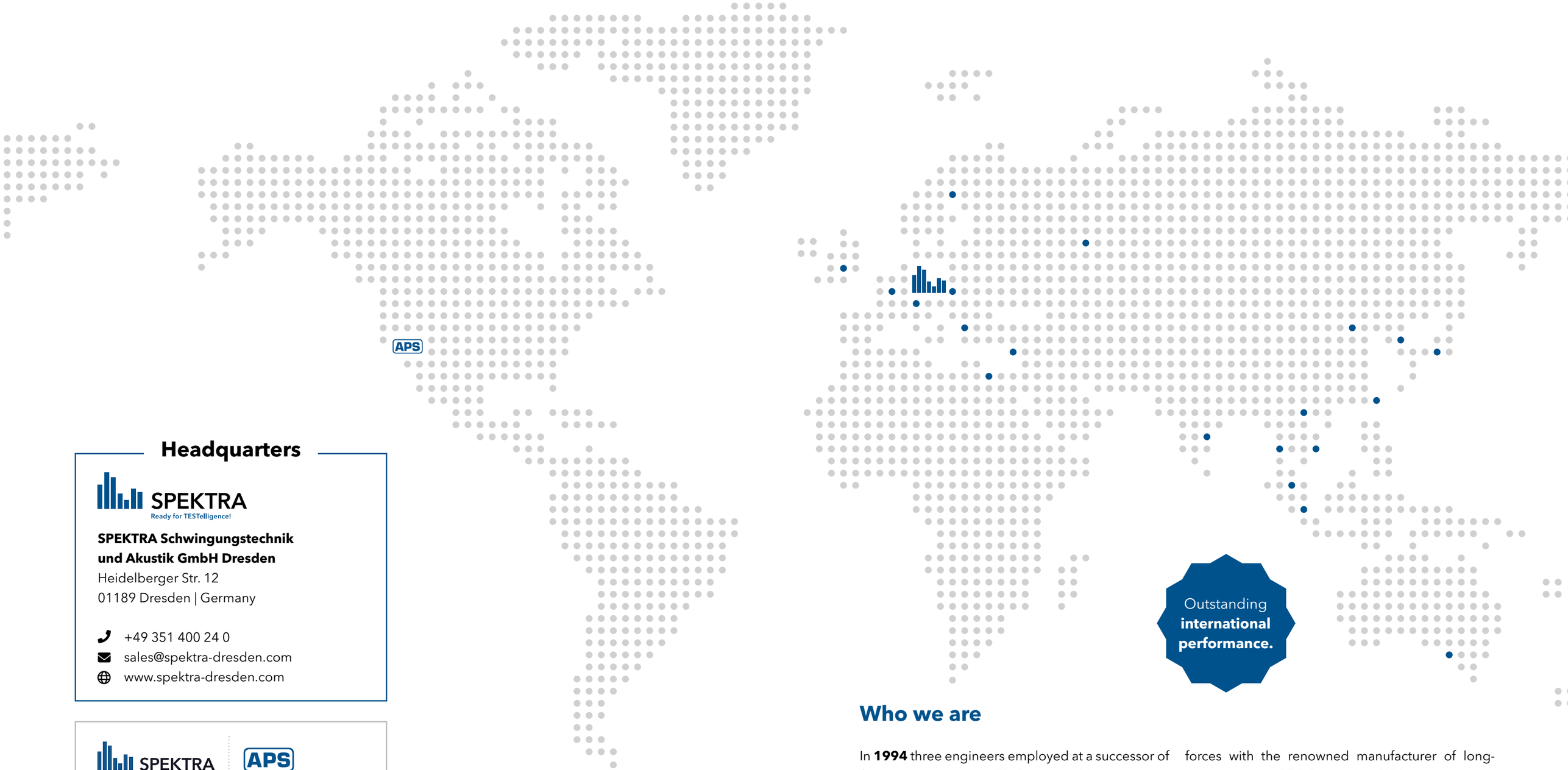
ST

SPEKTRA
Ready for TESTelligence!

