

# PROVEN VIBRATION TEST SYSTEMS

World class supplier of affordable vibration test equipment

[www.sentekdynamics.eu](http://www.sentekdynamics.eu)



**SENTEK**  
DYNAMICS





Sentek Dynamics supplies vibration test equipment to reproduce real-world environmental conditions for global manufacturers and offers technology capable of reproducing a wide-variety of test requirements – vibration (sine, random, shock, SoR, RoR, RSTD and others), data recording and dynamic signal analysis.

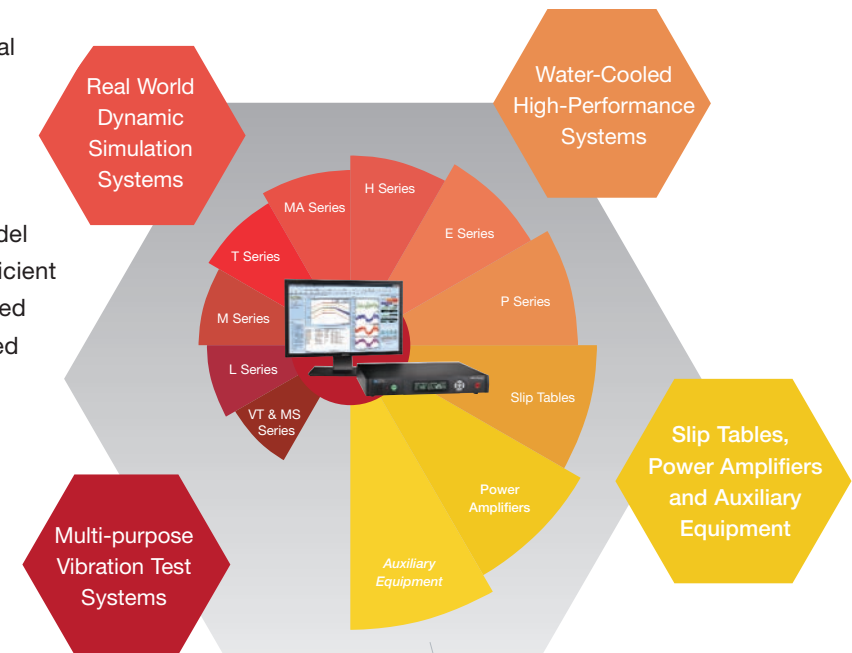
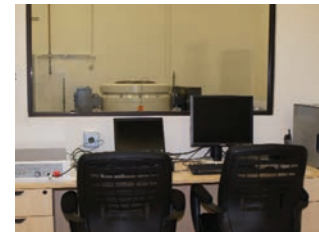
Located in the center of Silicon Valley, Sentek Dynamics is dedicated to testing, measurement and sensor technology. With this comprehensive product line Sentek Dynamics is able to offer turn-key vibration testing solutions for today’s demanding test requirements.

## Total Quality Culture

Delivery and quality initiatives form an integral part of the Sentek Dynamics’ culture. This enables Sentek Dynamics to consistently deliver a wide-variety of standard and custom-engineered products that exceed the specifications of other vibration test equipment manufacturers.

Sentek Dynamics’ world-class vibration testing equipment is produced in a modern, state-of-the-art ISO 9001 accredited facility with separate production areas for water-cooled and air-cooled system assembly.

As part of our focus we offer numerous optional features to suit specific requirements; large displacement systems suited to transportation test requirements; simultaneous 3-axis testing systems to reproduce real-world vibration environments in the lab; high performance model with 1470 m/s<sup>2</sup> (150 g) acceleration, energy efficient digital switching power amplifiers with integrated controller, keyboard and LCD display; motorized gearboxes for shaker rotation; and slip tables in low and high-pressure designs when affordability or high resistance to overturning moments is the priority.



# Multi-purpose Test Systems

## L Series (low force) and M Series (medium force)

Sentek Dynamics' L Series and M Series are air-cooled vibration testing systems ideally suited to testing small to medium sized components and assemblies and are cost-effective solutions to today's demanding test requirements. They are available in vertical only and mono-base configurations (integral slip table). Each system includes the shaker, amplifier, blower and interconnecting cables and hose.

