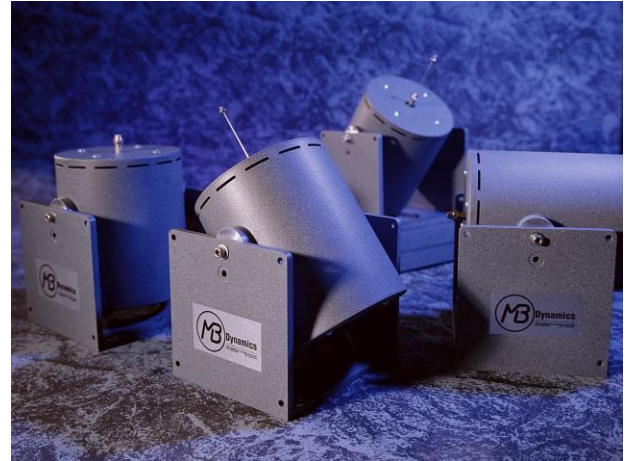


## **MODAL 50A** *Excitation Made Easy!*

### **THE EXCITER - #1 SELLING WORLDWIDE**

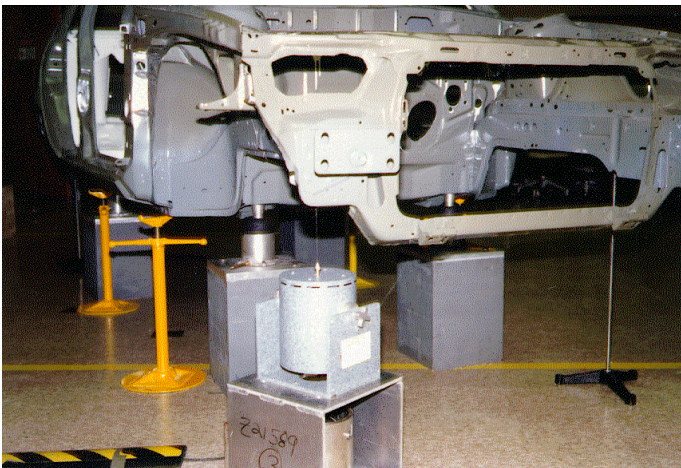
"The MODAL 50A along with MB's MODAL APPLICATIONS EXPERTISE have revolutionized modal testing!" This Exciter was designed by a team of world-respected modal testers, including University of Cincinnati professors, to eliminate problems encountered when using traditional shakers for modal tests. The MODAL 50A slashes setup time to a minimum! Conveniences in fixturing and setup like the clearance hole through the armature and shaker and a collet chuck for gripping a threadless stinger make easy the attachment of the MODAL 50A to a test structure. 50 pounds dynamic force from an Exciter weighing little more than 50 lbs makes it portable and easy to setup by one person.



### **THE COMPANY - UNIQUELY QUALIFIED**

MB's three principals (SDRC alumni) have over seven decades of combined experience performing extensive dynamic testing - both in the USA and Europe. These experienced test veterans have solved real-world test challenges, and have helped hundreds of new and experienced modal testers alike properly apply the right excitation source to achieve good modal data faster! Choosing an MB Modal Exciter gains you access to applications experience unsurpassed in the marketplace today ... whether you need custom-tailored testing solutions ... on-site consulting ... seminars on theory, applications, excitation ... practical hints for acquiring valid modal data ... you'll get it with MB Modal Exciters.