ST | Structural Testing

Edition 03-2023

APS
a brand of SPEKTRA



Headquarters

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Ready for TESTelligence!

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● SPEKTRA Representatives

Outstanding **international performance.**

Who we are

In **1994** three engineers employed at a successor of former state-owned VEB Robotron Messelektronik Dresden - Department of sound, vibration and force measurement were dissatisfied with the progress of the enterprise. Willing to seize the opportunities provided by the new dynamic economy of a reunified Germany, they decided to launch their own business, **SPEKTRA Dresden**, Germany. It all started with the development and manufacturing of a final test system for the production of the first generation of MEMS-based airbag sensors. In 2008 SPEKTRA joined forces with the renowned manufacturer of long-stroke shakers **APS Dynamics, USA** to extend the product portfolio and strengthen the international sales force. Since then SPEKTRA has developed into a stable, mid-sized enterprise in the field of testing, calibration and characterization of sensors for the measurement of dynamic mechanical quantities. With expertise in mechanical, electrical and software engineering, SPEKTRA develops target-oriented, customized solutions that address the challenges of laboratory and volume production applications.

CS | Calibration Solutions

DT | Device Testing

ST | Structural Testing

ES | Engineering Solutions

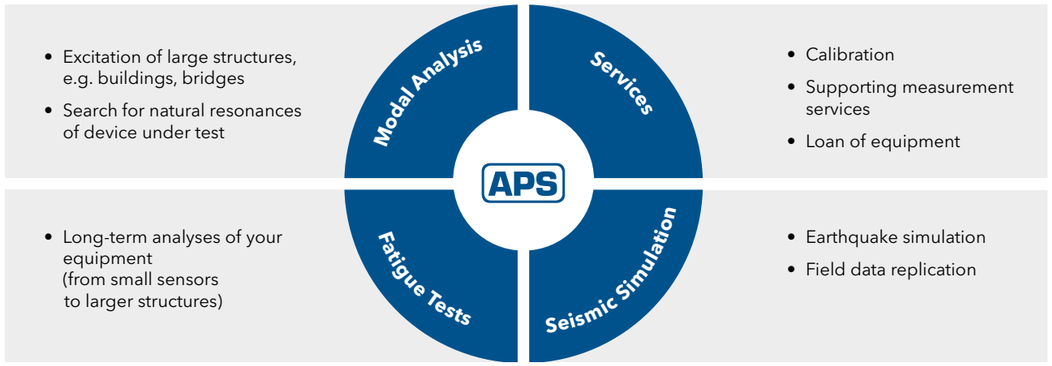
Ready for TESTelligence!



Portfolio

50 Years of Experience in Modal Excitation

APS has been a well-known supplier of modal exciters for 50 years. In 2008 SPEKTRA and APS joined forces and have built a new generation of even stronger exciters together – based on decades of know-how from both sides. Do you need to ensure the structural stability and endurance of your equipment under stress? Would you like to verify your product's properties? Do you need modal exciters for tests in your laboratory or in the field? SPEKTRA will find a solution for your individual measurement task.



- Excitation of large structures, e.g. buildings, bridges
- Search for natural resonances of device under test

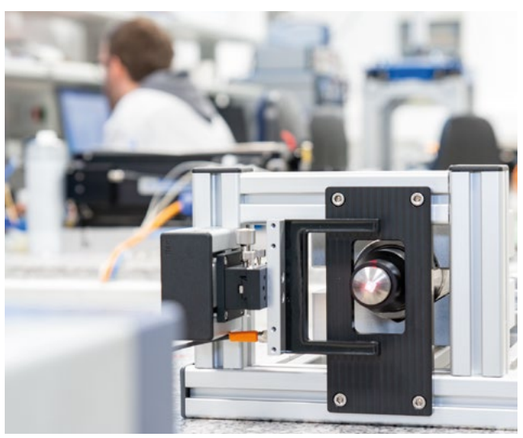
- Calibration
- Supporting measurement services
- Loan of equipment

- Long-term analyses of your equipment (from small sensors to larger structures)

- Earthquake simulation
- Field data replication

Your One-Stop-Shop for Measurement Tasks

- ✓ Professional and qualified consultation for your shaker selection
- ✓ Modular shaker system with a wide range of components and specialized accessories
- ✓ Turnkey solution including vibration controller and software
- ✓ Calibration services (DAkkS or A2LA accredited) for impact hammers, impedance sensors, accelerometers, seismometer, force transducers, et al.





