



Advanced Test Equipment Corp.

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# AIR COOLED 'L' SERIES VIBRATION TESTING SYSTEMS

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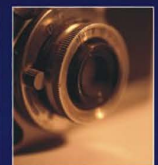
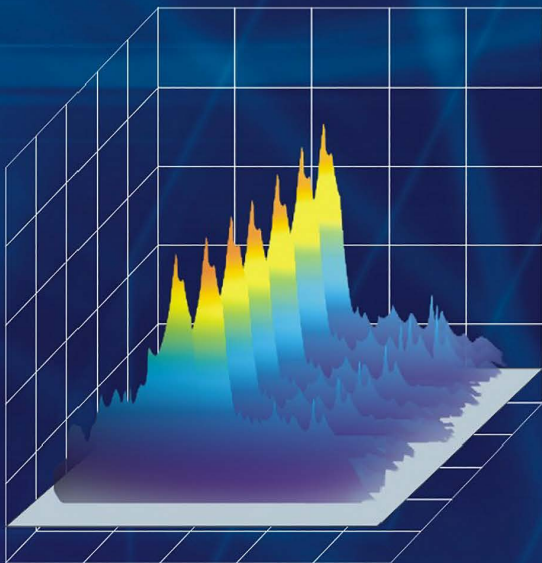
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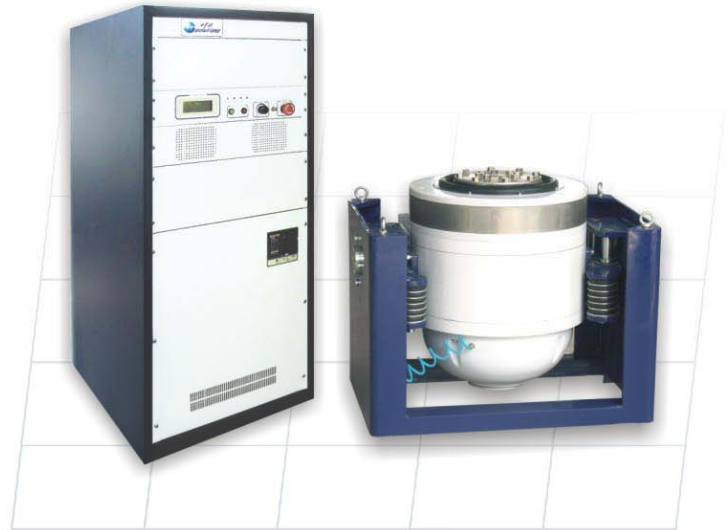
# Vibration Testing System — 'L' Series

Vibration system force rating from  
200 kgf to 600 kgf

## System Models:

MPA101/L215M  
MPA101/L315M  
MPA101/L323A  
MPA102/L620M

The 'L' Series vibration testing system is ideal for screening of small electronic assemblies, automotive components, handheld units, storage devices, connectors etc. Designed to meet military and international test standards including MIL, ASTM, IEC, ISO, BS, JIS etc. A large diameter armature with high cross axial stiffness will allow using a proportioned head expander to test multiple specimens simultaneously yet achieving good vibration transmissibility ratio. Other test requirements including transportation vibration simulation, combined vibration-climatic test and seismic simulations for small size components can easily be fulfilled by the 'L' Series. ETS Solutions 'L' Series is the low cost vibration product qualification and testing solution for small sized test specimens.



## Features

### The Performance

- ◎ Specimen payload up to 300 kg
- ◎ Excellent random performance meeting ISO standard with 3 sigma peak current rating
- ◎ Armature diameters range from 150mm to 230mm
- ◎ Up to 51 mm continuous displacement
- ◎ Test frequency up to 4,500 Hz

### The Shaker

- ◎ Rugged trunnion design with bearing guidance
- ◎ Air bag or elastomer isolator built-in reducing dynamic floor stress
- ◎ Dual layer reinforced armature for high acceleration performance
- ◎ Roller-truss flexure suspension system with high cross axial stiffness

### The Amplifier

- ◎ Integrated with high performance MPA100 series small sized amplifier
- ◎ Modular designed amplifier
- ◎ 12 kVA power module with two self-reliant compact 6kVA sub-modules
- ◎ High modulation switching frequency
- ◎ High signal to noise ratio
- ◎ Low total harmonic distortion
- ◎ Individual power module operation indication light

