 'quiet' electrodynamic shakers support industry standard QA practices for Squeak and Rattle vibration testing, ensuring automotive components and interiors remain durable and free from noise.

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Rotating Machinery Test

LDS Vibration Analyzers provide all the tools you need to rapidly isolate and diagnose vibration and noise problems in rotating machinery. Order tracking analysis, real-time waterfalls and spectrograms, octave band analysis, orbit plots, and cepstrum analysis are all available.



Custom Solutions

Customers seeking to improve on the reliability of existing vibration test systems whether LDS or third party, can upgrade in a simple two stage maximum value way, by first replacing their power amplifier with the latest LDS SPAK 8-176kVA digital switching amplifier, and then optionally upgrading to a complete LDS vibration test solution.

The LDS FPCMI, Field Power and Cooling Management Interface product allows a two stage maximum value way of incorporating a SPAK series 8-176 kVA amplifier. It provides signal connections between the amplifier and the customer's existing Field Power Supply (FPS), Cooling Unit (CU) and Vibrator.

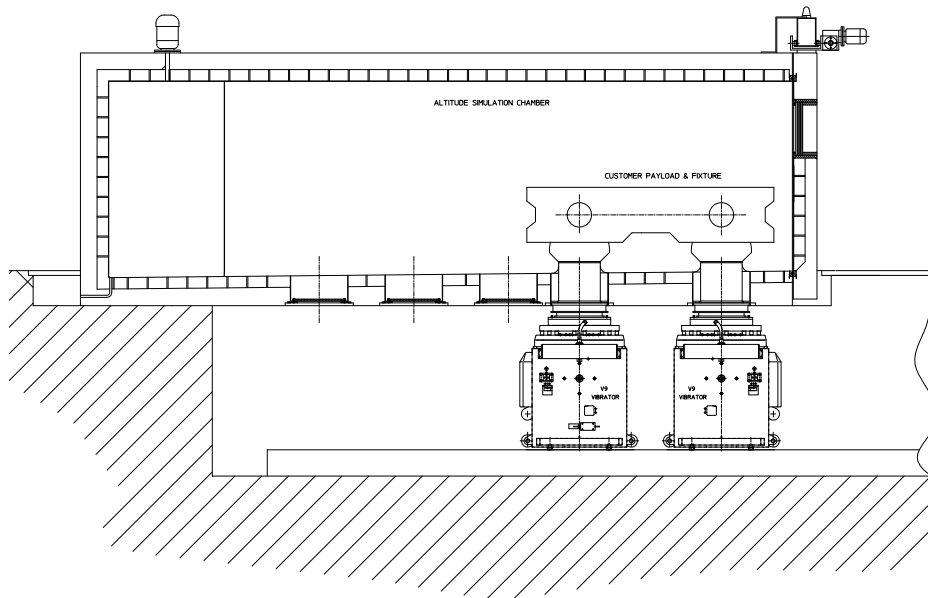
It is a compact 19in rack mounted product and through its easy-to-use front panel touch-screen display, it allows configuration and customisation of up to 32 potential-free interlocks (e.g. shaker, slip table, head expander, FPS/CU, and more). It ensures safety signals are captured, displayed to the user, and relayed back to the amplifier to shutdown equipment when required. It also features Thermocouple K inputs for temperature monitoring and interlocking, and an Emergency-Stop push button.

The FPCMI is the ideal solution for customers wishing to upgrade their Vibration Test System with a new generation, high performance digital-switching amplifier fully integrated with their existing equipment.



Custom Solutions

The Dual V9 (105kN) Vibration Test System has been specially adapted to operate in conjunction with an altitude simulation chamber, to enable testing of large payloads under near-vacuum conditions.



To prevent the vacuum pulling the Vibrator Armature up into the environmental chamber, the vibrator is fitted with a special Vacuum Compensation Extender System which provides an opposing force to hold the armature down to its mid-position. In both static and dynamic testing, the Vibrator Armature and Body positions are controlled by a special balancing control system.

To ensure the consistency of any vacuum effect, the vibrator is sealed to the floor of the altitude simulation chamber, allowing full Armature movement within its Velocity, Displacement and Acceleration capabilities.