- Up to 6500 kgf (14,300 lbf) Sine force capability.
- Static payload capability up to 1000 kgf (2200 lbf).
- Working frequency up to 5000 Hz.
- Pneumatic load support.
- Air-isolated trunnion.
- Available options:
  - Air-isolation feet, pads or mounts.
  - Automatic armature centering in static and dynamic modes.
  - Motorized gearbox for shaker rotation - standard on systems at or above 5000 kgf (11,000 lbf).

## VT Series Desk Top and MS Series Modal Shakers

Sentek Dynamics' VT and MS Series permanent magnet shakers are designed for vibration testing of very small components and assemblies, modal studies and structural analysis.



## L Series - Low-Force Shakers Air-cooled Shakes 100 – 1000 kgf (220 – 2200 lbf)

System Performance	L0111A	L0211A	L0315M	L0620M	L1024M
Sine Force Peak kgf (lbf)	100 (220)	200 (440)	300 (660)	600 (1320)	1000 (2200)
Random Force rms kgf (lbf)	100 (220)	200 (440)	300 (660)	600 (1320)	1000 (2200)
Shock Force (6 ms) kgf (lbf)	200 (440)	400 (880)	600 (1320)	1200 (2640)	2000 (4400)
Frequency Range Hz	5 - 4500	5 - 4500	5 - 4500	5 - 5000	5 - 3500
Continuous Displacement mm (in)	25 (1.0)	25 (1.0)	40 (1.5)	51 (2.0)	51 (2.0)
Shock Displacement mm (in)	25 (1.0)	25 (1.0)	40 (1.5)	51 (2.0)	51 (2.0)
Max Velocity m/s (in/s)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	490 (50)	980 (100)	980 (100)	980 (100)	980 (100)
Armature Diameter mm (in)	110 (4.3)	110 (4.3)	150 (5.9)	200 (7.9)	240 (9.5)
Effective Armature Mass kg (lb)	2 (4.4)	2 (4.4)	3 (6.6)	6 (13.2)	10 (22.0)
Max Static Payload kg (lb)	70 (154)	70 (154)	120 (264)	200 (440)	200 (440)

## M Series - Medium-Force Shakers Air-cooled Shakers 1500 – 6500 kgf (3300 – 14,300 lbf)

System Performance	M1528A	M2232A	M3240A	M4040A	M5044A	M6044A	M6544A
Sine Force Peak kgf (lbf)	1500 (3300)	2200 (4840)	3200 (7040)	4000 (8800)	5000 (11,000)	6000 (13,200)	6500 (14,300)
Random Force rms kgf (lbf)	1500 (3300)	2200 (4840)	3200 (7040)	4000 (8800)	5000 (11,000)	6000 (13,200)	6500 (14,300)
Shock Force (6 ms) kgf (lbf)	3000 (6600)	4400 (9680)	6400 (14,080)	8000 (17,600)	10,000 (22,000)	12,000 (26,400)	13,000 (28,600)
Frequency Range Hz	5 - 3000	5 - 3000	5 - 2500	5 - 2400	5 - 2500	5 - 2500	5 - 2500
Continuous Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)
Shock Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)
Max Velocity m/s (in/s)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	784 (80)	980 (100)	980 (100)	980 (100)	980 (100)	980 (100)	980 (100)
Armature Diameter mm (in)	280 (11.0)	320 (12.6)	400 (15.8)	400 (15.8)	445 (17.5)	445 (17.5)	445 (17.5)
Effective Armature Mass kg (lb)	18 (39.6)	22 (48.4)	32 (70.4)	40 (88.0)	49 (107.8)	49 (107.8)	49 (107.8)
Max Static Payload kg (lb)	300 (660)	300 (660)	500 (1100)	500 (1100)	1000 (2200)	1000 (2200)	1000 (2200)

# High Performance Vibration Test System



## P Series High-Performance Water-cooled Shaker

With a max acceleration of 150 g Sine and 8000 kgf (17,600 lbf) Sine force peak the Sentek Dynamics' P Series vibration testing system offers exceptional performance at an affordable price. The P Series is available in vertical and horizontal operation with an optional slip table.

