Sdyn

REDEFINING
ENDURANCE TESTING

SARASWATI DYNAMICS

Saraswati Dynamics Private Limited (Sdyn) is the pioneer and market leader of Environmental Testing in India. We manufacture the complete range of Electrodynamic Vibration Systems and Environmental Chambers to meet the testing requirements of industries across the globe. The company has its headquarters and R&D facility in Roorkee, Uttarakhand, India. In the era of technical advancement, our company has realised its design, translating into products at par with any equipment of its kind, worldwide. Our products enable our clients to create real life environments to test and validate the quality and reliability of their products.

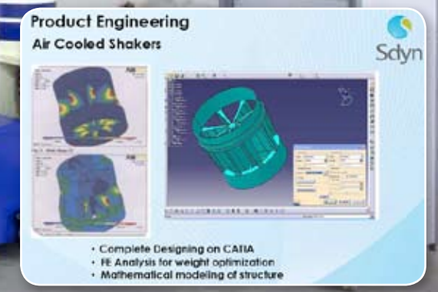
We have more than 650 installations globally. Our offices are located in all major metropolitan cities in India that include Delhi NCR, Bangalore, Chennai, Pune, and Hyderabad. Our distributor network is established throughout the world in both developed and developing economies.

Sdyn is recognised for its products, un-matched services and application support, making us a true value-for-money brand.

contents

infrastructure

- Manufacturing facility over area of 300000 square feet.
- National award for R&D in electronics from Ministry of Science and Technology
- National award for R&D in mechanical engineering from Ministry of Defense
- Product designed as per global standards
- Design documentation as per ISO norms
- 100 % CNC machined parts
- Manufacturing of electronic assemblies in air conditioned and antistatic environment to avoid any dust particle.
- Inventory of more than 5000 critical parts
- ERP for back traceability of parts for failure analysis.



THE VIBRATION TECHNOLOGY

Knowhow and Benefits

An Introduction

In the long chain of product manufacturing, the end-customer expects and demands the product to be of high quality and reliability. To fulfill this expectation, the manufacturer must consider the effect of vibrations on the product, since at some time in its life the product will be subjected to vibrations. Poor mechanical design will result in mechanical failure – and customer dissatisfaction. This will not only reduce the credibility of the company but also add extra costs to the company in the form of damage control.

All these ultimately contribute to profits

Requirements of a vibration test

- A vibration test system
- The test specification, and
- The product to be tested with its fixture

Vibration Test System

The sub assemblies of a vibration test system are:

- Shaker (referred as Vibrator or Exciter also)
- Amplifier
- Controller
- Accelerometer
- Attachments as needed

Vibration Test Specification World over there are hundreds of Vibration Test Specifications. It is important to ensure that the chosen test is correct for the product and will test the product satisfactorily.

Why is vibration testing necessary?

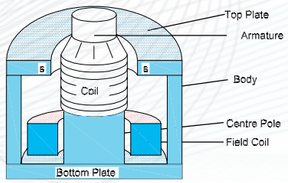
- Ensures a reliable product
- Reduces new product development time
- Ensures that the designed product is fit for designated use
- Reduces rework of on-line rejections
- Reduces damages during transit
- Reduces non-performance rejection during warranty
- Ensures good reputation for the company and its products

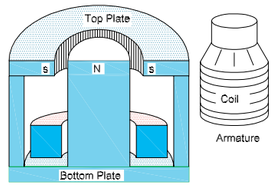
Product Testing

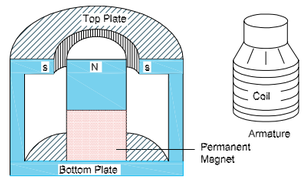
The test product must be fixed to the vibration table using a fixture/jig.

The fixture must transfer the vibrations from the table to the test item without adversely affecting the test.Time considerations must be given to the fixture design.

Vibrations that are transferred to the test item must be measured and controlled. The measurement is usually done using one or more accelerometers, but where and how the accelerometers are to be placed is a critical requirement and must form part of a control strategy.







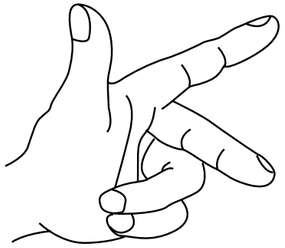
The working of a Shaker

In principle, the electrodynamic shaker operates like a loudspeaker where the movement of the coil (armature) is produced by electrical current when induced in a magnetic field generated by the static coil.

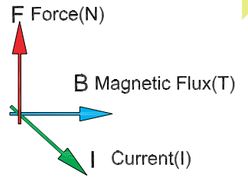
The static magnetic field is produced by a permanent magnet in very small shakers and by an electromagnet in larger shakers. The force that the coil (armature) can produce is proportional to the current flowing into it. To calculate the force produced, following formula is used:- F = BIL where;

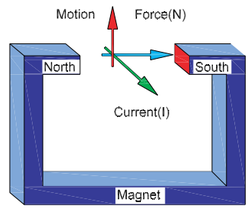
- F = force [Newton]
- B = magnetic flux density [Tesla]
- I = current [Ampere]
- L = length [Metre]

Optimising Design Performance The introducing of vibrations will help locate inherent weaknesses in the design of a product. Design defects can be cured before causing failures in the field and at the same time, areas of over-design can be eliminated thereby reducing the cost



Fleming's left hand rule





The Benefits of Vibration Testing Incorporating vibration testing during the development of your products will ensure;

- Fast launch of New products
- Optimisation of Product design
- Customers confidence in your products using routine vibration testing in both product design and production will provide you insight to;
- Reduce manufacturing costs
- Reduce variances in manufacturing
- Maintain consistency in quality standards
- Reduce warranty costs
- Reduce after-sales service costs
- Ensure products survive the effects of transportation

SYSTEM SELECTION NOTES

The system ratings are prepared as per the directions of ISO document 5344.

The following information assists in selecting a suitable configuration for your intended application.

To frame out ratings of a vibration system based upon test application calls for extensive calculations and analysis as all parameters are interlinked closely with specimen mass, dimension, frequency range and test axes playing a vital role. The selection of a suitable Vibration Test System is the most important aspect of application engineering. An electrodynamic shaker system consists of various sub- systems that perform independent functions but affect the overall performance of the system.

- Selecting A Vibration System System force requirement is estimated using the following formula:

Force (F) = Mass (m) × Acceleration (a)
where:
Force (F) is in Kgf.
Mass (m) is the total mass i.e. armature mass+mass of test specimen+ fixture mass+ payload support mass.

Acceleration (a) is the peak value in 'g' (acceleration due to gravity) which is equal to 9.80665 m/s.2

In the real world, vibration is a noise with infinite degree of freedom, but in a laboratory, this noise has to be made meaningful. We therefore break down vibration to Acceleration (m/s^2), Velocity (m/s) and Displacement (mpp) at a single or multiple Frequency (Hz). From these values we recreate the vibration in a controlled manner while monitoring the response of the Unit under Test (UUT).

For given Frequency and Acceleration, Velocity is derived by $v = \frac{g \times 9810}{2 \times p \times f}$

For given Frequency and Acceleration, Displacement is derived by $d = \frac{g \times 9810}{2 \times p^2 \times f^2}$

For given Frequency and Velocity, Acceleration is derived by $g = \frac{2 \times \pi \times f \times v}{9810}$

For given Frequency and Velocity, Displacement is derived by $d = \frac{v}{\pi \times f}$

For given Frequency and Displacement, Acceleration is derived by $g = \frac{2 \times p^2 \times f^2 \times d}{9810}$

For given Frequency and Displacement, Velocity is derived by $v = p \times f \times d$

Shaker-Amplifier	Armature		Rated Force						
Model	Diameter	Weight	Sine		Random				Payload Capacity
	(mm)	(Kg)	Kgf	L b f	Kgf	L b f	'g'	(p-p)mm	(Kg)
SEV 125 / DSA 1K	125	2	100	220	70	154	50	20	12
SEV 125 / DSA 1.5K	125	2	150	330	105	230	75	20	12
SEV 140 / DSA 2K	140	3.5	200	440	140	310	60	25	20
SEV 140 / DSA 3K	140	3.5	300	660	210	462	85	25	20
SEV 180 / DSA 4K	180	8	400	880	280	650	50	38	150
SEV 180 / DSA 6K	180	8	600	1320	420	925	75	38	150
SEV 240 / DSA 10K	240	13	1000	2200	1000	2200	75	38	240
SEV 240 / DSA 15K	240	17	1500	3300	1500	3300	90	38	260
SEV 300 / DSA 24K	300	25	2000	4400	2000	4400	80	51	350
SEV 300 / DSA 32K	300	25	2500	5500	2500	5500	100	51	350
SEV 360 / DSA 36K	360	35	3000	6600	3000	6600	85	51	350
SEV 360 / DSA 45K	360	35	3500	7700	3500	7700	100	51	350
SEV 440 / DSA 48K	440	50	4000	8800	4000	8800	80	51	550
SEV 440 / DSA 56K	440	50	4900	10800	4900	10800	95	51	550
SEV 440 / DSA 60K	440	50	5000	11000	5000	11000	100	51	550
SEV 440 / DSA 80K	440	60	6000	13200	6000	13200	100	51	550
SEW 500 / DSA 120K	500	82	7000	15400	7000	15400	85	38	800
SEW 500 / DSA 160K	500	100	10000	22000	10000	22000	100	38	1000
SEW 590 / DSA 200K	590	160	13000	28600	13000	28600	85	38	2000
SEW 590 / DSA 240K	590	160	16000	35200	16000	35200	100	38	2000
SEW 760 / DSA 260K	760	280	20000	44000	20000	44000	75	38	5000
SEW 760 / DSA 280K	760	280	25000	55000	20000	44000	75	38	5000
SEW 760 / DSA 320K	760	280	30000	66000	20000	44000	75	38	5000

* 51mm displacement for transient Shock operation.
Air blower is supplied with the air cooled shaker and heat exchanger with the water cooled shaker for heat extraction.
Microcontroller based logic unit is integral part of amplifier having feather touch control panel and alphanumeric display.
Head Expander, Vertical guided platform and Combo base Horizontal Slip Table of standard & customised sizes can be referred from the factory. Formal quote supersedes printed specifications.

In the real world, vibration is a noise with infinite degree of freedom, but in a laboratory, this noise has to be made meaningful

Electrodynamic Shaker

An Electrodynamic Shaker converts electrical energy from the Power Amplifier to mechanical vibrations using the principles of electromagnetism as described by Fleming's Left Hand Rule.

Power Amplifier
A Power Amplifier multiplies the output of the Vibration Controller by a fixed gain with great efficiency and feeds it to the Electrodynamic Shaker.

