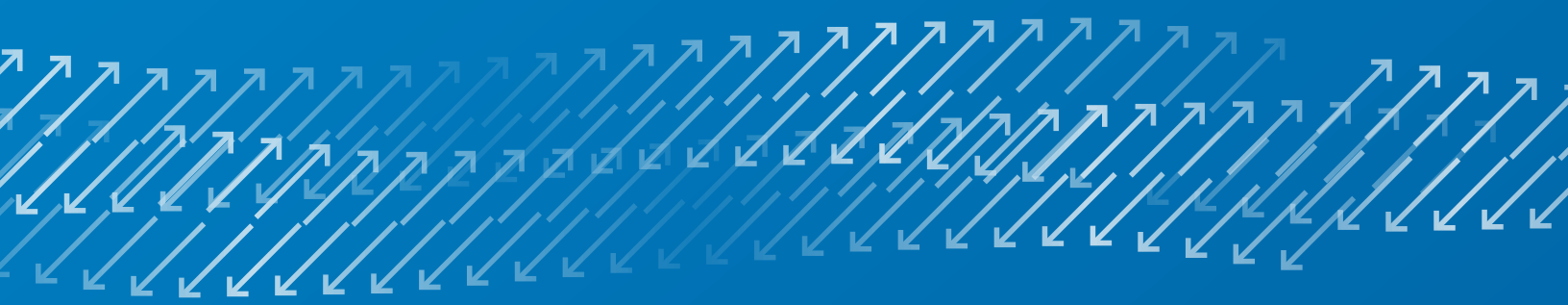




## MTS Acumen® Electrodynamic Test Systems

Delivering quieter, simpler and faster ways to get better data

DESIGNED TO DRIVE PRODUCTIVITY IN MATERIAL AND COMPONENT TESTING, **MTS ACUMEN TEST SYSTEMS** DELIVER AN UNDERSTANDING OF MATERIAL BEHAVIOR. CLEAN, QUIET AND ELEGANTLY ENGINEERED, THESE ENERGY-EFFICIENT SYSTEMS INCREASE TESTING EASE AND ACCURACY.





