LDS SHORT FORM CATALOG

Brüel & Kjær
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.
LDS’s experience and product portfolio of electrodynamic shakers, vibration slip tables, fixtures, amplifiers and vibration controllers together perfectly complement the Brüel & Kjær product range of transducers and data acquisition systems.

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

Brüel & Kjær
VIBRATION TEST SYSTEMS
LDS is a manufacturer of electrodynamic shakers for every vibration test need with force ranges from 2 lbf to 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, package testing, and stress testing of sub-assemblies through to complete systems. Markets include Automotive, Aerospace and Defense, Electronics, 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.
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 Brüel & Kjær’s transducers and high-speed data acquisition systems, a product’s reliability and integrity can be proven.

Satellite Testing
When launching a satellite or vehicle to explore a neighboring planet, ensuring the survival after launch is fundamental. As a leader in satellite vibration testing, from component through to launch ready payload, LDS’s experience makes us the obvious choice.

Aircraft Testing
From the latest unmanned combat drone through to the newest commercial airliner LDS’s products have tested the smallest component to finished jet engines. Field test applications include in-vehicle, structural and modal and rotating machinery diagnosis. Brüel & Kjær and LDS offer complete solutions, from transducers and data acquisition systems to shakers and controllers, for field to lab testing.

Ballistics & Missile Testing
Military personnel have to be confident that highly dangerous material is stored safely. In order to achieve this they often need to carry out a series of tests, including shock and vibration, temperature, altitude and humidity testing. LDS’s complete line of electrodynamic shakers and controllers ensure that the smallest of triggers to the largest of missiles are properly designed for safe storage and transport.

Marine Testing
Proving the integrity of onboard components and systems to ensure they hold up against the most extreme ocean conditions is essential.
Manufacturers of cars, motorcycles, trucks, buses and rail vehicles all face similar requirements for improving performance durability, comfort 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, for greater passenger comfort. As emerging hybrid and electrical vehicles become more common, battery durability testing is key to the next generation of transport. LDS has developed a custom vibration test system for hybrid battery testing in conjunction with Highly Accelerated Life (HAL) testing of multi-cell computer managed batteries.

**NVH Structural & Modal Testing**
LDS and Brüel & Kjær products provide solutions for a wide variety of noise, vibration, and harshness test requirements. Field test applications include in-vehicle, structural and modal and rotating machinery diagnosis. LDS and Brüel & Kjær also offer complete solutions, from transducers and data acquisition to shakers and controllers, for field to lab testing such as road test simulation.

**Rotating Machinery Testing**
Brüel & Kjær 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.
TRANSPORT SIMULATION

The Quad V9 (4 x 23,605 lbf) Vibration Test System has been specially designed for a transport simulation application testing structures at frequencies from DC and payloads exceeding 13,000 lbs. With a cross section over 20 ft x 10 ft it is much larger in size than the vibration system interface plates. The capability to independently control the vibration accelerations at multiple positions on a single payload of this size is revolutionary.

The payload interfaces for each of the 4 V9s are not connected to each other. Therefore to control their relative positioning, a new Position Indicator Control Stand has been developed.

A special version of the LDS combo has been designed to incorporate a solid trunnion vibrator body mounting, with the slip table combo frame being attached directly to steel plates on top of a seismic mass. The base fabrication is designed to accept a Load Bearing Platform (LBP) used for vertical vibration.

An air isolated seismic block has been designed so that all forces are transmitted to this block. Testing is controlled using an LDS Multiple Amplifier Control (MAC) System together with a Multi Input Multi Output vibration controller (MIMO) to simultaneously control each V9 system independently in order to achieve the required combined effect. Using Airglides, the four combos can be readily repositioned into multiple orientations to enable both vertical and horizontal testing of various sized payloads.
Most consumer products undergo vibration testing, the most common form being package testing. Package testing is designed to simulate a product’s journey once boxed at the factory for transport through to the customer’s home.

One such LDS package system was designed to enable the customer to simultaneously test two plasma screen television sets, weighing 187 lb each, in their transport boxes. The tests were designed to reproduce the effects of transport experienced by the televisions. These tests allowed for the optimization of the packaging design and savings on materials such as polystyrene packaging. The customer used a combination of Sine tests, typically <0.19 inch peak-to-peak in the 5 - 20 Hz range and Random tests <1.5g up to 200 Hz.

The system combines a rigidly mounted standard LDS V875-640 shaker with specially designed steel trunnions and a magnesium head expander, 5 ft 9 in x 7 ft 2 in, is supported by a Load Bearing Platform (LBP). The basic over-turning capability of the LBP is 3688 lbf ft, and it is restrained by guide shafts which are part of the steel work. Air-bags located underneath the trunnions isolate the vibration. Pneumatic isolation is incorporated to prevent unwanted vibration being transmitted into the building.