Vibration Controller
A Vibration Controller allows a user to create a test profile on a PC and generates a signal in real time to match the test profile. A sensor on the Electrodynamic Shaker provides negative feedback to keep the system in closed loop control.

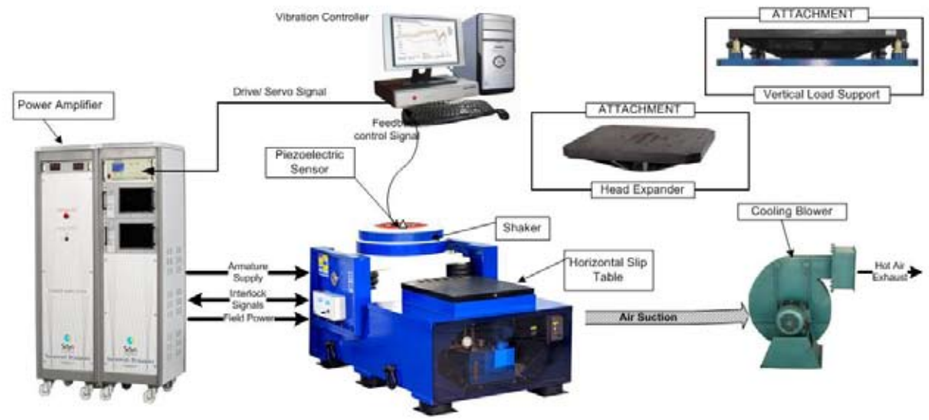
Horizontal Slip Table
A Horizontal Slip Table is a frictionless platform used for vibration testing in X and Y axis.

Head Expander
A Head Expander is bolted to the Armature head for increasing the platform size in Z axis only.

Vertical Load Support
A Vertical Load Support is bolted to the Armature head and supported by the shaker body for increasing the platform size in Z axis only.

Fixture
A Fixture is used to firmly hold the Unit Under Test (UUT) and provide proper mounting to the Armature or Attachment being used.

Schematic Diagram of Vibration Test System



Electrodynamic **Shaker**

Sdyn's SEV and SEW series of Electrodynamic Shaker produces vibration based on the principle of magnetism. The SEV series is air cooled and SEW series is water cooled, respectively. The product portfolio covers all ranges of shaker, from 100 kgf up to **30000 kgf and beyond.**

An Electrodynamic Shaker has two separate coils, one is stationary and the other is dynamic. A stationary magnetic field is produced from the stationary or field coil inside the shaker body and a dynamic magnetic field is produced from the dynamic or armature coil winded on the armature. Interaction

of these two magnetic fields causes the freely suspended armature to move. This principle of magnetism is based on Fleming's Left Hand Rule.

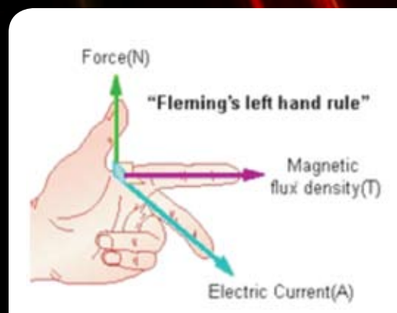
Major Sub Systems of the Electrodynamic Shaker are:

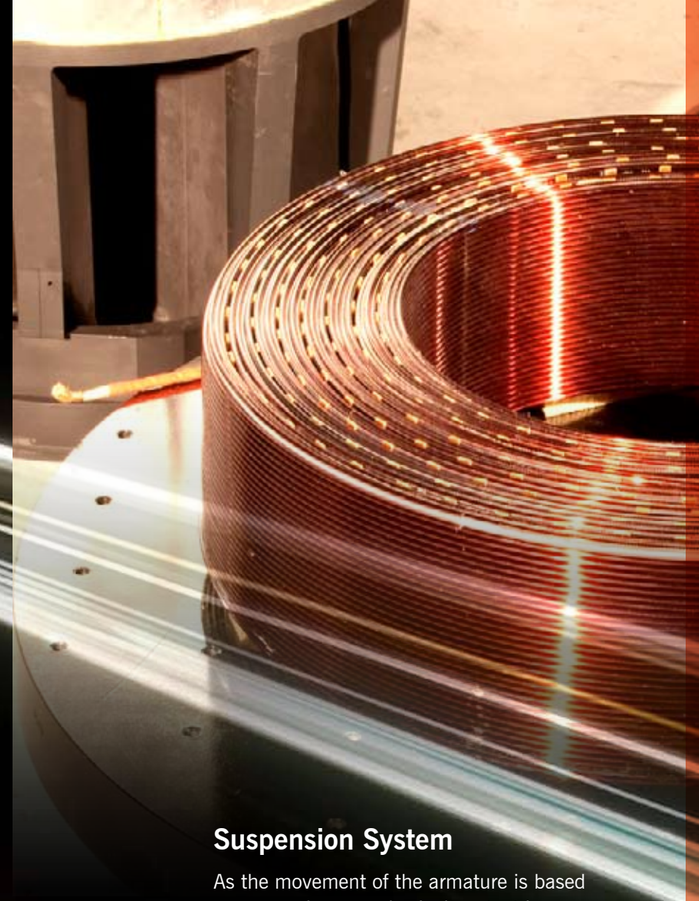
Armature Structure

Constructed from magnesium alloy, an armature is the heart of any Electrodynamic Vibration System. Our armature features a web structure to minimise weight, while maintaining structural integrity. The pattern can only be casted, therefore, in order to achieve the best quality, we import these castings from one of the world's most renowned sources. Complete tooling, milling, drilling, and tapping of these castings is performed in our in-house CNC centre located in Noida, India.

The winding process is carried out at our headquarters in Roorkee, India. Industrial grade epoxy is used to ensure that the coils adhere to each other as well as the magnesium structure. Air cooled systems use a solid copper conductor for superior conductivity and water cooled systems use hollow aluminium conductor for weight reduction.

For an air cooled system, power is transferred to the armature coil using highly flexible copper ropes. For a water cooled system, power and water are transferred on the same line using highly flexible copper ropes and hose pipes, respectively. Only oxygen free copper is used to ensure long life of the conductor and the rope.





Suspension System

As the movement of the armature is based on magnetism, no physical contact is established with the shaker body. The armature is freely suspended in the air and without any suspension or auto centring system, it will sit at the bottom of the shaker. To achieve full displacement of the shaker, its armature should be centred. At Sdyn, we have multiple designs to centre the armature based on customer specifications and test requirements.

Our low displacement system (less than or equal to 2 inch / 51 mm) features a rolling strut design which offers mechanical stiffness to keep the armature centred. Our high displacement system (more than 2 inch / 51 mm) feature a rocker design which offers no mechanical stiffness and the armature is centred via DC from the amplifier. Both the designs use an air bellow at the bottom of the shaker to assist in the centring process.

Field Structure

Housed inside the shaker's body, field coils are always stationary and produce a constant magnetic field. Sdyn's proprietary design uses two field coils with two copper rings between them. Location of the copper rings falls directly in the front and at the back of the armature coil with minimal space between the rings and the armature for smooth operation. As the field is powered with DC supply and the armature with AC supply, interaction of flux of these coils causes the movement of the armature. The copper rings are used to reduce the effect of induction caused by the AC supply to the armature coil.

The field coil is the primary source of heating inside the shaker as it is powered with a constant DC supply regardless of the test profile. The coils itself are made of copper for every system to reduce conductor losses. In an air cooled system, these coils are cooled by forced air which flows through the air gaps between each winding of both the coils. In a water cooled system, these coils are cooled by water flowing through each winding of both the coils. To ensure proper cooling of the field coils in a water cooled system, both the field coils are built by stacking multiple disks of thin coils. These discs are connected in parallel for cooling and in series for transfer of electricity.

ELECTRODYNAMIC SHAKER

Major **Constituent Isolation** System

Our shakers are capable of producing vibrations over a wide range of frequencies at high g levels. These vibrations are produced on the armature head from where they are transmitted to various attachments and fixtures depending on the test. However undesirable it may be, a certain part of these vibrations are also transferred into the body of the shaker. It is necessary to isolate the vibration in the body of the shaker from its base. This is achieved with a complex array of air bellows and spring, placed between the shaker and its base.

As an option for a customer requiring further isolation, air bellows can be attached to the bottom of the base or the combo base in case of a system with a Horizontal Slip Table.

Cooling System

It is not possible to run a shaker reliably without proper cooling because the extensive heat produced inside the shaker can damage the armature coil. Small shakers (50kgf and below) generally feature a permanent magnet instead of a field coil, therefore, they can operate without any cooling at light loads. A similar feature can also be offered with bigger systems to meet certain test requirements like Squeak and Rattle test being performed on an air cooled shaker.

A shaker can either be air cooled or water cooled. Each method has its own key features, advantages, and disadvantages. Selecting a cooling method that meets customer's test requirement is crucial. Both these methods are discussed below:

Air Cooling

An air cooled shaker features a centrifugal blower for forced air cooling. A hose pipe connects the bottom of the shaker to the blower which sucks air from a perforated sheet at the top of the shaker. It is very important to ensure that the blower is not located in close vicinity of the shaker because this might cause the exhaust air from the blower to be sucked back by the shaker. In this scenario, the shaker's temperature will keep increasing as it is being cooled by the same air in a loop, causing thermal runaway and even burning of the armature coil. To ensure safety and proper operation of the cooling system, various sensors are installed in the shaker that are mentioned below:

- Air Pressure Sensor - To ensure sufficient air pressure for proper suction
- Air Temperature Sensor - To stop the system if the air temperature is too high to ensure proper cooling

Due to suction, audible noise is always present near the shaker and the blower. It is suggested to take measures during installation to prevent this audible noise from creating an un-conducive working environment for the test/ lab personnel.

To effectively reduce it, the most effective way is to install the blower system outside the lab and route a flexible hose from the shaker. This can be done by puncturing a hole in the separation wall of the lab to the blower installed outside. A typical sketch is shown in the (**figure 1**).

If the placement of blower outside fails in some path way where the acoustic noise would still disturb the surroundings then a soundproof booth can be made for the blower as shown in the (**figure 2**).

Excitation noise of the shaker becomes dominant when testing at higher frequencies, sometimes exceeding 10 0db at higher acceleration levels. Encapsulating the shaker and the blower both in a sound booth is an effective remedy if higher frequency testing are regular and the work place is small as shown in the (**figure 3**).

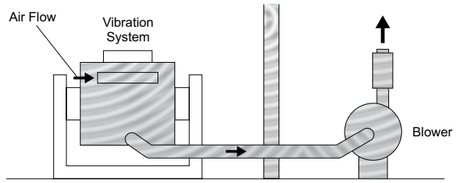
If there is place available to keep the blower outside but excitation noise is dominant (high frequency testing), then a sound booth can be erected just around the blower for effective reduction of noise as shown in the (**figure 4**).