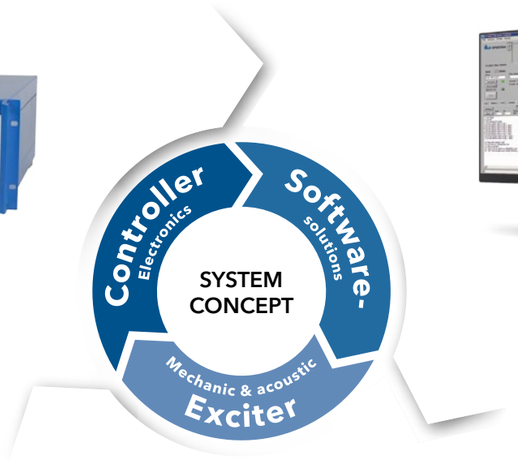
System Concept

We provide well-balanced sets of exciter, amplifier, controller and sensor to get optimal performance and high precision in a wide range of applications. The software is dedicated to structural test solutions and ready for synchronization and system integration.

Various multi-channel control options are available. Possible modes are manual control for investigation, script-based control to perform test rows and remote control by DLL, ethernet or digital I/O to be a part of a test system.



CONTROLLER
High flexibility allows system configuration according to your individual needs.





SOFTWARE
Various applications are made possible with high flexibility in our software.



EXCITER
Based on your requirements you may choose from our portfolio of modal exciters.

Advantages

- Optimized for low frequency operation with long stroke
- MIMO capabilities – up to 8 control channels and scalable number of input channels
- Locked phase with adjustable and controlled phase shift for multiple I/O channels
- Dual-Mode amplifiers (current / voltage mode) with lowest backlash on testing structure
- Integrated overload protection (temperature, stroke, current)

Exciters



Attributes*	APS 113
Frequency	DC…200 Hz
Stroke	158 mm
Armature / body weight	2.3 kg / 35 kg
Force	186 N



Attributes*	APS 400
Frequency	DC…200 Hz
Stroke	158 mm
Armature / body weight	2.7 kg / 70 kg
Force	445 N



Attributes*	APS 420
Frequency	DC…200 Hz
Stroke	150 mm
Armature / body weight	3.8 kg / 136 kg
Force	900 N

Dual-Mode Amplifiers



Attributes*	PA 500 DM
Power output	500 VA
Voltage output	45 V RMS
Current output	11 A RMS
Frequency range	DC … 60 kHz

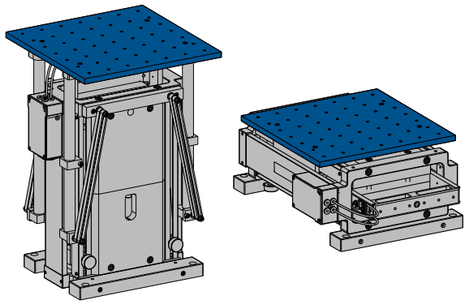


Attributes*	PA 800 DM
Power output	810 VA
Voltage output	45 V RMS
Current output	18 A RMS
Frequency range	DC…10 kHz