Low Maintenance



Industry-leading Performance



Small Footprint



Reduced Cost of Ownership



Operational Simplicity



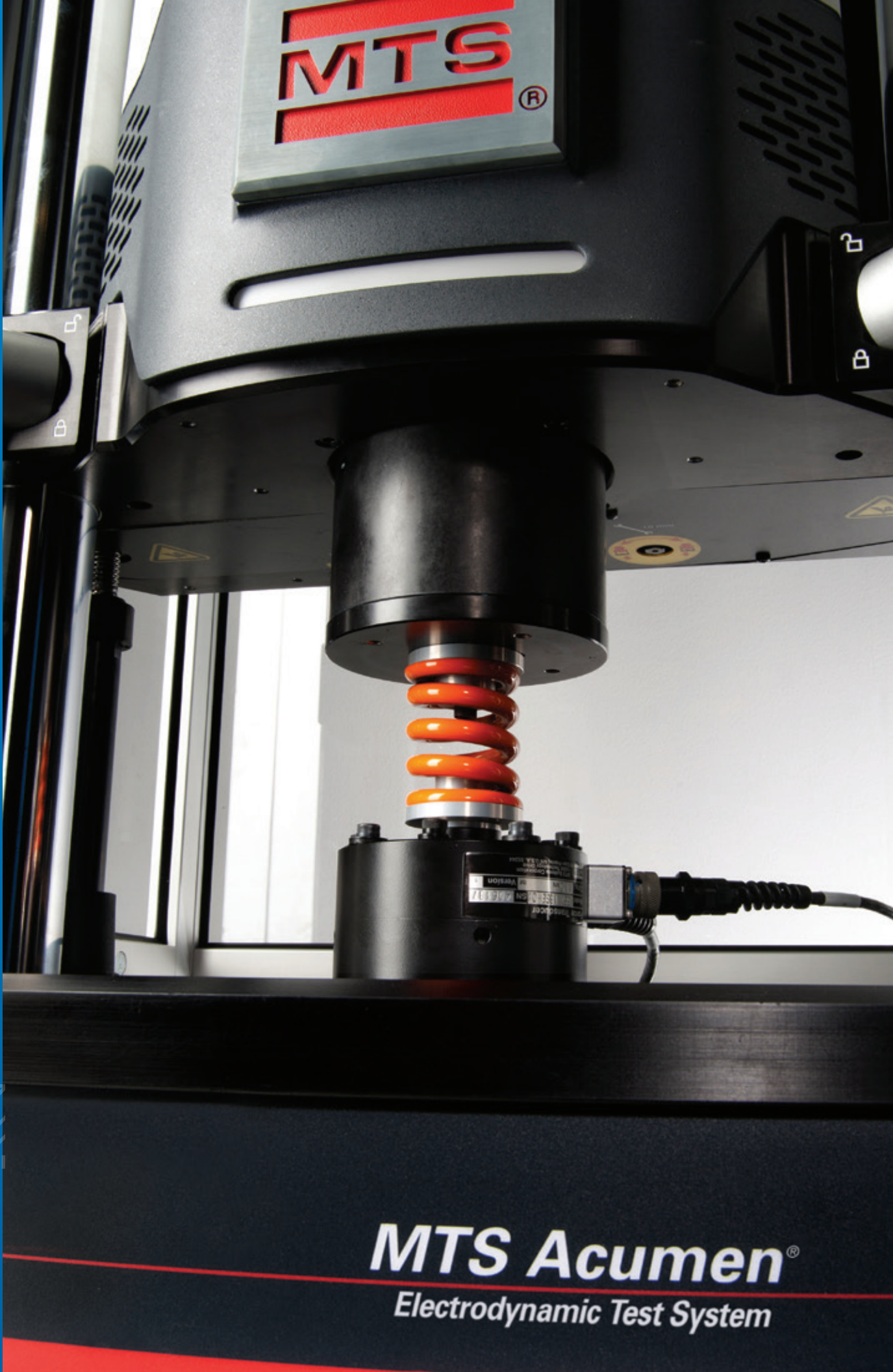
Energy Efficient



Quiet Operation



Oil Free



# MTS Acumen<sup>®</sup>

Electrodynamic Test System

## Engineered for Your Industry

The MTS Acumen portfolio accommodates a wide range of material and component testing

MTS Acumen electrodynamic test systems deliver the capabilities researchers and test engineers need to perform high-fidelity dynamic and static tests that are vital to improving the efficiency, reliability and performance of materials and components.

Combining the extensive functionality MTS solutions are known for with a user-centric design, MTS Acumen systems give test professionals a fast, easy way to establish or expand in-house capacity. These compact systems are easy to install, operate and maintain. They leverage more than three decades of MTS electrodynamic expertise, offering a solution that demonstrates our commitment to providing high-quality systems for the full spectrum of materials testing.

### Biomedical

- » Medical devices
- » Orthopaedics
- » Dental
- » Tissue
- » Vascular
- » Medical packaging
- » Fluid baths and accessories allow for in-vivo conditions

### Materials Test Types

- » Fatigue and fracture
- » Component strength and durability
- » FDA regulatory tests
- » Tension
- » Compression
- » Flex / bend
- » Dynamic Mechanical Analysis (DMA)

### Microelectronics

- » Semiconductor research
- » Printed circuit boards
- » Flex circuiting
- » Switches / buttons
- » Tactile feel
- » Fine wires and connectors
- » Solder fatigue testing

### Aerospace

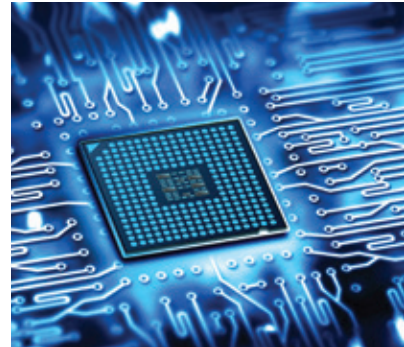
- » Lightweighting
- » Composites
- » Adhesives
- » High-temperature engine materials
- » Additive manufactured components