### The Accessories

- ◎ Air load support for armature centering
- ◎ Dynamic and static armature centering available
- ◎ Rotary worm-gear built-in for uni-base slip table
- ◎ Thermal barrier for combined climatic chamber test available
- ◎ Remote control capabilities available

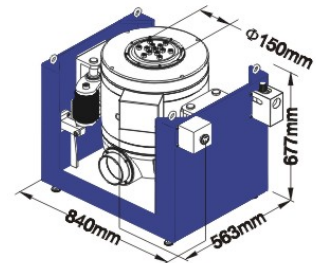
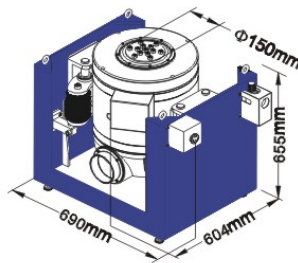
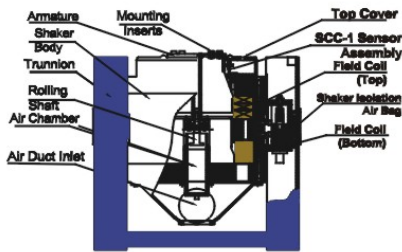
## Benefits

- ✓ Simple system operation
- ✓ State-of-the-art microprocessor logic control unit
- ✓ High energy conversion efficiency (greater than 90%)
- ✓ Reasonably priced optimal performance system for major test standards
- ✓ Compact shaker and amplifier size saving valuable floor space

- ✓ Shaker air cooled by rugged outdoor blower for continuous long period operation
- ✓ Air cooled amplifier power electronics for safe and reliable operation
- ✓ Designed to reduce reliance on mechanical switch gears with CPU logic controlled
- ✓ All-encompassing fuse protection designs for high current system components
- ✓ Detailed scope of system interlock protections
- ✓ Complies with USA, European and international safety and EMC regulations

- ✓ Compatible with any vibration controller
- ✓ Remote control panel available with full functional features
- ✓ Low profile body design ready for chamber integration
- ✓ Integration with unibase or standalone slip table

- ✓ Simple initial self system setup
- ✓ Interactive diagnostic "System Status" displayed on LCD
- ✓ Easy maintenance and rapid servicing
- ✓ Full three years warranty on armature and field coil
- ✓ Worldwide spare parts support



**Metric**

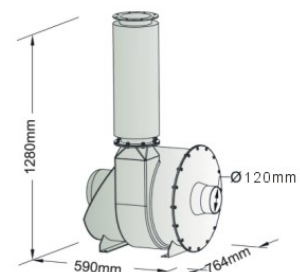
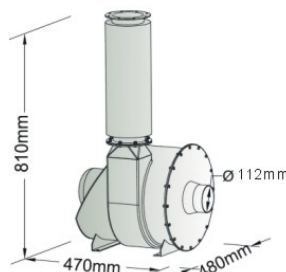
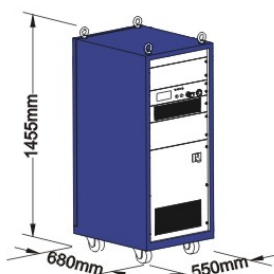
**Metric**