### **APPLICATIONS EXPERTS - BEHIND EVERY EXCITER**

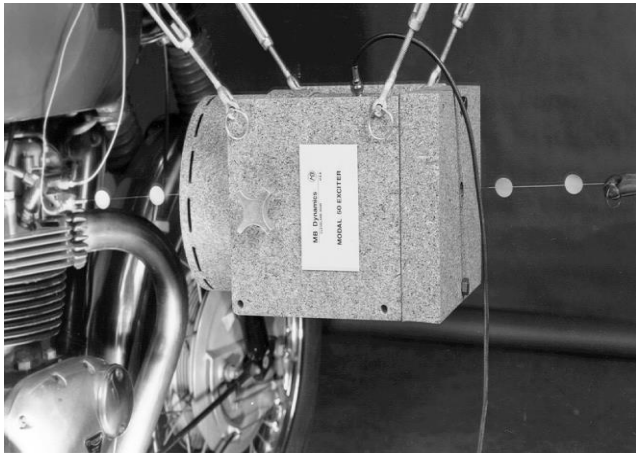


The MODAL 50A (and multiples thereof) is ideal for exciting structures smaller than say, a full-size automobile. Total vehicle modal tests on anything larger (truck, jet, even a space shuttle) requires multiple MODAL 50A's or the MODAL 250A.

Modal testing of structures needs an Exciter that is highly portable and easy to setup and operate. The lightweight, compact MODAL 50A was designed with these needs in mind. A center bore extending through the armature, housing, trunnion base, and inertial masses allows a stinger to be easily positioned along its axis. It may then be placed as close to the test article as desired and the chuck tightened down to grip the stinger firmly. The stinger need not be cut off, thus retaining flexibility for future use in different orientations and applications.

The ideal stinger would be infinitely stiff in the axial direction and have no bending stiffness. Since this is not possible, it can be approached with a pre-loaded thin wire. Replacing the 1/8" stinger with piano wire is easy by simply changing one of the collets provided in the Accessory Kit. Once installed, the wire can be pre-loaded using bungee cord and a small block pulley. An oscillatory force of 50 pounds keeps the tension in the stinger while delivering peak dynamic force. This virtually eliminates measurement errors due to bending moments and side loads that can result when using compression loading of traditional stingers.

## EASY TO FIXTURE & SETUP -- *SLASHES SETUP TIME*



- Clearance hole through armature and shaker allows unlimited positioning along the axis of the stinger
- Collet chuck with clearance hole through armature and shaker provides easy attachment of "one size fits all" stinger
- 'Piano wire' minimizes cross-axis measurement errors; allows large static force to be applied without derating 220N / 50 lbf dynamic force
- Quick disconnect turnbuckles for adjustable suspension and easy, 6 dof positioning
- Lightweight shaker, easy-mount inertial masses/accessories allows one-man setup and portability to remote locations
- Trunnion base with two hand-knobs and three screw feet allow adjustment to virtually any excitation angle
- Quick connect/disconnect of additional mass supplies large inertial restraint for low frequency tests

## UNIVERSAL -- *NO NEED FOR SMALL FORCE OR LONG STROKE SHAKERS*

- 25mm p-p stroke - sufficient for flexible structures and low frequency "suspended shaker" tests (Optional: 30mm p-p)
- 220 N sine peak dynamic force - enough for large test articles such as mid- to full-size automobile
- Lightweight armature ( $\leq 0.15$  kg) enables testing small items
- Broad usable frequency range (DC-5000 Hz) handles almost every modal survey
- Ideal for multi-shaker random, single-point random, multi-point sine dwell, and even burst random

## ACCURATE -- *FEWER MEASUREMENT ERRORS DUE TO FIXTURING*

- The 'current mode' of MB's MB500VI amplifier virtually eliminates mass loading of very small test items
- Lightweight armature minimizes mass loading - dramatically reduces force drop-off at resonances of the test specimen
- Low armature axial suspension stiffness ( $< 2.6$  N/mm) assures shaker dynamics are decoupled from the test specimen's
- Ultra thin stinger decouples force inputs in cross-axis directions - avoids "cross axis" error in force measurement
- Applies/Maintains pre-loaded tension to the stinger, eliminating buckling problems - *results in superior forcing function!*

## ACCESSORY KIT

Includes chucks, turnbuckles, nuts, bolts, bolt-on masses, wrenches for bolt-on masses, stingers, user's manual, and extra storage for your stingers and load cells