### Automotive

- » Vibration isolation
- » Composites
- » Tire / rubber
- » Adhesives
- » Fasteners
- » Lightweighting

### Consumer Products

- » Quality control and quality assurance
- » End-of-line testing
- » Durability
- » Additive manufacturing
- » Packaging



# MTS Acumen Electrodynamic Test Systems

Available in force capacities up to 12 kN with options for torsion testing of components



## Comprehensive Testing Capabilities

MTS provides hardware, software and application expertise to support any testing requirements

### Fatigue & Fracture

- » High-cycle fatigue to 100 Hz
- » From pre-cracking to fatigue crack growth
- » Low-cycle fatigue for high-temperature applications
- » File playback and spectrum loading to simulate automotive, aerospace and biomedical duty cycles
- » Fracture mode failure evaluation of full ductile-to-brittle material spectrum

### Production Line Quality Control (QC)

- » Hardware and software configurations for in-line inspection and pass/fail quality control testing
- » Measure stiffness and other dynamic properties of viscoelastic materials, like the vibration isolation functionality used in automotive elastomer-based engine mounts
- » Smaller footprint than oil-based systems

### DMA / Dynamic Characterization

- » Standard and high-force DMA, from -140C to 350C
- » Temperature and frequency sweeps
- » Assess dynamic properties as a function of fatigue
- » Tension, compression, bending, shear, and fully-reversed double cantilever
- » Modulus characterization down to 0.2 N peak-to-peak
- » Master Curves for product life evaluation

### Tension / Compression

- » Ultimate strength of materials and components
- » Determine strain rate sensitivity
- » Controlled buckling failure
- » Creep and stress relaxation
- » Hold and pulse tests of products with buttons and switches
- » Pull and shear tests (common for adhesives and films)

### Torsion

- » Unprecedented versatility (speed, angular displacement, number of cycles, continuous rotation, etc.)
- » Accessory versatility accommodates bone screws, fine wire, electronics, pill bottles, laminate shearing, biological tissue, etc.

### Low-force Testing

- » Microscale testing (milli-Newtons)
- » Combined low-force and low-torque testing
- » Low-torque testing of very small components
- » Tactile-feel load measurement in displacement control
- » Simulate a physiological pressure range (80-120 mmHg)

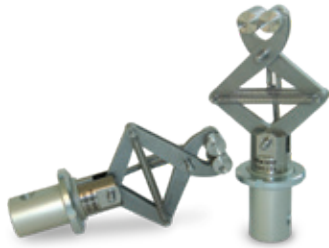
Equipped with a Bionix® EnviroBath, MTS Acumen test systems enable efficient, accurate testing of biomedical and general material specimens in fluids heated to body temperature.



## Accessories for Dynamic & Static Testing

A sample of the many accessories available for Acumen systems

### Grips & Fixtures



Scissors Action Grip



Thumb Screw Grips



Spring Action Grip



645 Pneumatic Grips



Shear Fixtures



Tension/Compression Grips



Bend Fixtures



Cam-action Tensile Grips



Compression Platens

### Environmental



Environmental Chambers

Bionix EnviroBath

### Accessories



Alignment Fixture

XY table



Pinned Attachment Kit  
(threaded also available)

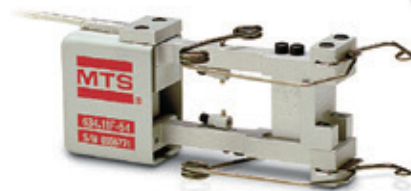
### Load/Strain Measurement



661 Load Cell



632 Axial Extensometer



634 Axial Extensometer

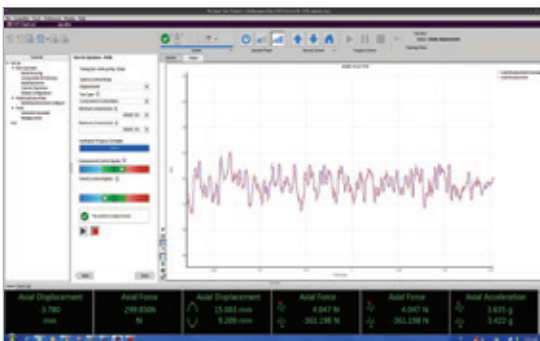
## Test Productivity

Industry leading MTS TestSuite™ software simplifies test setup and data collection, display, and analysis