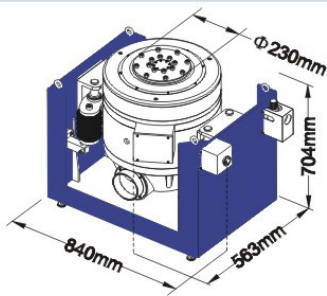
System Model	MPA 101/L215M	MPA 101/L315M
Sine Force	200 kgf	300 kgf
Random Force	200 kgf	300 kgf
Shock Force (6 ms)	400 kgf	600 kgf
Usable Frequency Range	DC-4,500 Hz	DC-4,000 Hz
Continuous Displacement <sup>①</sup>	25.4 mm	25.4 mm
Shock Displacement	25.4 mm	25.4 mm
Max. Velocity (Sine)	2 m/s	2 m/s
Max. Acceleration (Sine)	981 m/s <sup>2</sup>	981 m/s <sup>2</sup>
Shaker Unit	L215M	L315M
Armature Diameter	150 mm	150 mm
Effective Moving Element Mass	2 kg	2.5 kg
Load Attachment Points	12 stainless steel inserts	12 stainless steel inserts
Inserts Size (Standard)	M8	M8
Grid Pattern (Diameter, Circle)	6 on 60 mm $\phi$ ; 6 on 120 mm $\phi$	6 on 60 mm $\phi$ ; 6 on 120 mm $\phi$
Nominal, Bare Table <sup>②</sup>	3,100 Hz	2,900 Hz
Max. Static Payload	70 kg	120 kg
Natural Frequency-Thrust Axis	<5 Hz	<5 Hz
Stray Flux Density <sup>③</sup>	Less than 10 gauss	Less than 10 gauss
Dimension(Uncrated)(L x W x H)	690x604x655 mm	840x563x677 mm
Shaker Weight (Uncrated)	440 kg	490 kg
Amplifier Unit	MPA101	MPA101
Amplifier Output	2 kVA	3 kVA
Total Harmonic Distortion (At Rated Output)	From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 4,500 Hz less than 1.0%	
Signal-Noise-Ratio	More than 65 dB at 100 V rms output, 10 K $\Omega$ input termination with rated resistive load	
DC Stability	Less than 0.05% of full output voltage with 10% change in line voltage	
Input Drive	1.5 V rms into 10 K $\Omega$ for full output (120 V rms)	
Amplifier Frequency response <sup>④</sup>	From DC(0.1 Hz) to 4,500 Hz: $\pm 3$ dB; From 10 Hz to 3,000 Hz: $\pm 1$ dB	
Switching Frequency	112 kHz	112 kHz
Max. Output Voltage	120 V rms	120 V rms
Max. Output Current Per Module (Continuous)	50 A rms	50 A rms
Max. Output Current Per Module (Transient)	150 A rms	150 A rms
Amplifier Efficiency	> 90%	> 90%
Dimension(Uncrated)(L x W x H)	550x680 x 1455 mm	550x680 x 1455 mm
Amplifier Weight (Uncrated)	230 kg	230 kg
Blower Unit	HP-1	HP-1
Power Requirement	0.75 kW	0.75 kW
Air Flow	0.12 m <sup>3</sup> /s	0.13 m <sup>3</sup> /s
Air Pressure	0.011 kgf/cm <sup>2</sup>	0.012 kgf/cm <sup>2</sup>
Dimension(Uncrated)(L x W x H)	470x480 x 810 mm	470x480 x 810 mm
Weight (Uncrated)	36 kg	36 kg

**MPA100 Series**

**HP-1**

**HP-2**





**Metric**

**MPA 101/L323A**

300 kgf  
300 kgf  
600 kgf  
DC-3,000 Hz  
40 mm  
40 mm  
2 m/s  
392.4 m/s<sup>2</sup>

**L323A**

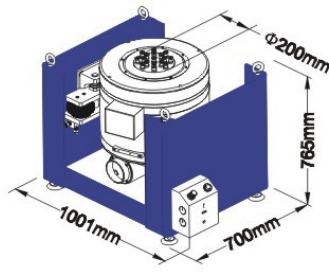
230 mm  
7 kg  
16 stainless steel inserts  
M8  
8 on 100 mm  $\phi$ ; 8 on 200 mm  $\phi$   
3,000 Hz  
120 kg  
<5 Hz  
Less than 10 gauss  
840x563x704 mm  
490 kg

**MPA 101**

3 kVA  
From DC (0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 4,500 Hz less than 1.0%  
More than 65 dB at 100 V rms output, 10 K  $\Omega$  input termination with rated resistive load  
Less than 0.05% of full output voltage with 10% change in line voltage  
1.5 V rms into 10 K  $\Omega$  for full output (120 V rms)  
From DC (0.1 Hz) to 4,500 Hz:  $\pm 3$  dB; From 10 Hz to 3,000 Hz:  $\pm 1$  dB  
112 kHz  
120 V rms  
50 A rms  
150 A rms  
> 90%  
550x680 x 1455 mm  
230 kg

**HP-1**

0.75 kW  
0.15 m<sup>3</sup>/s  
0.014 kgf/cm<sup>2</sup>  
470x480 x 810 mm  
36 kg



**Metric**

**MPA 102/L620M**

600 kgf  
600 kgf  
1,200 kgf  
DC-3,500 Hz  
51 mm  
51 mm  
2 m/s  
981 m/s<sup>2</sup>

**L620M**

200 mm  
6 kg  
16 stainless steel inserts  
M8  
8 on 100 mm  $\phi$  8 on 160 mm  $\phi$   
3,300 Hz  
300 kg  
<5 Hz  
Less than 10 gauss  
1001x700x765 mm  
730 kg

