APS Long Stroke Shaker ELECTRO-SEIS®

with Air Bearing and Load Mounting Table

APS 129

APS 500

APS 600

Applications

- Seismic simulation for components
- Calibration and test for seismic instruments
- Sensor characterization

Range of Use

- Departments for the supervision of measuring instruments in research, industry, automotive, aviation, space, military
- Test and calibration laboratories

Features

- Long stroke shaker for sine wave, swept sine wave, random or impulse force waveforms
- Mounting table for high payloads
- Low noise vibration by means of air bearing guidance and support

Specifications

	APS 129	APS 129-HF Increased Force	APS 500	APS 600
Force (Sine Peak)	133 N (30 lbf)	186 N (42 lbf)	95 N (21 lbf)	215 N (48 lbf)
Stroke (Peak - Peak)	158 mm (6.25 inch)		152 mm (6.0 inch)	400 mm (15.7 inch)
Frequency Range	DC … 200 Hz			DC … 100 Hz
Operation	horizontal or vertical			
Armature Weight	8.5 kg (18.7 lb)		1.5 kg (3.3 lb)	9.3 kg (20.5 lb)
Max. Payload Horizontal	23.0 kg (50.7 lb)		3.0 kg (6.6 lb)	25 kg (55 lb)
Max. Payload Vertical	11.0 kg (24.3 lb)		1.3 kg (2.9 lb)	8 kg (18 lb)
DC Coil Resistance	4.4 or 1.1 Ω	1.4 Ω	1.2 Ω	1.7 Ω
Air Pressure Required	4 bar … 5 bar (60 psig … 70 psig)			2 bar … 3 bar (30 psig … 45 psig)
Air Flow Required	650 l/h (0.4 cfm)			
Total Shaker Weight	79.0 kg (174.2 lb)		64.0 kg (141.1 lb)	250 kg (550 lb)
Overall Dimension L x W x H	889 x 219 x 216 mm (35 x 8.6 x 8.5 inch)		813 x 219 x 210 mm (32 x 8.6 x 8.3 inch)	905 x 440 x 360 mm (35.6 x 17.4 x 14.2 inch)
Load Table Size L x W	254 x 254 mm (10 x 10 inch)		79.5 x 79.5 mm (3.1 x 3.1 inch)	254 x 254 mm (10 x 10 inch)

Accessories (optional)

	APS 129	APS 129-HF	APS 500	APS 600
Power Amplifier	APS 125			
System Cables for Connection Shaker to Amplifier	APS 0082-6E			
Zero Position Controller for Vibration Exciters	APS 0109			
Vertical Mounting Kit / Vertical Operation Kit	APS 1291		APS 5002	-

Additional accessories available

APS Long Stroke Shaker ELECTRO-SEIS®

with Air Bearing

Overview 2/2

APS 113-AB

APS 113 AB-LA

Applications

- Seismic simulation for components
- Calibration and test for seismic instruments
- Sensor characterization

Range of Use

- Departments for the supervision of measuring instruments in research, industry, automotive, aviation, space, military
- Test and calibration laboratories

Features

- Long stroke shaker for sine wave, swept sine wave, random or impulse force waveforms
- Low noise vibration by means of air bearing guidance and support

Specifications

	APS 113-AB	APS 113-AB-HF Increased Force	APS 113-AB-LA Lightweight Armature
Force (Sine Peak)	133 N (30 lbf)	186 N (42 lbf)	95 N (21 lbf)
Stroke (Peak - Peak)	158 mm (6.25 inch)		
Frequency Range	DC … 200 Hz		DC … 400 Hz
Operation	horizontal or vertical		
Armature Weight	2.7 kg (5.8 lb)		0.95 kg (2.1 lb)
Max. Overhung Load at Armature Attachment Point	1.5 kg (3.3 lb)		1.0 kg (2.2 lb)
Impedance	4.4 or 1.1 Ω	1.4 Ω	1.2 Ω
Air Pressure Required	4 bar … 5 bar (60 psig … 70 psig)		
Air Flow Required	500 l/h (0.3 cfm)		
Air Quality	ISO 8573.1 Class 3		
Total Shaker Weight	36.0 kg (80 lb)		34.0 kg (75 lb)
Overall Dimension L x W x H	526 x 213 x 168 mm (20.7 x 8.4 x 6.6 inch)		

Accessories (optional)

	APS 113-AB	APS 113-AB-HF	APS 113-AB-LA
Power Amplifier	APS 125		
System Cables for Connection Shaker to Amplifier	APS 0082-6E		
Zero Position Controller for Vibration Exciters	APS 0109		
Vertical Mounting Kit / Vertical Operation Kit	APS 0162		

Additional accessories available

All data are subject to change without notice

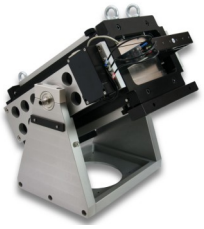
January 2018

APS Long Stroke Shaker ELECTRO-SEIS®

with Linear Ball Bearings

APS 113 horizontal

APS 400 vertikal
with APS 0412 Reaction Mass



APS 420 horizontal
with APS 4222 Trunnion Base

Applications

- Modal analysis of dynamic loaded structures
- Seismic simulation for components
- Calibration and test for seismic instruments
- Geoservice, Geoscience, Geophysics, Geoseismic

Range of Use

- Departments for the supervision of measuring instruments in research, industry, automotive, aviation, space, military and civil engineering
- Test and calibration laboratories

Features

- Long stroke shaker for sine wave, swept sine wave, random or impulse force waveforms
- Optimized to deliver power to resonant load with minimum shaker weight and drive power
- Rugged linear guidance system

Specifications

	APS 113 / APS 113-HF	APS 400	APS 420
Force (Sine Peak)	133 N / 186 N (30/42 lbf)	445 N (100 lbf)	900 N (200 lbf)
Velocity (Sine Peak)	1,000 mm/s (39 inch/s)		
Stroke (Peak - Peak)	158 mm (6.25 inch)		150 mm (5.9 inch)
Frequency Range	DC … 200 Hz		
Operation	horizontal or vertical		
Armature Weight	2.3 kg (5.1 lb)	2.8 kg (6.2 lb)	3.6 kg (8.0 lb)
Max. Overhung Load at Armature Attachment Point	9.0 kg (20 lb)		
DC Coil Resistance	4.4 or 1.1 Ω / 1.4 Ω	1.6 Ω	1.1 Ω
Total Shaker Weight	36.0 kg (80 lb)	73.0 kg (161 lb)	140.0 kg (310 lb)
Dimension L x W x H	526 x 213 x 168 mm (20.7 x 8.4 x 6.6 inch)	526 x 314 x 178 mm (20.7 x 12.4 x 7.0 inch)	591 x 360 x 280 mm (23.3 x 14.2 x 11.0 inch)

APS Long Stroke Shaker ELECTRO-SEIS®

with Linear Ball Bearings

Accessories (optional)

	APS 113	APS 400	APS 420
Power Amplifier	APS 125	APS 145	
System Cables for Connecting Shaker to Amplifier	APS 0082-6E	APS 0082-6E	
Auxiliary Table Kit − Horizontal	APS 0052	APS 0452	
Auxiliary Table Kit − Vertical	APS 0077	APS 0477	
Auxiliary Table Kit − Horizontal and Vertical	APS 0078	APS 0478	
Reaction Mass Assembly	APS 0112	APS 0412	APS 4212
Lifting Handles (Set of 4)	APS 0414	APS 0414	APS 4221
Carrying Handles and Tie-down Bars	APS 0108	APS 0421	
Trunnion Base	APS 4222		
Over Travel Switch	APS 8543		
Modal Stinger Kit	APS 8610		
Steel Cable Kit	APS 8611	APS 8612	

Additional accessories available

APS 113-AB ELECTRO-SEIS®

Long Stroke Shaker with Linear Air Bearings

The **APS 113-AB ELECTRO-SEIS®** Air Bearing shaker is a long stroke, electrodynamic force generator specifically designed to be used for calibration and evaluation of accelerometers and other motion transducers. It provides excellent properties for low frequency excitation of such devices. Furthermore it is optimized for measuring decay rates in very lightly damped structures.

Applications

- Calibration and test for seismic instruments
- Seismic simulation for components
- Determination of natural mode frequencies, shapes, damping ratios, and stress distributions

Features

- Designed for calibration and evaluation of accelerometers
- Can be used to generate sine wave, swept sine wave, random or impulse force waveforms, fully adjustable at source
- Optimized to deliver power to very lightly damped structures with minimum shaker weight and drive power
- Adjustable armature re-centering for horizontal and vertical operation or other external pre-loads
- Rugged standard armature and air bearing guidance system
- One-Man Portability - 36 kg (80 lb) total weight

Description and Characteristics

The APS 113-AB ELECTRO-SEIS® shaker, the Air Bearing version of the APS 113 ELECTRO-SEIS® shaker, is a long stroke, electrodynamic force generator, designed for calibration and evaluation of accelerometers and other motion transducers.

