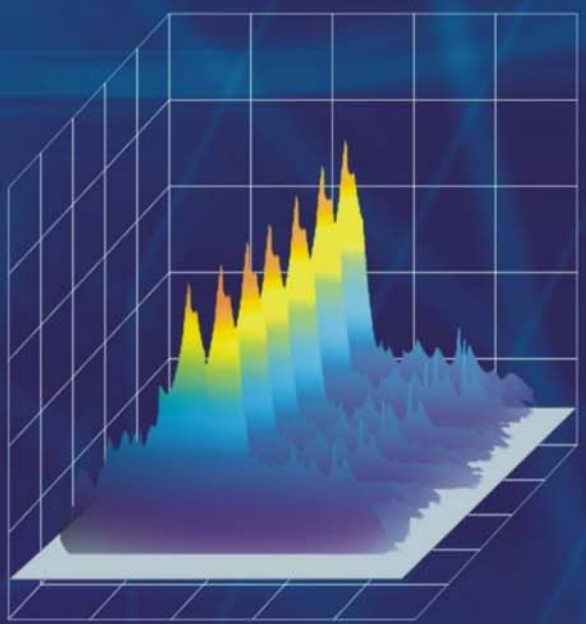
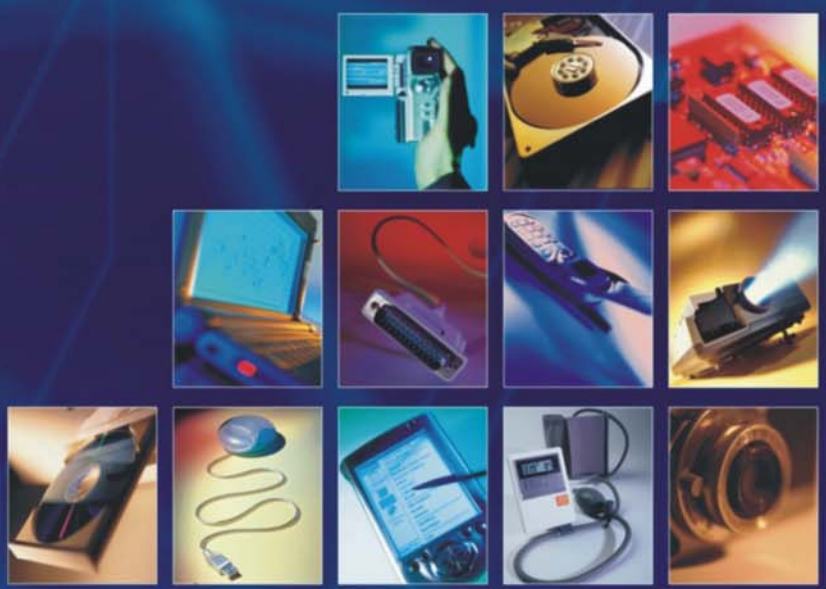
# AIR COOLED 'L' SERIES VIBRATION TESTING SYSTEMS

- Classical Shock
- Random Test
- Sine-on-Random
- Swept Sine
- Sine and Random on Random
- Step Sine
- Sine Resonance Phase Track & Dwell
- Random-on-Random
- Shock Response Spectra
- Road Simulation





- Shaker Systems
- Power Amplifier
- Vertical Guidance System
- Guided Oil Film Slip Tables
- Hydrostatic Bearing Slip Tables
- Load Bearing Platform
- Head Expanders
- Customized Fixtures
- Combined Vibration - Climatic System
- Vibration Control System

ets solutions

ADVANCING TECHNOLOGY IN DYNAMIC TESTING

## 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 (℃)* | 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(℃) | 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℃, derate at 5% per ℃ to 50℃.