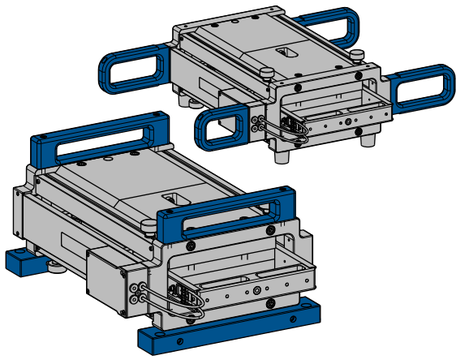
* detailed values can be found in our datasheets

Accessories for APS shaker

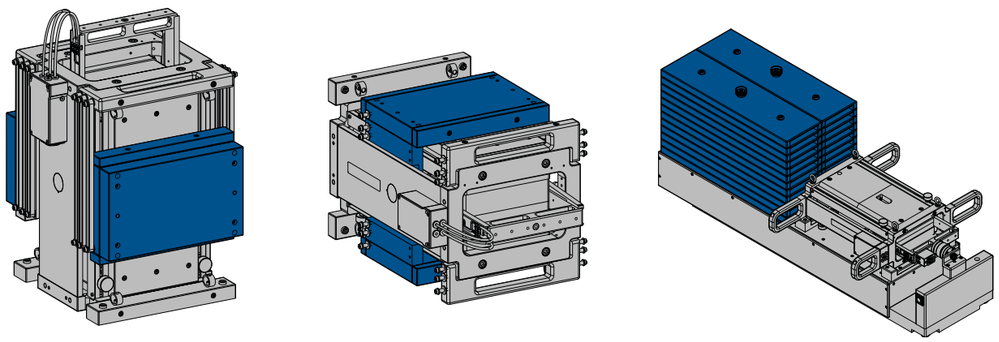
Auxiliary Table Kit

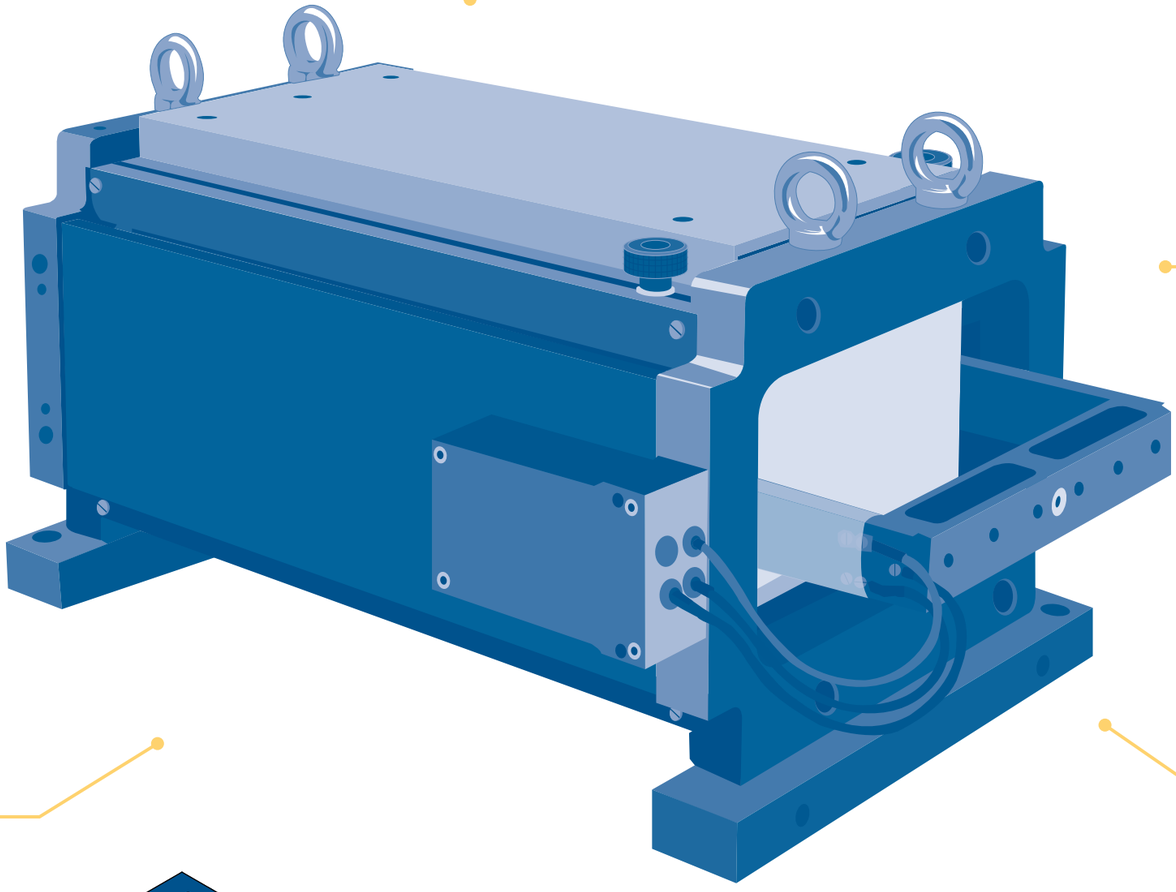


Handles

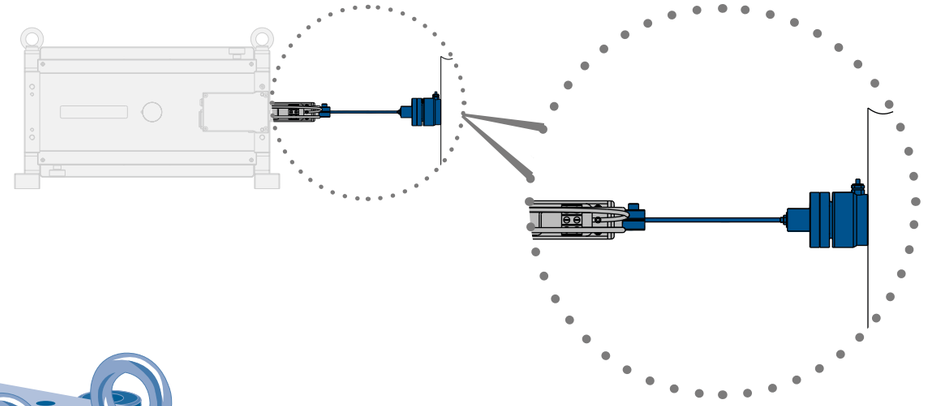


Reaction Mass

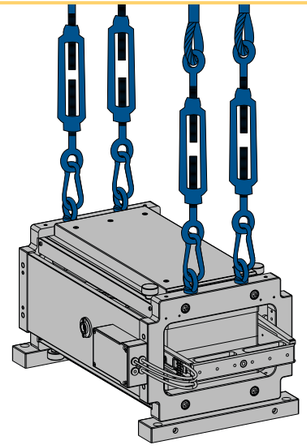




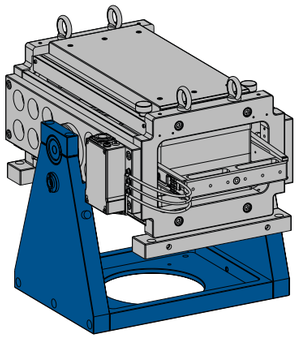
Modal Stinger Kit



Steel Cable Kit

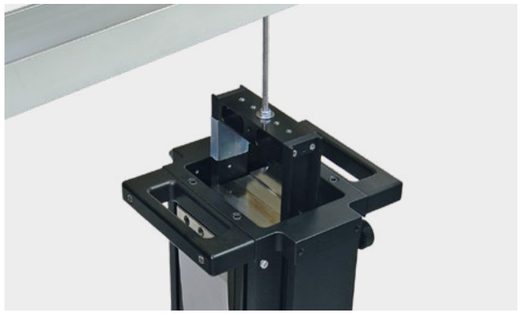


Trunnion Base



Modes of Operation

Fixed Body Mode

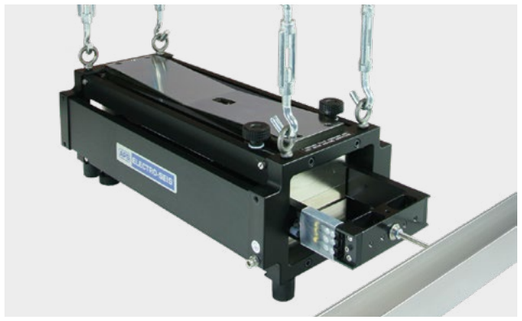


Key Features

- (Generated) shaker force applied directly to structure
- Low influence on structure due to low armature mass
- Measurement of delivered force by force transducer or shaker current

In the Fixed Body Mode, the shaker body is fixed and the armature is attached to the test structure. So, shaker force is delivered directly to the test structure. In this mode, force delivered to the test structure can be measured by inserting a force transducer in the thrust linkage between the armature and test structure. Alternatively, with the armature/body suspension bands removed, shaker current can be used as a direct measure of the generated force. The generated force is approximately equal to the force delivered to a resonant test structure, because the armature mass is typically small compared to the modal mass of most large test structures.

Free Body Mode



Key Features

- Suitable if the test object is in high altitude
- Accelerated shaker body inserts reaction force to the test structure
- Measurement of inserted force by a force transducer or the acceleration of the shaker body