Air lubricated bushings replace the linear ball bearings used in the basic ELECTRO-SEIS® armature guidance system. In addition an air distribution system, tie down and leveling base are provided.

The near zero friction of the air bushings is an essential feature for measuring resonance decay rates in very lightly damped structures.

The unit employs a permanent magnet and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range. This feature, along with the air bearings, assures a high degree of force linearity and absence of armature guidance induced noise and distortion. Drive power for the shaker is obtained from a low frequency power amplifier, such as the APS 125 - Power Amplifier.

Modes of operation requiring high bearing loads (table mode and APS 0112 - Reaction Mass mode), permissible with the standard linear ball bushing version, are not permitted with the APS 113-AB shaker. Since the suspension system need not support the armature and test load weight when used in the horizontal mode, a soft suspension may be used, minimizing non-linearity effects. The maximum overhung load that may be used is 1.5 kg (3.3 lb) concentrated at the mounting point.

The shaker may be used with various optional accessory items to extend the areas of application:

APS 0108 - CARRYING HANDLES AND TIE-DOWN BARS - improve the portability feature of the shaker.

APS 0109 - ZERO POSITION CONTROLLER - automatically controls the zero position of a vibration exciter irrespective of its load.

APS 0162 - VERTICAL MOUNTING KIT - permits vertical orientation of the shaker, either free-standing or rigid bench attachment.

APS 113-AB with APS 0162
Vertical Mounting Kit

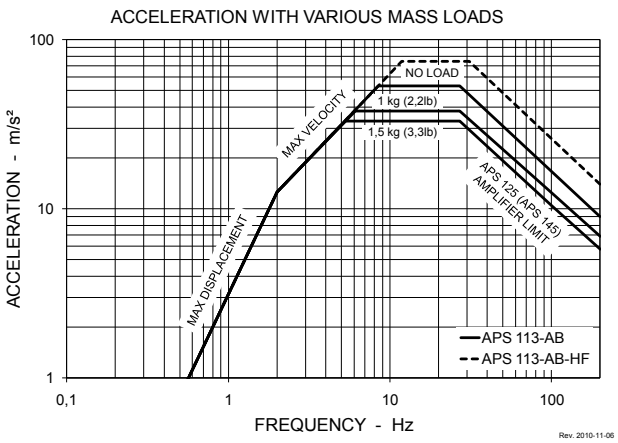
Optional Configurations

APS 113-AB-HF

All features of the basic APS 113-AB shaker are retained. The drive coil is made for 40 % increase in force with a 50 % duty cycle (30 min cycle).

Performance

Acceleration performance of the APS 113-AB shaker with various mass loads is shown in the lower graph.



Specifications

Shaker	APS 113-AB	APS 113-AB-HF
Force (Sine Peak)	133 N (30 lbf)	186 N (42 lbf)
Stroke (Peak - Peak)	158 mm (6.25 inch)	
Frequency Range	DC … 200 Hz	
Operation	horizontal or vertical	
Armature Weight	2.7 kg (5.8 lb)	
Max. Overhung Load at Armature Attachment Point	1.5 kg (3.3 lb)	
DC Coil Resistance	4.4 or 1.1 Ω	1.4 Ω
Air Pressure Required	4 bar … 5 bar (60 psig … 70 psig)	
Air Flow Required	500 l/h (0.3 cfm)	
Air Quality	ISO 8573.1 Class 3	
Total Shaker Weight	36.0 kg (80 lb)	
Shipping Weight	41.0 kg (90 lb)	
Overall Dimension L x W x H	526 x 213 x 168 mm	
Operating Temperature	5 ... 40 degrees C	
Storage Temperature	-25 ... 55 degrees C	

Accessories (optional)

Shaker	APS 113-AB	APS 113-AB-HF High Force
Power Amplifier	APS 125	
System Cable for Connection Shaker to Amplifier	APS 0082-6E	
Carrying Handles	APS 0108	
Zero Position Controller for Vibration Exciters	APS 0109	
Vertical Mounting Kit	APS 0162	
Overtravel Switch	APS 8543	

Additional accessories available

All data are subject to change without notice

March 2014

APS 129 ELECTRO-SEIS®

Long Stroke Shaker with Air Bearing Load Mounting Table

The **APS 129 ELECTRO-SEIS®** Air Bearing shaker is a long stroke, electrodynamic force generator specifically designed to be used for calibration and evaluation of accelerometers and other motion transducers. It provides excellent properties for low frequency excitation of such devices. The model consists of an air bearing driver attached to an air bearing load mounting table that allows high payloads up to 23 kg (50 lb) e.g. for the calibration of geophones and heavy seismic sensors.

Applications

- Calibration and test for seismic instruments like geophones and heavy seismic sensors
- Seismic simulation for components

Features

- 133 N (30 lbf) or 186 N (42 lbf) force (sine peak)
- 254 x 254 mm (10 x 10-in) load mounting table
- Air bearing guidance and support system carries up to 23 kg (50 lb) test load with very low cross-axis motion
- Efficient electrodynamic driver produces sine, random or transient waveforms
- Excellent waveform purity

Description

The APS 1290 ELECTRO-SEIS® shaker consists of a load mounting table and air bearing assembly driven by an APS 113-AB ELECTRO-SEIS® long stroke air bearing shaker. The shaker imparts transverse base excitation to items mounted on the table.

Static and dynamic loads normal to the table surface are transferred through a large area precision air bearing to a rigid guide bar of rectangular cross section. The driver unit and guide bar assembly are mounted on a common rigid base, ensuring correct alignment of all moving parts.

The standard hole pattern consists of 25 threaded holes in a 5 x 5 array. Optional metric threads and spacing are available.

The APS 113-AB driver unit employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range ensuring a high degree of linearity. The self-cooled armature coil requires power from a matching electronic power amplifier.

Clean, water and oil free air for bearing operation is carried to the moving bearing housing by flexible PVC tubing, constrained to move with a rolling action.

The shaker may be used with optional accessory items to extend the areas of application:

APS 0109 - ZERO POSITION CONTROLLER - automatically controls the zero position of a vibration exciter irrespective of its load.

APS 1291 - VERTICAL MOUNTING KIT - permits vertical orientation of the shaker with a rigid bench attachment.

Optional Configurations

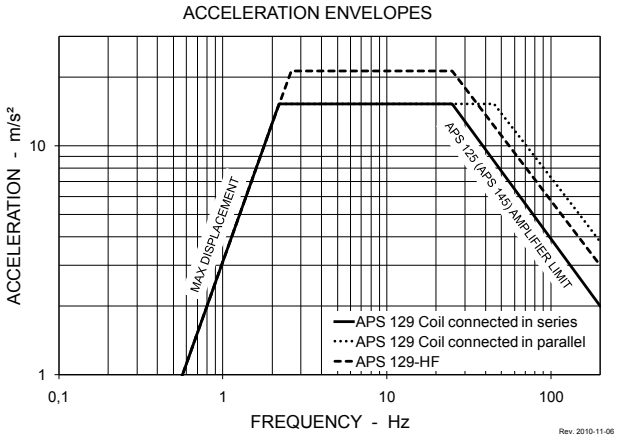
APS 129-HF

All features of the basic APS 129 ELECTRO-SEIS® shaker are retained. The drive coil is made for 40 % increase in force with a 50 % duty cycle (30 min cycle).

APS 129 with APS 1291 - Vertical Mounting Kit

Performance

Test loads of up to 23 kg (50 lb) can be driven to acceleration levels typical of those found in seismic specifications. Performance envelopes of the APS 129 shaker with the APS 125 Power Amplifier are given in the graph. These envelopes represent the maximum acceleration with no test load that can be achieved on the table.