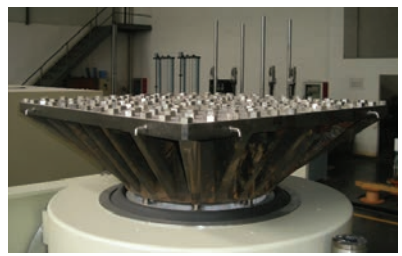
- 8000 kgf (17,600 lbf) Sine force capability.
- Max acceleration 150 g Sine peak.
- Max static payload capability 800 kgf (1760 lbf).
- Frequency range 5 – 2500 Hz.
- Pneumatic load support.
- Motorized gearbox for shaker rotation.
- Air-isolated trunnion.
- Available options:  
Air-isolation pads or mounts.  
Automatic armature centering in static and dynamic modes.  
Low and high-pressure slip tables for horizontal testing.

## P Series High-Performance Water-Cooled Shaker 8,000 kgf (17,600 lbf)

System Performance	P8044A
Sine Force Peak kgf (lbf)	8,000 (17,600)
Random Force kgf rms (lbf)	8,000 (17,600)
Shock Force (6 ms) kgf (lbf)	16,000 (35,200)
Frequency Range Hz	5 - 2500
Continuous Displacement mm (in)	51 (2.0)
Shock Displacement mm (in)	51 (2.0)
Max Velocity m/s (in/s)	2.0 (78.7)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	1470 (150)
Armature Diameter mm (in)	445 (17.5)
Effective Armature Mass kg (lb)	53 (117)
Max Static Payload kg (lb)	800 (1760)

## Auxiliary Equipment and Accessories Head Expanders and Fixtures

Sentek Dynamics provides a wide-variety of standard head expanders with and without guidance or load support and guidance. Cube, L-type and T-type fixtures for testing multiple components are available to accommodate multi-axis testing without a slip table.



# Water-Cooled Vibration Test Systems



## H Series and E Series Shakers

Sentek Dynamics' H Series and E Series are water-cooled vibration testing systems designed for high-force, long-duration development and production testing of large aerospace, automotive and industrial components and assemblies. Like Sentek Dynamics' air-cooled systems they provide cost-effective solutions to today's demanding test requirements. They are available in vertical only and mono-base configurations (integral slip table). Each system includes the shaker, amplifier, cooling unit and interconnecting cables and hoses.



- Up to 40,000 kgf (88,000 lbf) Sine force capability.
- Static payload capability up to 6000 kgf (13,200 lbf)
- Working frequency up to 2500 Hz.
- Pneumatic load support.
- Air-isolated trunnion.
- Motorized gearbox for shaker rotation standard.
- Available options:  
Air-isolation pads or mounts.  
Automatic armature centering in static and dynamic modes.  
Extended stroke available on most models.  
Low and high-pressure slip tables for horizontal testing.

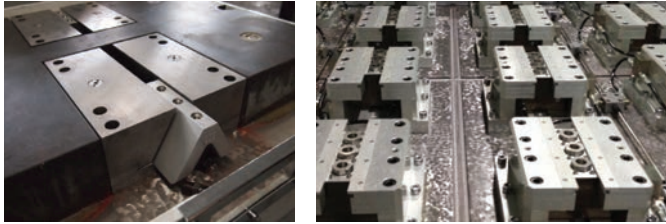
### H Series - High-Force Water-Cooled Shakers Water-cooled 6500 – 16,000 kgf (14,300 – 35,200 lbf)

System Performance	H6544A	H8044A	H10056A	H12056A	H16060A
Sine Force Peak kgf (lbf)	6500 (14,300)	8000 (17,600)	10,000 (22,000)	12,000 (26,400)	16,000 (35,200)
Random Force kgf rms (lbf)	6500 (14,300)	8000 (17,600)	10,000 (22,000)	12,000 (26,400)	16,000 (35,200)
Shock Force (6 ms) kgf (lbf)	13,000 (28,600)	16,000 (35,200)	20,000 (44,000)	24,000 (52,800)	32,000 (70,400)
Frequency Range Hz	5 - 2500	5 - 2500	5 - 2400	5 - 2400	5 - 2200
Continuous Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)
Shock Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)	51 (2.0)
Max Velocity m/s (in/s)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)	2.0 (78.7)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	980 (100)	980 (100)	980 (100)	980 (100)	980 (100)
Armature Diameter mm (in)	445 (17.5)	445 (17.5)	560 (22.1)	560 (22.1)	600 (23.6)
Effective Armature Mass kg (lb)	50 (110)	60 (132)	100 (220)	100 (220)	160 (352)
Max Static Payload kg (lb)	1000 (2200)	1000 (2200)	1500 (3300)	1500 (3300)	2000 (4400)

