

■ Range of Power Amplifiers to suit old and new LDS shakers, as well as 3<sup>rd</sup> party shakers

**SPA-K and DPA-K Power Amplifiers**

- Scalable power in 8 kVA increments, allows future upgrade of shaker without replacing the amplifier
- Complete control of shaker system possible from control room using amplifier remote control and shaker control in *COMET<sub>USB</sub><sup>TM</sup>* or *LASER<sub>USB</sub><sup>TM</sup>*
- Energy efficient Class 'D' amplifier design (greater than 90 %) with additional Economy Running mode reduces system operating costs
- Space efficient design minimizes floor real estate
- Low Distortion, wide bandwidth (20 Hz to 3 kHz), and signal to noise ratio better than -3 dB
- Configurable interlocks provide multiple safety mechanisms
- Can be used as an alternative to 3<sup>rd</sup> party amplifiers

**PA Series Power Amplifiers**

- Compact (4U high, bench or 19" rack mounted), linear power amplifiers
- Available in 50 W, 150 W, 500 W and 1000 W units
- Total Harmonic distortion typically less than 0.5 %
- Signal to Noise Ratio greater than 75 dB

**POWER AMPLIFIERS**

**Power on Demand**

LDS' modular approach to power amplifier design delivers a cost effective and future-proofed solution for your vibration test capabilities. Extra power modules can be added into the SPA-K and DPA-K amplifiers in the event that you need a larger shaker or have a different test requirement in the future. It also minimises support costs as individual power modules can easily be replaced as required.

The whole test system can be controlled remotely, using an amplifier remote control unit for the SPA-K and DPA-K amplifiers, and the *COMET<sub>USB</sub><sup>TM</sup>* or *LASER<sub>USB</sub><sup>TM</sup>* controllers for the shaker. Extensive safety interlocks enable the system to be automatically and safely shut down in the event of a fault. The amplifiers are designed with both power

and space efficiency in mind. The compact designs maximize cabinet space yet deliver the power required with up to 90 % efficiency.

The PA series amplifiers provide the power to drive smaller shakers, with output power up to 1000 W. These amplifiers incorporate energy efficient designs in a compact format.

All amplifiers can also be used to control 3<sup>rd</sup> party shakers.



8 kVA modules in cabinet. This approach maximizes system availability and allows for future upgrades.



Shaker Model	SPA-K	DPA-K
Power Range	8-56 kVA in 8kVA increments	8-280 kVA in 8kVA increments
Total Harmonic Distortion	up to 0.4 %	up to 0.5 % at full load
Input Impedance	10 k ohm nominal	
Input Sensitivity	1 V rms input for 100 V rms output (Differential Input). Compatible with all standard controllers	
Signal to Noise Ratio (dB)	> 68	
Switching Frequency (Hz)	150,000	
Modulation Range (Hz)	DC - 10000	
Rated Output Voltage - Sine (V rms)	100	
Continuous Output Current (A rms)	80 A rms (Sine and Random) per 8kVA increment	
Transient Output Current (A)	240 A for 100 ms per 8kVA increment	
Full Power Bandwidth (Hz - kHz)	20 - 3000	
Protection	Integral protection to prevent the output devices working outside their specified limits	





### Amplifiers Overview

LDS' purpose designed *PA*, *HPA-K*, *SPA-K* and *DPA-K* ranges of power amplifiers are used to power our extensive range of shakers, along with the associated cooling systems and field power supplies.

The *PA*-series amplifiers and the *HPA-K* amplifiers are designed to power the small air-cooled shakers up to 5 kN. Their compact size makes them ideal for laboratory or modal test applications.

The *HPA-K*, *SPA-K* and *DPA-K* ranges use Class D amplifier designs for the optimum in power efficiency. The amplifiers are modular in design offering the benefits of scalability and redundancy. The amplifiers also control the safety of the system via an array of interlocks. If broken, these interlock circuits will safely shut the system down, protecting both personnel and the equipment under test.