To allow testing of large and long-shaped payloads, the V9 Vibrators are operated in a dual configuration using the LDS Multiple Amplifier Control System; they are driven to tight amplitude and phase tolerances of each other to ensure consistent application of vibration, and cross-coupled to ensure system and payload safety.

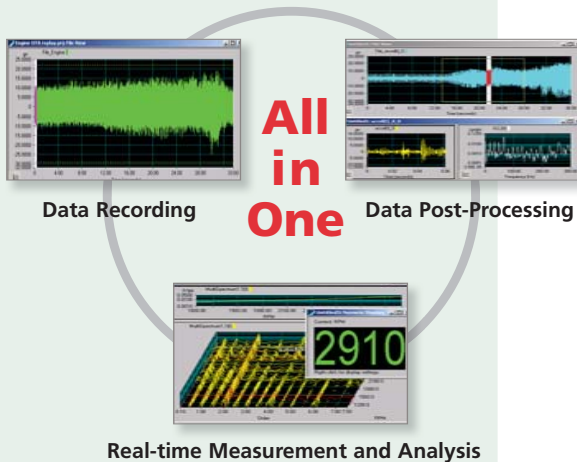




Dynamic Signal Analyzers

Portable Real-Time Analyzers with a USB interface

- USB interface for the ultimate in convenience and performance
- Real-time analysis, data recording, and post-processing all available with only one click
- Fast real-time processing for quick set-up, instant results, and on-site data verification
- Tape recorder functionality with a new level of accuracy
- Speeds time from data acquisition to analysis
- High accuracy FFT Analyzers with 24-bit inputs and output



An All-In-One Analyzer combines the functions of multiple instruments into a single efficient, cost-effective system.

PHOTON+™

Ultra-Portable Real-Time Analyzer

Ultra-portable, the *PHOTON+* Dynamic Signal Analyzer comes with 2 to 4 inputs, an output, and a tachometer input. No separate power supply is required as *PHOTON+* is powered via the host PC's USB port. Its real-time rate as an FFT Analyzer is 42 kHz on all four channels.

A full range of easy to use software applications are available for noise and vibration, FFT analysis, order tracking and rotating machinery analysis, sound quality, and automated production line testing.

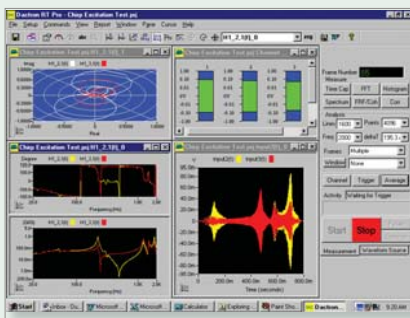


Ultra-portable, the *PHOTON+* real-time analyzer comes with 2 to 4 inputs and it is powered by the PC's USB port.

Dynamic Signal Analysis Software

Ready to Test, Easy to Use Software

- Real-time data acquisition and signal analysis for *PHOTON+*[™], *COMET_{USB}*[™] and *LASER_{USB}*[™]
- Applications for FFT analysis, modal analysis, order tracking, octave band analysis, acoustics, transient capture, SRS analysis and automated limits testing
- Waveform recording to a PC hard disk including tape recorder functions such as voice annotation
- Instrument like operation
- Complete set of time, frequency and amplitude domain functions
- Flexible display capabilities including waterfall plots
- Full complement of data cursor functions
- Generate reports with a single click
- Signal calculator for virtual signal creation
- Export data in ASCII, UFF or WAV formats



RT PRO[™]

Powerful Tool for Noise and Vibration Analysis

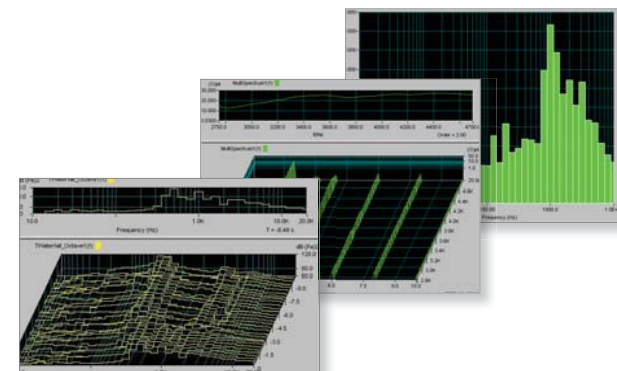
RT Pro offers powerful data acquisition and real-time signal processing capabilities. Instrument-like operation, via a Windows[®] graphical user interface, makes it easy to learn and use *RT Pro*. The Signal Analysis and Waveform Source base-package of *RT Pro* provides comprehensive capabilities for general signal analysis and modal data acquisition. Optional software packages in the *RT Pro Dynamic Signal Analysis Series* offer many more application-tailored solutions for the range of noise and vibration testing including real-time octave analysis, order tracking and waterfall analysis, transient capture, and SRS analysis.