## System Options

| System Options | MPA101/L215M | MPA101/L315M | MPA101/L323A | MPA102/L620M |
|---|---|---|---|---|
| Table Inserts | | | | |
| M8 | ■ | ■ | ■ | ■ |
| M10 | — | — | — | □ |
| 1/2"UNC | — | — | — | □ |
| 3/8"UNC | □ | □ | □ | □ |
| Internal Load Support | ■ | ■ | ■ | ■ |
| 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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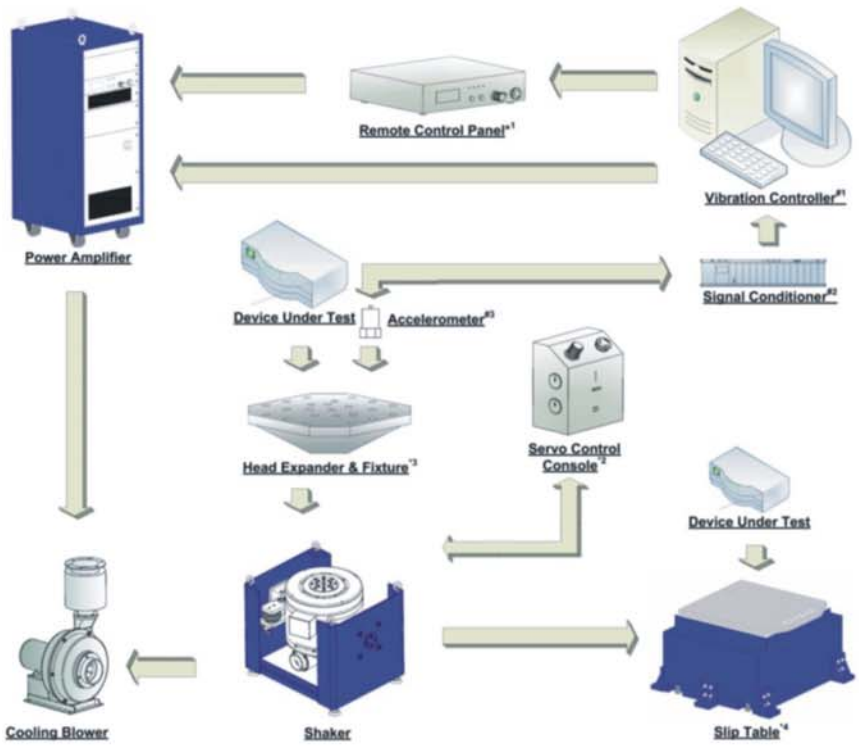
# Vibration Test and Why?

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 L215 M, L315 M and L323 HM 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.

# Vibration Testing System — 'L' Series

Vibration system force rating from
200 kgf (440 lbf) to 600 kgf (1,320 lbf)

### 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 transmissibilityratio.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(660 lbs)
- Excellent random performance meeting ISO standard with 3 sigma peak current rating
- Armature diameters range from 150mm to 230mm( 5.9 inch to 9.1 inch)
- Up to 51 mm (2 inch) 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

### Operational Reliability & Safety

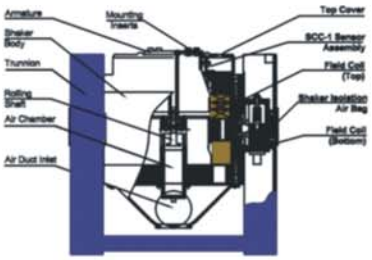
- ✓ Simple system operation
- ✓ State-of-the-art microprocessor logic control unit
- ✓ High energy conversion efficiency (greater than 90%)
- ✓ Reasonably priced optimal performance system for major test standards
- ✓ Compact shaker and amplifier size saving valuable floor space
- ✓ Shaker air cooled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

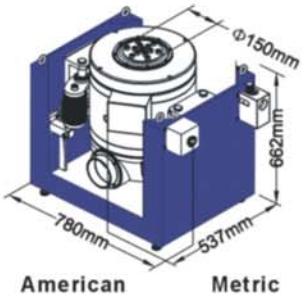
### Compatiblilty

- ✓ 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

### Serviceability

- ✓ 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

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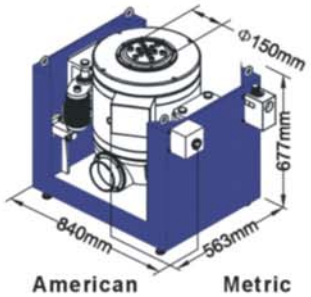



American Metric

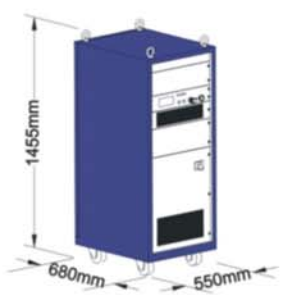
| System Model | MPA101/L215M | | MPA101/L315M | |
|---|---|---|---|---|
| Sine Force | 440 lbf | 200 kgf | 660 lbf | 300 kgf |
| Random Force | 440 lbf | 200 kgf | 660 lbf | 300 kgf |
| Shock Force (6 ms) | 880 lbf | 400 kgf | 1,320 lbf | 600 kgf |
| Usable Frequency Range | DC-4,500 Hz | DC-4,500 Hz | DC-4,000 Hz | DC-4,000 Hz |
| Continuous Displacementc① | 1 inch | 25.4 mm | 1 inch | 25.4 mm |
| Shock Displacement | 1 inch | 25.4 mm | 1 inch | 25.4 mm |
| Max. Velocity (Sine) | 78.7 in/s | 2 m/s | 78.7 in/s | 2 m/s |
| Max. Acceleration (Sine) | 100 g | 981 $m/s^2$ | 100 g | 981 $m/s^2$ |