The desired force input points on many test structures lie at a considerable distance above ground level. For tests on such items, it becomes difficult and expensive to use Fixed Body Mode support structures. For such applications, the Free Body Mode can be employed. In this mode the shaker body is used as the reaction mass by suspending the shaker from an overhead support. Besides using a force transducer, a very convenient measure of the load force is the axial acceleration of the shaker body. This allows simplification of the test system instrumentation, in that force can be measured with an accelerometer system which is identical to that used to measure the structural response.

Reaction Mass Mode



Key Features

- Inertial vibration exciter
- Vertical or horizontal operation
- Easy to install reaction mass

Many large test structures with horizontal surfaces, such as floors, require vertical or horizontal force applied to these surfaces to generate resonant modes of vibration. The APS shakers may be used in a vertical or horizontal Free Armature Mode by resting the shaker body on the horizontal surface. The moving armature provides a reaction mass that allows for delivery of the shaker force via the shaker body to the surface (inertial shaker). Below a certain cross-frequency the shaker stroke limits the acceleration of the armature and thus the maximum force. Additional masses, e.g. APS 0112 or APS 4001, lower this frequency. The force applied to the structure can be measured by a force transducer or by measuring the acceleration of the moving masses.

Shaker Table Mode



Key Features

- Horizontal and vertical long stroke tables
- Rugged design for harsh environment
- High payload – up to 20 kg