The *SPA-K* and *DPA-K* amplifiers can also be controlled from the safety of a Control Room using the Remote Control options, either in hardware or software running on a conventional pc.

LDS amplifiers are also available to replace 3<sup>rd</sup> party amplifiers running 3<sup>rd</sup> party shakers, bringing all the benefits all these advantages to the broader Vibration Test market.



Advanced design switching power amplifier and field power supply.

### SPA-K

The *SPA-K* range of amplifiers delivers power from 8 kVA up to 50 kVA, and are used on the *V800* Series, *V8* and *V9* shakers.

The amplifier provides drive power for the shaker, as well as the power for the Field Power Supply (FPS), and the cooling unit for these shakers.

Power is delivered by individual 8 kVA modules connected in parallel to give scalability and resilience.

Using this modular approach, power will continue to be delivered to the shaker system in the event a module fails. The system will continue to operate at lower force output until the module can be replaced. Alternatively, additional modules can be fitted to provide redundancy, and allow continuous and uninterrupted shaker system performance at maximum force.

Electronically controlled equal current sharing minimises overloading and delivers maximum efficiency in random and shock conditions. Reliability and performance benefit further from the high 150 kHz switching frequency, economy field setting and low 0.15 % full field harmonic distortion.

### DPA-K

The *SPA-K* range of amplifiers delivers power from 70 kVA up to 280 kVA, and are used on the *V900* Series of LDS shakers.

The *DPA-K* amplifier uses similar power modules to those used in the *SPA-K* amplifiers, along with all the benefits of using a parallel architecture.

The amplifiers incorporate an extensive set of safety interlocks circuits, which will safely shut the system down in the event of any of them being activated.





### HPA-K

The *HPA-K* Amplifier is a dedicated 5 kVA unit optimised for use with the *V650* and *V780* air-cooled shakers to deliver greater force than if using the *PA1000* amplifier. This compact unit delivers the power for both the shaker and the field coils, as well as power for the cooling fans.

### PA Series

The *PA* Series of amplifiers ranges in power output from 25 W to 1000 W. These amplifiers offer a cost effective solution for permanent magnet and small electro-dynamic shakers used in a variety of tests. These amplifiers are also used extensively to power 3<sup>rd</sup> party shakers.



V830-SPA16K shaker system with an environmental chamber.

### Remote Control Capability

The Remote Control option allows complete control of the *SPA-K* or *DPA-K* amplifier from a remote location over 200 m away.

The *DPA-K* is controlled by a dedicated hardware unit mounted in a 19" rack. This unit (RCP9) offers all the controls available on the amplifier itself and can be located over 200 m away connected via a fibre-optic or copper cable.

The *SPA-K* is controlled using a software interface run on a conventional pc connected to the amplifier. The software allows the operator to see all the functions available on the amplifiers front panel on his VDU, and can be run in addition to the shaker control software such as *COMET<sub>USB</sub>* or *LASER<sub>USB</sub>*.

In all cases, a built-in safety feature shuts down the amplifier in the event that communication between the amplifier and Remote Panel is interrupted. The Emergency Stop switch remains active on both the local and remote panels during shaker operation.

### Replacement Amplifiers

LDS has a wealth of experience in designing power amplifiers to suit most shakers available or in operation today. These include requirements for specific tests which may not be possible with an off-the-shelf solution.

The *SPA-K* range of amplifiers has been designed to replace obsolete amplifiers previously supplied by LDS. The amplifiers can also be used to replace amplifiers supplied to drive 3<sup>rd</sup> party shakers. All requests will be reviewed by our in-house Special Projects team who will recommend the optimum solution to meet the customers requirements.

### Service and Support

Despite being a global company, LDS prides itself on its ability to provide support to our customers with the speed and care of a local company.