Water Cooling

A water cooled shaker features a dedicated cooling system for storing, circulating, and cooling distilled water that is used for cooling. The system is assembled in two 19-inch racks of 42 unit height. Pressure pump is installed in the cooling rack to circulate distilled water at high pressure through the shaker's field and armature coils. Heat exchanger is installed in the cooling rack to cool this distilled water with another supply of water from a cooling tower or chiller at the customer's site. To ensure safety and proper operation of the cooling system, various sensors are installed in the cooling racks that are mentioned below:

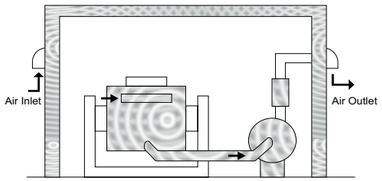
- Liquid Pressure Sensor - To measure the water pressure in the pipes in order to detect any obstruction in the pipeline
- Liquid Flow Sensor - To measure the water flow in the pipes in order to detect any leakages in the pipeline
- Liquid Temperature Sensor - To measure the temperature of the incoming and outgoing water in order to detect overheating

Figure1



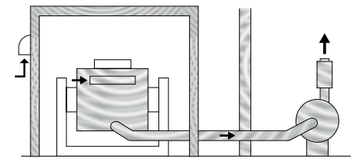
Installing the blower outside

Figure 2



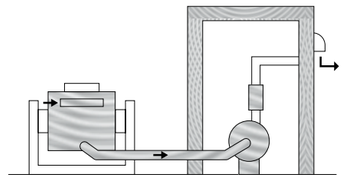
Sound Booth: For both Vibration system and blower

Figure 3



Sound Booth: Only for Vibration system

Figure 4



Sound Booth: Only for blower

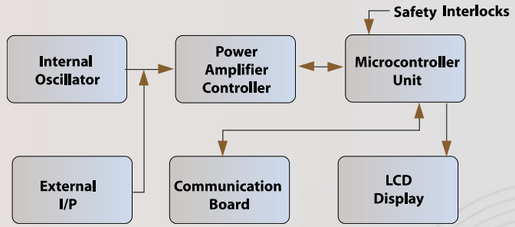
NEW GENERATION POWER AMPLIFIERS

Technological Highlights of The Switching Amplifiers

DSA Series of solid state digitally modulated power Amplifiers utilize pulse width modulation technique. Modular amplifiers convert the mains input to a variable frequency adjustable power for delivery to inductive loads with extremely high (>90%) conversion efficiency to drive the Shaker. Amplifiers modules are integral fan cooled and designed for continuous duty to drive corresponding shaker with the help of associated instrumentation.

DSA amplifiers are compatible to drive electrodynamic shakers of any make worldwide and are designedto provide continuous duty RMS rated voltage and current to any type of load.

Power modules of the switching amplifier are constructed using HEXFET assemblies for low conduction losses, high voltage & current capability to enhance the package density.e reduces with additional length.



New generation hi-rating Power Modules inducted into the latest series of DSA amplifiers have an inbuilt PWM management and generation. These modules are stacked in any master/any slave configuration for their parallel operation in the amplifier. Paralleled modules are synchronized through buffered clock and the 3-sigma design ensures peak current capability for continuous Random operation.

Further to the advancement in design, the latest feature of remotely operating the vibration system from a distance is introduced named as Remote Link.

Major Sub Systems of Digital Switching Amplifier

- Digital Logic Unit
- HVDC section
- Safety Interlocks
- Power Modules

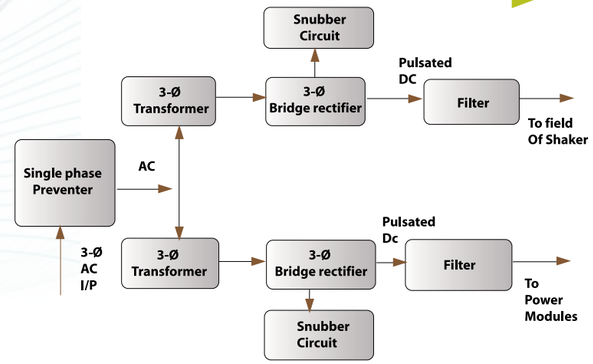
Digital Logic Unit

Micro-controller based logic unit monitors and controls the system features and safety interlocks. The logic unit acts as an user friendly interface between user and the equipment.

System parameters and Trip interlocks are displayed on the alphanumeric display of feather touch membrane keyboard front panel. Soft start and controlled shut down is offered with an online key on the front panel. Logic Unit can be operated both in manual and auto mode.

HVDC Section

The switching amplifier runs on wide acceptable range of input 3- phase mains line voltage and does not require any special operating environment or support equipment

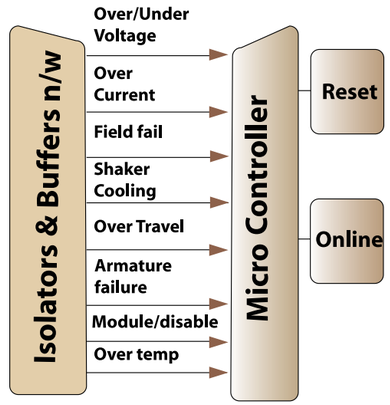


Step-down 3-phase AC output of highly efficient vacuum impregnated transformer is rectified using three phase bridge rectifiers. Rectifiers are planner chips passivated with good heat sinking capability and occupy less space.

Bank of high voltage capacitors are used to suppress transients, minimize mains ripple and noise. The high voltage DC is supplied to field coil and power modules thru isolated bus bars. Low ESR capacitors are capable of sustaining extreme temperature and provide ripple free Power Source.

Different protection circuits are coupled at various stages of the DC supply for synchronization of power amplifier and shaker as shown in fig.

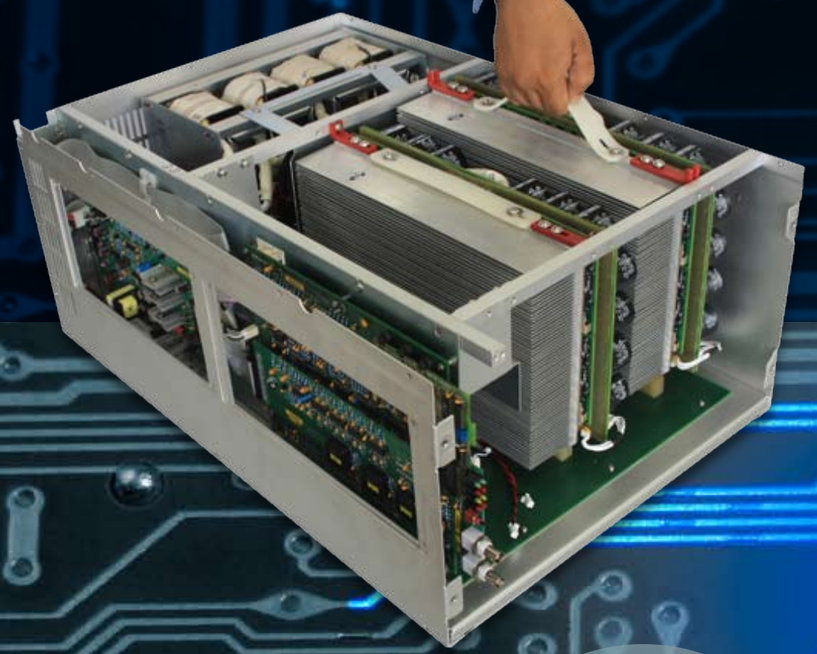
2. Single Phase Preventor is used at the 3-phase input, which senses for any phase loss or any unbalance in 3-phase line voltage through phase synchronization relay and displays the desired indication for Phase status.

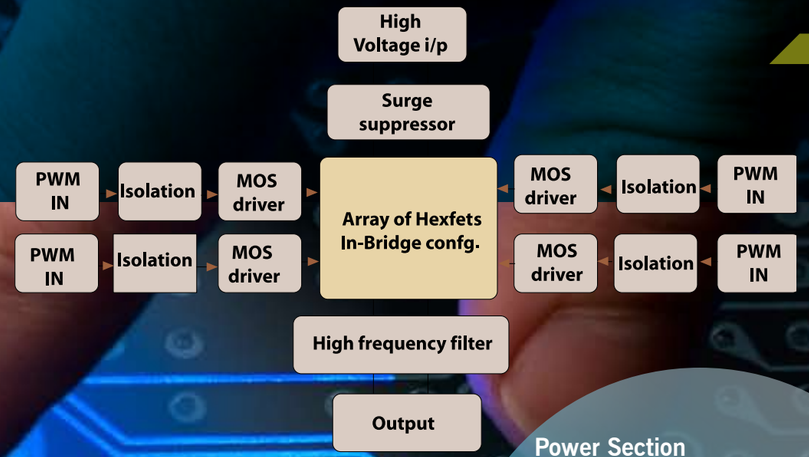


Safety Interlocks

Shaker and amplifier safety interlocks are monitored and indicated on the front panel through a micro-controller chip. Interlock signals are routed through matching isolators and buffer network for proper latching to prevent false triggering. The feather touch amplifier front panel has provision for gain control and programming the set output current. The signals are latched on to the fault analysis section of intelligent micro- controller. Once the fault is set right,system gets ready for operation. Major system interlocks associated with DSA series of amplifier and the condition leading to interlocks are:

POWER MODULES





Over Current
The armature load current exceeds the amplifier rated current.

Field Failure
No current flows through field coil of shaker. It is sensed through non- contact type current sensor.

Over travel shaker
The shaker travel exceeds the specified displacement which is sensed through a opto switch.

Cooling Shaker
The blower of the shaker is in off condition.

Over Temperature PA
The temperature of power devices mounted on the heat sink and inductor filters is sensed by high-grade thermistors mounted at Automatic thermal shutdown takes place in case the temperature goes beyond set value.

Power Module
The schematic is as shown in fig. 4. The explaination 2of major blocks is as follows -

Driver Section
Driver section of the Power module provides the necessary gate pulse to switch the power HEXFETs ON/OFF and contains a high-speed isolator with high peak current capability and is shielded from external noise. The final stage of driver has a MOS circuit in push - pull configuration for fast charging and discharging of gate capacitances of the power devices at high frequency

Power Section
Power section is a high frequency pulse width modulated power converter. The hybrid power devices are connected in full bridge common heat sink. The integral cooling fans ensure safe thermal operation.

Each half of the bridge switches at modulated frequency such that the duty cycle varies at input signal rate, each side is driven out of phase so that an amplified PWM signal appears across the bridge output.

Feedback system
Voltage feedback from the output terminal of power section (within the output filter) to the PWM controller makes a flat response power amplifier. The loop incorporates DC and high frequency derivative feedback. An integrator in the loop provides linear gain and low harmonic distortion.