Auxiliary table accessory units for both horizontal and vertical use employ the high load capability of the APS 113 armature guidance and suspension systems to provide long stroke tables for excitation of test loads. Each auxiliary table has a pattern of threads with helical inserts to mount the test load directly or a fixture on the table. The mechanical input impedance at the base of a test load that is resonant in the operating frequency range can vary significantly. Thus, the acceleration response of the table and test item base will exhibit the familiar „peaks“ and „notches“ as frequency varies. So it is recommended to observe the response of the structure using accelerometers.

APS 4001 – Horizontal Reaction Mass System



Assume you have to identify lateral modal modes of a bridge or building that may be well damped in a frequency range down to 1 Hz or lower. Thus, a modal test by means of an inertial shaker would require passing the full rated exciter force horizontally into the building. An APS 400 long-stroke shaker can be equipped with reaction masses for this purpose, but can develop its full force only down to 3.7 Hz. Below this frequency the maximum force decreases with 12 dB/Octave due to the limited stroke. Increasing the reaction mass can significantly compensate this limitation. The Horizontal Reaction Mass System APS 4001 provides a means of extending the rated force output for the APS 400 shaker to frequencies as low as 0.5 Hz. For this purpose, the system can be equipped with up to 700 kg moving mass. This is heavy but still a mobile solition because the APS 4001 can be easily dismantled into subassemblies that can be carried by man.