Our service to our customers extends well beyond the supply of vibration test and measurement equipment. We provide training and technical support at the customers site delivered by dedicated industry specialists. Combined with excellent system reliability and maintenance, we ensure you get the best possible return for your investment and trust in LDS.



## PA<sup>1</sup> Series Power Amplifier Characteristics

Amplifier Model	PA 25E	PA 100E	PA 500L	PA 1000L
Rated sinusoidal power output matched resistive load	48 W 5.3 Ω	147 W 2.9 Ω	500 W	1000 W
Maximum continuous sinusoidal VA output, 0.5 pf	48 VA	147 VA	700 VA	1400 VA
Frequency range at rated power	10 Hz-10 kHz	10 Hz-10 kHz	10 Hz-14 kHz	10 Hz-14 kHz
Total harmonic distortion at rated output 20 Hz - 10 Hz	Typ 0.3 %	Typ 0.5 %	Typ 0.2 %	Typ 0.2 %
Maximum output voltage	16 V rms	20 V rms	40 V rms	80 V rms
Maximum no load voltage	24 V rms	32 V rms	45 V rms	86 V rms
Voltage regulations	1 %	3 %	2 %	2 %
Output current at rated VA	2.7 A rms	7 A rms	18 A rms	18 A rms
Maximum output current	3 A rms	7 A rms	18 A rms	18 A rms
Random output	5.9 A pk	14 A pk	54 A pk	54 A pk
Overcurrent trip level	4.2 A rms	10 A rms	20 A rms	20 A rms
Input sensitivity for maximum output (400 Hz)	1.0 V rms	1.0 V rms	1.0 V rms	1.0 V rms
Signal to noise ratio	> 75 dB	> 75 dB	> 75 dB	> 80 dB
Amplifier efficiency	59 %	58 %	59 %	59 %
Protection	Fast acting current limit	Fast acting current limit	Output device protection	Output device protection

	HPA-K <sup>2</sup>	SPA-K <sup>3</sup> and DPA-K <sup>4</sup>
Power Range	5 kVA	8-56 kVA in 8 kVA increments (SPA-K) 70-280 kVA in 5 kVA increments (DPA-K)
Input Sensitivity	1 V rms for 100 V rms output (Differential Input)	1 V rms for 100 V rms output (Differential Input)
Rated Output Voltage	100 V rms (sine)	100 V rms (sine)
Input Impedance	10 k Ω nominal	10 k Ω nominal
Signal to Noise Ratio	> 68 dB	> 68 dB
Amplifier Efficiency	> 90 %	> 90 %
Module Frequency	93 %	93 %
Total Harmonic Distortion	Typ. 0.15 % when measured into resistive load	Typ. 0.15 % when measured into resistive load
Switching Frequency	150 kHz	150 kHz
Modulation Range	DC to 5000 Hz	DC to 10000 Hz
Continuous Output Current	50 A rms (sine and random)	80 A rms (sine and random) per 8 kVA increment
Transient Output Current	150 A for 100 ms	240 A for 100 ms per 8 kVA increment
Full Power Bandwidth		10 Hz to 5000 Hz

## Replacement Amplifiers

SPA-K amplifiers are available to replace discontinued LDS amplifiers used with the following LDS shakers.

These amplifiers are also available to replace 3<sup>rd</sup> party amplifiers running 3<sup>rd</sup> party shakers. These amplifiers can be used with the Software Remote Control option.

- 1 PA Series used with: V101/2, V201/3, V406/8, V450/1, V455/6, V550/1, V555/6, V650/1, V721/2 shakers.
- 2 HPA-K used with: V650 and V780 shakers.
- 3 SPA-K used with: V830, V850, V875, V8 and V9 shakers.
- 4 DPA-K used with: V964, V984, V994 shakers.