### E Series - Extra High-Force Water-Cooled Shakers Water-cooled 2000 – 40,000 kgf (44,000 – 88,000 lbf)

System Performance	E20060A	E30076A	E40082A
Sine Force Peak kgf (lbf)	20,000 (44,000)	30,000 (66,000)	40,000 (88,000)
Random Force kgf rms (lbf)	20,000 (44,000)	30,000 (66,000)	40,000 (88,000)
Shock Force (6 ms) kgf (lbf)	40,000 (88,000)	60,000 (132,000)	80,000 (176,000)
Frequency Range Hz	5 - 2200	5 - 1900	5 - 1700
Continuous Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)
Shock Displacement mm (in)	51 (2.0)	51 (2.0)	51 (2.0)
Max Velocity m/s (in/s)	2.0 (78.7)	1.8 (70.9)	1.8 (70.9)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	980 (100)	980 (100)	980 (100)
Armature Diameter mm (in)	600 (23.6)	760 (29.9)	820 (32.3)
Effective Armature Mass kg (lb)	160 (352)	230 (506)	350 (770)
Max Static Payload kg (lb)	2000 (4400)	3200 (7040)	6000 (13,200)

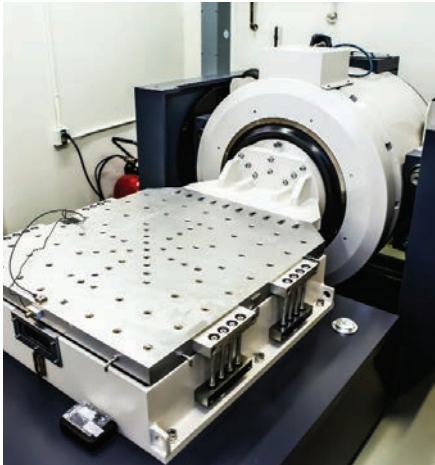
# Mono-base & Stand-alone Slip Tables



With today's demanding test requirements there is an increasing need for slip tables to facilitate testing in a horizontal position. Sentek Dynamics offers mono-base and stand-alone slip tables in low and high-pressure designs in standard sizes ranging from 300 mm (12 inches) to 2500 mm (98 inches). Custom sizes are also available including expandable slip tables when a larger mounting area is occasionally required.

In a mono-base configuration the shaker and slip table share a structural steel body that enables rapid conversion between vertical and horizontal positions, and the accurate alignment of the shaker relative to the slip table when rotated to the horizontal position.

In a stand-alone configuration an independent steel platform supported by leveling feet allows any vertical shaker from Sentek Dynamics or other manufacturer to couple with the slip table assembly.



### LST Series

Sentek Dynamics' low-pressure LST Series slip tables provide an affordable solution to horizontal testing requirements. LST Series slip tables utilize V-groove bearings to guide the magnesium slip plate over an oil-film on a precision ground granite slab. Oil from an integral hydraulic power supply is dispersed through ports in the granite slab under the magnesium slip plate.

- Affordable solution for horizontal testing.
- Integral hydraulic pump, reservoir and filter.

### HST Series

High-pressure slip tables utilizing T-slot bearings designed for testing heavy payloads with a high center of gravity. The HST Series provides the highest resistance to pitch, roll and yaw over-turning moments.

- Optimum solution for testing heavy payloads with a high center of gravity.
- Separate hydraulic power supply and oil cooler.
- More reliable than hydrostatic journal bearings.
- Lower maintenance costs over an extended period of time.