Advantages

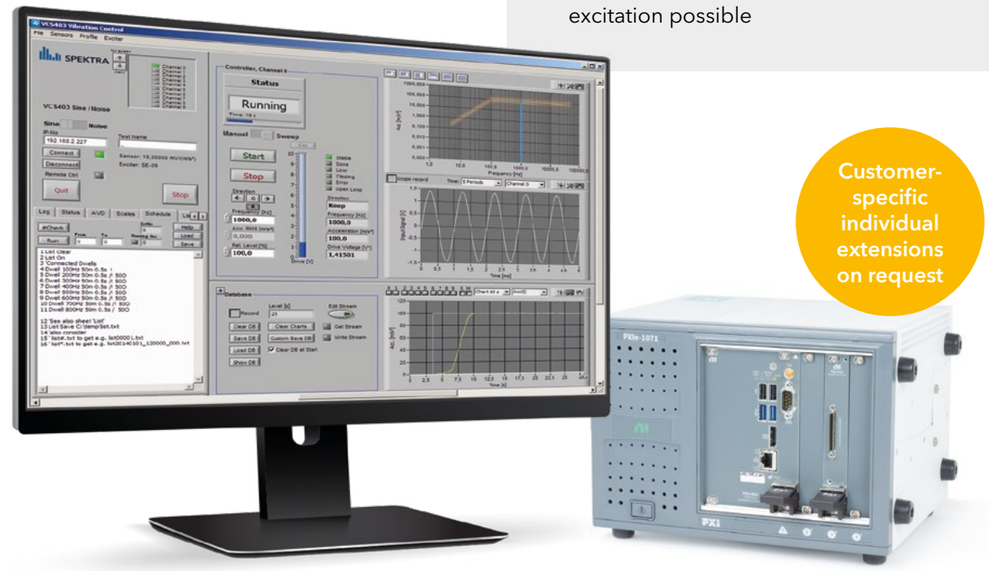
- Horizontal excitation with 400 N rated force from 0.5 Hz … 20 Hz
- Up to 700 kg reaction mass attachable
- Easy to disassemble and transport to a test location
- Can be equipped with a reference force transducer (option)

Controller & Software

Our software is a perfect match to the hardware of National Instruments. It is a LabVIEW-based software solution. So it can easily be integrated into your environment. The LabVIEW software package allows for driving several exciters to achieve different physical measurements in parallel and updating the test system for further purposes as required. In addition you can use it for laboratory applications and scale it up to an automated test system.

Flexible Software Components

- Scalable technology, from a very simple control unit up to a very high-performance, multi-channel controller
- Operation modes: sine, random, shock, chart, FDR, …
- Coordinated synchronized multi-channel excitation, also synchronized 3-dimensional excitation possible