## SPECIFICATIONS

RATED FORCE: Sine Peak/Random RMS	110/75 N (25/17 lbf) convection cooling; 220/150 N (50/35 lbf), forced air
STROKE: peak-to-peak, continuous duty	25mm (1 in.)
MAX. ACCELERATION: Sine Peak/ Random RMS	100 g's Peak/70 g's RMS
MAX. VELOCITY: Sine Peak	1.5 m/s (70 in/sec)
MAX. RATED CURRENT: RMS	8.0 A
ARMATURE RESONANCE	$> 7.0$ kHz
ARMATURE WEIGHT	$< 0.15$ kg
ARMATURE SUSPENSION STIFFNESS	2.6 N/mm
USABLE FREQUENCY RANGE	DC – 5 kHz
STINGER ATTACHMENTS	Chuck and collets handle stinger sizes from 0.5 – 3.0 mm
SHAKER ATTACHMENTS (for mounting)	Floor: screw feet in trunnion base: suspended via multiple turnbuckles
TEST SPECIMEN STATIC PRE-LOAD	Capable of tensioning stinger in excess of 220 N (50 lbf)
WEIGHT	Shaker with trunnion base: 25 kg (55 lbs.)
DIMENSIONS	292 mm (to top of chuck with feet retracted); 190 mm x 235 mm footprint
DRIVE CABLE LENGTH	10 m standard (other lengths available as options)

*Specifications subject to change without notice (0921)*



# MODAL 110

Exciter System

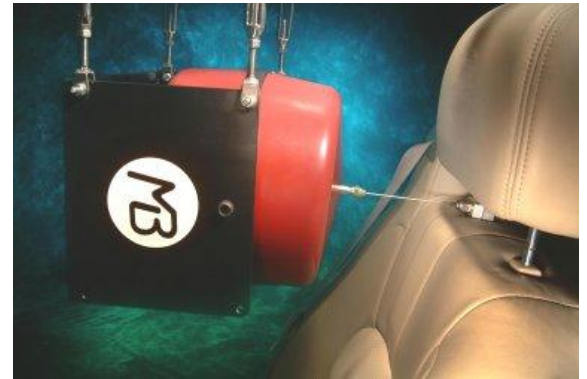


- ❖ **MB's MODAL 110 – longer – lighter – stronger – and RED!**
- ❖ **MB MODAL EXCITERS are the #1 selling exciters in the world -- over 1300 in use worldwide!**

The MODAL 110 delivers 110 lbs force (500N) and 1.5" (38 mm) stroke pk-pk; has twice the force and 50% more stroke than the MODAL 50.



- ❖ **Long Stroke**
- ❖ **Light moving element mass**
- ❖ **Low longitudinal stiffness**
- ❖ **Stiff radial stiffness**
- ❖ **Patented flexure assembly**
- ❖ **Neodymium magnets**
- ❖ **Light-weight exciter**
- ❖ **Thru-hole to attach stinger**