Overall current of the power module is sensed by a non-contacting sensor which is used for the purpose of tripping and current sharing.

High frequency filter Sufficient attenuation to high frequency is done by L-C filters to get a pure amplified output. The major part is a combination of inductor and low ESR high frequency capacitors. The final stage of filter section contains capacitor network for minimizing any noise and electromagnetic interference

REMOTE **OPERATION** OF VIBRATION SYSTEM

Remote Link Module developed for high-end applications offers an optional 485 communication interface which facilitates remote operation of the complete vibration system.

Remote Module is based on microcontroller chip-board driven by a software command, communicating identical functionality of Amplifier's control- panel to a remotely located PC for a distance upto one kilometer. Simulated on the PC monitor, it becomes the control centre for Amplifier gain and makes the complete vibration system On- line, providing signal commands for auxiliary systems like field & cooling for their on / off in a sequential manner.

Salient features

System Controls
- Shaker field
- Shaker cooling
- Reset
- On-line
- Amplifier Gain

System Parameters
- Output voltage
- Output current
- Amplifier temperature
- Shaker temperature
- Pre-defined Gain

Safety Interlocks
- Amplifier's
- Shakers's

Redefining Endurance testing

SEV
125&140
SERIES

SEV
180&240
SERIES

SEV
300&360
SERIES

SEV
440
SERIES

SEV
500&590
SERIES

AUTOMOTIVE, AGRICULTURE
TRANSPORTATION & RAILWAYS
AERONAUTICS, ASTRONAUTICS &
DEFENCE CONSUMER ELECTRONICS
INSTRUMENTATIONS
ELECTRICAL EQUIPMENT
GENERAL USAGE

electrical equipment

In the long chain of product manufacturing, the end-customer expects and demands the product to be of high quality and reliability. To fulfill this expectation, the manufacturer must consider the effect of vibrations on the product, since at some time in its life the product will be subjected to vibrations. Poor mechanical design will result in mechanical failure – and customer dissatisfaction. This will not only reduce the credibility of the company but also add extra costs to the company in the form of damage control.

- Overhead Transmission Line Dampers, Energy Meters, HVDC Equipment, Isolators, Light Masts, Electronic Ballast, LED Luminaries,Contactors, Domestic Inverters, UPS, Voltage, Current Coils, Connection Leads

- Voltage and Current ransformers, Fuel Battery, Industrial Power Generators, Industrial Inverters, Large Lithium Battery, Solar Lights

- Power Generation System, Power Distribution System, Heavy Transformers

SEV 125 & 140 SERIES

System Description

The SEV 125 Series of shakers are matched with the DSA1K and DSA1.5K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch rack mountable bench/ table top cabinet.

The SEV 140 Series of Shakers are matched with the DSA 2K and DSA 3K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch network rack of 30 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Self-lubricating central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position

Optional Features

- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Customisation for operation in Damper Testing Application
- Customisation for operation in Rubber Testing Application

Technical Specifications

SEV Series Shaker, DSA Series Amplifier	SEV 125 – DSA 1K	SEV 125 – DSA 1.5K	SEV 140 – DSA 2K	SEV 140 – DSA 3K
System Performance				
Armature Diameter	125 mm	125 mm	140 mm	140 mm
Sine Force (peak)	100 kgf (220 lbf, 1 kN)	150 kgf (330 lbf, 1.5 kN)	200 kgf (440 lbf, 2 kN)	300 kgf (660 lbf, 3 kN)
Random Force (rms)	70 kgf (154 lbf, 0.7 kN)	105 kgf (230 lbf, 1 kN)	140 kgf (310 lbf, 1.4 kN)	210 kgf (462 lbf, 2 kN)
Acceleration (sine)	50 g	75 g	60 g	85 g
Velocity (sine peak)	1.2 m/sec	1.2 m/sec	1.4 m/sec	1.4 m/sec
Displacement (pk-pk)	20 mm (0.8 in)	20 mm (0.8 in)	25 mm (1.0 in)	25 mm (1.0 in)
Axial Resonance (±5%)	4200 Hz	4200 Hz	3600 Hz	3600 Hz
Useful Frequency Range	DC to 4500 Hz	DC to 4500 Hz	DC to 4000 Hz	DC to 4000 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer			
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA			
Shaker Characteristics				
Moving Element Mass	2 kg	2 kg	3.5 kg	3.5 kg
Internal Load Capability	12 kg	12 kg	20 kg	20 kg
Suspension Axial Stiffness	1.6 kg/mm	1.6 kg/mm	1.6 kg/mm	1.6 kg/mm
Suspension Cross-Axial Stiffness	230 kg/mm	230 kg/mm	230 kg/mm	230 kg/mm
Stray Magnetic Field*	< 3.0 mT (30 gauss)	< 3.0 mT (30 gauss)	< 3.0 mT (30 gauss)	< 3.0 mT (30 gauss)
Cooling Air Flow	300 cfm	300 cfm	400 cfm	400 cfm
Compressed Air**	Not Required	Not Required	Not Required	Not Required
Shaker Body Mass	400 kg	400 kg	600 kg	600 kg
Dimensions (L x W x H)	540 x 375 x 495 (mm)	540 x 375 x 495 (mm)	585 x 415 x 535 (mm)	585 x 415 x 535 (mm)
Amplifier Characteristics				
Power Output	1 kVA	1.5 kVA	2 kVA	3 kVA
Total Harmonic Distortion***	Typically 0.5%	Typically 0.5%	Typically 0.5%	Typically 0.5%
Input Impedance	> 10 kΩ	> 10 kΩ	> 10 kΩ	> 10 kΩ
Input Sensitivity	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers
Signal-to-Noise Ratio	> 70 dB	> 70 dB	> 70 dB	> 70 dB
Power Efficiency	> 90%	> 90%	> 90%	> 90%

Armature Insert Pattern	**SEV 125 Shaker**			**SEV 140 Shaker**		
Pattern	PCD	PCD	PCD	PCD	PCD	PCD
Position of Insert	Centre	64 mm	90 mm	Centre	70 mm	100 mm
No. of Inserts (Total – 9)	1	4	4	1	4	4

Safety Norms	
CE	Complies with 73/23/EEC Low Voltage Directive, 89/336/EEC Electromagnetic Compatibility Directive and 98/37/EC Machinery Directive

Notes:
*150 mm above armature head
**Compressed air to be provided by customer at installation site
***Measured on pure resistive load
Customised specifications are also tailored on request
Please contact Sdyn for advice on the optimum specifications to meet your testing requirements
Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

consumer electronics

- Electronic Games (Video), Laptops, Tablets, Optical Disc Players, Scanners, Wireless Keyboards, Set Top Box, Electronic Clocks, LED/LCD TV, Digital Cameras, Video Recorders, Watches, Computer Mouse

- Plasma TV, Microwave Owen, Printers, Plotters, VDU, General Purpose Motor, In Rack Equipment, PC, Printed Circuit Board, Audio Amplifiers, Automatic Data Processing Machines

- Servo Stabiliser, Refrigerator, Industrial Washer, Industrial Electronics

SEV **180** & **240** Series

System Description

The SEV 300 Series of Shakers are matched with the DSA 24K and DSA 32K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch network rack of 36 unit height.

The SEV 360 Series of Shakers are matched with the DSA 36K and DSA 45K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch network rack of 36 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Imported magnesium alloy armature structure
- Imported hose pipe of extended temperature range
- Self-lubricating central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position
- Pneumatic based auto-centring of armature head
- Body isolation using air bellows to isolate vibrations from the shaker
- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Integration with Environmental Chamber
- Lowering of gauss level at the armature head
- Long stroke with displacement up to 76 mm (3 inch)

Technical Specifications

SEV Series Shaker, DSA Series Amplifier	SEV 180 – DSA 4K	SEV 180 – DSA 6K	SEV 240 – DSA 10K	SEV 240 – DSA 15K
System Performance				
Armature Diameter	180 mm	180 mm	240 mm	240 mm
Sine Force (peak)	400 kgf (880 lbf, 4 kN)	600 kgf (1320 lbf, 6 kN)	1000 kgf (2200 lbf, 10 kN)	1500 kgf (3300 lbf, 15 kN)
Random Force (rms)	280 kgf (650 lbf, 2.8 kN)	420 kgf (925 lbf, 4.2 kN)	1000 kgf (2200 lbf, 10 kN)	1500 kgf (3300 lbf, 15 kN)
Shock Force (rms)	800 kgf (1760 lbf, 8 kN)	1200 kgf (2640 lbf, 12 kN)	2000 kgf (4400 lbf, 20 kN)	3000 kgf (6600 lbf, 30 kN)
Acceleration (sine)	50 g	75 g	75 g	90 g
Velocity (sine peak)	1.6 m/sec	1.6 m/sec	1.7 m/sec	1.7 m/sec
Displacement (pk-pk)	38 mm (1.5 in)**	38 mm (1.5 in)	38 mm (1.5 in)	38 mm (1.5 in)
Axial Resonance (±5%)	3200 Hz	3200 Hz	2800 Hz	2800 Hz
Useful Frequency Range	DC to 3500 Hz	DC to 3500 Hz	DC to 3200 Hz	DC to 3200 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer			
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA			
Shaker Characteristics				
Moving Element Mass	8 kg	8 kg	13 kg	17 kg
Internal Load Capability	150 kg	150 kg	240 kg	260 kg
Suspension Axial Stiffness	3.2 kg/mm	3.2 kg/mm	5 kg/mm	5 kg/mm
Suspension Cross-Axial Stiffness	250 kg/mm	250 kg/mm	300 kg/mm	300 kg/mm
Stray Magnetic Field*	< 2.0 mT (20 gauss)	< 2.0 mT (20 gauss)	< 1.5 mT (15 gauss)	< 1.5 mT (15 gauss)
Cooling Air Flow	700 cfm	700 cfm	1200 cfm	1200 cfm
Compressed Air***	4 bar (58 psi)	4 bar (58 psi)	6 bar (87 psi)	6 bar (87 psi)
Shaker Body Mass	850 kg	850 kg	1500 kg	1500 kg
Dimensions (L x W x H)	725 x 500 x 795 (mm)	725 x 500 x 795 (mm)	1000 x 660 x 880 (mm)	1000 x 660 x 880 (mm)
Amplifier Characteristics				
Power Output	4 kVA	6 kVA	10 kVA	15 kVA
Total Harmonic Distortion****	Typically 0.5%	Typically 0.5%	Typically 0.5%	Typically 0.5%
Input Impedance	> 10 kΩ	> 10 kΩ	> 10 kΩ	> 10 kΩ
Input Sensitivity	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers
Signal-to-Noise Ratio	> 70 dB	> 70 dB	> 70 dB	> 70 dB
Power Efficiency	> 90%	> 90%	> 90%	> 90%

Armature Insert Pattern	**SEV 180 Shaker**			**SEV 240 Shaker**			
Pattern	PCD	PCD	PCD	PCD	PCD	PCD	
Position of Insert	Centre	100 mm	141.4 mm	Centre	141.4 mm	200 mm	
No. of Inserts (Total – 9)	1	4	4	1	4	4	

Safety Norms	
CE	Complies with 73/23/EEC Low Voltage Directive, 89/336/EEC Electromagnetic Compatibility Directive and 98/37/EC Machinery Directive

Notes:
*51 mm displacement on request
**150 mm above armature head
***Compressed air to be provided by customer at installation site
****Measured on pure resistive load Customised specifications are also tailored on request
Please contact Sdyn for advice on the optimum specifications to meet your testing requirements
Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

transportation

- Rolling Stock Equipment, Road Shipping Goods, Rail Coach Lights
- Rail Vehicle Equipment, Naval Shipping Container, Railway Braking System
- Packing Cases, Heavy Vehicle Radiator, Railway Refrigeration System

SEV 300 & 360 SERIES

System Description

The SEV 300 Series of Shakers are matched with the DSA 24K and DSA 32K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch network rack of 36 unit height.