Once on site the head expander is positioned at floor level, allowing the loading and unloading of the payloads by pallet truck for the quick turn around of large test articles. A remotely operated safety mechanism to lock and unlock the LBP had to be designed to allow access to the shaker.
DEFENSE TESTING

Designed to test payloads for a defense customer, the Dual LDS V850-440 SPA24/56K special Vibration Test System has been engineered for coupled operation.

Each shaker is fitted with a Guided Head Expander that allows interfacing to the customer’s specialized payload. A steel truss rigidly connects the shakers together.

To ensure the dual system is mobile as required by the customer, each shaker base is integrated with Airglides allowing the full shaker assembly to be moved effectively on a cushion of air.

The special LDS Pneumatic Control Stands provide the operator with shaker body and armature position display and control. Shaker armature and body position are automatically controlled to ensure that the complete system remains balanced.

Both shakers can be used either individually or in the standard dual (push-push) configuration; the LDS Multiple Amplifier Control (MAC) System allows this. Each shaker is driven to a tight amplitude and phase tolerance of the other to ensure consistent application of vibration, minimizing cross-coupling and ensuring system and payload safety.
To prevent the vacuum pulling the shaker armature up into the environmental chamber, the shaker 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 shaker armature and body positions are controlled by a special balancing control system.

To ensure the consistency of any vacuum effect, the shaker 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 shakers are operated in a dual configuration using the LDS Multiple Amplifier Control (MAC).
This range of permanent magnetic shakers is 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.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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</table>
Vibration Testing Solutions for Modal, Structural and Component Testing

- Wide frequency range from DC up to 6,300 Hz
- Peak force ratings from 150 lbf to 1150 lbf
- Lightweight, high performance armature design (4.33 in to 7.09 in 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 COMETUSB™ and LASERUSB™ 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

*Control strategy and isolation dependant

Industry Applications

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

V556, V651, V722, 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-round 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 COMETUSB™ or LASERUSB™ system controllers, or are compatible with 3rd party controllers or amplifiers.

<table>
<thead>
<tr>
<th>Shaker Model</th>
<th>V556-PA 1000L</th>
<th>V651-PA 1000L</th>
<th>V651-HPA-K</th>
<th>V722-PA 1000L</th>
<th>V780-HPA-K</th>
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<tbody>
<tr>
<td>System Sine Force Peak (lbf)</td>
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<td>364</td>
<td>495</td>
<td>652</td>
<td>1150</td>
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<tr>
<td>System Max Random Force rms (lbf)</td>
<td>143</td>
<td>245</td>
<td>346</td>
<td>427</td>
<td>950</td>
</tr>
<tr>
<td>Max Acceleration Sine Peak (g_r)</td>
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<td>73.7</td>
<td>100</td>
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<tr>
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<td>55.1</td>
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<td>4.94</td>
<td>4.94</td>
<td>9.50</td>
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Industry Applications

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

Vibration Testing Solutions for Modal, Structural and Component Testing

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

V556, V651, V722, AND V780 SHAKERS

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

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<td>364</td>
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<td>Moving Element Mass (lb)</td>
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<td>4.94</td>
<td>4.94</td>
<td>9.50</td>
<td>10.36</td>
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</table>
Medium and Large Air-Cooled Electrodynamic Shakers

- V800 - V8 series shaker systems are ideal for sine, random and high-acceleration shock tests and many more control profiles
- 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 COMETUSB™ and LASERUSB™ Vibration Controllers
- Vertical or horizontal operation with optional slip table

Briel & Kjær offers a full range of accelerometers to complement your LDS vibration test system.

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.

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<tr>
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<td>88.0</td>
<td>139.3</td>
<td>92.6</td>
<td>103.6</td>
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</table>
High-Force Long-Duration Electrodynamical Shaker

- Full water cooling, including body cooling, enables prolonged testing at maximum force levels
- Long 3 inch 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 vibration control system enables remote monitoring and control
- Payloads up to 3,968 lb
- Systems can be tailored for special applications such as load bearing platforms
- Vertical or horizontal operation with optional slip table

V9 SHAKER

The 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.

<table>
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<th>Shaker Model</th>
<th>V9</th>
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<td>Max Acceleration Sine Peak (g)</td>
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<td>System Velocity Sine Peak (in/s)</td>
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<td>Displacement Continuous pk-pk (in)</td>
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<td>Moving Element Mass (lb)</td>
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<tr>
<td>Usable Frequency Range (Hz)</td>
<td>DC - 2,700*</td>
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</tbody>
</table>

*Control strategy and isolation dependant

Industry Applications

- High force, long duration automotive testing
- Avionics and military hardware testing
- Low-frequency and shock pulse testing
- Product and package testing
V964, V984, AND V994 SHAKERS

High Force, High Reliability

Ideal where large payloads need high performance vibration or shock testing, the LDS 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 are suited 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 centers of gravity 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.