MODAL 110 EXCITER SPECS	MB500VI AMPLIFIER SPECS
<ul style="list-style-type: none"> <li>❖ Force: 110 lbf peak (500 N) forced-air cooled; 55 lbf pk (250 N) convection air cooled</li> <li>❖ Force: 75 lbf RMS (350 N) forced-air cooled; 40 lbf RMS (175 N) convection air cooled</li> <li>❖ Stroke: 1.5" (38 mm) p-p; 1.6" (41 mm) between stops</li> <li>❖ Max. Acceleration: 830 m/s<sup>2</sup> peak</li> <li>❖ Max. Velocity: 1.6 m/s peak</li> <li>❖ Bandwidth: DC-5000 Hz</li> <li>❖ Moving element: 0.9 lbs (0.41 kg)</li> <li>❖ Axial resonance frequency: &gt; 5,000 Hz</li> <li>❖ Longitudinal stiffness; 30 lb/in (5.2N/mm)</li> <li>❖ Shaker weight: &lt;55 lbs (25 kg)</li> <li>❖ Shaker cooling: shop air, with integral air coupling; aux. fan cooling package</li> <li>❖ Clearance hole through armature for stinger</li> <li>❖ Compression and piano wire stingers, secured with collets &amp; chuck via 5/16-24 (M8) threads</li> <li>❖ Overtravel protection</li> <li>❖ Current limiting shutdown</li> <li>❖ DC Resistance: 0.4 Ω; AC Impedance: 1.0 Ω</li> <li>❖ Options: Accessory Kit &amp; Cooling Unit</li> <li>❖ Continuous Operation: 5 – 35 degC; &lt;85% RH</li> <li>❖ CE Mark</li> </ul>	<ul style="list-style-type: none"> <li>❖ Linear amplifier design for high fidelity, low noise (50% efficient); convection cooled</li> <li>❖ Frequency range; DC-20 KHz; usable to 50 KHz</li> <li>❖ AC or DC coupled, separate BNCs</li> <li>❖ Current feedback and voltage feedback, external switch selectable</li> <li>❖ Output power: 625 VA; 25 VRMS max. voltage; 25 ARMS max. current, 35 A peak</li> <li>❖ Output connector: 3-pin AMP, mates to shaker</li> <li>❖ Output current measurement, BNC</li> <li>❖ Over-current, over-voltage shutdown protection</li> <li>❖ Over-temperature protection</li> <li>❖ Internal DC Supply: 42VDC and 20ADC</li> <li>❖ Signal-to-noise: &gt;100dB THD: &lt;0.1%</li> <li>❖ Options include: set-up &amp; monitor with PC via Ethernet; shutdown via TTL or contact closure; remote monitoring of MODAL 110 temperature</li> <li>❖ User-adjustable current and voltage trip limits</li> <li>❖ Input power: 100, 110, 120, 200, 220, 240V; 48 - 62 Hz (1.0 KVA); in-line fuse protection</li> <li>❖ Sig. IN for max OUT: ±3Vpk; also ±1, 5, 10Vpk</li> <li>❖ Input Impedance: &gt;10kOhm</li> <li>❖ 19" rack x 3½"H (89mm) x 14¼"D (362mm)</li> <li>❖ Weight: 33 lbs (15 kg)</li> <li>❖ CE Mark</li> </ul>



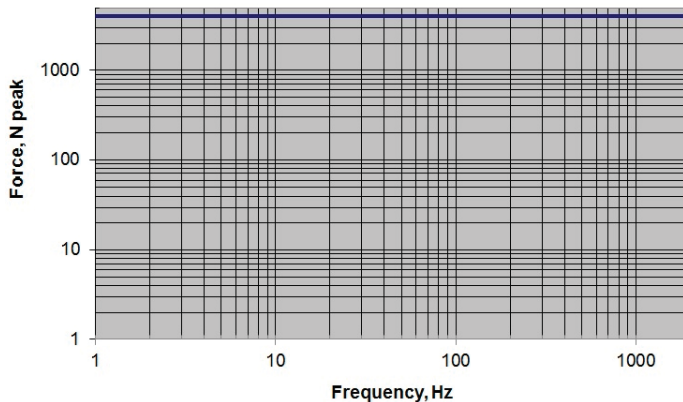
## MODAL 1000 Exciter Technical Specifications

*There's more to using and buying Modal Exciters than meets the eye. Misjudging modal testing applications can be fraught with unforeseen hazards that contaminate data and miscalculating hidden costs can be risky. MB Dynamics is the leading world-wide supplier of MODAL Exciters and MODAL Excitation Testing Applications.*