The SEV 360 Series of Shakers are matched with the DSA 36K and DSA 45K Series of Power Amplifiers. Its armature and field supplies are assembled in one 19-inch network rack of 36 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Imported magnesium alloy armature structure
- Imported hose pipe of extended temperature range
- Self-lubricating central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position
- Pneumatic based auto-centring of armature head
- Body isolation using air bellows to isolate vibrations from the shaker

Optional Features

- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Integration with Environmental Chamber
- Lowering of gauss level at the armature head
- Long stroke with displacement up to 76 mm (3 inch)

SEV Series Shaker, DSA Series Amplifier	SEV 300 – DSA 24K	SEV300 – DSA 32K	SEV 360 – DSA 36K	SEV 360 – DSA 45K
System Performance				
Armature Diameter	300 mm	300 mm	360 mm	360 mm
Sine Force (peak)	2000 kgf (4400 lbf, 20 kN)	2500 kgf (5500 lbf, 25 kN)	3000 kgf (6600 lbf, 30 kN)	3500 kgf (7700 lbf, 35 kN)
Random Force (rms)	2000 kgf (4400 lbf, 20 kN)	2500 kgf (5500 lbf, 25 kN)	3000 kgf (6600 lbf, 30 kN)	3500 kgf (7700 lbf, 35 kN)
Shock Force (rms)	4000 kgf (8800 lbf, 40 kN)	5000 kgf (11000 lbf, 50 kN)	6000 kgf (13200 lbf, 60 kN)	7000 kgf (15400 lbf, 70 kN)
Acceleration (sine)	80 g	100 g	85 g	100 g
Velocity (sine peak)	1.8 m/sec	1.8 m/sec	1.8 m/sec	1.8 m/sec
Displacement (pk-pk)	51 mm (2 in)*	51 mm (2 in)	51 mm (2 in)	51 mm (2 in)
Axial Resonance (±5%)	2700 Hz	2700 Hz	2600 Hz	2600 Hz
Useful Frequency Range	DC to 3000 Hz	DC to 3000 Hz	DC to 2800 Hz	DC to 2800 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer			
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA			
Shaker Characteristics				
Moving Element Mass	25 kg	25 kg	35 kg	35 kg
Internal Load Capability	350 kg	350 kg	350 kg	350 kg
Suspension Axial Stiffness	8 kg/mm	8 kg/mm	8 kg/mm	8 kg/mm
Suspension Cross-Axial Stiffness	400 kg/mm	400 kg/mm	400 kg/mm	400 kg/mm
Stray Magnetic Field**	< 1 mT (10 gauss)	< 1 mT (10 gauss)	< 1 mT (10 gauss)	< 1 mT (10 gauss)
Cooling Air Flow	1500 cfm	1500 cfm	1800 cfm	1800 cfm
Compressed Air***	6 bar (87 psi)	6 bar (87 psi)	6 bar (87 psi)	6 bar (87 psi)
Shaker Body Mass	3250 kg	3250 kg	3500 kg	3500 kg
Dimensions (L x W x H)	1360 x 825 x 1100 (mm)	1360 x 825 x 1100 (mm)	1420 x 885 x 1165 (mm)	1420 x 885 x 1165 (mm)
Amplifier Characteristics				
Power Output	24 kVA	32 kVA	36 kVA	45 kVA
Total Harmonic Distortion****	Typically 0.5%	Typically 0.5%	Typically 0.5%	Typically 0.5%
Input Impedance	> 10 kΩ	> 10 kΩ	> 10 kΩ	> 10 kΩ
Input Sensitivity	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers
Signal-to-Noise Ratio	> 70 dB	> 70 dB	> 70 dB	> 70 dB
Power Efficiency	> 90%	> 90%	> 90%	> 90%

Armature Insert Pattern	SEV 300 Shaker			SEV 360 Shaker			
Pattern	PCD	PCD	PCD	PCD	PCD	PCD	PCD
Position of Insert	Centre	141.4 mm	200 mm	250 mm	141.4 mm	200 mm	300 mm
No. of Inserts (Total – 13)	1	4	4	4	4	4	8

Safety Norms	
CE	Complies with 73/23/EEC Low Voltage Directive, 89/336/EEC Electromagnetic Compatibility Directive and 98/37/EC Machinery Directive

Notes:
*63 mm displacement on request
**150 mm above armature head
***Compressed air to be provided by customer at installation site
****Measured on pure resistive load
Customised specifications are also tailored on request
Please contact Sdyn for advice on the optimum specifications to meet your testing requirements
Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

Automotive, Agriculture & Railways

- ECU, Window Regulator, Engine Sensor, Car Audio System, Navigation System, Horns, Lamps, Flashers, Lighting Assemblies, Mirrors, Solenoid, Pumps, ABS, Seat Belt, Latch, Ignition Switch, Door Handle, Gear Shifters, Car Radiators, Rear View Mirror, Steering Column Wheel, Engine Mounts (Rubber), Sensors, Switches, Air Conditioning Vent
- Vehicle Battery, Braking System, Seating Cabin, HVAC, Generator Radiators, HCV Radiators, Tractor Fenders, Starter Alternators, ECU Related Parts, Instrument Cluster Dashboard, Hybrid Related Systems, EV Parts, Electric Pump, Muffler, Catalyst, Fuel Battery, ABS Coil, Seat Belt, Bogie and Coach Braking System
- Compressor, Heavy Mounting Brackets, Catalytic Convertors, CNG Units, Hydraulic Sensors Starter, Alternator, Muffler, Hybrid Motor, Dynamo Power Unit

SEV **440** SERIES

System Description

The SEV 440 Series of Shakers are matched with the DSA 48K, DSA 56K, DSA 60K, and DSA 80K Series of Power

Amplifiers. Its armature and field supplies are assembled in two 19-inch network racks of 36 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Imported magnesium alloy armature structure
- Imported hose pipe of extended temperature range
- Self-lubricating central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position
- Pneumatic based auto-centring of armature head
- Body isolation using air bellows to isolate vibrations from the shaker

Optional Features

- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Integration with Environmental Chamber
- Lowering of gauss level at the armature head
- Long stroke with displacement up to 76 mm (3 inch)

SEV 440 Series Shaker, DSA Series Amplifier	SEV 440 –DSA 48K	SEV 440 –DSA 56K	SEV 440 –DSA 60K	SEV 440 –DSA 80K
System Performance				
Armature Diameter	440 mm	440 mm	440 mm	440 mm
Sine Force (peak)	4000 kgf	4900 kgf	5000 kgf	6000 kgf
	(8800 lbf, 40 kN)	(10800 lbf, 49 kN)	(11000 lbf, 50 kN)	(13200 lbf, 60 kN)
Random Force (rms)	4000 kgf	4900 kgf	5000 kgf	6000 kgf
	(8840 lbf, 40 kN)	(10800 lbf, 49 kN)	(11000 lbf, 50 kN)	(13200 lbf, 60 kN)
Shock Force (rms)	8000 kgf	9800 kgf	10000 kgf	12000 kgf
	(17600 lbf, 80 kN)	(21600 lbf, 98 kN)	(22000 lbf, 100 kN)	(26400 lbf, 120 kN)
Acceleration (sine)	80 g	95 g	100 g	100 g
Velocity (sine peak)	1.8 m/sec	1.8 m/sec	1.8 m/sec	1.8 m/sec
Displacement (pk-pk)	51 mm (2 in)*	51 mm (2 in)	51 mm (2 in)	51 mm (2 in)
Axial Resonance (±5%)	2100 Hz	2100 Hz	2100 Hz	2000 Hz
Useful Frequency Range	DC to 2400 Hz	DC to 2300 Hz	DC to 2300 Hz	DC to 2000 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer			
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA			
Shaker Characteristics				
Moving Element Mass	50 kg	50 kg	50 kg	60 kg
Internal Load Capability	550 kg	550 kg	550 kg	550 kg
Suspension Axial Stiffness	15 kg/mm	15 kg/mm	15 kg/mm	15 kg/mm
Suspension Cross-Axial Stiffness	500 kg/mm	500 kg/mm	500 kg/mm	500 kg/mm
Stray Magnetic Field**	< 1 mT (10 gauss)	< 1 mT (10 gauss)	< 1 mT (10 gauss)	< 1 mT (10 gauss)
Cooling Air Flow	2000 cfm	2000 cfm	2000 cfm	3000 cfm
Compressed Air***	6 bar (87 psi)	6 bar (87 psi)	6 bar (87 psi)	6 bar (87 psi)
Shaker Body Mass	5000 kg	5100 kg	5000 kg	6000 kg
Dimensions (L x W x H)	1605 x 985 x 1245 (mm)	1605 x 985 x 1245 (mm)	1605 x 985 x 1245 (mm)	1700 x 1080 x 1345 (mm)
Amplifier Characteristics				
Power Output	48 kVA	56 kVA	60 kVA	80 kVA
Total Harmonic Distortion****	Typically 0.5%	Typically 0.5%	Typically 0.5%	Typically 0.5%
Input Impedance	> 10 kΩ	> 10 kΩ	> 10 kΩ	> 10 kΩ
Input Sensitivity	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers
Signal-to-Noise Ratio	> 70 dB	> 70 dB	> 70 dB	> 70 dB
Power Efficiency	> 90%	> 90%	> 90%	> 90%
Armature Insert Pattern	**SEV 440 Shaker**			
Pattern	PCD	PCD	PCD	
Position of Insert	Centre	200 mm	400 mm	
No. of Inserts (Total – 17)	1	4	4	
Safety Norms				
CE	Complies with 73/23/EEC Low Voltage Directive, 89/336/EEC Electromagnetic Compatibility Directive and 98/37/EC Machinery Directive			

Notes:
*63 mm displacement on request
**150 mm above armature head
***Compressed air to be provided by customer at installation site
****Measured on pure resistive load
Customised specifications are also tailored on request
Please contact Sdyn for advice on the optimum specifications to meet your testing requirements
Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

aeronautics, astronautics & defence

- Systems, Resin Products, Sealing Agents, Engine Blades, Airborne Instruments, Rocket Launch Equipment, Research Profiles

- Display Systems, Optical Navigation Systems, Radars, In Flight Communication System, Seating, Airborne Equipment, Space Launch Vehicle Systems, On Board Computers, Atomic and Defence Equipment, Microwave Tubes

- Launch Vehicle, Ground Systems, Satellite Sections, Rocket Mounted Computers, Cryogenic Equipment, Helicopter Assemblies, Propeller, Defence Associated Equipment, Missile Associated Component, Propeller, Flight Structures

System Description

The SEW 500 Series of Shakers are matched with the DSA 120K and DSA 160K Series of Power Amplifiers. Its armature and field supplies are assembled in three 19-inch network racks of 36 unit height. The water cooling system is assembled in two 19-inch network racks of 42 unit height.