Specifications

Shaker	APS 129	APS 129-HF
Force (Sine Peak)	133 N (30 lbf)	186 N (42 lbf)
Stroke (Peak - Peak)	158 mm (6.25 inch)	
Frequency Range	DC … 200 Hz	
Operation	horizontal or vertical	
Armature Weight	8.5 kg (18.7 lb)	
Max. Payload Horizontal Vertical	23.0 kg (50.7 lb) 11.0 kg (24.3 lb)	
DC Coil Resistance	4.4 or 1.1 Ω	1.4 Ω
Air Pressure Required	4 bar … 5 bar (60 psig … 70 psig)	
Air Flow Required	650 l/h (0.4 cfm)	
Air Quality	ISO 8573.1 Class 3	
Total Shaker Weight	79.0 kg (174.2 lb)	
Overall Dimension L x W x H	889 x 219 x 216 mm (35 x 8.6 x 8.5 inch)	
Load Table Size L x W	254 x 254 mm	
Operating Temperature	5 ... 40 degrees C	
Storage Temperature	-25 ... 55 degrees C	

Accessories (optional)

Shaker	APS 129	APS 129-HF High Force
Power Amplifier	APS 125	
System Cable for Connection Shaker to Amplifier	APS 0082-6E	
Zero Position Controller for Vibration Exciters	APS 0109	
Vertical Operation Kit	APS 1291	
Overtravel Switch	APS 8543	

Additional accessories available

APS 500 ELECTRO-SEIS®

Long Stroke Shaker with Air Bearing Load Mounting Table

The **APS 500 ELECTRO-SEIS®** Air Bearing shaker is a long stroke, electrodynamic force generator specifically designed to be used for calibration and evaluation of accelerometers and other motion transducers. It provides excellent properties for low frequency excitation of such devices. The model consists of an air bearing driver attached to an air bearing load mounting table that allows payloads up to 3.0 kg (6.6 lb).

Applications

- Calibration and test for seismic instruments like geophones and heavy seismic sensors
- Seismic simulation for components

Features

- Designed for calibration and evaluation of seismic instruments with higher acceleration levels
- 21 lb, 95 N vector force
- 3.13 x 3.13-in, 79.5 x 79.5 mm load mounting table
- Air bearing guidance and support system carries up to 3.0 kg (6.6 lb) test load with very low cross-axis motion
- Efficient electrodynamic driver produces sine, random or transient waveforms
- Excellent waveform purity

APS 500 ELECTRO-SEIS®

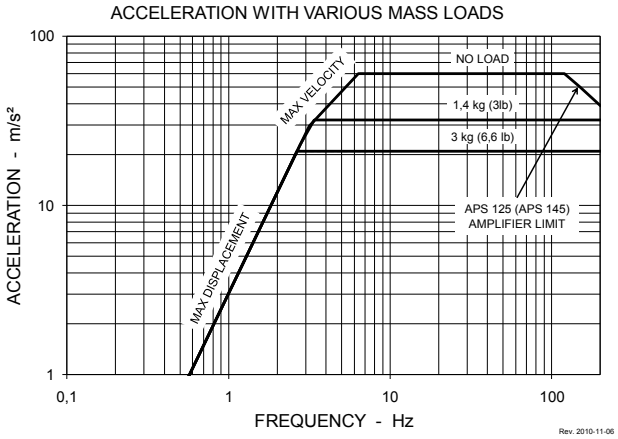
Long Stroke Shaker with Air Bearing Load Mounting Table

Description and Characteristics

The APS 500 ELECTRO-SEIS® shaker consists of a load mounting table and air bearing assembly driven by an APS 113-AB-LA ELECTRO-SEIS® long stroke air bearing shaker. The shaker imparts transverse base excitation to items mounted on the table.

Static and dynamic transverse loads are transferred through a large area precision air bearing to a rigid guide bar of square cross section. The driver unit and guide bar are mounted on a common rigid base, ensuring correct alignment of all moving parts. The standard hole pattern consists of 25 threaded holes in a 5 x 5 array. Optional metric threads and spacing are available.

The APS 113-AB-LA driver unit uses permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range ensuring a high degree of linearity. The self-cooled armature coil requires power from a matching electronic power amplifier.



Specifications

Shaker	**APS 500**
Force (Sine Peak)	95 N (21 lbf)
Stroke (Peak - Peak)	152 mm (6.0 inch)
Frequency Range	DC … 200 Hz
Operation	horizontal or vertical
Armature Weight	1.5 kg (3.3 lb)
Max. Payload Horizontal Vertical	3.0 kg (6.6 lb) 1.3 kg (2.9 lb)
DC Coil Resistance	1.2 Ω
Air Pressure Required	4 bar … 5 bar (60 psig … 70 psig)
Air Flow Required	650 l/h (0.4 cfm)
Air Quality	ISO 8573.1 Class 3
Total Shaker Weight	64.0 kg (141.1 lb)
Overall Dimension L x W x H	813 x 219 x 210 mm
Load Table Size L x W	79.5 x 79.5 mm
Operating Temperature	5 ... 40 degrees C
Storage Temperature	-25 ... 55 degrees C

Accessories (optional)

Shaker	**APS 500**
Power Amplifier	APS 125
System Cable for Connection Shaker to Amplifier	APS 0082-6E
Zero Position Controller for Vibration Exciters	APS 0109
Vertical Operation Kit	APS 5002

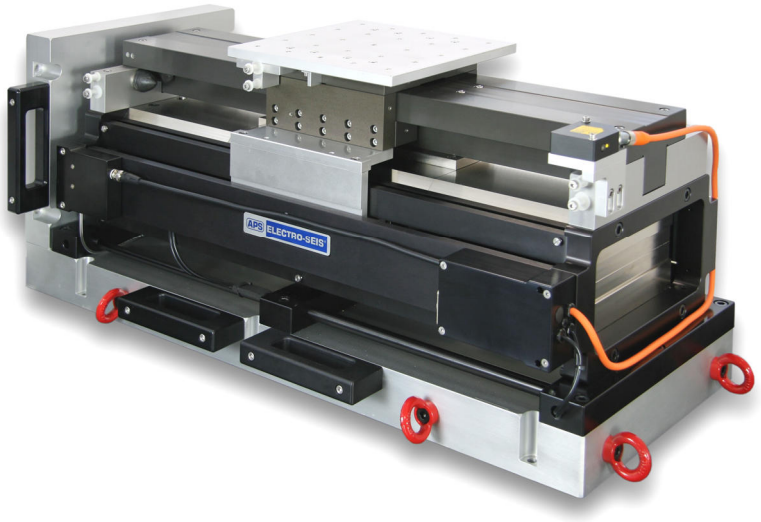
Additional accessories available

All data are subject to change without notice

March 2014

APS 600 ELECTRO-SEIS®

Very Long Stroke Shaker with Air Bearing Load Mounting Table



The **APS 600 ELECTRO-SEIS®** Air Bearing shaker is a very long strong force generator specifically designed to be used for calibration and evaluation of accelerometers and other motion transducers. It provides excellent properties for very low frequency excitation of such devices. This model consists of an air bearing table that allows high payloads up to 25 kg (55 lb) e.g. for the calibration of geophones and heavy seismic sensors.

Applications

- Calibration and test for seismic instruments like geophones and heavy seismic sensors
- Seismic simulation for components

Features

- 215 N (48 lbf) force (sine peak)
- 450 mm stroke (peak - peak)
- 254 x 254 mm (10 x 10-in) load mounting table
- Air bearing guidance and support system carries up to 25 kg (55 lb) test load with very low cross-axis motion
- Efficient electrodynamic driver produces sine, random or transient waveforms
- Excellent waveform purity
- Horizontal and vertical operation

Description

The APS 600 ELECTRO-SEIS® shaker consists of a driver attached to a load mounting table and air bearing assembly. The shaker imparts transverse base excitation to items mounted on the table.

Static and dynamic loads normal to the table surface are transferred through a large area precision air bearing to a rigid guide bar of rectangular cross section. The driver unit and guide bar assembly are mounted on a common rigid base.

The standard hole pattern consists of 25 threaded holes in a 5 x 5 array. Optional metric threads and spacing are available.

The driver unit employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range ensuring a high degree of linearity. The self-cooled armature coil requires power from a matching electronic power amplifier.

APS 600 - Vertical Operation
with APS 0109 - Zero Position Controller

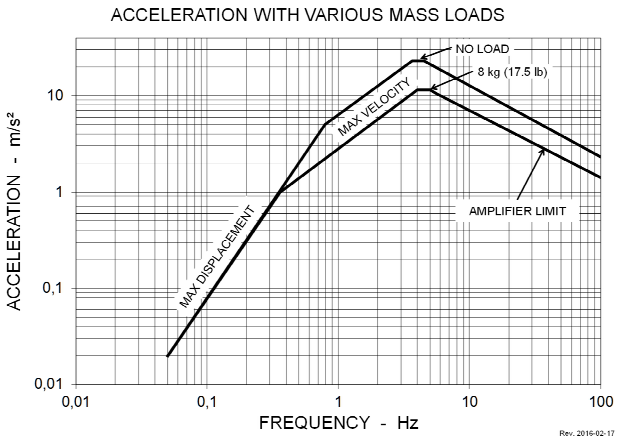
Clean, water and oil free air for bearing operation is carried to the moving bearing housing by flexible PVC tubing, constrained to move with a rolling action.

The shaker may be used with optional accessory items to extend the areas of application:

APS 0109 - ZERO POSITION CONTROLLER - automatically controls the zero position of a vibration exciter irrespective of its load.