MODAL 1000 Exciter



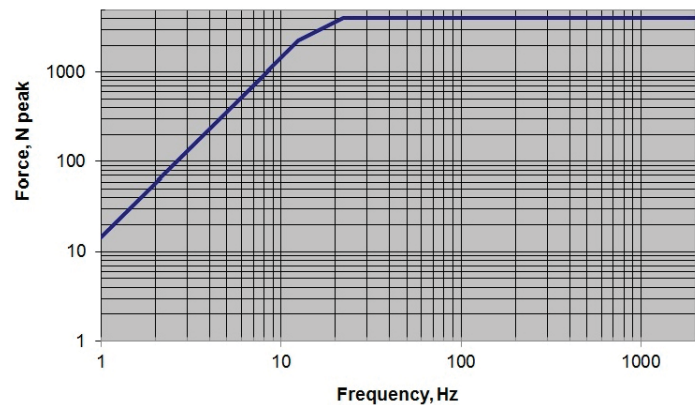
MODAL 1000 Performance, Blocked Armature



Blocked Armature: high stiffness reflected by test item back into MODAL 1000 and no movement of MODAL 1000 body. A measure of low frequency force output

Free Armature: no stiffness reflected by test item back into MODAL 1000 and no movement of MODAL 1000 body. A measure of low frequency force output

MODAL 1000 Performance, Free Armature



## MODAL 1000, *continued*

### Technical Specifications for MODAL 1000

Force Output with Forced Air Cooling	* 4,000N pk sine excitation (900 lbf); 2,600N RMS random (585 lbf)
Force Output with Ambient Air Cooling	* 2,000N pk sine excitation (450 lbf); 1,300N RMS random (290 lbf)
Stroke	* 45mm peak-to-peak (1.8 in. p-p)
Velocity	* 1.75m/s peak (70 inches/second)
Acceleration	* 25 g pk continuous sine (MODAL 1000 moving element only)
Frequency Range	* DC-2000 Hz
Moving Element Weight	* 16.4kg (36 lbs.)
Moving Element Axial Resonance	* > 2,000 Hz
Driven-Axis Stiffness	* 31 N/mm (180 pounds/inch)
Exciter Weight, incl. Trunnion Base	* 364kg (800 pounds)
Stinger Kit (Stainless Steel)	* ½” hex stingers: three 400mm long, three 200mm long; each has 3/8-16 UNC threads on one end and ¼-28 UNF-2B on the other
Stinger Attachment	* Chuck (1/2” drill size) and wrench key for tightening on stingers
Shaker Attachments	* Floor mount with trunnion base; with vertical-only base; suspension mount with optional turnbuckles & trunnion base
Dimensions in trunnion base	* 570mm X 485mm Footprint X 910mm High (to top of chuck)
Drive Cable Length	* 10m (32 ft.)
Power Amplifier	* MB Model PVL-S (see Data Sheet; amplifier only, no field supply)
Cooling (optional)	* Portable unit; optional Quiet Enclosure < 60dBA; or shop air
Accessory Kit & Inertial Mass (optional)	* Bolt-on-masses with nuts & bolts for mounting: 38kg and 50kg
Force Sensor (optional)	* 4,450N (1,000 lbs.) tension & compression; 5mV/lb (1124 mV/kN)