Customer-specific individual extensions on request

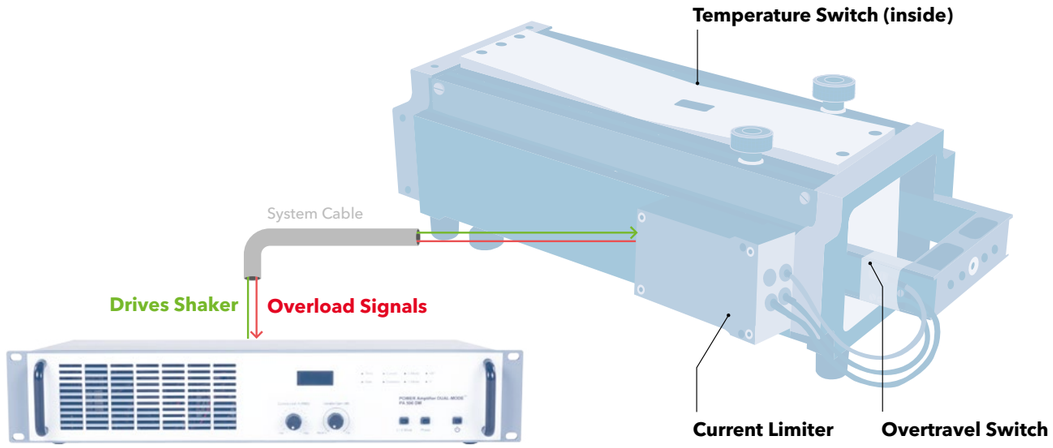
Advantages

- Single and multichannel excitation
- Synchronized excitation channels
- Adjustable and controlled phase shift between excitation channels
- Earthquake simulation
- Field data replication (FDR)
- Multi-channel data acquisition
- Intuitive handling
- Configurable CSV result files
- Remote control
- Synchronizing and trigger signals
- Reports and monitoring
- Frequency range 0.01 Hz…95 kHz
- Integration of laser vibrometer



Featured Protection Functions

Since APS shakers are used for multiple applications and test scenarios, this can lead to situations where the shaker needs to be driven to its limits. SPEKTRA spent a lot of effort to protect the shaker and power amplifier against damages when operating in the limit range or due to accidental events. For this purpose, the shaker is connected with the corresponding APS power amplifier by means of a special system cable. Besides the regular power transmission from the amplifier to the shaker, this cable additionally allows transmitting signals from the shaker to the amplifier. Receiving an overload signal from the shaker, the power amplifier will immediately shut down the output signal and thus protect the shaker.



Temperature Switch

- attached to the coil to prevent an overheating
- protection if shaker is operated continuously over a long time with high force amplitude

Overtravel Switch

- attached to the armature to prevent mechanical damages due to an exceeding stroke
- protect the shaker when it is operated at the stroke limit

Current Limiter

- to protect the shaker against a too high current through the coil
- for shaker operation at the rated force limit



Applications



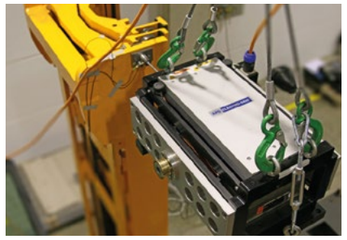
Aviation

e.g. determination of dynamic properties of an airplane wing and its substructures



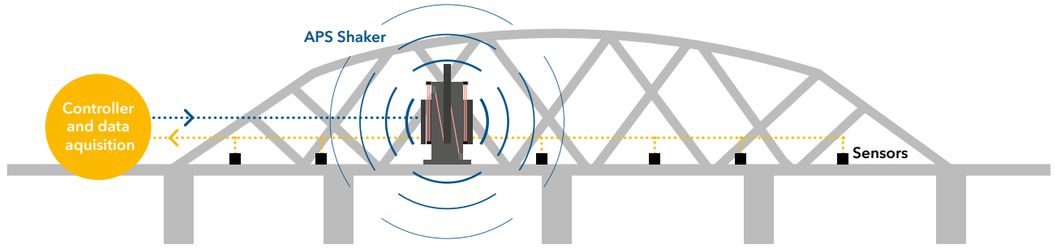
Seismic Simulation

Earthquake simulation, Field data replication



Fatigue Tests

e.g. sine excitation of forklift structure



Excitation of bridges

Have you ever heard of the tragic collapse of Tacoma Narrows Bridge in 1940 which was later called the "Pearl Harbor of engineering"? Unfortunately, the structure of the bridge had not been tested the way our APS shakers can test its dynamic properties.

? How can the Dual-Mode Amplifiers support your Application?

The **Voltage Mode** is used for general shaker operation. This mode produces high internal damping in the shaker armature motion due to the low amplifier source impedance. The **Current Mode** is normally used in modal test excitation or whenever the shaker is required to have minimum effect on the system damping. This is particularly important during measurement of damping by the decay method. For this reason, a Mute function is provided which retains the current mode operation with the drive signal removed. This function provides a convenient means to initiate system response delay.