Performance

Test loads of up to 25 kg (55 lb) can be driven to acceleration levels typical of those found in seismic specifications. Performance envelopes of the APS 600 shaker with the APS 125 Power Amplifier are given in the graph. These envelopes represent the maximum acceleration for various test loads that can be achieved on the table.



Specifications

Shaker	**APS 600**
Force (Sine Peak) [1) 2)]	215 N (48 lbf)
Stroke (Peak - Peak) [3)]	400 mm (15.7 inch)
Frequency Range	DC … 100 Hz
Operation	horizontal or vertical
Armature Weight	9,3 kg (20.5 lb)
Max. Payload Horizontal Vertical	25 kg (55 lb) 8 kg (18 lb)
DC Coil Resistance	1.7 Ω
Air Pressure Required	2 bar … 3 bar (30 psig … 45 psig)
Air Flow Required	650 l/h (0.4 cfm)
Air Quality	ISO 8573.1 Class 3
Total Shaker Weight	230 kg (505 lb)
Overall Dimension L x W x H	905 x 440 x 360 mm (35.6 x 17.4 x 14.2 inch)
Load Table Size L x W	254 x 254 mm (10 x 10 inch)
Operating Temperature	23 degrees C (± 2 K)
Storage Temperature	-25 ... 55 degrees C

Accessories (optional)

Shaker	**APS 600**
Power Amplifier	APS 125
System Cable for Connection Shaker to Amplifier	APS 0082-6E
Zero Position Controller for Vibration Exciters	APS 0109

[1)] Peak sine

[2)] Intervall mode of operation

[3)] Recommended operation range peak-peak; mechanical stops at 450 mm (17.5 inch)

Additional accessories available

All data are subject to change without notice

March 2016

APS 113 ELECTRO-SEIS®

Long Stroke Shaker with Linear Ball Bearings

The **APS 113 ELECTRO-SEIS®** shaker is a long stroke, electrodynamic force generator specifically designed to be used alone or in arrays for studying dynamic response characteristics of various structures. It finds use in modal excitation of complex structures, particularly when low frequencies are required. Furthermore it can be used for low frequency vibration testing of components and assemblies.

Applications

- Determination of natural mode frequencies, shapes, damping ratios, and stress distributions
- Excitation of manufactured equipment in the factory or installed in the field to demonstrate compliance with seismic specification criteria
- Seismic simulation for components
- Test and calibration for seismic instruments
- Geological Services, Science, Physics and Seismic

Features

- Can be used to generate sine wave, swept sine wave, random or impulse force waveforms, fully adjustable at source
- Test set-up flexibility - operates fixed body, free body, free armature
- Optimized to deliver power to resonant load with minimum shaker weight and drive power
- Adjustable armature re-centering for horizontal and vertical operation or other external pre-loads
- Rugged standard armature and linear guidance system carries full weight of body
- One-Man Portability - 36 kg (80 lb) total weight

Description and Characteristics

The APS 113 ELECTRO-SEIS® shaker has been optimized for driving structures at their natural resonance frequencies. It is an electrodynamic force generator, the output of which is directly proportional to the instantaneous value of the current applied to it, independent of frequency and load response. It can deliver random or transient as well as sinusoidal waveforms of force to the load. The armature has been designed for minimum mass loading of the drive point. The ample armature stroke allows driving antinodes of large structures at low frequencies and permits rated force at low frequencies when operating in a free body mode.

APS 113 with APS 0112 - Reaction Mass Assembly and APS 0414 - Lifting Handles

The unit employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range - assuring force linearity. The enclosed, self-cooled construction provides safety and minimum maintenance. Attachment of the armature to the drive point is accomplished by a simple thrust rod like the APS 8610 - Modal Stinger.

An amplifier, such as the APS 125 - Power Amplifier, is required to provide armature drive power.

The drive coil is wound in a manner which allows series or parallel connection, offering the user the choice of standard or low impedance. This option is required if the shaker is to be used with the APS 125 - Power Amplifier for extended frequency range or random noise excitation.

APS 113 with APS 0112 Reaction Mass Assembly

Modes of Operation

Free Armature Mode

In this mode, the armature provides the reaction mass for force delivered to the test structure via the shaker body. Auxiliary reaction mass may be added to the armature to decrease the low frequency limit for rated force operation.

The APS 113 shaker and APS 0112 - Reaction Mass may be used in a vertical or horizontal free armature mode with rated force down to 2 Hz. Feet and carrying handles are provided for ease in placement of the shaker on horizontal test surfaces.

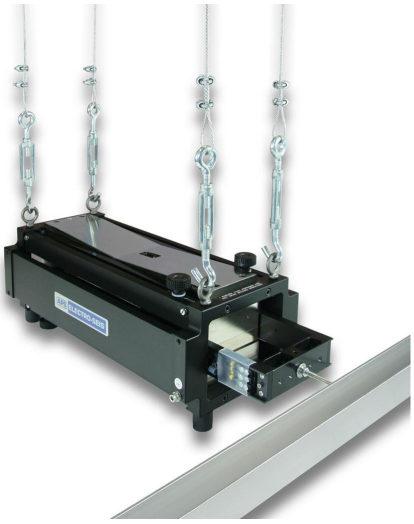
Fixed Body Mode

By providing a rigid attachment between the body and ground, the full relative velocity and stroke capability is available for load motion. Maximum rated force can be delivered down to 0.01 Hz and 70% maximum to 0 Hz.

APS 113 with APS 0108 - Carrying Handles and Tie-down Bars and APS 8610 - Modal Stinger prepared for Fixed Body Mode operation

Free Body Mode

In this mode, the body provides the reaction mass. Load and body motion are accommodated within the total relative velocity and stroke. Because of the high cross-axis stiffness provided by the armature linear guidance system, the shaker may be supported above ground level by means of suspension lines (APS 8611 - Steel Cable Kit) attached to the body. This provides a convenient mounting for introducing force parallel to a horizontal mounting surface. Examples of such surfaces include floors, roofs, platforms, cabinets, bridges and tanks.



APS 113 with APS 8610 - Modal Stinger and APS 8611 - Steel Cable Kit prepared for Free Body Mode operation

Shaker Table Mode

Auxiliary tables are available which attach directly to the armature and enable the basic shaker to provide long stroke, low frequency excitation to components or model structures mounted on the tables. APS 0052 - Auxiliary Table provides a 10 in x 10 in horizontal load mounting surface for horizontal motion rated for 23 kg (50 lb) test loads. The APS 0077 - Auxiliary Table provides the same load mounting surface for vertical motion. The APS 0078 provides for both vertical and horizontal applications.

APS 113 with APS 0052 - Auxiliary Table Kit – Horizontal

APS 113 with APS 0077 - Auxiliary Table Kit – Vertical

Performance

One application of the APS 113 ELECTRO-SEIS® shaker is to determine the dynamic characteristics of mechanical structures. At resonance, a large amount of energy is contained in the structure, and the shaker must accommodate the resulting motion. However, it need only supply the real mechanical power dissipated by damping mechanisms within the structure.

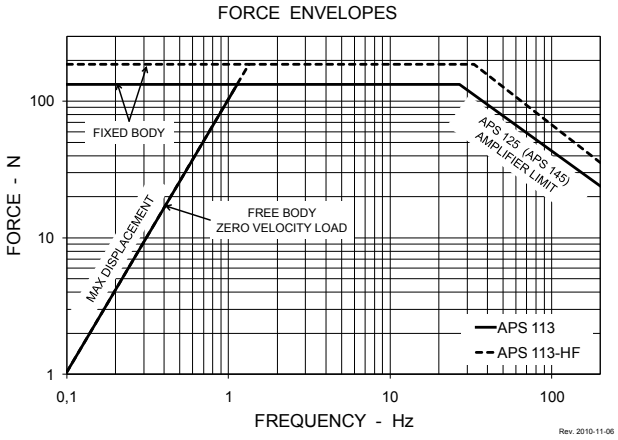
If a drive point on a structure in resonance is vibrating with a velocity of 1,000 mm/s (39 in/s) peak and a force of 133 N (30 lbf) peak is required to sustain the vibration level, then the shaker will be delivering approximately 65 W RMS to the structure. Such a load on the shaker is termed a matched resonant load, and it is purely resistive since the force is in a phase with the velocity.