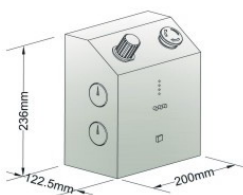
**MPA 102**

6 kVA  
From DC (0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 4,500 Hz less than 1.0%  
More than 65 dB at 100 V rms output, 10 K  $\Omega$  input termination with rated resistive load  
Less than 0.05% of full output voltage with 10% change in line voltage  
1.5 V rms into 10 K  $\Omega$  for full output (120 V rms)  
From DC (0.1 Hz) to 4,500 Hz:  $\pm 3$  dB; From 10 Hz to 3,000 Hz:  $\pm 1$  dB  
112 kHz  
120 V rms  
50 A rms  
150 A rms  
> 90%  
550x680 x 1455 mm  
290 kg

**HP-2**

4 kW  
0.22 m<sup>3</sup>/s  
0.046 kgf/cm<sup>2</sup>  
590x764 x 1280 mm  
153 kg

**Servo Control Console (SCC-1 Unit)**



**Remote Control Panel (RCP)**



**Basic Guide on Choosing Shaker**

**Guide 1 - Determine Required Shaker Force Rating**

Using the fundamental formula ( $F = MA$ ), to determine the required shaker force rating. Below is a more detailed illustration.

$F = (M_a + M_f + M_s) * A$

Where:

- F = Shaker required Rated Force (N)
- M<sub>a</sub> = Armature Effective Mass
- M<sub>f</sub> = Fixture's mass
- M<sub>s</sub> = Test Specimen Mass
- A = Acceleration

**Guide 2 - Calculating Displacement and Velocity Factor**

Below is an illustration on the fundamental sinusoidal vibration relationship between acceleration, velocity, displacement and frequency.

$V = \pi f D$

$G = 0.0511 f^2 D$

$G = 0.0163 V f$

	SI Units	Gravitational Units	Imperial Units
Force (F)	N	kgf	lbf
Mass	kg	kg	lbs
Acceleration (A)	m/s <sup>2</sup>	G	G
Frequency (f)	Hz	Hz	Hz
Displacement (D)	mm (pk - pk)	mm (pk - pk)	in (pk - pk)

**Useful Conversion Factor**

Force	1 kgf = 9.807N	1 kgf = 2.2 lbf
Mass	1 kg = 2.2 lbs	
Acceleration	1 G = 9.807 m/s <sup>2</sup>	
Length	1 inch = 25.4 mm	
Velocity	1 m/s = 39.37 in/s	

**Remarks**

- ① Test payload should be less than 10% of shaker weight.
- ② Natural frequency at  $\pm 5\%$  tolerance.
- ③ Measured at 152 mm above armature table. Contact us for lower gauss level requirement.
- ④ Sine mode, resistive load.
- ⑤ Optional Remote Control Panel.
- ⑥ Amplifier power rating includes the field supplies and blower motor.

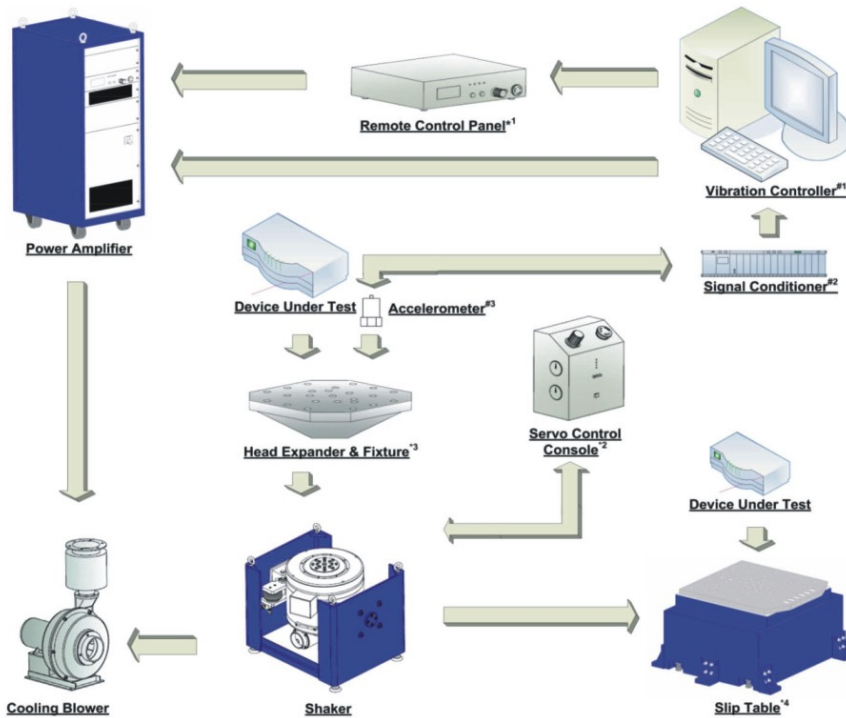
# Vibration Testing and Why?