#### MB Dynamics, Inc.

25865 Richmond Road · Cleveland OH · 44146 USA  
+1 (216) 292-5850 phone +1 (216) 292-5614 fax  
www.mbdynamics.com

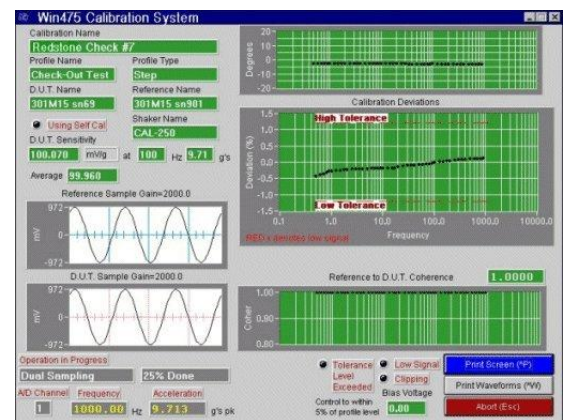
- **Accelerometers and velocity transducers**
- **IEPE, charge, voltage, PR, capacitive, MEMS, TEDS**
- **Expanded System Uncertainty as low as 0.6%**
- **System Transfer Uncertainty as low as 0.57%**
- **Range: <0.1Hz – 50kHz, with options**
- **CAL25HF exciter: 2Hz-50kHz, 10mm, 20g's pk**
- **CAL50 exciter: 1Hz-10kHz, 25mm p-p, 55g's pk**
- **Swept & step sine, random and shock excitation**
- **FFT processing at calibration frequency**
- **PC-controlled signal conditioner minimizes errors**
- **DC measurements; ZMO & shunt calibration**



The MB Win475 is an automated calibration system that slashes calibration costs, maximizes productivity, and assures repeatable low-uncertainty calibrations. It is cost-justified with as few as 50 transducers. System Transfer Uncertainty matches or surpasses more expensive alternatives. Labs can use the Win475 to comply for calibration of vibration transducers - with ANSI/NCCL Z540-1-1994 "Calibration Laboratories and Measuring and Test Equipment - General Requirements" and relevant requirements of ISO 9000 (ANSI/ASQC Q90 Series), ISO/IEC 17025, ISO 16063-21 and ISO 5347. Win475 satisfies ASME OM CODE-1998; SUBSECTION ISTB (invoked by NRC). The Win475 is a proven product with a sizable installed base. MB provides an Uncertainty Budget in accordance with ISO 16063-21.

## Key Benefits

- Excellent Expanded System Uncertainty – see Table below
- Small uncertainty and affordable price = outstanding value
- Saves money, by replacing out-sourced calibration services
- Keeps calibration in-house; shortens turnaround time
- Proper calibration process and accurate records aid compliance during ISO audits
- Allows more frequent calibrations to assure good test data
- Automation eliminates human errors with manual systems
- Speeds-up calibration that frees-up users for other tasks
- Simplifies record-keeping
- Intuitive and self-tutorial -- ideal for infrequent users



## System Configurations

Win475 Systems are characterized by key performance specifications: their Expanded System Uncertainty (ESU); method used to calibrate the Reference Standard Accelerometer (REF); frequency range of use; and mass of the transducer being calibrated (DUT).

MB defines System Transfer Uncertainty (STU) as the uncertainty of the Win475 measurement and vibration generation system, including the PC, data acquisition board, software, Model 405-X signal conditioner, calibration exciter, and power amplifier, but excluding the REF. MB evaluates STU in accordance with ISO 16063-21 "Vibration calibration by comparison to a reference transducer". STU is a measure of the ability of the calibration system to accurately transfer the uncertainty of the REF to the DUT.

The uncertainty of the REF is separately reported on its Calibration Certificate by the entity that calibrated it. MB offers two sources for the REF's sensitivity data: absolute calibration using laser interferometry and secondary or back-to-back comparison calibration. Absolute calibration provides smaller REF uncertainties, but is more expensive. However, REF uncertainty dominates ESU of the Win475 so there are real advantages to having low REF uncertainty values. User choices are provided to meet uncertainty needs.

Expanded System Uncertainty (ESU) combines STU and REF uncertainty, using the “square root of the sum of the squares” method (since they are independent parameters). ESU evaluates the uncertainty inherent to the Win475 calibration system itself. The user’s uncertainty budget related to DUT calibrations using the Win475 depends on the quality, resolution, sensitivity, etc. of the DUT, on operator skill and training, human errors, environmental conditions in a user’s lab and on many other factors unrelated to ESU. These factors do not impact STU or ESU.