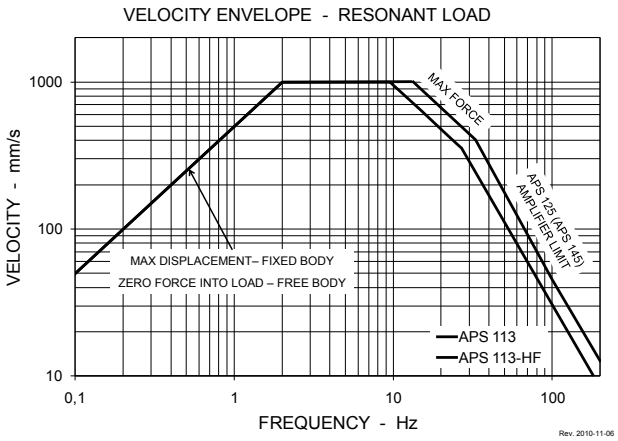
If the resonant load input is other than 133 N x 1,000 mm/s, the full 65 W of mechanical power cannot be delivered to the structure, the system being either force or velocity limited. If the resulting maximum response level is not great enough, the user may have the option of moving the shaker to a drive point having an impedance closer to the matched value, or adding more shakers to the array driving the structure.

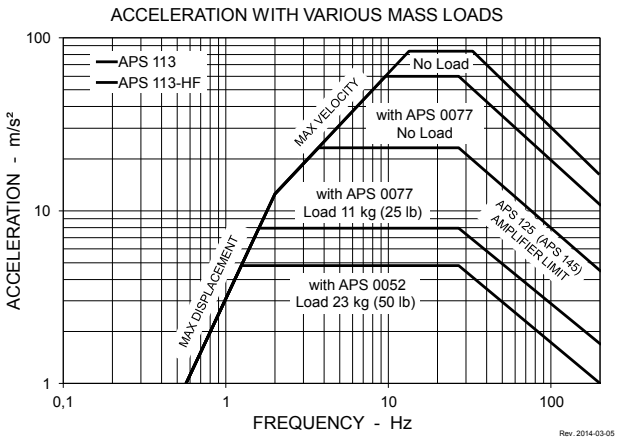
Within the limitations of maximum force and velocity, the actual power delivered to a structure is a function of the input mechanical impedance at the drive point. In typical modal testing, this input impedance varies widely in magnitude and phase angle. At different frequencies, the input impedance of the drive point may appear predominately spring-like, mass-like, or resistive. Since the object of the tests is to establish resonant modes, at which the input mechanical impedance of all drive points are resistive, the shaker's maximum performance capability is most meaningful stated in terms of the force and velocity that can be obtained when driving a matched resistive load.

Therefore performance is given in the form of graphs which present the envelopes of maximum force and velocity delivered to a resonant structure as functions of the resonance frequency of the structure.

Another application is the excitation for sensor calibration. Acceleration performance of the APS 113 ELECTRO-SEIS® shaker with various mass loads is shown in the lower graph.







Optional Configurations

APS 113-HF

All features of the basic APS 113 shaker are retained. The drive coil is made for 40 %increase in force with a 50 % duty cycle (30 min cycle).

Specifications

Shaker	APS 113	APS 113-HF High Force
Force (Sine Peak)	133 N (30 lbf)	186 N (42 lbf)
Velocity (Sine Peak)	1,000 mm/s (39 inch/s)	
Stroke (Peak - Peak)	158 mm (6.25 inch)	
Frequency Range	DC ... 200 Hz	
Operation	horizontal or vertical	
Armature Weight	2.3 kg (5.1 lb)	
Max. Overhung Load at Armature Attachment Point	9.0 kg (20 lb)	
DC Coil Resistance	4.4 or 1.1 Ω	1.4 Ω
Total Shaker Weight	36.0 kg (80 lb)	
Shipping Weight	41.0 kg (90 lb)	
Overall Dimension L x W x H	526 x 213 x 168 mm (20.7 x 8.4 x 6.6 inch)	
Operating Temperature	5 ... 40 degrees C	
Storage Temperature	-25 ... 55 degrees C	

Accessories (optional)

Shaker	APS 113	APS 113-HF High Force
Power Amplifier	APS 125	
System Cable for Connecting Shaker to Amplifier	APS 0082-6E	
Auxiliary Table Kit − Horizontal	APS 0052	
Auxiliary Table Kit − Vertical	APS 0077	
Auxiliary Table Kit − Horizontal and Vertical	APS 0078	
Carrying Handles and Tie-down Bars	APS 0108	
Zero Position Controller for Vibration Exciter	APS 0109	
Reaction Mass Assembly	APS 0112	
Lifting Handles (Set of 4)	APS 0414	
Overtravel Switch	APS 8543	
Modal Stinger Kit	APS 8610	
Steel Cable Kit	APS 8611	

Additional accessories available

APS 400 ELECTRO-SEIS®

Long Stroke Shaker with Linear Ball Bearings

The **APS 400 ELECTRO-SEIS®** shaker is a longstroke, electrodynamic force generator specifically designed to be used alone or in arrays for studying dynamic response characteristics of various structures. It finds use in modal excitation of complex structures, particularly when low frequencies are required. Furthermore it can be used for low frequency vibration testing of components and assemblies.

Applications

- Determination of natural mode frequencies, shapes, damping ratios, and stress distributions
- Excitation of manufactured equipment in the factory or installed in the field to demonstrate compliance with seismic specification criteria
- Seismic simulation for components
- Test and calibration for seismic instruments
- Geological Services, Science, Physics and Seismic

Features

- Can be used to generate sine wave, swept sine wave, random or impulse force waveforms, fully adjustable at source
- Test set-up flexibility - operates fixed body, free body, free armature
- Optimized to deliver power to resonant load with minimum shaker weight and drive power
- Adjustable armature re-centering for horizontal and vertical operation or other external pre-loads
- Two-Man Portability - 73 kg (160 lb) total weight

Description and Characteristics

The APS 400 ELECTRO-SEIS® shaker has been optimized for driving structures at their natural resonance frequencies. It is an electrodynamic force generator, the output of which is directly proportional to the instantaneous value of the current applied to it, independent of frequency and load response. It can deliver random or transient as well as sinusoidal waveforms of force to the load. The armature has been designed for minimum mass loading of the drive point. The ample armature stroke allows driving antinodes of large structures at low frequencies and permits rated force at low frequencies when operating in a free body mode.

The unit employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range - assuring force linearity. The enclosed, self-cooled construction provides safety and minimum maintenance. Attachment of the armature to the drive point is accomplished by a simple thrust rod like the APS 8610 - Modal Stinger.

An amplifier, such as the APS 145 - Power Amplifier, is required to provide armature drive power.

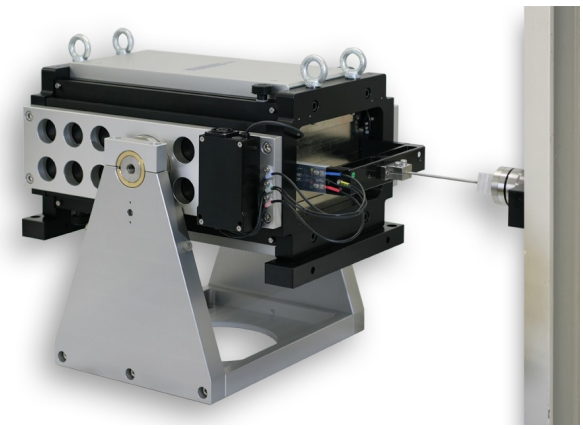
APS 400 with APS 0412
Reaction Mass Assembly

Modes of Operation

Free Armature Mode

In this mode, the armature provides the reaction mass for force delivered to the test structure via the shaker body. Auxiliary reaction mass may be added to the armature to decrease the low frequency limit for rated force operation.

The APS 400 shaker and APS 0412 - Reaction Mass may be used in a vertical or horizontal free armature mode with rated force down to less than 3 Hz. Feet and carrying handles are provided for ease in placement of the shaker on horizontal test surfaces.



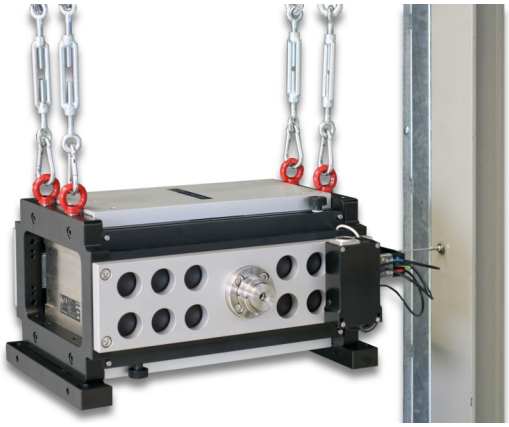
APS 420 with APS 4222 - Trunnion
and APS 8610 Modal Stinger

Fixed Body Mode

By providing a rigid attachment between the body and ground, the full relative velocity and stroke capability is available for load motion. Maximum rated force can be delivered down to 0.01 Hz and 70 % maximum to 0 Hz.