### Customized test templates or guided test setup

- » Easy – Standard test templates
- » Flexible – Fast tailoring of standard templates
- » Powerful – Detailed implementation of specific testing techniques



### Auto-tuning capability

- » Increased usability without compromising capabilities
- » Auto-tuning allows software to measure and enter specimen parameters
- » No need to enter stiffness values
- » Raw control loop parameter access for advanced users
- » Axial and torsional auto-tuning



### Generating & distributing data

- » Full-function oscilloscope and meters to show real-time display of parameters (velocity, hysteresis, cyclic data)
- » Real-time display of calculated results; no need for test to finish and perform post-test analysis
- » Quick save of displayed data for real-time evaluation of long-term tests
- » Choose from a variety of application programs tailored to specific tests and standards



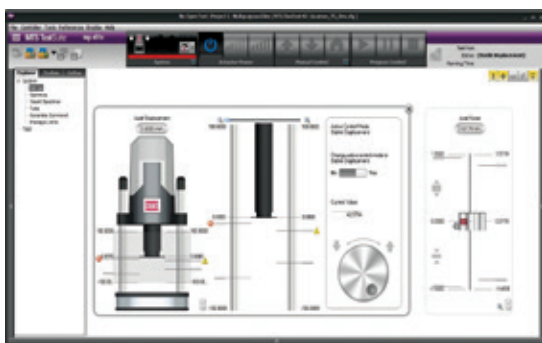
## Ease of Use

Simple installation, setup, test monitoring and modification



### Color-coded system status display

- » Verify system status at a glance and from a distance
  - » Immediately know if your test is running
- Green:** Test or program in progress  
**Blue:** Test ready to run but system has not been started  
**White:** Standby mode optimizes conditions for test setup  
**Red:** System disabled until safety interlocks are cleared



### Virtual graphical display

- » Visual display of limits instead of clicking open a menu
- » Protect your specimen, protect your system
- » Instantly view and respond to errors and safety interlocks
- » Critical parameters quickly adjusted to meet test requirements



### Intuitive system installation

- » Powered by a standard single phase electrical outlet
- » Bundled and color-coded cables help ensure error-free attachment and a clear test space

## Technical Highlights

Features of the Acumen platform focus on testing flexibility and safety

### Test setup designed with safeguards

- » System control mode during test setup and tuning is stable, helping prevent pretest sample or system damage
- » Test limit settings are accomplished easily and quickly with mouse-controlled adjustments to visually simple graphics
- » Visual directional control graphics ensure error-free test parameter settings and modifications
- » Guided and automated test setup processes facilitate creating new or modifying existing test protocols

### Controlled stop feature enhances system stability

- » Establishes the desired end-of-test specimen condition eliminating excessive or undesirable specimen damage
- » Enables quick recovery and return to intended test conditions
- » Ensures actuator remains safely controlled and predictable when test limits are reached
- » Safe and reliable limit actions increase confidence and efficiency during test setup

### Auto-tune methodology - uniquely MTS

- » Accurate electrodynamic system tuning, accomplished with patent-pending software algorithms for comprehensive specimen characterization
- » All system control modes are tuned simultaneously in one simple step, for both axial & torsional testing
- » Verification feature measures quality of tuning
- » Tuning options for even the most challenging samples

### Mounting hardware & sensor options provide convenience & flexibility

- » Easily and quickly transition the system load cell between the base and the actuator
- » Standard T-Slot base with common functionality across frames
- » Common threaded interface with pilot features on the load cell, actuator, and base plate all provide reliable and consistent alignment
- » Optional threaded attachment kits for leveraging a wide array of MTS and customer grips and fixtures
- » Several system and tandem load cell options and also an optional high performance Advanced Dynamic Response (ADR) sensor for very low-force testing of dynamic loads (as low as 0.2 N peak-to-peak)