### Win475 System Configurations

System Name	ESU at 100 & 160Hz	REF Calibration	Frequency Range	Mass of DUT
Win475-Standard, CAL25HF	±0.6%	Absolute	2 – 20,000Hz	< 910gm
Win475-Standard, CAL25AB	±0.6%	Absolute	2 – 15,000Hz	< 910gm
Win475-Standard, CAL50	±0.7%	Absolute	1 – 10,000Hz	< 910gm
Win475-Basic, CAL50	±1.2%	Secondary	1 – 10,000Hz	< 910gm
Win475-Low Frequency	±0.6%	Absolute	0.1 – 100Hz	< 3kg
Win475-Multiple DUT	±1.2%	Secondary	5 – 4,000Hz	< 10gm, 8 max
Win475-Transverse Sensitivity		Secondary	30 – 2,000Hz	< 910gm
Win475-DC Accelerometers	±1.2%	Secondary	DC – 10,000Hz	< 910gm

### STU, REF and ESU of Popular Win475 Systems

Frequency Range	System Name	STU	REF	ESU
5Hz	Win475-Standard, CAL25HF exciter (10mm p-p)	±0.9%	±0.3%	±1.0%
50Hz	Win475-Standard	±0.8%	±0.5%	±1.0%
500Hz	Win475-Standard	±0.8%	±0.5%	±1.0%
1,000Hz	Win475-Standard	±0.8%	±0.5%	±1.0%
<5,000Hz	Win475-Standard	±0.8%	±1.0%	±1.3%
10,000Hz	Win475-Standard	±1.3%	±1.5%	±2.0%
20,000Hz	Win475-Standard	±2.8%	±2.0%	±3.5%
5Hz	Win475-Basic, CAL50 exciter (25mm p-p)	±0.9%	±2.0%	±2.2%
50Hz	Win475-Basic	±0.8%	±1.5%	±1.7%
500Hz	Win475-Basic	±0.9%	±1.0%	±1.3%
1000Hz	Win475-Basic	±0.9%	±1.0%	±1.3%
<5,000Hz	Win475-Basic	±1.0%	±2.5%	±2.7%
10,000Hz	Win475-Basic	±1.5%	±2.5%	±2.9%
0.5Hz – 10Hz	Win475-Low Freq, CAL2-300H (280mm p-p)	±0.9%	±0.3%	±1.0%
>10Hz – <100Hz	Win475-Low Freq, CAL2-300H (280mm p-p)	±0.9%	±0.3%	±1.0%

### Standard Features, Designed with Users in Mind

- ✚ Calibrates virtually all accelerometers regardless of size and weight including: Charge, Low impedance, Voltage, Servos, Strain Gage, Piezoresistive, Capacitive, TEDS, and AC- and DC-coupled
- ✚ Calibrates displacement and velocity transducers, even those with a built-in meter and no AC output
- ✚ No operator adjustments required for gain, vibration levels, etc. Software-control virtually eliminates operator error, enhances repeatability and ensures optimum signal-to-noise ratio and minimizes uncertainty
- ✚ Operator is not required to adjust amplifier gain levels, knobs or switches to perform a calibration
- ✚ Combination charge, displacement, voltage and low impedance voltage mode dual-channel signal conditioner
- ✚ System Transfer Uncertainty (STU) is evaluated as a “total system”, by computing it from a “summation of many independent components” as stipulated in ISO 16063-21
- ✚ STU provides values across frequency bands, not one number
- ✚ Users can measure and re-verify STU at any future time
- ✚ Repeatability of nominal sensitivity at 100 Hz, 40 runs, @ 95% confidence level = average ± 0.075%
- ✚ Uses “back to back” mounting where each transducer is bolted to a fixture that attaches to the exciter’s moving element. Uses “single-ended” REF.