Industry Applications

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

<table>
<thead>
<tr>
<th>Shaker Model</th>
<th>V964 - DPA-K</th>
<th>V984 - DPA-K</th>
<th>V994 - DPA-K</th>
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<td>60,000</td>
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<td>Max Acceleration Sine Peak (g)</td>
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<td>System Velocity Sine Peak (in/s)</td>
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<td>DC-2,500*</td>
<td>DC-2,000*</td>
<td>DC-1,700*</td>
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</tbody>
</table>

*Control strategy and isolation dependant
The LDS line of linear and digital switching amplifiers offers energy efficient and robust operation for power requirements up to 280 kVA.

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 and range from 8kVA to 176kVA.

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 100L - 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 when required.
COMET™ VIBRATION CONTROL SYSTEM

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

Offering high performance at a very affordable price, the COMET™ Vibration Controller is an ideal solution to the everyday demands of your shock and vibration testing. COMET™ provides the flexibility to do random, swept sine, and shock testing on electrodynamic shakers. Easy to use software together with extensive automation features make it a perfect fit for vibration stress screening and production test applications.
Delivering what Test Engineers Demand:
Convenience, Performance, Flexibility and Safety

LASER\textsuperscript{USB}\textsuperscript{™} is the ideal controller for your test lab as it combines convenience, performance, flexibility and safety. It offers 24-bit precision with wide control dynamic range, and fast loop times to provide superb control for your most challenging tests. LASER\textsuperscript{USB}\textsuperscript{™} is also a highly flexible answer for your test needs with full capability control and analysis software applications for random, swept sine, resonance dwell, classical shock, random on random, sine on random, shock SRS, and field data replication. Advanced technologies such as kurtosis control and fatigue monitoring reduce test time and increase the reliability of your product. One-click reporting makes it quick and easy to create comprehensive reports for your design group or customer, and special Active Reports allow you to re-scale, zoom, or cursor any data plots within a Microsoft\textsuperscript{®} Word report document.

Lab Integration

LASER\textsuperscript{USB}\textsuperscript{™} can make your lab more efficient with capabilities that integrate and coordinate all of your test equipment. The Amplifier Controller software option allows control of a LDS SPA-K amplifier from the same PC used to run the Vibration Control software. A seamless connection with the control software of many popular chamber makers is provided by the Chamber Interface option. NET-Integrator provides ActiveX commands that interface Vibration Control applications to user programs. This capability makes it possible to develop simple user interfaces and automate complex test procedures.

Advanced Technologies

\textit{Kurtosis Control for Better Real World Simulation} - The capability to specify kurtosis, the "peakedness" of a random signal, provides for better simulation of real world environments. Tailoring kurtosis is also important to accelerate fatigue tests.

\textit{Fatigue Monitor Protects Test Article & Shaker} - Offering an unprecedented level of protection, the Fatigue Monitor detects looseness or fatigue in the product, fixture or shaker system.

LASER\textsuperscript{USB}\textsuperscript{™} has a USB 2.0 interface for easy PC connectivity and its multiple DSP processors handle the control loop independent of the PC host.
Developed as an advanced solution for sound and vibration measurement, Brüel & Kjær’s PULSE™ is the analyzer platform of the future. With its vast range of software applications and hardware configurations, PULSE is today the most popular analyzer solution in the world with more than 10,000 systems delivered.
Data Acquisition
With the LAN-XI PULSE front-end your data acquisition is scalable from 2 channels to more than 1000 channels with an analysis measurement bandwidth of up to 100kHz. The LAN-XI PULSE front end supports one-cable operation where both synchronization (PTP), power (POE) and data transfer is achieved using standard ethernet cable. PULSE LAN-XI front ends can even synchronize with your existing PULSE IDAe front ends allowing modular expansion of existing systems.

Real-time
The real-time capability of PULSE means that there is the closest possible link between cause and effect. You see your analysis results instantaneously on-screen as they are measured, enabling you to validate your data immediately.

Multi-analysis
The multi-analysis side of PULSE means that you can perform FFT, 1/n-octave (CPB), order, and overall analyses simultaneously on the same or different channels/signals while displaying real-time results on screen and possibly storing the acquired time data.

Post Processing
With PULSE’s brand new range of post processing products, PULSE Reflex, you get a work-flow oriented post processing tool with integrated time data editing, strong post-processing analysis tools together with extremely flexible display function.

Reporting
PULSE Reflex with built-in support for Microsoft® Word, Microsoft® Excel® and Microsoft® PowerPoint® makes reporting easy whether it is for a meeting or a report.

Solid Foundation
PULSE’s flexibility, combined with industry-specific solutions, has made PULSE the best-selling analyzer platform in a wide range of industries, including:
• Automotive
• Electroacoustics and Telecommunications
• Aerospace and Defense
• Consumer Products

PULSE Reflex Modal Analysis guides you efficiently through measurement validation, parameter estimation setup, mode selection, analysis validation and reporting. Type 4524 a lightweight triaxial piezoelectric accelerometer, as seen left. Images left courtesy of CTag.
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 Service 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 Service 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.

Consider the benefits

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

LDS University is part of the Brüel & Kjær Knowledge Network.

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.