### System-level engineering delivers added precision & accuracy

- » Sturdy design increases system stiffness
- » Acceleration compensation techniques deliver unparalleled closed loop performance
- » High resolution linear encoder for precise crosshead measurements
- » Alignment fixtures are available
- » Engineered options for complex Dynamic Mechanical Analysis (DMA) testing through glass transition, including Master Curves



Acumen 12

## Scalable Controllers & Remote Monitoring Solutions

Best-in-class multi-station control and remote monitoring solutions for labs with multiple systems

- » Industry-leading control performance enabled by lowest latency
- » Advanced control algorithms and compensators achieve unparalleled testing accuracy
- » Mezzanine card-based design enables future expandability
- » Four chassis sizes provide the right level of scalability
- » Versatile and easy to reconfigure as your testing needs change
- » Independent safety interlock chains for each station ensure the right response to limit trips
- » Large selection of modules to support a wide variety of sensors and equipment
- » Support for Transducer Electronic Data Sheets (TEDS)

*\* MTS Echo® Intelligent Lab offers cloud-based or local network solutions to monitor test status and equipment health*



## Torsion Testing

Acumen systems offer higher speeds, higher torque and more continuous rotation

### Applications

- » Biomechanics studies of orthopaedic systems and implants
- » Torsional strength and stiffness characterization of bone screws and small scale medical devices, fine wires, fibers, etc,
- » Wound healing (bone) studies that define an exercise and drug regimen to expedite healing outcome
- » Complex medical packaging evaluation, including childproof pill bottles that are designed to be easier for seniors to open
- » Torsional shear performance of adhesives
- » Support and validate FEA or materials models that have torsional elements



Bone Screw Testing

## Multi-Sample Fatigue Fixture

Monitor fracture of multiple endovascular samples simultaneously

The MTS MSF15 Fixture is designed for use with MTS Acumen Electrodynamic Test Systems to provide a cost-effective high-cycle fatigue testing solution for fatigue life curve development.

### Features

- » 15 test sites per fixture +25% more samples in one test (vs. 12)
- » 50 mm test space clearance at each test site
- » Adjustable test height for larger/smaller samples
- » Individual station load sensing & break detection with choice of load cell capacities such as 45 N (5 kg)
- » Individual mean strain adjustment to balance all samples to the same initial strain level
- » Proprietary design simplifies alignment for each test site
- » Easy to load design allows the user to set up each test site at an easy to reach location then lower the fixture into the preconditioned bath
- » The 37 C (+/-2C) Transparent Bath allows simple video verification for each test site during the test



Endovascular Device Testing

## Lab Productivity

MTS offers the products, engineering support and application expertise to maximize lab efficiency



### Optimize your test system readiness

- » Hardware and software maintenance programs
- » Spares programs, extended warranties
- » Accredited calibration services & system alignment
- » Remote test monitoring with MTS Echo<sup>®</sup> products
- » Predictive maintenance programs
- » Lab facility efficiency audits



### Maximize your testing efficiency

- » Hardware and software training classes at MTS offices or at your facility
- » Material and application consulting
- » Advanced test design software training
- » Custom test template design services
- » Local service engineers
- » Lab process efficiency audits

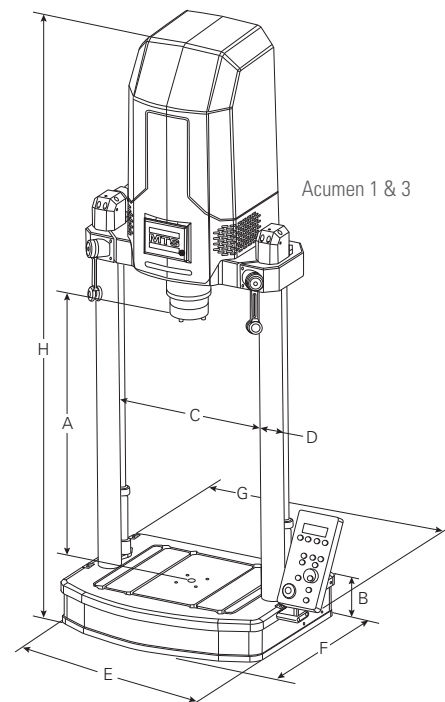
### Tailor your lab's data management requirements

MTS' solutions are designed to fit seamlessly into the overall laboratory LIMS ecosystem, and MTS consultants are available to customize data integration.