The SEW 590 Series of Shakers are matched with the DSA 200K and DSA 240K Series of Power Amplifiers. Its armature and field supplies are assembled in six 19-inch network racks of 36 unit height. The water cooling system is assembled in two 19-inch network racks of 42 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Imported magnesium alloy armature structure
- Hydrostatic central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position
- Pneumatic based auto-centring of armature head
- Body isolation using air bellows to isolate vibrations from the shaker
- Hermetically sealed construction

Optional Features

- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Integration with Environmental Chamber
- Lowering of gauss level at the armature head

SEV Series Shaker, DSA Series Amplifier	SEW 500 – DSA 120K	SEV 500 – DSA 160K	SEW 590 – DSA 200K	SEW 590 – DSA 240K
System Performance				
Armature Diameter	500 mm	500 mm	590 mm	590 mm
Sine Force (peak)	7000 kgf (15400 lbf, 70 kN)	10000 kgf (22000 lbf, 100 kN)	13000 kgf (28600 lbf, 130 kN)	16000 kgf (35200 lbf, 160 kN)
Random Force (rms)	7000 kgf (15400 lbf, 70 kN)	10000 kgf (22000 lbf, 100 kN)	13000 kgf (28600 lbf, 130 kN)	16000 kgf (35200 lbf, 160 kN)
Shock Force (rms)	14000 kgf (30800 lbf, 140 kN)	20000 kgf (44000 lbf, 200 kN)	26000 kgf (57300 lbf, 260 kN)	32000 kgf (70550 lbf, 320 kN)
Acceleration (sine)	85 g	100 g	85 g	100 g
Velocity (sine peak)	1.8 m/sec	2.0 m/sec	2.0 m/sec	2.0 m/sec
Displacement (pk-pk)	38 mm (1.5 in)*	38 mm (1.5 in)	38 mm (1.5 in)	38 mm (1.5 in)
Axial Resonance (±5%)	2000 Hz	2000 Hz	1700 Hz	1700 Hz
Useful Frequency Range	DC to 2000 Hz	DC to 2000 Hz	DC to 2000 Hz	DC to 2000 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer			
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA			
Shaker Characteristics				
Moving Element Mass	82 kg	100 kg	160 kg	160 kg
Internal Load Capability	800 kg	1000 kg	2000 kg	2000 kg
Suspension Axial Stiffness	8 kg/mm	8 kg/mm	10 kg/mm	10 kg/mm
Suspension Cross-Axial Stiffness	2000 kg/mm	2200 kg/mm	3200 kg/mm	3200 kg/mm
Stray Magnetic Field**	< 1.0 mT (10 gauss)	< 1.0 mT (10 gauss)	< 1 mT (10 gauss)	< 1 mT (10 gauss)
Compressed Air***	6 bar (87 psi)	6 bar (87 psi)	7 bar (100 psi)	7 bar (100 psi)
Cooling	A dedicated cooling system for storing, circulating and cooling distilled water used for cooling			
Amplifier Characteristics				
Power Output	120 kVA	160 kVA	200 kVA	240 kVA
Total Harmonic Distortion****	Typically 0.5%	Typically 0.5%	Typically 0.5%	Typically 0.5%
Input Impedance	> 10 kΩ	> 10 kΩ	> 10 kΩ	> 10 kΩ
Input Sensitivity	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers	4 Vrms, Compatible with all standard controllers
Signal-to-Noise Ratio	> 70 dB	> 70 dB	> 70 dB	> 70 dB
Power Efficiency	> 90%	> 90%	> 90%	> 90%

Armature Insert Pattern	SEV 500 Shaker			SEV 590 Shaker			
Pattern	PCD	PCD	PCD	PCD	PCD	PCD	PCD
Position of Insert	Centre	200 mm	400 mm	Centre	200 mm	400 mm	550 mm
No. of Inserts (Total – 17)	1	8	8	1	8	8	8

Safety Norms	
CE	Complies with 73/23/EEC Low Voltage Directive, 89/336/EEC Electromagnetic Compatibility Directive and 98/37/EC Machinery Directive

Notes:

*51 mm displacement on request

**150 mm above armature head

***Compressed air to be provided by customer at installation site

****Measured on pure resistive load

Customised specifications are also tailored on request

Please contact Sdyn for advice on the optimum specifications to meet your testing requirements

Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

System Description

The SEW 760 Series of Shakers are matched with the DSA 280K and DSA 320K Series of Power Amplifiers. Its armature and field supplies are assembled in eight 19-inch network racks of 36 unit height. The water cooling system is assembled in two 19-inch network racks of 42 unit height.

Standard Features

- Complies with EMC, Low Voltage and Machinery Directives under CE
- Imported magnesium alloy armature structure
- Hydrostatic central guidance bearing
- Compatible with all standard Vibration Controllers
- Trunnion mounted shaker for operation in vertical and horizontal position
- Pneumatic based auto-centring of armature head
- Body isolation using air bellows to isolate vibrations from the shaker
- Hermetically sealed construction

Optional Features

- Air isolation mounts between base and ground
- PC based Power Amplifier Remote
- Attachment to Horizontal Slip Table, Head Expander and Vertical Load Support
- Integration with Environmental Chamber
- Lowering of gauss level at the armature head

SEV Series Shaker, DSA Series Amplifier	SEW 760 – DSA 260K	SEV 760 – DSA 280K	SEW 760 – DSA 320K
System Performance			
Armature Diameter	760 mm	760 mm	760 mm
Sine Force (peak)	20000 kgf (44000 lbf, 200 kN)	25000 kgf (55000 lbf, 250 kN)	30000 kgf (66000 lbf, 300 kN)
Random Force (rms)	20000 kgf (44000 lbf, 200 kN)	20000 kgf (44000 lbf, 200 kN)	20000 kgf (44000 lbf, 200 kN)
Acceleration (sine)	75 g	75 g	75 g
Velocity (sine peak)	1.9 m/sec	1.9 m/sec	1.9 m/sec
Displacement (pk-pk)	38 mm* (1.5 in)	38 mm* (1.5 in)	38 mm* (1.5 in)
Armature Resonance (±5%)	1300 Hz	1300 Hz	1300 Hz
Useful Frequency Range	DC to 1700 Hz	DC to 1700 Hz	DC to 1700 Hz
Protection Interlocks	Mains Input Over & Under Voltage, Over Current, Loss of Input Phase, Over Temperature Amplifier & Shaker, Field Fail, Cooling, User Safety Interlock if specifically required by the customer		
Safety Compliance	System complies and marks to the international safety requirements w.r.t. CE and CSA		
Shaker Characteristics			
Moving Element Mass	280 kg	280 kg	280 kg
Internal Load Capability	5000 kg	5000 kg	5000 kg
Suspension Axial Stiffness	91 N/mm	91 N/mm	91 N/mm
Suspension Cross-Axial Stiffness	72 kN/mm	72 kN/mm	72 kN/mm
Stray Magnetic Field**	2.0 mT (20 gauss)	2.0 mT (20 gauss)	2.0 mT (20 gauss)
Compressed Air***	7 bar	7 bar	7 bar
Cooling	A dedicated cooling system for storing, circulating and cooling distilled water used for cooling		

*51 mm displacement on request

Optimising Design Performance

The introducing of vibrations will help locate inherent weaknesses in the design of a product. Design defects can be cured before causing failures in the field and at the same time, areas of over-design can be eliminated thereby reducing the cost

Sdyn India

Vibration Controller

Saraswati Dynamics Pvt. Ltd.
C-7, Industrial Estate, Roorkee - 247667, Uttarakhand, India
Tel: +91 1332 262093/94, Fax: +91 1332 264723, Email: info@sdyn.in, Web: www.sdyn.in

SVibration **Controller**

Sdyn's Vibration Controllers are tailored in 4/8/16 channel configuration to bring users the most advanced and complete range of vibration testing solutions. Our Vibration Controllers are compatible with any make of amplifier and shaker combination available worldwide.

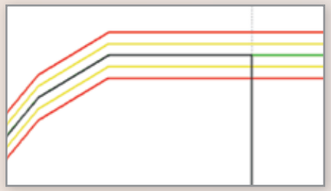
These controllers are perfectly suitable to perform vibration testing in all segments of the industry including defence, space, automobile, seismic, field equipment and consumer electronics. Coupled with analysis and documentation tools, our Vibration Controller makes the complete vibration system user friendly and an ideal means for checking the performance and reliability of your product against hazardous vibration environment to which your product would be exposed during usage. Our Vibration Controller can drive the complete range of electro-dynamic and servo-hydraulic shakers for single axis and multi-axis control applications in single and multi-shaker configurations.

Sdyn's Vibration Controllers employ high speed Digital Signal Processing (DSP) technology, low noise hardware design, optimised vibration control algorithms and high speed data transfer protocols.

The software and firmware are based on multi-tasking topology with close-loop control operation between DSP and PC. This ensures true efficiency of real-time control with timely correction in input excitation to counter sudden change in response of the test system. We provide powerful features, high performance, greater than 110 dB of dynamic range and control frequency range up to 20 kHz, besides providing test engineers easy-to- use application software packages.

These Vibration Controllers are available with 4 to 16 input channels and are consistently modified/ upgraded to meet the demand of the latest vibration testing needs. Bundles of application software and embedded functions are specifically designed to work together so as to offer the best loop time and stable control during vibration testing. Our Vibration Controllers have the capability for making independent measurements of transfer functions and spectra of all the channels in use during vibration testing. These measurements may be independently scheduled at any time during the test and can be specifically set for analysis. Test data can be exported or imported into our software in all popular formats. Sdyn's Vibration Controllers can be interfaced with any desktop or laptop running on Windows through USB or Ethernet interface.