## LST and HST Series - Mono-base and Stand-alone Slip Tables

Series Designation	Max Payload		Slip Plate Thickness		Slip Plate Mass		No. of Bearings	Mass per Bearing		Total Bearing Mass		Pitch		Over-Turning Moments			
	kg	lb	mm	in	kg	lb		kg	lb	kg	lb	N-m	lbf-ft	N-m	lbf-ft	N-m	lbf-ft
LST300A	100	220	25	1.0	9	20	1	2	4.4	2	4.4	500	370	500	370	200	148
LST400M	150	330	25	1.0	10	22	1	2	4.4	2	4.4	875	648	875	648	200	148
LST500MT	150	330	25	1.0	14	31	2	2	4.4	4	8.8	1538	1138	1538	1138	200	148
LST500M	300	660	45	1.8	24	52	2	2	4.4	4	8.8	1538	1138	1538	1138	200	148
LST600M	300	660	45	1.8	34	74	2	2	4.4	4	8.8	2200	1628	2200	1628	200	148
LST700M	300	660	45	1.8	48	106	2	2	4.4	4	8.8	3000	2220	3000	2220	200	148
LST800M	400	880	45	1.8	60	132	2	2	4.4	4	8.8	3900	2886	3900	2886	200	148
LST900M	400	880	45	1.8	78	171	2	2	4.4	4	8.8	4900	3626	4900	3626	200	148
LST1000M	500	1100	45	1.8	135	297	4	2	4.4	8	17.6	6600	4884	6600	4884	1400	1036
LST1200M	500	1100	50	2.0	144	317	4	2	4.4	8	17.6	9100	6734	9100	6734	1540	1140
LST1500M	800	1760	50	2.0	246	541	6	2	4.4	12	26.4	14,750	10,915	14,750	10,915	3150	2331
LST1800M	1000	2200	60	2.4	323	711	6	2	4.4	12	26.4	20,700	15,318	20,700	15,318	3780	2797
LST2000M	1000	2200	60	2.4	478	1052	8	2	4.4	16	35.2	27,200	20,128	27,200	20,128	5600	4144
HST800M	8,000	17,600	45	1.8	81	178	4	5	11.0	20	44.0	45,000	33,300	38,000	28,120	8600	6364
HST1000M	10,000	22,000	50	2.0	121	266	9	5	11.0	45	99.0	90,000	66,600	82,000	60,680	15,000	11,100
HST1200M	10,000	22,000	50	2.0	183	403	9	5	11.0	45	99.0	112,000	82,880	98,000	72,520	17,000	12,580
HST1500M	15,000	33,000	50	2.0	292	642	16	5	11.0	80	176.0	200,000	148,000	156,000	115,440	24,000	17,760
HST1800M	15,000	33,000	50	2.0	384	845	16	5	11.0	80	176.0	224,000	165,760	178,000	131,720	28,000	20,720
HST2000M	18,000	39,600	60	2.4	598	1316	25	5	11.0	125	275.0	238,000	176,120	195,000	144,300	36,000	26,640
HST2500M	25,000	55,000	60	2.4	909	2000	36	5	11.0	180	396.0	265,000	196,100	202,000	149,480	45,000	33,300

# Real World Dynamic Simulation Systems

## T Series Long-stroke Shaker Systems

Transportation and package test requirements require low-frequency and large displacement performance. Sentek Dynamics' long-stroke T Series vibration testing systems are designed for test requirements normally performed by servo-hydraulic shakers. Compared to a servo-hydraulic shaker where the maximum test frequency is limited to approximately 450 Hz Sentek Dynamics' T Series is capable of up to 2300 Hz.

- Up to 5400 kgf (11,880 lbf) Sine force capability,
- Static payload capability up to 800 kgf (1760 lbf).
- Working frequency up to 2300 Hz.
- Displacements up to 100 mm (3.9 in).
- Pneumatic load support.
- Air-isolated trunnion.
- Motorized gearbox for shaker rotation standard.
- Available options:
  - Air-isolation pads or mounts.
  - Automatic armature centering in static and dynamic modes.
  - Low and high-pressure slip tables for horizontal testing.