- » Customize your test system data output
- » Automate data flow between the test machine & LIMS systems or material databases
- » Leverage MTS system consultants for system integration challenges

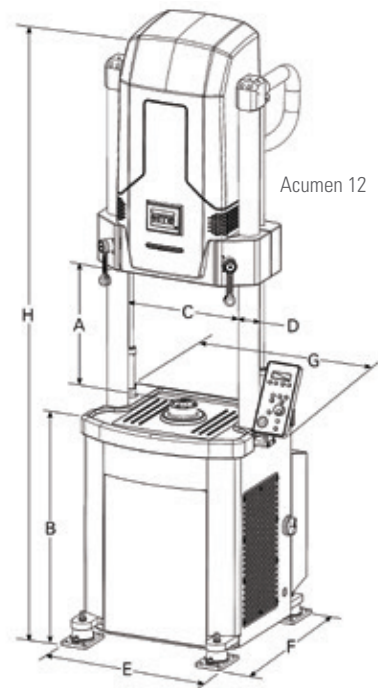
## Specifications

Load Frame Specifications <sup>1</sup>	Diagram Detail	MODEL		
		Acumen 1	Acumen 3	Acumen 3 A/T
<b>Dynamic force<sup>2</sup></b>		1250 N (281 lbf)	3000 N (670 lbf)	3000 N (670 lbf)
<b>Static force<sup>2</sup></b>		850 N (191 lbf)	2000 N (450 lbf)	2000 N (450 lbf)
<b>Dynamic torque rating</b>		–	–	±30 Nm (265 in-lb)
<b>Static torque rating</b>		–	–	±21 Nm (185 in-lb)
<b>Actuator dynamic stroke</b>		70 mm (2.75 in)	70 mm (2.75 in)	70 mm (2.75 in)
<b>Angular displacement</b>		–	–	±135° ±20 revolutions 0.001 rpm - 100 rpm continuous rotation to 350 rpm
<b>Dynamic performance</b>		≤100 Hz	≤100 Hz	≤100 Hz
<b>Minimum test space height<sup>3</sup></b>	A	26 mm (1.02 in)	26 mm (1.02 in)	0 mm (0.00 in)
<b>Maximum test space height<sup>4</sup></b>	A	603 mm (23.74 in)	819 mm (32.24 in)	603 mm (23.74 in)
<b>Working height<sup>5</sup></b>	B	133 mm (5.24 in)	133 mm (5.24 in)	133 mm (5.24 in)
<b>Test space width (measured between columns)</b>	C	375 mm (14.76 in)	460 mm (18.11 in )	460 mm (18.11 in )
<b>Base plate design</b>		T-Slot (industry standard: 8 mm)	T-Slot (industry standard: 8 mm)	T-Slot (industry standard: 8 mm)
<b>Column diameter</b>	D	63.5 mm (2.5 in)	63.5 mm (2.5 in)	63.5 mm (2.5 in)
<b>Frame footprint width</b>	E	550 mm (21.62 in)	634 mm (24.96 in)	634 mm (24.96 in)
<b>Frame footprint depth<sup>6</sup></b>	F	485 mm (19.09 in)	501 mm (19.72 in)	501 mm (19.72 in)
<b>Overall width<sub>6</sub> (with frame-mounted controller)</b>	G	679 mm (26.73 in)	764 mm (30.08 in)	764 mm (30.08 in)
<b>Overall height<sup>7</sup></b>	H	1511 mm (59.49 in)	1726 mm (67.95 in)	1726 mm (67.95 in)
<b>Weight</b>		159 kg (350 lb)	188 kg (415 lb)	230 kg (507 lb)
<b>Noise level - typical<sup>8</sup></b>		47 dbA	47 dbA	47 dbA
<b>Noise level - maximum<sup>8</sup></b>		69 dbA	69 dbA	69 dbA
<b>Mounting</b>		Tabletop: Vertical	Tabletop: Vertical	Tabletop: Vertical
<b>Standard load cell</b>		1.5 kN Accel Comp	3 kN Accel Comp	3 kN Accel Comp
<b>Operating temperature</b>		+5C° to +40C°	+5C° to +40C°	+5C° to +40C°
<b>Cooling</b>		Automated forced air	Automated forced air	Automated forced air
<b>Electrical requirements<sup>9</sup></b>	Voltage - VAC Frequency - Hz Current - Amps Phase	100-120 (200-240) 50 - 60 7 (4) Single	200-240 50 - 60 10 Single	200-240 50 - 60 20 Single