| Shaker Unit | L215M | | L315M | |
|---|---|---|---|---|
| Armature Diameter | 5.9 inch | 150 mm | 5.9 inch | 150 mm |
| Effective Moving Element Mass | 4.4 lbs | 2 kg | 5.5 lbs | 2.5 kg |
| Load Attachment Points | 12 stainless steel inserts | | 12 stainless steel inserts | |
| Inserts Size (Standard) | M8 | M8 | M8 | M8 |
| Grid Pattern (Diameter, Circle) | 6 on 60 mm Φ; 6 on 120 mm Φ | | 6 on 60 mm Φ; 6 on 120 mm Φ | |
| Nominal, Bare Table ② | 3,100 Hz | 3,100 Hz | 2,900 Hz | 2,900 Hz |
| Max. Static Payload | 154 lbs | 70 kg | 264 lbs | 120 kg |
| Natural Frequency-Thrust Axis | <5 Hz | <5 Hz | <5 Hz | <5 Hz |
| Stray Flux Density ③ | Less than 10 gauss | Less than 10 gauss | Less than 10 gauss | Less than 10 gauss |
| Dimension(Uncrated)( L x W x H) | 30.7x21.1x26.1 inch | 780x537x662 mm | 33.1x22.2x26.7 inch | 840x563x677 mm |
| Shaker Weight (Uncrated) | 968 lbs | 440 kg | 1,078 lbs | 490 kg |

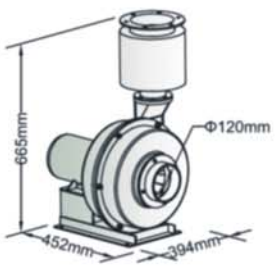
| Amplifier Unit | MPA101 | | MPA101 | |
|---|---|---|---|---|
| Amplifier Output | 2 kVA | 2 kVA | 3 kVA | 3 kVA |
| Total Harmonic Distortion (At Rated Output) | From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 5,000 Hz less than 1.0% | | | |
| Signal-Noise-Ratio | More than 65 dB at 100 V rms output, 10 KΩ 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 Ohms for full output (120 V rms) | | | |
| Amplifier Frequency response ④ | From DC(0.1 Hz) to 4,500 Hz: ±3 dB; From 10 Hz to 3,000 Hz:±1 dB | | | |
| Switching Frequency | 112 kHz | 112 kHz | 112 kHz | 112 kHz |
| Max. Output Voltage | 120 V rms | 120 V rms | 120 V rms | 120 V rms |
| Max. Output Current Per Module (Continuous ) | 50 A rms | 50 A rms | 50 A rms | 50 A rms |
| Max. Output Current Per Module (Transient) | 150 A rms | 150 A rms | 150 A rms | 150 A rms |
| Amplifier Efficiency | > 90% | > 90% | > 90% | > 90% |
| Dimension(Uncrated)( L x W x H) | 21.7x26.8x57.3 inch | 550x680 x1455 mm | 21.7x26.8x57.3 inch | 550x680 x1455 mm |
| Amplifier Weight (Uncrated) | 506 lbs | 230 kg | 506 lbs | 230 kg |

| Blower Unit | HP-1 | | HP-1 | |
|---|---|---|---|---|
| Power Requirement | 0.75 kW | 0.75 kW | 0.75 kW | 0.75 kW |
| Air Flow | 254.28 $ft^3/m$ | 0.12 $m^3/s$ | 275.46 $ft^3/m$ | 0.13 $m^3/s$ |
| Air Pressure | 0.156 PSI | 0.011 $kgf/cm^2$ | 0.17 PSI | 0.012 $kgf/cm^2$ |
| Dimension(Uncrated)( L x W x H) | 17.8x15.5x26.2 inch | 452x394x665 mm | 17.8x15.5x26.2 inch | 452x394x665 mm |
| Weight (Uncrated) | 79.2 lbs | 36 kg | 79.2 lbs | 36 kg |

**MPA100 Series**




**HP-1**

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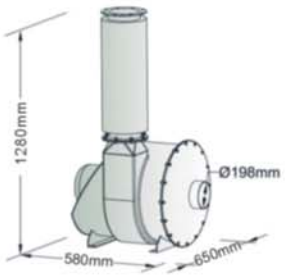

