ElectroForce™ Apex 1
Mechanical Testing Instrument

Modern material and product development labs are tasked with developing innovative products with enhanced strength and durability, necessitating reliable, efficient material characterization. Mechanical testing is critical to ensuring the performance and longevity of your materials and products. It can be used to evaluate materials under relevant conditions including different temperatures, loading mechanisms, and rates.

Performing mechanical testing on your materials and products can accelerate development by limiting build/test cycles and preventing premature failure of products after they are launched. The ElectroForce Apex 1 Instrument enables scientists, engineers, and technicians to quickly and confidently measure and evaluate mechanical properties from monotonic tests (also known as tensile tests), fatigue studies, and other material characterization techniques without extensive training.

Table Top | Floor Standing

Analysis of Mechanical Properties

Mechanical testing is commonly used by leading labs and manufacturers to inform material selection and design, followed by component and product performance assessments. Employing mechanical testing early in development can reduce costs by identifying and eliminating weaknesses in material selection and design before it becomes very costly in the validation or even the post-launch phase.

Using ElectroForce Apex 1 Instrument for material development can provide quick measurements of strength and durability and help you assess the effects of many changes in formulation and processing.

- Elastic (Young's) modulus
- Yield strength
- Ultimate strength
- Elongation at break
- Fatigue life
- Creep compliance
- Stress relaxation
- Fracture toughness
- Fatigue crack growth

Electroforce Apex 1 Technology

ElectroForce Apex technology delivers:

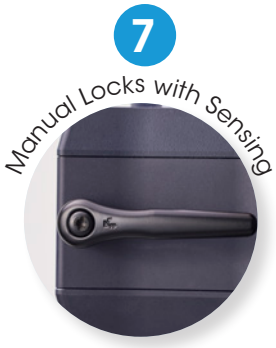
- Reliable testing with simplified setup enables automated tuning and confidence in data acquisition
- Sample protection with safe and smooth test preparation, including immediate instrument halt upon sample fracture
- Full utilization of longer stroke (100mm) expands testing capabilities with consistent performance and durability
- Precise force and friction-free motor design ensures subtle material behaviors are observed
- Enhanced sensor resolution ensures precise control and measurement of displacement
- Integrated software automatically imports data for seamless viewing and analysis

Advanced Features Amplify Performance

Building on a legacy of high performance and reliability, the new ElectroForce Apex 1 Instrument now adds enhanced stroke length with a streamlined workflow, eliminating many operator steps.

Key features keep you informed of the status of your instrument, enable quick reconfiguration, and reduce the possibility of operator errors which compromise test results. The ElectroForce Apex 1 Instrument is designed to easily and reliably produce accurate results.

1. An **integrated motor brake** securely holds the motor, enabling easy test setup and sample protection
2. **High accuracy displacement sensor** far exceeds ASTM E2309 Class A calibration accuracy with 1 nanometer resolution
3. **SmartSwap sensor technology** enables easy sensor or extensometer connection and configuration
4. The **System Status Indicator (SSI)** provides a fast visual signal to see the status of the instrument
5. **100mm of motor stroke** provides for easy test setup by helping minimize crosshead adjustments
6. **Powered crosshead lifts** allow fast and easy adjustment of the test space when installing accessories or clamps
7. **Integrated crosshead lock sensing** prevents the execution of an experiment if not properly locked
8. Available in **3 configurations:** Axial – Tabletop, Axial - Floor Standing, Axial Torsional - Floor Standing
9. Wide **range of accessories** enable simulation of real-life end-use environments when measuring sample behavior



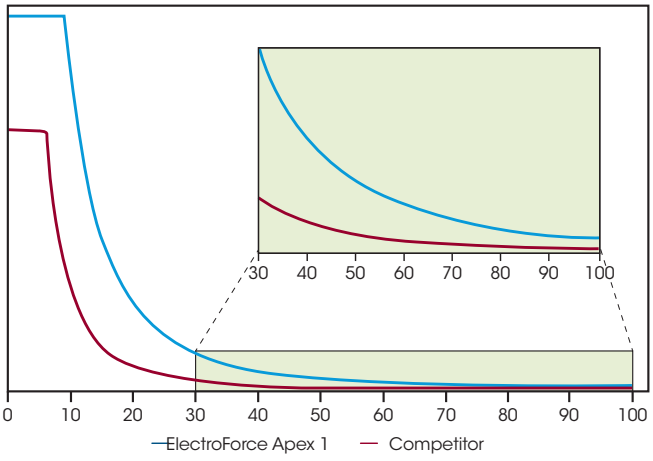
Versatile Testing with Precise Motor Control

The unique ElectroForce Apex 1 Linear Motor Technology enables testing across a wide range of forces, frequencies, and dynamic displacements. From <1Hz to >100Hz frequency and microns to 100mm of displacement, the new ElectrForce Apex 1 Instrument motor will precisely and reliably execute your desired experiment and ensure a faster test completion time.