Free Body Mode

In this mode, the body provides the reaction mass. Load and body motion are accommodated within the total relative velocity and stroke. Because of the high cross-axis stiffness provided by the armature linear guidance system, the shaker may be supported above ground level by means of suspension lines (APS 8612 - Steel Cable Kit) attached to the body. This provides a convenient mounting for introducing force parallel to a horizontal mounting surface. Examples of such surfaces include floors, roofs, platforms, cabinets, bridges and tanks.



APS 420 with APS 8610 - Modal Stinger and APS 8612 - Steel Cable Kit prepared for Free Body Mode operation

Shaker Table Mode

Auxiliary Table Kits are available which, when installed on the basic shaker, enable the shaker to provide long stroke excitation to components or model structures mounted on the table.

The APS 0452 Auxiliary Table Kit provides horizontal motion, the APS 0477 Auxiliary Table Kit provides vertical motion and the APS 0478 Auxiliary Table Kit provides either the vertical or horizontal motion configuration.

APS 400 with APS 0452 - Auxiliary Table Kit – Horizontal

APS 400 with APS 0477 - Auxiliary Table Kit – Vertical

Performance

The primary purpose of the APS 400 ELECTRO-SEIS® shaker is to determine the dynamic characteristics of mechanical structures. At resonance, a large amount of energy is contained in the structure, and the shaker must accommodate the resulting motion. However, it need only supply the real mechanical power dissipated by damping mechanisms within the structure.

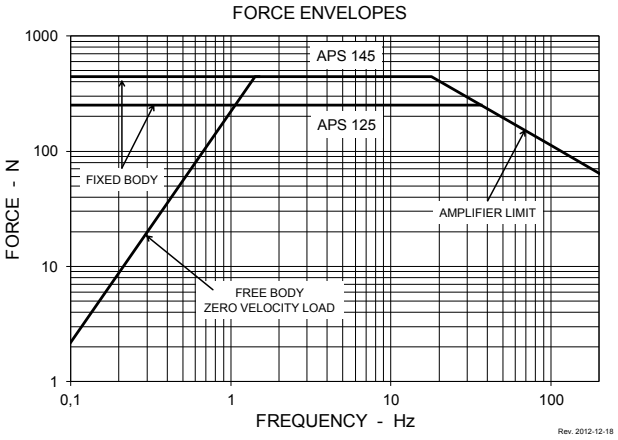
If a drive point on a structure in resonance is vibrating with a velocity of 1,000 mm/s (39 in/s) peak and a force of 445 N (100 lbf) peak is required to sustain the vibration level, then the shaker will be delivering approximately 220 W RMS to the structure. Such a load on the shaker is termed a matched resonant load, and it is purely resistive since the force is in a phase with the velocity.

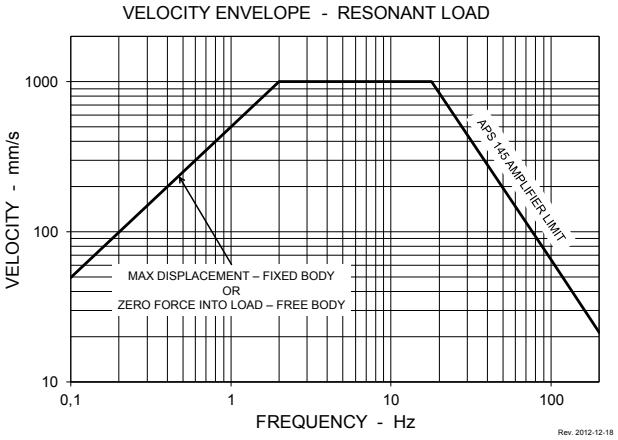
If the resonant load input is other than 445 N x 1,000 mm/s, the full 220 watts of mechanical power cannot be delivered to the structure, the system being either force or velocity limited. If the resulting maximum response level is not great enough, the user may have the option of moving the shaker to a drive point having an impedance closer to the matched value, or adding more shakers to the array driving the structure.

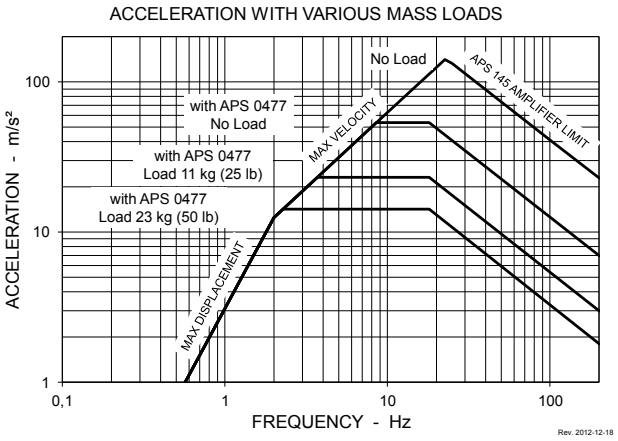
Within the limitations of maximum force and velocity, the actual power delivered to a structure is a function of the input mechanical impedance at the drive point. In typical modal testing, this input impedance varies widely in magnitude and phase angle. At different frequencies, the input impedance of the drive point may appear predominately spring-like, mass-like, or resistive. Since the object of the tests is to establish resonant modes, at which the input mechanical impedance of all drive points are resistive, the shaker's maximum performance capability is most meaningful stated in terms of the force and velocity that can be obtained when driving a matched resistive load.

Therefore, performance is given in the form of graphs which present the envelopes of maximum force and velocity delivered to a resonant structure as functions of the resonance frequency of the structure.

Another application is the excitation for sensor calibration. Acceleration envelopes of the APS 400 ELECTRO-SEIS® shaker with various mass loads is shown in the lower graph for the 445 N rating.







Specifications

Shaker	**APS 400**
Force (Sine Peak)	445 N (100 lbf)
Velocity (Sine Peak)	1,000 mm/s (39 inch/s)
Stroke (Peak - Peak)	158 mm (6.25 inch)
Frequency Range	DC … 200 Hz
Operation	horizontal or vertical
Armature Weight	2.8 kg (6.2 lb)
Max. Overhung Load at Armature Attachment Point	9.0 kg (20 lb)
DC Coil Resistance	1.6 Ω
Total Shaker Weight	73.0 kg (161 lb)
Shipping Weight	86.0 kg (190 lb)
Overall Dimension L x W x H	526 x 314 x 178 mm (20.7 x 12.4 x 7.0 inch)
Operating Temperature	5 ... 40 degrees C
Storage Temperature	-25 ... 55 degrees C

Accessories (optional)

Shaker	**APS 400**
Power Amplifier	APS 145
System Cable for Connecting Shaker to Amplifier	APS 0082-6E
Zero Position Controller for Vibration Exciters	APS 0109
Reaction Mass Assembly	APS 0412
Lifting Handles (Set of 4)	APS 0414
Carrying Handles and Tie-down Bars	APS 0421
Auxiliary Table Kit − Horizontal	APS 0452
Auxiliary Table Kit − Vertical	APS 0477
Auxiliary Table Kit − Horizontal and Vertical	APS 0478
Horizontal Reaction Mass System	APS 4001
Overtravel Switch	APS 8543
Modal Stinger Kit	APS 8610
Steel Cable Kit	APS 8612

Additional accessories available

APS 420 ELECTRO-SEIS®

Long Stroke Shaker with Linear Ball Bearings

The **APS 420 ELECTRO-SEIS®** shaker is a long stroke, electrodynamic force generator specifically designed to be used alone or in arrays for studying dynamic response characteristics of various structures. It finds use in modal excitation of complex structures, particularly when low frequencies are required. Furthermore it can be used for low frequency vibration testing of components and assemblies.

Applications

- Determination of natural mode frequencies, shapes, damping ratios, and stress distributions
- Excitation of manufactured equipment in the factory or installed in the field to demonstrate compliance with seismic specification criteria
- Seismic simulation for components
- Test and calibration for seismic instruments
- Geological Services, Science, Physics and Seismic

Features

- Can be used to generate sine wave, swept sine wave, random or impulse force waveforms, fully adjustable at source
- Test set-up flexibility - operates fixed body, free body, free armature
- Optimized to deliver power to resonant load with minimum shaker weight and drive power
- Adjustable armature re-centering for horizontal and vertical operation or other external pre-loads

Description and Characteristics

The APS 420 ELECTRO-SEIS® shaker has been optimized for driving structures at their natural resonance frequencies. It is an electrodynamic force generator, the output of which is directly proportional to the instantaneous value of the current applied to it, independent of frequency and load response. It can deliver random or transient as well as sinusoidal waveforms of force to the load. The armature has been designed for minimum mass loading of the drive point. The ample armature stroke allows driving antinodes of large structures at low frequencies and permits rated force at low frequencies when operating in a free body mode.

The unit employs permanent magnets and is configured such that the armature coil remains in a uniform magnetic field over the entire stroke range - assuring force linearity. The enclosed, self-cooled construction provides safety and minimum maintenance. Attachment of the armature to the drive point is accomplished by a simple thrust rod like the APS 8610 - Modal Stinger.