Reporting Tools Make Your Documentation Task Easier

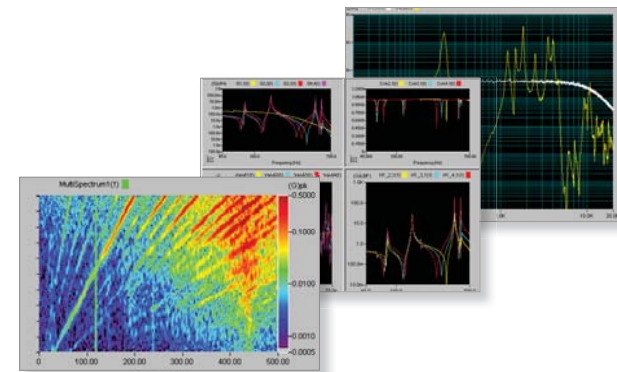
RT Pro offers the reporting tools that you need to create reports quickly in a professional format. These tools use Windows native software to create data plots and full reports within a Microsoft Word document. Creating a report is as simple as clicking on a toolbar icon. Then a new Microsoft Word document is opened - Word is automatically started if it is not already open - and the desired plots and parameter tables are embedded into a new Word document.

RT Pro Playback Provides Powerful Post-Processing

The *RT Pro* Playback option provides a flexible tool for post processing of recorded waveforms. This is a stand-alone software tool that does not require any analyzer hardware to work. So you will be able to email data files around the world and anyone with *RT Playback* can easily post-process the data. The user interface of *RT Pro Playback* is identical to *RT Pro* so no additional learning is needed. Once you have used the friendly *RT Pro* user interface, using *RT Pro Playback* will be easy.



RT Pro addresses a wide range of applications including FFT analysis, octave band analysis, order tracking and much more.



The display flexibility of *RT Pro* allows you to quickly and easily diagnose vibration noise problems.

Vibration Test Systems

LDS is a manufacturer of electrodynamic shakers for every vibration test need with force ranges from 9N (2 lbf) to 289 kN (65,000 lbf). Our electrodynamic shaker systems offer high performance with high reliability.

LDS vibration testing solutions provide excellent all-round testing capabilities, with designs that have proven themselves under the most demanding requirements. With an impressive range of standard and optional fittings, there is sure to be a solution to meet virtually any test requirement in the world today. Our extensive technical experience means that we are able to specially tailor solutions in the event that a standard solution is not available.

We provide solutions for applications as diverse as laboratory testing, modal and structural analysis, squeak and rattle, and stress testing of sub-assemblies through to complete systems. Markets include Automotive, Aerospace and Defense, and Electronic, Electrical and Machinery production. We currently deliver the industry-standard vibration test system for testing of complete satellite systems around the world.

The complete LDS solution comprises the latest control systems, energy-efficient power amplifiers, shakers and excellent global support, servicing and training.



Low Force Range

Solutions for Vibration Testing of Components, Small Assemblies, or Modal and Structural Analysis

- Wide frequency band (5 Hz to 13 kHz) combined with high peak forces (2 lbs - 110 lbs peak sine force)
- Low mass, high performance armature construction
- Robust, lightweight suspension system provides excellent torsional and transverse stiffness with minimal impact on system acceleration
- Base or trunnion mounted
- Powered by compact, quiet, energy efficient amplifiers
- Compatible with LDS *COMET_{USB}*[™] and *LASER_{USB}*[™] Vibration Controllers



V406 shaker being used to test camcorder to ensure product reliability during operation.