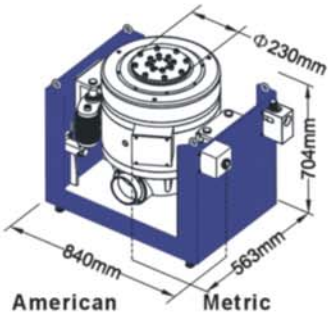


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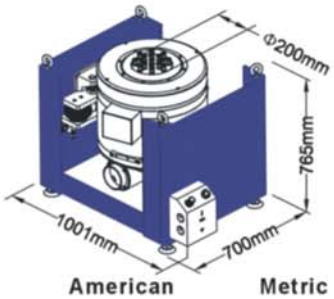



American Metric

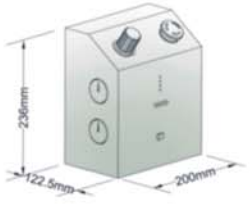
| MPA101/L323A | | MPA102/L620M | |
|---|---|---|---|
| 660 lbf | 300 kgf | 1,320 lbf | 600 kgf |
| 660 lbf | 300 kgf | 1,320 lbf | 600 kgf |
| 1,320 lbf | 600 kgf | 2,640 lbf | 1,200 kgf |
| DC-3,000 Hz | DC-3,000 Hz | DC-3,500 Hz | DC-3,500 Hz |
| 1.57 inch | 40 mm | 2 inch | 51 mm |
| 1.57 inch | 40 mm | 2 inch | 51 mm |
| 78.7 in/s | 2 m/s | 78.7 in/s | 2 m/s |
| 40 g | 392.4 $m/s^2$ | 100 g | 981 $m/s^2$ |

| L323A | | L620M | |
|---|---|---|---|
| 9.1 inch | 230 mm | 7.9 inch | 200 mm |
| 15.4 lbs | 7 kg | 13.2 lbs | 6 kg |
| 16 stainless steel inserts | | 16 stainless steel inserts | |
| M8 | M8 | M8 | M8 |
| 8 on 100 mm Φ;8 on 200 mm Φ | | 8 on 100 mm Φ8 on 160 mm Φ | |
| 3,000 Hz | 3,000 Hz | 3,300 Hz | 3,300 Hz |
| 264 lbs | 120 kg | 660 lbs | 300 kg |
| <5 Hz | <5 Hz | <5 Hz | <5 Hz |
| Less than 10 gauss | Less than 10 gauss | Less than 10 gauss | Less than 10 gauss |
| 33.1x22.2x27.7 inch | 840x563x704 mm | 39.4x27.6x30.1 inch | 1001x700x765 mm |
| 1,078 lbs | 490 kg | 1,606 lbs | 730 kg |

| MPA101 | | MPA102 | |
|---|---|---|---|
| 3 kVA | 3 kVA | 6 kVA | 6 kVA |
| From DC(0.1 Hz) to 500 Hz less than 0.5%; From 500 Hz to 5,000 Hz less than 1.0% | | | |
| More than 65 dB at 100 V rms output, 10 KΩ 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 Ohms for full output (120 V rms) | | | |
| From DC(0.1 Hz) to 4,500 Hz: ±3 dB; From 10 Hz to 3,000 Hz:±1 dB | | | |
| 112 kHz | 112 kHz | 112 kHz | 112 kHz |
| 120 V rms | 120 V rms | 120 V rms | 120 V rms |
| 50 A rms | 50 A rms | 50 A rms | 50 A rms |
| 150 A rms | 150 A rms | 150 A rms | 150 A rms |
| > 90% | > 90% | > 90% | > 90% |
| 21.7x26.8x57.3 inch | 550x680 x1455 mm | 21.7x26.8x57.3 inch | 550x680x1455 mm |
| 506 lbs | 230 kg | 638 lbs | 290 kg |

| HP-1 | | HP-2 | |
|---|---|---|---|
| 0.75 kW | 0.75 kW | 4 kW | 4 kW |
| 381.41 $ft^3/m$ | 0.15 $m^3/s$ | 466.17 $ft^3/m$ | 0.22 $m^3/s$ |
| 0.199 PSI | 0.014 $kgf/cm^2$ | 0.653 PSI | 0.046 $kgf/cm^2$ |
| 17.8x15.5x26.2 inch | 452x394x665 mm | 22.8x25.6x50.4 inch | 580x650 x1280 mm |
| 79.2 lbs | 36 kg | 330 lbs | 150 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.

$F = (Ma + Mf + Ms) * A$

Where:

F = Shaker required Rated Force (N)

Ma = Armature Effective Mass

Mf = Fixtures mass

Ms = 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.

| | SI Units | Gravitational Units | Imperial Units |
|---|---|---|---|
| Force (F) | N | kgf | lbf |
| Mass | kg | kg | lbs |
| Acceleration (A) | $m/s^2$ | 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 $m/s^2$ |
| 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 ± 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.