Load Frame Specifications <sup>1</sup>	Diagram Detail	MODEL	
		Acumen 12	Acumen 12 A/T
<b>Dynamic force<sup>2</sup></b>		12000 N (2697 lbf)	12000 N (2697 lbf)
<b>Static force<sup>2</sup></b>		8500 N (1910 lbf)	8500 N (1910 lbf)
<b>Dynamic torque rating</b>		–	±120 Nm (1056 in-lb)
<b>Static torque rating</b>		–	±84.8 Nm (746 in-lb)
<b>Actuator dynamic stroke</b>		70 mm (2.75 in)	70 mm (2.75 in)
<b>Angular displacement</b>		–	±135° ±20 revolutions 0.001 rpm - 100 rpm continuous rotation to 100 rpm
<b>Dynamic performance</b>		≤100 Hz	≤100 Hz
<b>Minimum test space height<sup>3</sup></b>	A	55 mm (2.17 in)	0 mm (0.00 in)
<b>Maximum test space height<sup>4</sup></b>	A	985 mm (38.8 in)	810 mm (31.9 in)
<b>Working height<sup>5</sup></b>	B	815 mm (32.1 in)	815 mm (32.1 in)
<b>Test space width (measured between columns)</b>	C	460 mm (18.11 in)	460 mm (18.11 in)
<b>Base plate design</b>		T-Slot (industry standard: 14 mm)	T-Slot (industry standard: 14 mm)
<b>Column diameter</b>	D	76.2 mm (3 in)	76.2 mm (3 in)
<b>Frame footprint width</b>	E	651 mm (25.6 in)	651 mm (25.6 in)
<b>Frame footprint depth<sup>6</sup></b>	F	817 mm (32.2 in)	817 mm (32.2 in)
<b>Overall width<sup>6</sup> (with frame-mounted controller)</b>	G	805 mm (31.7 in)	805 mm (31.7 in)
<b>Overall height<sup>7</sup></b>	H	2810 mm (110.7 in)	2810 mm (110.7 in)
<b>Weight</b>		953 kg (2100 lb)	1043 kg (2300 lb)
<b>Noise level - typical<sup>8</sup></b>		62	62
<b>Noise level - maximum<sup>8</sup></b>		78	78
<b>Mounting</b>		Floor: Vertical	Floor: Vertical
<b>Standard load cell</b>		12 kN Accel Comp	12 kN Accel Comp
<b>Operating temperature</b>		+5C° to +40C°	+5C° to +40C°
<b>Cooling</b>		Automated forced air & self contained water cooled	Automated forced air & self contained water cooled
<b>Electrical requirements<sup>9</sup></b>	Voltage - VAC Frequency - Hz Current - Amps Phase	200-240 50 - 60 38 Single	200-240 50 - 60 38 Single

- Specifications subject to change without notice.
- Verifiable with MTS compression spring test. Performance may vary depending on test type, test set-up, frequency, specimen, environment and other factors.
- Assumes standard system load cell installed, crosshead fully lowered and actuator fully extended to end of the dynamic stroke.
- Assumes standard system load cell installed, crosshead fully raised and actuator fully retracted to end of the dynamic stroke.
- From table to top of work surface; without optional isolation pads.
- For systems with optional test area enclosure, add 98 mm (3.8 in.) to dimension F and 45 mm (1.8 in) to dimension G for overall system dimensions.
- Measured with crosshead fully raised, without optional isolation pad.
- Typical usage at 1 m, free field. Noise level varies depending upon test type, specimen, environment and other factors.
- Acumen 1 current rated at 100 (200) VAC. Acumen 3 current rated at 200 VAC.



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