Industry Applications

- ✓ Modal and structural analysis
- ✓ Electronic assembly test
- ✓ Laboratory experiments



V101/2, V201/3, V406/8, V450/1 AND V455/6 SHAKERS

This range of permanent magnetic shakers are ideal for modal analysis. Their efficient armature design enables them to deliver impressive peak forces and accelerations over a wide frequency range.

The shakers are controlled using either the *COMET_{USB}* or *LASER_{USB}* system controllers, or are compatible with 3rd party controllers and amplifiers.

Shaker Model	V101/2 -PA 25E	V201/3 -PA 25E	V406/8 -PA 100E	V406/8 -PA 500L	V450/1 -PA 500L	V455/6 -PA 1000L
System Sine Force Peak (lbf)	2.0	4.0	22.0	44.0	70.0	110
System Max Random Force rms (lbf)	-	-	8.5	20.0	48.0	68.0
Max Acceleration Sine Peak (gn)	140	91.0	50.0	100	74.5	117
System Velocity Sine Peak (in/s)	51.6	58.7	60.0	70.0	70.0	98.4
System Displacement Continuous pk-pk (in)	0.1	0.2	0.55	0.69	0.75	0.75
Moving Element Mass (lb)	0.0143	0.044	0.44	0.44	0.94	0.94
Usable Frequency Range (Hz)	5-12,000	5-13,000	5-9,000	5-9,000	5-7,500	5-7,500



Low-Medium Force Range

Vibration Testing Solutions for Modal, Structural and Component Testing

- Wide frequency range from DC up to 6,300 Hz
- Peak force ratings from 150 lbs to 1149 lbs
- Lightweight, high performance armature design (4.3" to 7" in diameter) delivers excellent acceleration and velocity performance
- Vertical or horizontal operation
- Optional software allows system tests to be controlled remotely using a PC
- Compatible with LDS COMET_{USB}[™] and LASER_{USB}[™] Vibration Controllers
- Ease of use and power saving features on LDS amplifiers reduce operating costs
- Proven reliability maximizes system availability, combined with global servicing and support



Industry Applications

- ✓ Automotive component testing
- ✓ Electronic assembly testing
- ✓ Structural testing
- ✓ Modal investigation
- ✓ Vibration stress testing under varied environmental conditions
- ✓ In-house test and calibration facilities



V550, V555, V650, V721, AND V780 SHAKERS

Total System Solutions

With a combination of wide frequency range, high force and acceleration, this range of air-cooled shaker solutions delivers excellent all-around testing capabilities.

A number of optional extras enable the system to be tailored to suit most applications. Trunnion mounting and slip tables enable both

vertical and horizontal testing, and the further addition of a thermal barrier allows for improved product testing under diverse environmental conditions.

The shakers can be controlled using either the COMET_{USB} or LASER_{USB} system controllers, or are compatible with 3rd party controllers or amplifiers.

Shaker Model	V550/1 -PA 500L	V555/6 -PA 1000L	V650/1 -PA 1000L	V650/1 -HPA-K	V721/2 -PA 1000L	V780 -HPA-K
System Sine Force Peak (lbf)	150	211	364	495	665	1,149
System Max Random Force rms (lbf)	125	143	245	346	427	949
Max Acceleration Sine Peak (gn)	68.8	100	73.7	100	70.0	111
System Velocity Sine Peak (in/s)	41.7	59.1	55.1	59.1	27.6	74.8
Moving Element Mass (lb)	2.18	2.07	4.94	4.94	9.5	10.36
Usable Frequency Range (Hz)	DC - 6,300	DC - 6,300	DC - 5,000	DC - 5,000	DC - 4,000	DC - 4,000

Medium Force Range

Medium and Large Air-Cooled Electrodynamic Shakers

- V800 - V8 series shaker systems can be used for sine, random and high-acceleration shock tests
- V875 LS offers 3" displacement
- Lightweight yet robust interchangeable armatures give the highest performance with reduced capital cost
- Advanced switching power amplifiers offer high reliability, reduced space requirements, simple installation and operation
- Systems can be tailored for special applications
- State-of-the-art vibration control system enables remote monitoring and control
- Compatible with LDS COMET_{USB}[™] and LASER_{USB}[™] Vibration Controllers
- Vertical or horizontal operation with optional slip table



V800-V8 SERIES SHAKERS

Industry Standard for Automotive, Military and Electronic Testing

Providing the versatility and capability demanded by research and development, product qualification and stress screening, the V800 - V8 series shaker systems combine superior performance with low capital and running costs.