## T Series - Long-Stroke Shakers

Air-cooled 3000 – 5400 kgf (6600 – 11,880 lbf)

System Performance	T3044A	T4044A	T5444A
Sine Force Peak kgf (lbf)	3000 (6600)	4000 (8800)	5400 (11,880)
Random Force rms kgf (lbf)	3000 (6600)	4000 (8800)	4330 (9,510)
Shock Force (6 ms) kgf (lbf)	6000 (13,200)	8000 (17,600)	10,800 (23,760)
Frequency Range Hz	5 - 2200	5 - 2200	5 - 2300
Continuous Displacement mm (in)	100 (3.9)	100 (3.9)	100 (3.9)
Shock Displacement mm (in)	100 (3.9)	100 (3.9)	100 (3.9)
Max Velocity m/s (in/s)	2.4 (94.4)	2.4 (94.4)	2.4 (94.4)
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	588 (60.0)	784 (70.9)	784 (70.9)
Armature Diameter mm (in)	445 (17.5)	445 (17.5)	445 (17.5)
Effective Armature Mass kg (lb)	50 (110)	50 (110)	68 (119)
Max Static Payload kg (lb)	500 (1100)	500 (1100)	800 (1760)

## MA Series Simultaneous 3-Axis Systems

Reproduction of a real-world environment in many cases requires a simultaneous 3-axis (X, Y and Z axes) vibration testing system to reproduce the failure mode which the single-axis test cannot. The Sentek Dynamics' MA Series is the affordable solution to MIL-STD-810G, Method 527 requirements for multi-exciter (axis) testing.

- Up to 6000 kgf (13,200 lbf) Sine force capability per axis.
- Working platform size up to 1000 x 1000 mm.



## MA Series - Simultaneous 3-Axis Shakers

Air-cooled 1000 – 6000 kgf (2200 – 13,200 lbf)

System Performance	MA-1000-4H	MA-3000-4H	MA-5000-5H	MA-6000-5H
Sine Force Peak kgf (lbf)	1000 (2200)	3000 (6600)	5000 (11,000)	6000 (13,200)
Random Force rms kgf (lbf)	700 (1540)	2100 (4620)	3500 (7700)	4400 (9680)
Frequency Range Hz	5 - 2000	5 - 2000	5 - 2000	5 - 2000
Max Acceleration Sine Peak m/s <sup>2</sup> (g)	78.4 (8)	78.4 (8)	78.4 (8)	78.4 (8)

# Power Amplifiers

## Digital Switching Power Amplifiers

Sentek Dynamics' modular digital switching (Class D) PA Series power amplifiers are air-cooled and designed for maximum reliability and efficiency. Rated power outputs range from 2 to 400 kVA. All amplifiers are provided with locking casters and BNC connectors on the front and rear panels of the logic control module. The power supply for shaker field coils and ancillary units are provided by the amplifier. Integrated ancillary units can be part of the start-up and stop sequences.

The logic control module with an LCD display and interactive microprocessor provides a user friendly interface and compatibility with most electrodynamic shakers. System status is continuously displayed and fault events are displayed on the LCD panel. Any over-current, over-travel, over-temperature or short-circuit will trigger an immediate system interrupt. A remote control panel is available that duplicates the features and functions of the logic control module front panel.

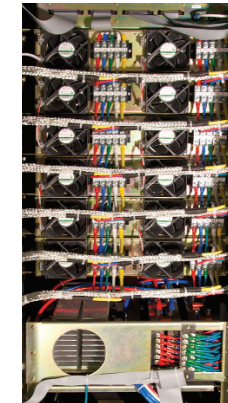
Designed to reduce the loss of power in the event of a failed component, each 12 kVA power-module consists of two independent 6 kVA sub-modules utilizing the latest in MOSFET technology. Ample air-cooling is provided to allow continuous operation at high-output levels.



- LCD panel displays system status with instantaneous output voltage and current.
- Conversion efficiency greater than 90%.
- High modulation switching frequency.
- High signal to noise ratio.
- Low total harmonic distortion.
- Certified to meet applicable CE requirements for EMC and safety.

## Linear Power Amplifiers

Sentek Dynamics' LA Series compact linear power amplifiers are designed to be used with Sentek Dynamics' line of permanent magnet desk top and modal shakers. They are adaptable to other manufacturer's permanent magnet shakers and applications requiring a linear amplifier. The LA Series of amplifiers is available with outputs ranging from 100 to 1500 VA. A built-in signal generator is included in the 100 VA model.



## Replacement Amplifier Program

Sentek Dynamics offers a full line of high-performance digital switching power amplifiers. These amplifiers are offered as replacements for older vacuum tube amplifiers and bi-polar transistor amplifiers.