LDS Vibrator	Force (Sine)	Force (Random)	Power Output	Blower Size
V706 L	1000	974	16 K	0.37 kW (0.5 HP)
V710 L	720	567	8 K	0.75 kW (1.0 HP)
V712	700	517	8 K	0.55 kW (0.75 HP)
V714	700	517	8 K	0.55 kW (0.75 HP)
V716	650	410	8 K	0.55 kW (0.75 HP)
V721	922	495	8 K	0.37 kW (0.5 HP)
V724 MK1	1500	1623	16 K	0.75 kW (1.0 HP)
V724 MK2	1500	1623	16 K	0.75 kW (1.0 HP)
V725	1500	1263	16 K	0.75 kW (1.0 HP)
V726	1500	835	8 K	0.75 kW (1.0 HP)
V730-185	2000	1300	16 K	2.2 kW (3.0 HP)
V730-335	2000	2000	16 K	2.2 kW (3.0 HP)
V804	3000	2700	16 K	1.5 kW (2.0 HP)
V804 LS	3000	2700	16 K	1.5 kW (2.0 HP)
V805 HZ (Series)	2500	1149	8 K	1.5 kW (2.0 HP)
V805 LZ (Parallel)	3000	1549	16 K	1.5 kW (2.0 HP)
V806	3000	1900	8 K	1.5 kW (2.0 HP)
V810-240	4000	3000	24 K	3.0 kW (4.0 HP)
V810-440	4000	4000	24 K	3.0 kW (4.0 HP)

SPA 24K

LDS Vibrator	Force (Sine)	Force (Random)	Power Output	Blower Size
V824 MK1	6000	5400	32 K	4 kW (5.5 HP)
V824 MK2	6000	5400	32 K	4 kW (5.5 HP)
V824 LS MK2	6000	5656	32 K	4 kW (5.5 HP)
V825 L	6000	3685	32 K	4 kW (5.5 HP)
V826	6000	3331	16 K	4 kW (5.5 HP)
V826 LS	5400	3640	16 K	4 kW (5.5 HP)
V860 HD Low Z P	7500	5790	24 K	4 kW (5.5 HP)
V860 High Z Parallel	4500	3610	8 K	4 kW (5.5 HP)
V860 Low Z Parallel	6300	5389	16 K	4 kW (5.5 HP)
V860 Low Z Series	3300	2774	8 K	4 kW (5.5 HP)
V890	12000	12500	48 K	5.5 kW (7.5 HP)
V894	12000	12500	48 K	5.5 kW (7.5 HP)

SPA 56K

LDS Test and Measurement Ltd  
Jarman Way, Royston  
Herts, SG8 5BQ

Phone: +44 (0) 1763 255 255  
E-Mail: info-uk@lds.spx.com

[www.lds-group.com](http://www.lds-group.com)

LDS Test and Measurement LLC  
8551 Research Way, M/S 140  
Middleton, WI 53562 USA

Phone: +1 (608) 821-6600  
E-Mail: info-us@lds.spx.com

[www.bksv.com](http://www.bksv.com)

LDS Test and Measurement GmbH  
Carl-Zeiss-Ring 11-13  
D-85737 Ismaning

Phone: +49 (0) 89 92 33 33 0  
E-Mail: info-de@lds.spx.com

[www.lds.spx.com](http://www.lds.spx.com)

LDS Test and Measurement SARL  
9 Avenue du Canada - BP 221  
F-91942 Courtaboeuf CEDEX

Phone: +33 (0)164864545  
E-Mail: info-fr@lds.spx.com

[www.lds.spx.com](http://www.lds.spx.com)

LDS Test and Measurement  
Room 2912, Jing Guang Centre  
Beijing, China 100020

Phone: +86 10 6597 4006  
E-Mail: info-cn@lds.spx.com

[www.lds.spx.com](http://www.lds.spx.com)

Brüel & Kjær Sound & Vibration  
Measurement A/S  
Skodsborgvej 307,  
DK-2850 Nærum, Denmark

Phone: +45 4580 0500  
Fax: +45 4580 1405



Brüel & Kjær