Industry Applications

- ✓ Automotive parts and systems - qualification testing
- ✓ Electronic assembly, computer equipment testing
- ✓ Avionics and military hardware testing
- ✓ Satellite component testing
- ✓ Product and package testing
- ✓ General stress screening



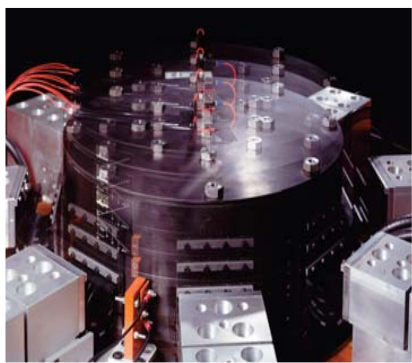
Shaker Model	V830-185	V830-335	V850-240	V850-440	V875-240	V875LS-440	V875LS-640	V875-640EF	V8-440	V8-640
System Sine Force Peak (lbf)	2,000	2,205	4,000	5,000	8,000	8,000	8,000	8,494	13,000	12,500
System Max Random Force rms (lbf)	1,300	2,205	3,000	5,000	7,000	8,000	7,000	8,494	14,800	12,500
Max Acceleration Sine Peak (gn)	120	82.6	125	60.0	162.7	112	90.9	57.3	140	40.0
System Velocity Sine Peak (in/s)	78.7	78.7	78.7	78.7	78.7	70.9	70.9	70.9	70.9	70.9
Displacement pk-pk (in)	2.0	2.0	2.0	2.0	2.0	3.0	3.0	2.0	2.5	2.5
Moving Element Mass (lb)	15.4	26.6	30.9	52.6	49.2	73.0	90.0	139	92.6	103.6



High Force Range

High-Force Long-Duration Electrodynamic Shaker

- Full water cooling, including body cooling, enables prolonged testing at maximum force levels
- Long 3" stroke allows greater acceleration at low frequencies, combined with higher maximum velocity
- Advanced switching power amplifier offers high reliability, simple installation and operation
- Powerful LDS-Dactron vibration control system enables remote monitoring and control
- Payloads up to 4,000 lbs
- Systems can be tailored for special applications such as load bearing platforms
- Vertical or horizontal operation with optional slip table



Industry Applications

- ✓ High force, long duration automotive testing
- ✓ Avionics and military hardware testing
- ✓ Low-frequency and shock pulse testing
- ✓ Product and package testing

V9 SHAKER

The New Standard for High Force, Long Duration Vibration Testing

Providing the versatility and capability demanded for both research and development and production testing, the V9 shaker system offers exceptional performance combined with low capital and running costs. The V9 shaker offers the highest achievable envelope of testing parameters.

Shaker Model	V9
System Sine Force Peak (lbf)	23,600
System Max Random Force rms (lbf)	23,600
Max Acceleration Sine Peak (gn)	150
System Velocity Sine Peak (in/s)	118
Displacement Continuous pk-pk (in)	3.0
Moving Element Mass (lb)	109
Usable Frequency Range (Hz)	DC - 2,700