Major Control Applications of the Vibration Controller are:

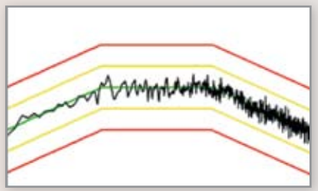


Sine Control Application

Sine Control Application provides all excitation energy at a single frequency. It generates analog signal with the help of programmable sweep parameters. Sine control application is most applicable to measure the dynamic response of any Unit Under Test (UUT).

Uses:

- Fatigue and Durability test at a single frequency or swept across a frequency band
- Characterisation of the structural dynamics of the UUT

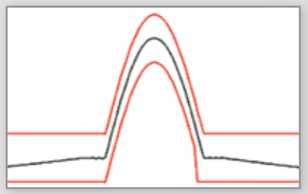


Random Control Application

Random vibration generates real word vibration environment which excites a combination of frequencies at any given instance. Due to the simultaneous generation of all frequencies within the specified frequency band, it is also called accelerated testing. Data to be recreated in represented in 'g2/Hz' vs. 'Frequency' format.

Uses:

- Production test, stress screening, prototype testing and qualification of products
- Field measurement replication

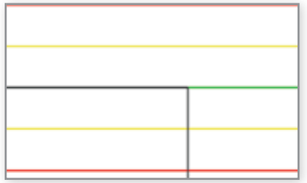


Classical Shock Control Application

Drop test methods do not provide accuracy and repeatability like Classical Shock testing. This tests determines if the UUT can withstand transient vibrations encountered during its life in real environmental conditions.

Uses:

- Computation of shock response spectrum
- Bump/ Impact test replacement by shaker

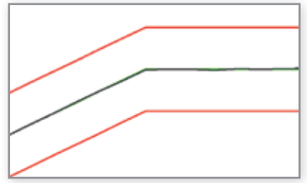


Resonance Search, Track, and Dwell (RSTD) Control Application

RSTD performs a swept sine test to locate the resonant frequency of the UUT, tracks this resonance and dwells on it. This is an invaluable tool for automation of fatigue testing. During dwelling, a special tracking filter is used for computing phase angle information to adjust the drive frequency to track the resonance as its changes during dwelling.

Uses:

- Fatigue and Durability test at resonance frequency
- Characterisation of the structural dynamics of the UUT

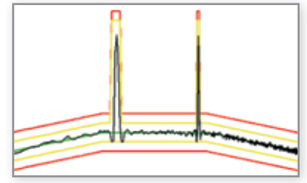


Shock Response Spectrum (SRS) Control Application

Shock Response Spectrum testing provides the ability to synthesize a complex waveform that can be applied to a shaker in a controlled manner. It varies from Classical Shock as it provides maximum achievable response in a single degree of freedom to a given transient signal. The severity of Shock test is maximised using SRS techniques.

Uses:

- Qualification of equipment sensitive to seismic activity like Nuclear Reactor
- A military aircraft taking off or landing on a ship - a high level and complex shock is induced in all the equipment while the engine is working

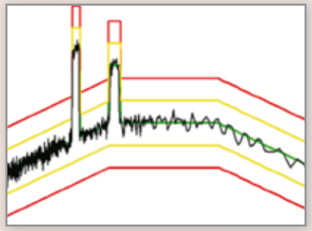


Sine on Random (SoR) Control Application

SoR is a combination of broadband random and sine tone. Sine tone can be shifted over a band of frequencies with a speed which can be linear or logarithmic.

Uses:

- Periodic bursts of gunfire form flying helicopters
- Propeller driven aircraft
- Automobile vibration in engine, drive train and transmission during speed changes

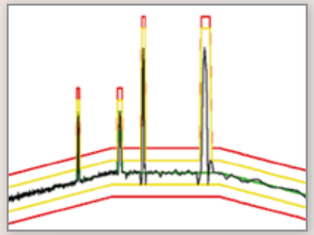


Random on Random (RoR) Control Application

RoR merges overall power spectral density where one Spark Vibration Controller Spandon Vibration Controller source of random vibration is consistent and the other varies.

Uses:

- An accelerating or decelerating vehicle on a rough road
- Propeller driven aircraft

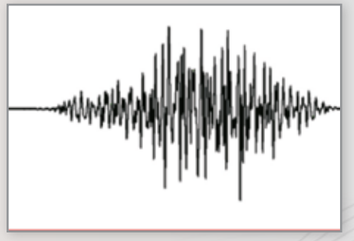


Sine on Random on Random (SoRoR) Control Application

SoRoR control application can create profile with narrowband random and sine tone signal superimposed on broadband random signal, which can be moving or stationery. User can activate or deactivate SoR or RoR profile individually to simulate acceleration, deceleration or periodic force acting on the UUT.

Uses:

- Testing of launch vehicles
- Gun fire form helicopter or propeller driven aircraft

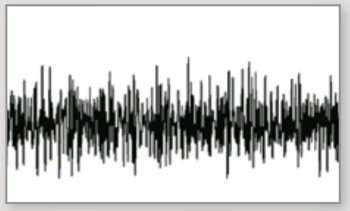


Transient Time History (TTH) Control Application

TTH control application provides a library which can be used to create a waveform like sine, chirp, beats and white noise signal. TTH can also play a short recorded data form field to simulate a transient or a pulse.

Uses:

- Reproduction of recorded data from field on the laboratory shaker system
- Door slam testing can be conducted with TTH control application



Long Time History (LTH) Control Application

LTH control application recreates field recorded data on the shaker. Unlike TTH, LTH can reproduce vibration on the shaker same as road vibration. Recorded data can be an earthquake or bumps on a road.

Uses:

- Reproduction of recorded data from field on the laboratory shaker system
- Door slam testing can be conducted with LTH control application

	Spark Vibration Controller	Spandon Vibration Controller
Input		
Channels	4	4, 8, 16
Resolution	16-bit ADC	24-bit ADC
Voltage Range	±1 or ±0.1 V	±10, ±1 or ±0.1 V
Filtering	Analog + 80 dB/octave Digital Filter	Analog + 160 dB/octave Digital Filter
Coupling	Charge & IEPE	Charge, IEPE & TEDS
Bandwidth	1 to 5 kHz	0.1 to 36 kHz
Maximum Input	±36 V Peak without damage	±36 V Peak
Dynamic Range	90 dB	110 dB
Output		
Channels	Drive & COLA	Drive & COLA
Resolution	16-bit DAC	24-bit DAC
Voltage Range	±10 V	±10 V
Filtering	Analog + 80 dB/octave Digital Filter	Analog + 160 dB/octave Digital Filter
Bandwidth	1 to 5 kHz	0.1 to 36 kHz
Maximum Output	±12 V Peak	±12 V Peak
Dynamic Range	90 dB	110 dB
Electrical		
AC Power	220 V, 50 Hz	
Consumption	45W	
Connectivity		
Operating System	Windows XP/ Vista/ 7/ 8/ 10	
Protocol	USB 2.0	
Environmental		
Temperature	5°-45° C	
Humidity	10%-95% RH non-condensing	
Regulatory Compliance		
Compliance	CE Marking	
Safety	EN 61326-1:1997, EN 61010-1:2001	

Notes:

1. Please contact Sdyn for advice on the optimum specifications to meet your testing requirements
2. Specifications are correct at the time of publication and are subject to improvement or amendment without prior notice

SLIP TABLES

For large or heavy loads

These are designed for the horizontal testing of large or heavy loads which require very high pitch, roll or yaw moments. Slip tables can be supplied standalone, with optional seismic base or integrated on a common base with a vibration shaker.

For small and medium loads

These are designed for testing small or medium loads, which have a lower centre of mass. Slip tables can be supplied standalone with optional seismic base or integrated on a common base with a vibration shaker.

Combo-base slip table

Slip tables can be integrated with a vibration system and mounted on a combo base. Depending on the choice of the slip table, it can be used for testing of small, medium or large test items that have a relatively low centre of gravity.

The combo structure can support the mobile unit which can easily be moved on the wheels to integrate with a climatic chamber. The pitch, roll and yaw restraint of the combo will also be related to the basic slip table. When the table is chosen, very heavy loads can be tested, but these should generally be of a low profile in order to avoid pitching motions about the base isolation system.

Drive Adaptor

Our standard magnesium drive adaptors attach to the entire shaker armature pattern for maximum transmissibility between the shaker and slip plate. Interfacing to the slip plate is accomplished using standard socket head screws installed at an easily accessible 200 angle. Angular orientation of fastners produces compression force across alternating surfaces giving superior dynamic performance. No special, high cost, expansion pins or other devices are required. The stepped interface between the slip plate and the drive

1. Low pressure

Combined base horizontal slip tables are designed for testing of heavy loads and voluminous objects in X and Y directions. The bearings are located to restrain pitch and roll moments. The slip table works on the principle of an oil film maintained between granite surface and slip plate supported by grid array bearings to eliminate overturning moments.

An oil film is automatically created through a closed loop system, when the oil pump coupled with the motor is started. Adequate oil supply is provided for table breakaway friction under heavy specimen loads. The oil supply is adjustable for various table loads and returns to the reservoir through flexible pipe under gravity. The amount of oil is indicated on the level indicator, generally to be replaced after every 5,000 hours of usage.

The discharge of hydraulic unit is supplied to two separate manifolds for supplying oil to bearings and for formation of film on the granite block. Pressure gauges are provided for each manifold.

The slip plate platform is precision- surfaced with integral object mounting facility through replaceable SS inserts. The slip table is finished with glossy and metallic coatings of the latest polyurethane paints with attractive colors.

Slip tables are categorised into two types as per the advancement in technology.