Many vibration test systems purchased over the last 40 years include low-efficiency water-cooled power amplifiers housed in large multi-bay cabinets. These old technology amplifiers consume large amounts of 3-phase electrical power, occupy excessive amounts of valuable floor space and require environmentally "unfriendly" watercooling systems. All of these problems have one solution – a new highly efficient, air-cooled digital switching power amplifier from Sentek Dynamics.



# TURN-KEY VIBRATION TEST SOLUTIONS

with Sentek Dynamics shakers and Crystal Instruments vibration control system . . .  
delivering what test engineers demand.

Sentek Dynamics has the unique ability to provide turn-key vibration testing solutions. Along with its sister company Crystal Instruments, Sentek Dynamics can offer a vibration test system complete with shaker and Spider-81 vibration controller. This simplifies system purchasing and provides a single source for training and system support issues.



# The **SPIDER-81** family represents the fourth generation - fully networked, built on Ethernet with IEEE 1588 time synchronization.

The Spider-81 is a highly modular, distributed, scalable vibration control system developed by our sister company, Crystal Instruments. It represents the fourth generation of vibration control systems because of its advanced technology not seen in the previous generations.

## DSP CENTRALIZED ARCHITECTURE

Unlike traditional controllers that rely heavily on an external computer for real-time operation. The Spider-81 is the first controller that directly integrates the time-synchronized Ethernet connectivity with embedded DSP technology. This strategy greatly increases the control performance, system reliability and failure protection of the controller. It also allows large number of channels to be configured without sacrificing system performance.

## LATEST HARDWARE DESIGN

Spider-81 modules have voltage, charge, and IEPE inputs which are ideal for shock, vibration and acoustic measurement or general purpose voltage measurement. The internal flash memory stores test configuration data for controlling up to hundreds of channels simultaneously and stores real-time analysis data. Multiple output channels provide various signal output waveforms that are synchronized with the input sampling rate. A bright LCD displays testing status info. Ten monitoring connections on each unit can be used to read the signals of analog inputs and outputs. The front panel has a dozen function buttons. There are built-in isolated digital I/O and RS-485 serial ports to interface with other hardware.

## SIMPLE NETWORK CONNECTION

Ethernet connectivity allows the Spider-81 to be physically located far from the host PC. This distributed structure greatly reduces the noise and electrical interference in the system. One PC can monitor and control multiple controllers over the network. Since all the control processing and data recording are executed locally inside the controller, the network connection won't affect the control reliability. With wireless network routers, the PC can easily connect to the Spider remotely via Wi-Fi.

## TIME SYNCHRONIZATION BETWEEN MULTIPLE MODULES

The Spider-81 is built on IEEE 1588 time synchronization technology. Spider modules on the same network can be synchronized with up to 100 ns accuracy, which guarantees  $\pm 1$  degree cross channel phase match up to 20 kHz. With such unique technology and high-speed Ethernet data transfer, the distributed components on the network truly act as one integrated system.



# THE SPIDER FAMILY SOFTWARE - Individual Modules

## Random Vibration Control

Random Vibration Control provides precise multi-channel control in real time. The device under test is subjected to true random noise with a precisely shaped spectrum with either Gaussian or non-Gaussian amplitude statistics. With control dynamic range up to 90dB, up to 512 channels can be enabled for Control, Notching, Monitoring and time data recording. The recording option records time-stream data at the full sample rate on all input channels. A unique hardware/firmware/software design featuring spectral overlapping provides a fast loop time of less than 15 ms in a typical test.

Kurtosis control can provide a more damaging non-Gaussian random Control time-history. Non-linear control provides better performance at frequencies near sharp resonances. Non-acceleration control allows measuring and controlling physical measures other than acceleration. Multi-Drive control can integrate multiple shakers into a test. FRF measurement provides the transmissibility between all channel pairs with high precision phase match. 12,800 lines of resolution and frequency ranges up to 4,900 Hz are standard (up to 46 kHz optional). Any measured channel may influence the test control by serving as a Notching, Alarm or Abort channel.

## Sine on Random Control

Run mixed mode tests with Sine tones superimposed on a Random background.

## Random on Random Control

Run controlled, Random spectrum tests with swept Random tones super imposed on a Random background.