An amplifier, such as the APS 145 - Power Amplifier, is required to provide armature drive power.

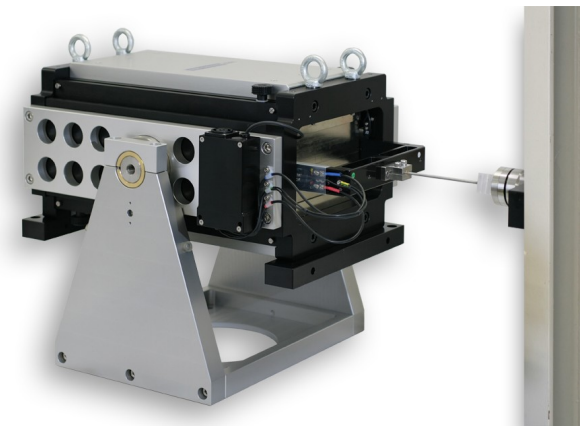
APS 420 with APS 4212
Reaction Mass Assembly

Modes of Operation

Free Armature Mode

In this mode, the armature provides the reaction mass for force delivered to the test structure via the shaker body. Auxiliary reaction mass may be added to the armature to decrease the low frequency limit for rated force operation.

The APS 420 and APS 4212 - Reaction Mass may be used in a vertical or horizontal free armature mode with rated force down to less than 4 Hz. Feet and carrying handles are provided for ease in placement of the shaker on horizontal test surfaces.



APS 420 with APS 4222 - Trunnion Base
and APS 8610 Modal Stinger

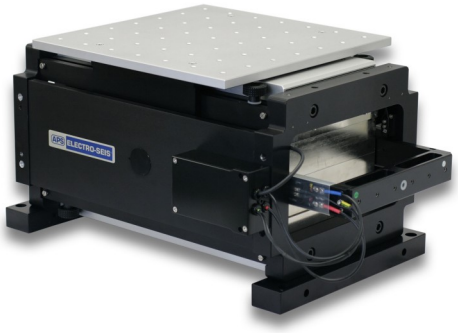
Fixed Body Mode

By providing a rigid attachment between the body and ground, the full relative velocity and stroke capability is available for load motion. Maximum rated force can be delivered down to 0.01 Hz and 70 % maximum to 0 Hz.

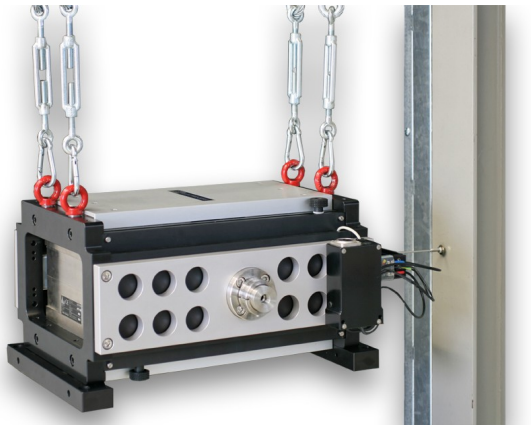
When choosing the best shaker location for tests, the APS 4222 - Trunnion Base allows the shaker to be set up in any axis from vertical to horizontal.

Free Body Mode

In this mode, the body provides the reaction mass. Load and body motion are accommodated within the total relative velocity and stroke. Because of the high cross-axis stiffness provided by the armature linear guidance system, the shaker may be supported above ground level by means of suspension lines (APS 8612 - Steel Cable Kit) attached to the body. This provides a convenient mounting for introducing force parallel to a horizontal mounting surface. Examples of such surfaces include floors, roofs, platforms, cabinets, bridges and tanks.



APS 420 with APS 4252 - Auxiliary Table Kit – Horizontal



APS 420 with APS 8610 - Modal Stinger and
APS 8612 - Steel Cable Kit prepared for
Free Body Mode operation

Shaker Table Mode

Auxiliary Table Kits are available which, when installed on the basic shaker, enable the shaker to provide long stroke excitation to components or model structures mounted on the table.

The APS 4252 Auxiliary Table Kit provides horizontal motion, the APS 4277 Auxiliary Table Kit provides vertical motion and the APS 4278 Auxiliary Table Kit provides either the vertical or horizontal motion configuration.

APS 420 with
APS 4277 - Auxiliary Table Kit - Vertical

Performance

The primary purpose of the APS 420 ELECTRO-SEIS® shaker is to determine the dynamic characteristics of mechanical structures. At resonance, a large amount of energy is contained in the structure, and the shaker must accommodate the resulting motion. However, it needs only supply the real mechanical power dissipated by damping mechanisms within the structure.

If a drive point on a structure in resonance is vibrating with a velocity of 1,000 mm/s (39 in/s) peak and a force of 900 N (200 lbf) peak is required to sustain the vibration level, then the shaker will be delivering approximately 450 W RMS to the structure. Such a load on the shaker is termed a matched resonant load, and it is purely resistive since the force is in a phase with the velocity.

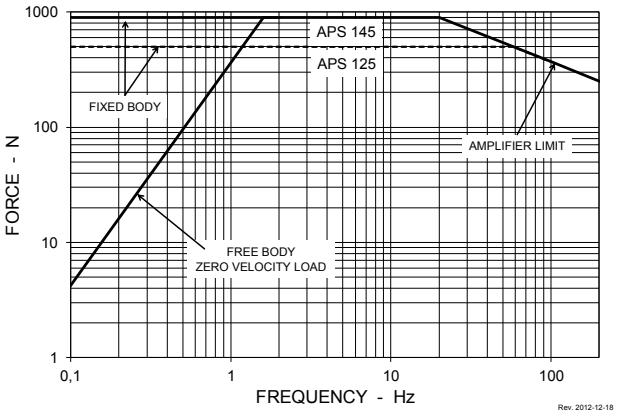
If the resonant load input is other than 900 N x 1,000 mm/s, the full 450 watts of mechanical power cannot be delivered to the structure, the system being either force or velocity limited. If the resulting maximum response level is not great enough, the user may have the option of moving the shaker to a drive point having an impedance closer to the matched value, or adding more shakers to the array driving the structure.

Within the limitations of maximum force and velocity, the actual power delivered to a structure is a function of the input mechanical impedance at the drive point. In typical modal testing, this input impedance varies widely in magnitude and phase angle. At different frequencies, the input impedance of the drive point may appear predominately spring-like, mass-like, or resistive. Since the object of the tests is to establish resonant modes, at which the input mechanical impedance of all drive points are resistive, the shaker's maximum performance capability is most meaningful stated in terms of the force and velocity that can be obtained when driving a matched resistive load.

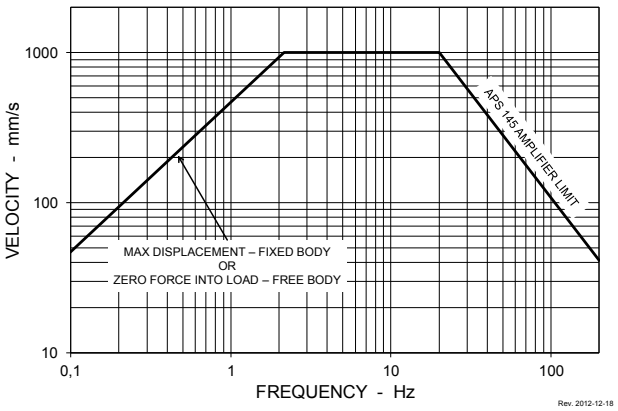
Therefore, performance is given in the form of graphs which present the envelopes of maximum force and velocity delivered to a resonant structure as functions of the resonance frequency of the structure.

Another application is the excitation for sensor calibration. Acceleration envelopes of the APS 420 ELECTRO-SEIS® shaker with various mass loads is shown in the lower graph for the 900 N rating.