- → Low pressure
- → High pressure hydrostatic

2. High pressure hydrostatic

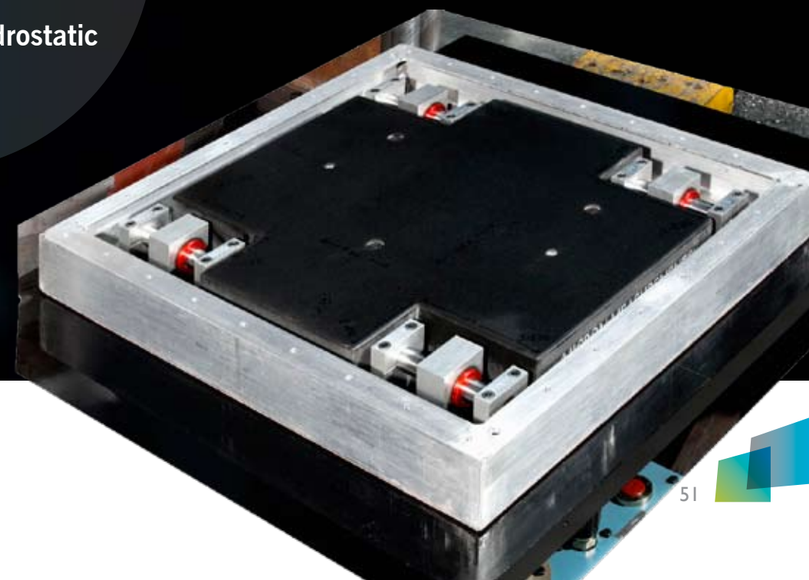
1. It incorporates standard oil film slip table technology to provide a highly damped horizontal slip surface. The basic system includes a drive magnesium slip plate with perimeter extensions that covers the oil recovery moat. This design protects the operator from exposure to the hydraulic oil while keeping fingers and clothing from accidental contact with moving components.

2. Special attention is given to operator safety.

3. Complete system comes with a precision ground natural granite slip surface extra large internal oil reservoir, adjustable trunion mounting blocks, and oversized magnesium slip plates. It is designed to mount the entire shaker assembly including the shaker's standard support base, directly to a common steel. The common platform also supports standard standalone slip table assemblies. So it allows the customers to incorporate their existing shakers inhouse.

Only the highest quality materials and components are used to produce the slip tables.

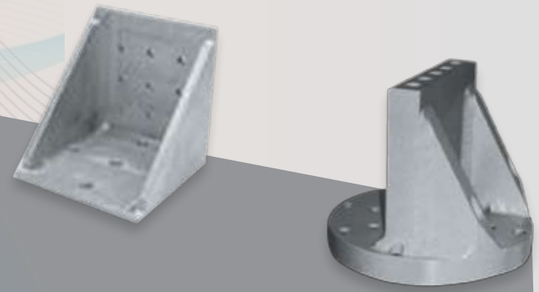
Hydrostatic bearing guidance is available for restraint of large load applications.



Head Expanders

To increase the working scope of your system, opt for Head Expanders. We offer a varied range of Head Expanders.

Head Expanders provide a mounting surface area to accommodate large test articles or multiple items.They are produced from highly damped Mg. casting wth circular design and deep web section.They can in most cases be used for testing in frequency range upto 2 KHz. Head Expanders are available in both round and square shapes. These are available for any size armature and with customized hole patterns

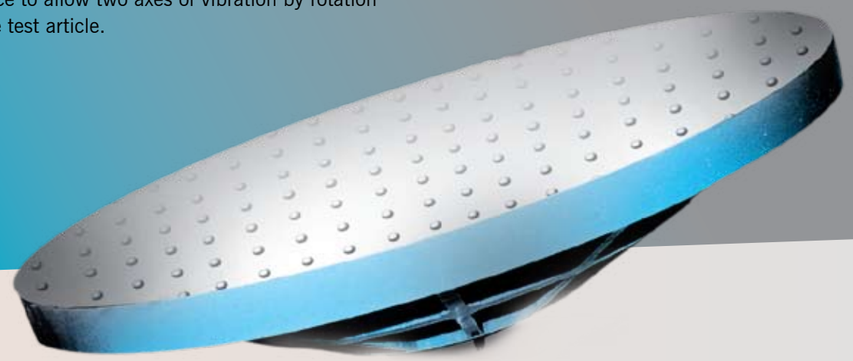


Fixtures

Saraswati Dynamics also offer custom-made fixtures, including removable extensions that provide temporary increase in the top mounting surface to mount an occasional test specimen that requires a larger mounting surface area. Thermal barriers, raised mounting inserts and multiple shaker armatures mounting patterns are also available.

Multi-axis vibration testing can be accomplished in several ways. One of the least expensive methods is through the use of fixtures. These fixtures provide at least one vertical mounting surface to allow two axes of vibration by rotation of the test article.

The fixtures often eliminate the need for more costly horizontal slip tables and hydrostatic bearing systems, since multiple test axes can be achieved on the shaker in the fixed vertical position. These are supplied as standard products for most sizes of vibration systems.



Technical Performance Parameters

Vertical Load Supports*

Model	Size (m m)	Mass (kg)	Mass (kg)
		Al	Mg
VLS 030	300X300	16	12
VLS 040	400X400	25	19
VLS 050	500X500	30	22
VLS 055	550X550	35	26
VLS 060	600X600	40	30
VLS 080	800X800	60	45
VLS 100	1000X1000	110	85

Circular head expander*

Model	Dia (mm)	Mass (kg)	For Shaker Models
Al	Mg		
CHE 010	100	1.2	0.9
CHE 020	200	5	3.5
CHE 030	300	12.5	9.5
CHE 040	400	17	12.5
CHE 050	500	22.5	17
CHE 060	600	35	26
CHE 080	800	60	45
CHE 100	1000	95	71

Square head Expander*

Model	Size (m m)	Mass (kg)	For Shaker Models
Al	Mg		
SHE 010	100 x 100	1.44	1.08
SHE 020	200 x 200	6	4.2
SHE 030	300 x 300	15	11.4
SHE 040	400 x 400	20.4	15
SHE 050	500 x 500	27	20.4
SHE 060	600 x 600	42	31.2
SHE 080	800 x 800	72	54
SHE 100	1000 x 1000	114	85.2

Customised sizes avail on request

Accelerated **Multi Environment** Test Systems

Vibration Integrated Chambers

A very broad range of automotive & electronic components can be subjected to combined tests with chamber integrated to Electrodynamic vibration testing machines as per the desired rate of change of temperature.

Product Features

Parameter	Specifications
Environment Simulation	Vibration Integratedas per customer's specifications
Temperature Range	- 70^0 C to +180^0 C Relative Humidity 10% to 98 % RH Construction Interior & Exterior constructed with satin finish stainless steel
Viewing window	300 x 300 mm with illumination, six panes of toughened glass filled with dry air. Micro controller
Controller based programmable unit	
Port holes	Pluggable
Interface	LAN/Serial
Input supply	Three Phase Changeable
Floors	

An array of Chambers combined with Vibration Shaker

Design & developed at our state of the art facility for the prestigious customers looking for testing their products in multi environments at one place.The facility consists of a series of chambers – Cold, Hot, Humidity and Climatic combined with Vibration Shaker. The Vibration Shaker slips over the rail guide and combines with anyone of the chambers as per the test requirement for electronic and electro-mechanical assemblies used in both ground and space borne applications.

Redefining Endurance testing

Thermal Shock

Product Features

Parameter	Specifications
Hot zone	Upto 200^0 C Cold zone Upto -70^0 C
Transfer	Pneumatic shift of basket
Construction	Stainless steel interior & exterior
Viewing window	Both hot & cold zones
Loading area	300mm to 500mm sized

CUSTOMER **SUPPORT** AND **TRAINING**

Customer service is not merely creating relations, it is oriented towards customer delight.

Every customer is an individual, hence special to us. When we are delighted to serve our customers, our customers too find our services delightful.

Enlightened with **effective** Services...

In this new era of customer services, Saraswati Dynamics goes beyond customer satisfaction.

Our commitment towards customer services

> **Developing trust:** Quality of service, knowledge, expertise, courtesy and promptness – these are the hallmarks on which we develop trust and keep it.
> **Information exchange:** Our customer relationship actually begins even before the sale. Each customer receives personal attention, and we make ourselves available at any time should our services be required.
> **Extended services:** Saraswati Dynamics offers comprehensive Annual Maintenance Contract (AMC) beyond the warranties. Our promptness saves the money and time of the customer. Some of the highlights of extended services include:
  > High quality customer support
  > 24 hrs x 7 days "Service hot-
  > Installation and Commissioning
  > Operation and parts warranty
  > Application guidance
  > Training programmes.
  > Original spares
> **Easy reach:** Our website contains all information about the company and products, product listing and their specifications, technology updates and current news. Just fill up the feedback form and get immediate response.
> **Design and Development:** Do you have a specific product in mind? Draw out the specifications and hand them over to our nearest sales representative. We shall advise you in case the specifications need modification so that you get what you want – in the shortest time and at optimum cost.
> **Single Source Supplier:** We provide our customers all the information, product and after sales service including technical and spares support which gives them the benefit of money and time saving.
> **Service Quality:** The ISO 9001:2000 norms of the company are stretched beyond 100% satisfaction to define customer delight. Saraswati Dynamics assures 12 months warranty including spares and labor. The warranty period starts from the date of commissioning.

Add-on Warranty

Under our add-on warranty option, the warranty can be extended on mutually agreed terms and cost. The add-on warranty comes with a number of benefits for the customers.

Installation and Commissioning The company's engineers are given extensive training, who then ensure that each installation meets the highest quality standards laid under ISO 9001:2000.

> During installation, our engineers comply to all performance requirements and safety standards.
> The system is fully tested and commissioned before the final handover.
> Training is given to authorized personnel of the customer.

Maintenance Contracts

Saraswati Dynamics' maintenance system is of the highest quality, available on mutually agreed terms and cost.

> **System health check:** Our regular visits to check the installation at the customers' premises gives them immense confidence.
> Flexible service: Our "service hotline" is available 24x7 for immediate action on the maintenance contracts.
> **Preventive maintenance:** All defective and worn out parts are replaced before anticipated failure and the system is brought back to operation.

Customer **Training**

Our technical manuals – comprising operation and service details – are user- friendly. Training programs are also conducted at customer's place and at our facility from time to time. Training has become an important part of product delivery to comply with safety requirements

Customised Vibration Testing Solutions at remarkably cost effective prices

Value for money products designed to outlast their purpose

On-demand support through widely distributed network of highly skilled and trained personnel

Legacy of continuous innovation in bringing cutting-edge technologies to the market

Sdyn

Scripting a SUCCESS STORY

1985-1989
- Launched Air Cooled Electrodynamic Shakers

1990-1994
- Developed PC based Vibration Controller and Low Frequency PWM Switching Power Amplifiers

1995-1999
- Introduced new generation of Electrodynamic Shakers with higher efficiency

2000-2004
- Upgraded technology for Air Cooled Electrodynamic Shakers up to 60kN
- Developed High Frequency PWM Switching Power Amplifiers
- Launched Air Cooled and Water Cooled Environmental Chambers

2005-2009
- Introduced Water Cooled Technology for Electrodynamic Shakers
- Integrated Electrodynamic Shakers with Environmental Chambers

2010 onwards
- Introduced Long Stroke Electrodynamic Shakers with over 76mm displacement and 2.0m/s velocity
- Introduced vertical movement of Environmental Chamber for combined testing in 3-axis
- Launched high-end Vibration Controller to meet demanding test requirements

Our global presence evinces the international quality of our products, services and application support

Sdyn

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