## Swept Sine Control

Swept Sine Vibration Control provides precise multi-channel control in real time. It provides a spectrally pure undistorted sine wave and a control dynamic range of up to 100 dB. As many as 512 channels can be enabled for Control, Notching, Monitoring and time-data recording. The recording option records a time-stream at the full sample rate on all input channels. A unique hardware design and spectral overlapping provides a fast loop time of less than 10 ms.

A random signal can be applied during pretest for checking the loop. Precise tracking filters are often applied to each channel with either fixed or proportional bandwidth. Spectral display resolution is from 256 to 4096 lines. Linear and logarithmic Sweep-speeds can be defined in Oct/Min, Hz/Sec, Dec/Min, Sweeps/Min, Sweep Time/Sweep or Cycles/Min. Non-acceleration control allows measuring and controlling on velocity or displacement sensors in lieu of acceleration. Multi-Drive control can drive more than one shaker. FRF measurement allows measuring the transmissibility between any channel-pair with high phase match. The standard frequency range is up to 4,900 Hz (up to 46 kHz optional). Notching, Alarm or Abort criteria can be set on each channel.

## Step Sine Control

Step Sine for a sequence of short dwells within a frequency range – steps are uniformly distributed in a log or linear frequency scale.

## Total Harmonic Distortion (THD) Measurement for Sine

This option adds the ability of computing Total Harmonic Distortion (THD) of the Control and Input signals. THD plots can be generated while drive signal either steps through multiple discrete frequencies or a swept sine tone within a predefined range.

## Classical Shock Control

Classical Shock Control provides precise, real-time, multi-channel control and analysis of transient time domain motion. Classical pulse shapes include half-sine, haversine, terminal-peak sawtooth, initial-peak saw tooth, triangle, rectangle, and trapezoid. The recording option records time stream data at the full sample rate on all input channels. Shock response spectrum (SRS) analysis can be applied to any input signal; optionally control of the DUT's SRS may be executed. Black Box mode allows a user to run the controller without a PC. Applicable *Test Standards* include MIL-STD-810F, MIL-STD-202F, ISO 9568 and IEC 60068 (plus user-defined specifications).

## Transient Time History Control (TTH)

Targeting seismic simulation applications, TTH controls shaker motion to match any user defined transient waveform.

Time waveforms can be imported to EDM in various formats. Scaling, editing, digital re-sampling, high-pass, low-pass filtering and compensation will tailor the waveform so that it may be duplicated on a particular shaker. Compensation varies the waveform so that it does not exceed the maximum shaker displacement. Methods include pre-pulse, post-pulse, pre and post-pulse, DC removal and high-pass filters. Pre-stored profiles include Bellcore Z1, Z2, Z3 and Z4; Sine; Chirp; Burst Sine and others. An option is available to run profiles requiring sampling frequency lower than 120Hz. Large block sizes up to 64,000 samples are provided.

Shock Response Spectrum analysis can be applied to any input time signals to generate SRS instantaneously. *SRS Type* includes maxi-max, primary, residual and composite. A low frequency option supports imported profiles with sampling rate lower than a few Hz. An option to compute pseudo-velocity shock response spectra (PVSRS) from acceleration measurements in accordance with ANSI S2.62-2009 and STANAG 4549 is available.

## Shock Response Spectrum (SRS) Synthesis and Control Time Waveform Replication

In mid 90s, James Zhuge invented a new algorithm that can precisely duplicate a recorded signal continuously on a shaker. By using this algorithm, Time Waveform Replication (TWR) provides precise, real-time, multi-channel control for long waveform duplication. TWR includes the Waveform Editor, a flexible importing and editing tools for long waveform signals. The Recording option records time-stream data at the full sample rate on all input channels.

Multiple waveform recordings can be available in the same test to automatically run, one after the other on the test specimen. The *maximum number of points* is subject to the internal flash memory space available for storing profile data (currently 3.7 GB), which corresponds to approximately 1 billion data points. At a sampling rate of 200 samples/sec. It can replicate a waveform of about 50 days.



## Individual Software Modules include:

Waveform Editing for TTH and TWR

Sine Oscillator

Dual-Shaker Control for Sine or Random

Non-Acceleration Control

Real-Time Sine Reduction

Sensor Calibration

Spider Front-end Calibration Software



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