High Force Range

High-Force Long-Duration Electrodynamic Shaker

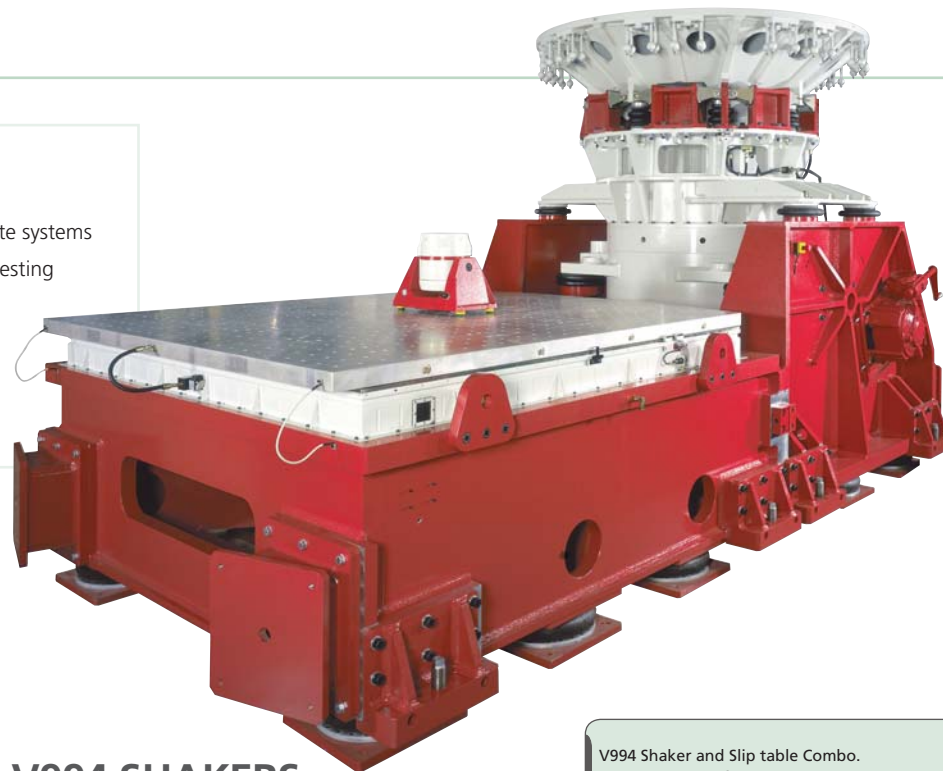
- Peak force ratings from 20,000 - 65,000 lbf – highest available force of any shaker available today!
- Wide frequency range up to 2,500 Hz
- Combination of high performance armature design and water-cooled coils delivers excellent acceleration and velocity performance
- Automatic armature and body position load compensation system ensures larger loads can be comfortably accommodated
- Trunnions feature Lin-E-Air suspension system as standard, resulting in improved low-frequency performance, providing air isolation from test vibration
- Rolling strut armature suspension system provides up to 2.0" displacement for sine operation and 2.5" transient pulses
- Vertical or horizontal operation, with optional slip table
- Thermal barriers available for all systems for improved environmental test capability
- Compatible with LDS COMET_{USB}[™] and LASER_{USB}[™] Vibration Controllers
- V994 features guided head expander



Mars Mission
Satellite Testing
(Photo courtesy of
NASA/JPL-Caltech).

Industry Applications

- ✓ 3 axis testing of complete satellite systems
- ✓ Avionics and military hardware testing
- ✓ Structural dynamics testing
- ✓ Clean room environments
- ✓ Multi-shaker, multi-axis applications



V994 Shaker and Slip table Combo.
Shaker is shown fitted with a head expander.

V964, V984, AND V994 SHAKERS

High Force, High Reliability

Used where large payloads need high performance vibration or shock testing, the V900 Series gives engineers the confidence they need to develop highly reliable products. These systems have been used in single and multi-shaker configurations, and have been used to test products such as satellites and missiles.

The Lin-E-Air shaker suspension system gives excellent isolation, reducing the effects of vibrations from the shaker on the surrounding environment. An optional guided head expander ensures that loads with off-center center of gravities can be tested effectively and safely. The addition of a slip table enables products to be tested in both vertical and horizontal axes. The slip table is also available with a thermal barrier for use in environmental tests.

Shaker Model	V964 - DPA-K	V984 - DPA-K	V994 - DPA-K
System Sine Force Peak (lbf)	20,000	36,000	65,000
System Max Random Force rms (lbf)	20,000	36,000	60,000
Max Acceleration Sine Peak (g _r)	100	100	75.0
System Velocity Sine Peak (in/s)	78.7	78.7	78.7
Displacement Continuous pk-pk (in)	1.5	1.5	2.0
Moving Element Mass (lbs)	130	287	562
Usable Frequency Range (Hz)	DC-2,500	DC-2,000	DC-1,700



Vibration Controllers

Powerful, Flexible and Economical Vibration Controllers

- *LASER_{USB}* and *COMET_{USB}* bring vibration test into the new era of USB connectivity!