The use of vibration in Environmental Stress Screening (ESS) has expanded from the past in purely military applications until today commonly applied in the commercial sector. The use of ESS becomes a standard customer-defined requirement in the aerospace and defence-related products to ensure safe operation of critical equipment. Commercial product manufacturers today typically have full ESS programs in place with vibration test or combined with thermal cycling. The ESS programs are designed to comply with military and other international standards such as MIL, ASTM, IEC, ISO, BS etc.

The use of vibration in ESS has been proven to be a way to increase product reliability. It is also a tool to assist engineer in the product development process. Simulating the environment condition on the developing product will allow the design engineers to classify and analyse screening data to identify problem areas and recommend early corrective action.

Vibration testing as a part of ESS ensures the occurrence of failures in the product infantile period is precipitated "artificially". These failures then occur before the units leave the manufacturing facility, dramatically improving field reliability. The optimal screening will maintain field failure cost savings.

## Vibration Testing System Setup



### Prerequisite System Components

- #1 Vibration controller required for test profiling control. ETS shakers are compatible with all major vibration controllers.
- #2 Signal conditioner required to provide current source for accelerometer or function as a charge amplifier.
- #3 Accelerometer built-in amplifier type or charge-type for signal feedback to vibration controller or data acquisition.

ETS is able to provide a complete system package with a suitable controller of your choice. Please contact ETS for a quote.

### Shaker Accessories Units

- \*1 Optional Remote Control Panel with full logic module replication function at remote site of up to 500 m.
- \*2 Servo Control Console for static and dynamic and armature auto-centering.  
(Optional for L215M, L315M, L323M and L620M shaker system)
- \*3 Customised head expanders and fixtures. Contact ETS for more information.
- \*4 Different sizes of slip table available for horizontal testing. Contact ETS for more information.

# Operating Environmental Data

Operating Environment	MPA101/L215M	MPA101/L315M	MPA101/L323A	MPA102/L620M
Max. Heat Rejection to Air(Shaker)(kW)	0.21	0.27	0.27	0.54
Max. Heat Rejection to Air(Amplifier)(kW)	0.3	0.45	0.45	0.85
Max. Heat Rejection to Air(Blower )(kW)	0.64	0.64	0.64	3.4
Working Ambient Temperature (°C)*	5~35	5~35	5~35	5~35
Working Ambient Pressure (mPa)	0.1	0.1	0.1	0.1
Relative Humidity (Non Condensing)	≤80%	≤80%	≤80%	≤80%
Max. Acoustic Noise(dB)	92	92	92	92
Temperature Range of Air Flow at Shaker Inlet(°C)	0~35	0~35	0~35	0~35
Air Line Supply Required (Compressed Air Supply) (bar)	6	6	6	6
Input Voltage (Standard)	380 VAC, 50 Hz, 3 Phase			
Power Requirements(kW)	6	7.5	7.5	10.5

\*Full power to 35°C, derate at 5% per °C to 50°C.

# System Options

System Options	MPA101/L215M	MPA101/L315M	MPA101/L323A	MPA102/L620M
<b>Table Inserts</b>				
M8	■	■	■	■
M10	—	—	—	□
1/2"UNC	—	—	—	□
3/8"UNC	□	□	□	□
<b>Internal Load Support</b>	■	■	■	■
Thermal Barrier	□	□	□	□
Unibase Slip Table	□	□	□	□
Air Caster	□	□	□	□
Degauss Coil	—	—	—	—
Air Compensator	□	□	□	□
Air Isolated Trunnion	■	■	■	■
Geared Aided Rotation (Ratchet Crank)	□	□	□	□
Servo Control Console(SCC-1 Unit)	□	□	□	□
Auxiliary Interlock Unit (AIU)	□	□	□	□
Remote Control Panel (RCP)	□	□	□	□

■ Standard    □ Optional    — Not Available

Specifications are correct at the time of publication. In keeping with our commitment to continuous product improvement, the information herein is subject to change. ETS reserves the rights to amend specifications without prior notice.



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