- Wide frequency range with one of two exciters, either 2-50kHz or 1-10kHz
- Longest stroke for broadband exciter, 10mm p-p and 25mm p-p
- Highest acceleration level of broadband exciter, 20 g's pk and 55 g's pk
- Calibration range not limited by DUT mass
- Compact bench-top package, conserves floor space; 19" rack not needed; can be supplied as an option
- NIST traceability
- Turnkey solution
- Real time display of waveforms
- Software performs amplitude linearity checks
- Internally compensated "total channel" calibration
- 100dB signal gain-ranging maximizes signal-to-noise at every signal level, using software-controlled Model 405-X Signal Conditioner and PCIe board or USB module
- Diagnostic software performs real-time monitoring and alarm of critical areas of operation and signal paths
- Unique "Self Check" quickly verifies system operation
- Manual Mode allows for "quick check" of transducers with full measurement accuracy
- Win475-Standard supports a Test Accuracy Ratio (TAR) of 4:1 while calibrating 5% devices
- Win475-Low Frequency Option delivers excellent performance on low sensitivity DUTs that must be accurately calibrated at below 1.0 Hz frequencies (as low as 0.07 Hz)
- Latest-generation Intel PC with ample hard drive and DVD to store data locally or archive on a network server
- Conventional Windows file structure, folders, etc.
- National Instruments LabWindows GUI and LabVIEW
- Menu-driven application software under mouse control
- Integrated test information database
- Aids scheduling and recall of transducers for calibration
- Permits comparison against historical results
- Password protection of critical set-up data
- English and SI units
- Several report formats (customizable)
- Automates repetitious and boring calibration tasks
- Provides a label printer for inserting Cal Label in accelerometer box
- Manuals written for users who are not vibration or electronics technicians/engineers
- Outputs ASCII file formats for use with any Windows-compatible application, such as Excel or Access

## SYSTEM SPECIFICATIONS

<b>Configuration:</b>	Desktop PC running under Windows 7 Dual channel signal conditioner, Model 405-X Dual channel signal processor, Nat'l Instr. Model PCI, PCIe, or USB Calibration exciters: CAL50, CAL25HF, CAL25AB, CAL12AB, and CAL2-300H Power amplifier: Model MB500VI or equivalent Reference transducer, traceable to NIST	
<b>Calibration Method:</b>	User selectable: back-to-back or piggyback	
<b>Inputs:</b>	<b>Charge:</b>	0.1pC – 500pC
	<b>IEPE/Voltage:</b>	1mV – 10V max
	<b>Velocity:</b>	1mV – 10V max
<b>Input Impedance:</b>	<b>Charge:</b>	> 1G ohm
	<b>Voltage:</b>	> 100 M ohm
	<b>IEPE:</b>	> 100 K ohm
<b>Frequency Range:</b>	<b>Acceleration:</b>	0.07 Hz to 55kHz
	<b>Velocity:</b>	60 CPM and above
<b>Operating Temperature:</b>	10 to 40°C ambient air, without loss of performance	
<b>Operating Humidity:</b>	20% to 50% relative humidity	



## Options

- Low frequency calibration as low as 0.07Hz on devices weighing up to 3kg
- Resonant search out to 50kHz
- Software and hardware compliant with ISO 16063-21
- Automation Package to upgrade existing manual calibration shaker, amplifier and REF accelerometer
- NIST-traceable reference accelerometers, calibrated by primary or secondary methods
- Reference accelerometer with 70kHz resonance and highly-stable sensitivity over time & temperature
- Shock calibration from 100 g's up to 13,000 g's
- Temperature sensitivity measurements, two options: +800 degC to -185 degC; +220 degC to -75 degC
- CAL25HF air bearing shaker conforming to ISO 16023-21 shaker specifications
- Transverse sensitivity measurement of accelerometer cross-axis performance
- Simultaneous calibration of four (4) and eight (8) accelerometers
- Calibrate heavy transducers and switches up to 4.5kg at 10g's pk with Win475-Heavy Transducer Option
- Programmable voltage excitation sources under software (DIO) control: -30VDC to 0 and 0 to +30VDC
- NIST-traceable Calibration Re-Certification Kit for data acquisition hardware
- Rack-mount cabinet
- Desk-style workstation consoles
- User Training – at MB or end-user site