LASER_{USB}

- Full capability for vibration control, data reduction, and signal analysis
- Multi-channel with 2 to 16 channels for multi-point control or analysis
- 24-bit resolution gives wide dynamic range to control highly dynamic structures
- Fast and safe with 100 millisecond loop time
- Amplifier and thermal chamber interfaces for seamless lab integration

COMET_{USB}

- Very economical yet suitable for random, sine and shock tests
- Simplified or advanced user interfaces are suitable for different operators and tests
- Set-up wizard for quick and sure test setup



LASER_{USB}TM VIBRATION CONTROL SYSTEM

Delivering what Test Engineers Demand: Convenience, Performance, Flexibility and Safety

LASER_{USB} brings vibration test into the new era of USB 2.0 connectivity. Combining convenience, performance, flexibility and safety, *LASER_{USB}* is the ideal controller for your test lab. It has 24-bit precision with wide control dynamic range, and fast loop times to provide superb control for your most challenging tests. *LASER_{USB}* is also a very flexible answer for your test needs with full capability control and analysis software applications for random, swept sine, resonance dwell, classical shock, random, sine on random, shock SRS, and field data replication.



LASER_{USB} has a USB 2.0 interface for easy PC connectivity and its multiple DSP processors handle the control loop independent of the PC host.

COMET_{USB}TM VIBRATION CONTROL SYSTEM

Economical for Production Test with the Performance for R&D Testing

Offering high performance at a very affordable price, the *COMET_{USB}* Vibration Controller is an ideal solution to the everyday demands of your shock and vibration testing. *COMET_{USB}* provides the flexibility to do random, swept sine, and shock testing on both electrodynamic and hydraulic shakers. Easy to use software together with extensive automation features make it a perfect fit for vibration stress screening and production test applications.



COMET_{USB} offers the convenience of USB 2.0 connectivity and it is an economical controller for random, sine and shock testing.

Amplifiers/Replacement Amps

The LDS line of linear and digital switching amplifiers offer energy efficient and robust operation for power requirements up to 280 kVA.

Replacement Amplifiers

The standard SPA-K range of power amplifiers can be used to power legacy LDS and third party shakers and include a unique remote control capability, allowing the user to control the amplifier remotely via a PC.

SPA-K & HPA-K Switching Power Amplifiers

These amplifiers power air-cooled electrodynamic shakers and come with integral field power and blower power supplies.

The HPA-K amplifier is designed for use with V650 and V780 electrodynamic shakers.

DPA-K Switching Power Amplifiers

Designed for use with water-cooled electrodynamic shakers, DPA-K amplifiers offer a maximum power output of 280kVA, providing optimum performance for your vibration test system.

PA 500L - PA 1000L Linear Power Amplifiers

Compact standalone amplifiers designed to support LDS vibration test systems use both permanent magnet shakers and also small electrodynamic shakers. Both are used with a separate field power supply.





Service

■ Consider the benefits

- Complete range of high quality support services
- Site surveys, installation, commissioning and decommissioning warranty plans
- Personalized maintenance contracts from a simple return to factory repairs to a complete on-site system strip-down
- System modifications and upgrades
- Spares service



Your choice of a service partner is as critical as your choice of system. Effective maintenance and adequate training are vital if you are to get the most out of your investment.

To make sure all our customers worldwide have access to professional services and training resources, LDS has developed a market-leading support network.

Whether installing a system for the first time or maintaining existing equipment, reliability, efficiency and investment protection will naturally be high priorities. LDS understands the cost implications of down-time and appreciates that no two users' needs are identical. We can provide a portfolio of support services which can be carefully tailored to complement your own resources, meeting your needs and budget, and ensuring compliance with all necessary safety directives.

Your needs. Our commitment.

The prime goal of LDS support services is to ensure that your system is fine tuned to your needs and that any problems are resolved quickly.

Training



LDS provides you with complete solutions that are ready to run. Even though they are designed for ease-of-use, we offer specialized training for your people to become real experts in less time.



LDS University offers both standard and custom training courses for established or new vibration test engineers. Regular scheduled courses are held globally; custom on-site courses can also be arranged explaining how to interpret specific vibration test specifications and apply them to customers' vibration test systems.



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