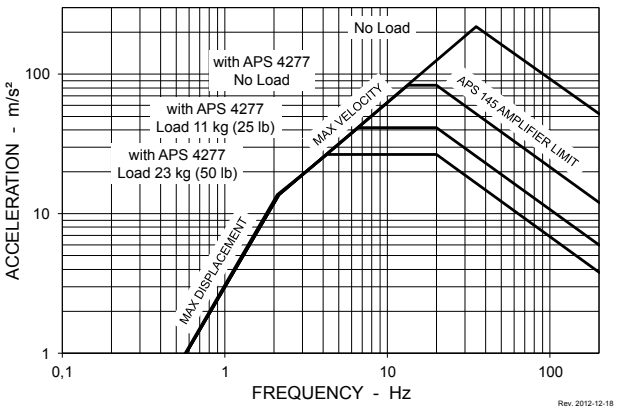
FORCE ENVELOPES



VELOCITY ENVELOPE - RESONANT LOAD



ACCELERATION WITH VARIOUS MASS LOADS



Specifications

Shaker	**APS 420**
Force (Sine Peak)	900 N (200 lbf)
Velocity (Sine Peak)	1,000 mm/s (39 inch/s)
Stroke (Peak - Peak)	150 mm (5.9 inch)
Frequency Range	DC … 200 Hz
Operation	horizontal or vertical
Armature Weight	3.6 kg (8.0 lb)
Max. Overhung Load at Armature Attachment Point	9.0 kg (20 lb)
DC Coil Resistance	1.1 Ω
Total Shaker Weight	140 kg (310 lb)
Shipping Weight	165 kg (365 lb)
Overall Dimension L x W x H	591 x 360 x 280 mm (23.3 x 14.2 x 11.0 inch)
Operating Temperature	5 ... 40 degrees C
Storage Temperature	-25 ... 55 degrees C

Accessories (optional)

Shaker	**APS 420**
Power Amplifier	APS 145
System Cable for Connecting Shaker to Amplifier	APS 0082-6E
Zero Position Controller for Vibration Exciters	APS 0109
Reaction Mass Assembly	APS 4212
Handles	APS 4221
Trunnion Base	APS 4222
Auxiliary Table Kit − Horizontal	APS 4252
Auxiliary Table Kit − Vertical	APS 4277
Auxiliary Table Kit − Horizontal and Vertical	APS 4278
Over Travel Switch	APS 8543
Over Temperature Switch	APS 8544
Modal Stinger Kit	APS 8610
Steel Cable Kit	APS 8612

Additional accessories available

APS 125

Power Amplifier

Applications

- Power amplifier for modal testing shaker
- Power amplifier for environmental testing systems

Range of Use

- Research and development departments in industry
- Environment testing laboratories
- Universities and research institutes

Features

- Voltage or current amplifier mode
- Frequency range DC ... 150 kHz
- Current and voltage monitor output
- Gain control
- Current limit control
- Multifunction display
- Switch for phase inversion (0° or 180°)
- Control inputs for remote emergency shut down
- Control mute input
- Amplifier state outputs for integration in testing systems
- Overload protection
- Forced air cooling for continuous operation
- High reliability operation

Description

The Power Amplifier Type APS 125 has been designed to drive any vibration or modal exciter requiring a 500 VA power amplifier.

The rated AC output is 500 VA into a 4 Ohm exciter or resistive load. Harmonic content of the output is very small as heavy negative feedback is used.

The instrument can tolerate temperature and supply line variations while maintaining excellent stability.

The APS 125 can be used as a voltage generator with low output impedance and a flat voltage frequency response, or as a current generator with high output impedance and a flat current frequency response.

The RMS output-current limit is adjustable.

Specifications

General	
Power Output, Max.	500 VA into a 4 Ohm exciter or resistive load, at 25°C, at 1 kHz and nominal mains voltage.
Voltage Output, Max.	45 V RMS, DC … 15 kHz
Current Output, Max.	5 A DC 5 A RMS, 0.1Hz..... 1 Hz 9 A RMS, 1 Hz .... 20 Hz 11 A RMS, 20 Hz .... 15 kHz
Frequency Range	20 Hz … 15 kHz full power DC ... 150 kHz small signal voltage (-20 dB)
Input Impedance	> 10 kOhm
Input Voltage, Max.	10 V RMS
Monitor Output	Voltage monitor: 0.1 V/V ± 3 %, 0.1 Hz ... 15 kHz Current monitor: 0.1 V/A ± 3 %, 0.1 Hz ... 15 kHz
Power Requirements	Single phase 100 V / 120 V / 230 V RMS, ± 10 %, 50 Hz ... 60 Hz. Approx. 1,000 VA at full load
Dimensions	Height: 2 U equivalent of 88 mm (3.5 in.) Width: 482.6 mm (19 in.) with flanges for standard 19" rack mounting Depth: 450 mm (17.7 in.)
Weight	21 kg (46 lb.)
Voltage Mode	
Frequency Response	DC Input: DC … 15 kHz ± 0.5 dB DC … 150 kHz ± 3.0 dB small signal voltage (-20 dB) AC Input: 5 Hz … 15 kHz ± 0.5 dB 2 Hz … 150 kHz ± 3.0 dB small signal voltage (-20 dB) (2 separate BNC sockets at back panel)
Total Harmonic Distortion + Noise	< 0.1 % (40 Hz … 5 kHz) < 0.2 % (5 kHz … 15 kHz)
Gain	18 V/V (± 2 dB) at 1 kHz
Current Mode	
Frequency Response	DC Input:: DC ... 15 kHz ± 0.5 dB DC ... 60 kHz ± 3.0 dB small signal voltage (-20 dB) AC Input:: 5 Hz ... 15 kHz ± 0.5 dB 2 Hz ... 60 kHz ± 3.0 dB small signal voltage (-20 dB)
Total Harmonic Distortion + Noise	< 0.2 % (40 Hz … 2 kHz) < 0.8 % (2 kHz … 15 kHz)
Gain	5.5 A/V (± 2 dB) at 1 kHz

All data are subject to change without notice

APS 145

Power Amplifier

Applications

- Power amplifier for modal testing shaker
- Power amplifier for environmental testing systems

Range of Use

- Research and development departments in industry
- Environment testing laboratories
- Universities and research institutes

Features

- Voltage or current amplifier mode
- Frequency range DC ... 50 kHz
- Current and voltage monitor output
- Gain control
- Current limit control
- Multifunction display
- Switch for phase inversion (0° or 180°)
- Control inputs for remote emergency shut down
- Control mute input
- Amplifier state outputs for integration in testing systems
- Overload protection
- Forced air cooling for continuous operation
- High reliability operation

APS 145
Power Amplifier

Description

The Power Amplifier Type APS 145 has been designed to drive any vibration or modal exciter requiring a 810 VA power amplifier.

The rated AC output is 810 VA into a 2.5 Ohm exciter or resistive load. Harmonic content of the output is very small as heavy negative feedback is used.

The instrument can tolerate temperature and supply line variations while maintaining excellent stability.

The APS 145 can be used as a voltage generator with low output impedance and a flat voltage frequency response, or as a current generator with high output impedance and a flat current frequency response.

The RMS output-current limit is adjustable.

Specifications

General	
Power Output, Max.	810 VA into a 2.5 Ohm exciter or resistive load, at 25°C, at 1 kHz and nominal mains voltage.
Voltage Output, Max.	45 V RMS, DC ... 15 kHz
Current Output, Max.	4 A DC 15 A RMS > 0.1 Hz, Z = 1.5 Ohm 18 A RMS > 0.1 Hz, Z = 2.5 Ohm − optimal impedance
Frequency Range	0.1 Hz ... 10 kHz full power DC ... 50 kHz small signal voltage (-20 dB)
Input Impedance	> 10 kOhm
Input Voltage, Max.	10 V RMS
Monitor Output	Voltage monitor: 0.1 V/V ± 3 %, 5 Hz ... 15 kHz Current monitor: 0.1 V/A ± 3 %, 5 Hz ... 15 kHz
Power Requirements	Single phase 100 V / 120 V / 230 V RMS, ± 10 %, 50 Hz ... 60 Hz (factory preset-ting) approx. 1,500 VA at full load
Dimensions	Height: 3 U equivalent of 132 mm (5.2 in.) Width: 482.6 mm (19 in.) with flanges for standard 19-inch rack mounting Depth: 451 mm (17.8 in.)
Weight	22 kg (48.5 lb.)
Voltage Mode	
Frequency Response	DC Input: DC ... 10 kHz ± 0.5 dB DC ... 50 kHz ± 3.0 dB small signal voltage (-20 dB) AC Input: 5 Hz ... 10 kHz ± 0.5 dB 2 Hz ... 50 kHz ± 3.0 dB small signal voltage (-20 dB) (2 separate BNC sockets at back panel)
Total Harmonic Distortion + Noise	< 0.2 % (0.1 Hz ... 5 kHz) < 0.3 % (5 kHz ... 10 kHz)
Gain	18 V/V ± 2 dB
Current Mode	
Frequency Response	DC Input: 0.1 Hz ... 10 kHz ± 0.5 dB DC ... 50 kHz ± 3.0 dB small signal voltage (-20 dB) AC Input: 5 Hz ... 10 kHz ± 0.5 dB 2 Hz ... 50 kHz ± 3.0 dB small signal voltage (-20 dB) (2 separate BNC sockets at back panel)
Total Harmonic Distortion + Noise	< 0.3 % (0.1 Hz … 2 kHz) < 0.8 % (2 kHz ... 10 kHz)
Gain	7.5 A/V ± 2 dB

All data are subject to change without notice

April 2011