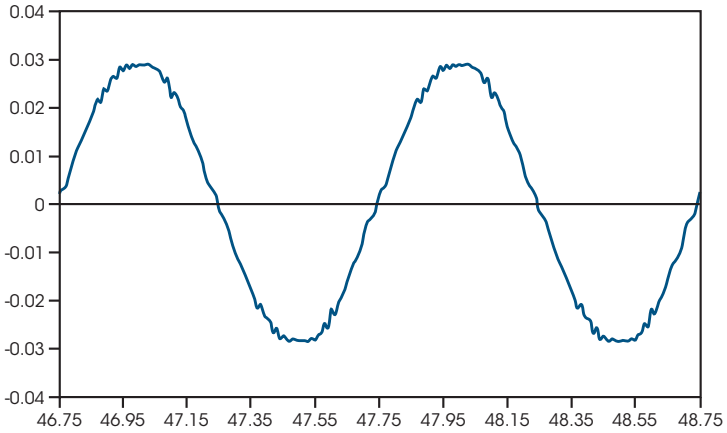
The ElectroForce Apex 1 Instrument Motor is specifically designed to be optimized for mechanical testing, from the copper to the magnets to the sophisticated guidance system. This allows you to perform your desired force and displacement at a higher frequency, getting your data quicker and accelerating your development programs.

The friction-free motor combined with our High Accuracy Displacement Sensor (HADS) technology enables accurate and precise motor control, to help ensure your tests are executed to your desired motions, and subtle material characteristics are not lost due to signal noise or filtering.

Performance Comparision



Low Displacement



Simplicity with Automated Control Technology

The ElectroForce Apex 1 Instrument uses next-generation TuneIQ technology which reduces or eliminates the need to carefully select and change control modes during setup and test execution.

Conventionally, a tuning process is required to measure the instrument and sample characteristics prior to executing the test. Our next-generation TuneIQ nearly eliminates that process, allowing you to simply install your sample and execute your test.

- Simplified test set-up process reduces operator training time and errors, increasing operator confidence
- Constant sample monitoring protects your sample and the instrument
- New sample break detection immediately stops the motor when a sample fracture is detected
- Sudden sample fractures and operator errors are handled gracefully by the instrument with little operator setup or input
- Test integrity is preserved by discontinuing the test and preventing damage to the sample surface after the sample is fractured

Sample Evaluation in Real-Life Conditions

Accurate mechanical testing often needs to simulate real-life sample conditions to best measure material properties. ElectroForce Apex 1 Instrument accessories empower users to measure sample behavior under a wide variety of conditions and end-use environments.

Environmental

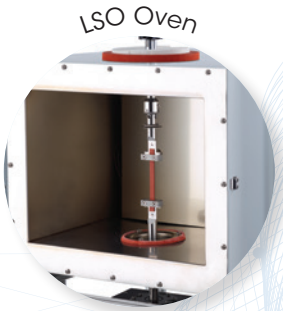
The ElectroForce Apex 1 Instrument offers a range of environmental accessories, from an oven to simulate a wide temperature range to the bath accessory typically used to simulate the human body for biomaterials and medical device research.

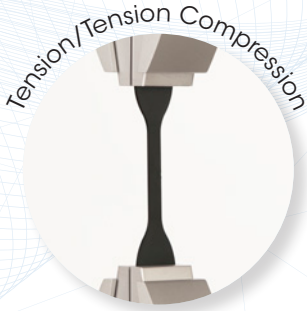
Clamps

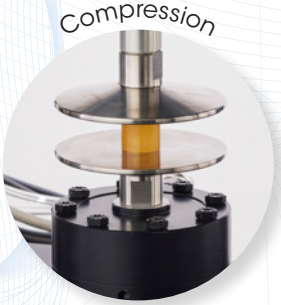
The ElectroForce Apex 1 Instrument can be equipped with a wide variety of grips and fixtures which can be easily changed in just seconds to minutes. While grips for tension or tension and compression are the most common, compression platens and bend fixtures are also widely used with a variety of options available.

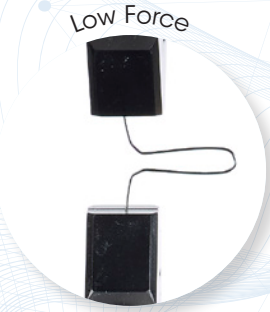
Sensors

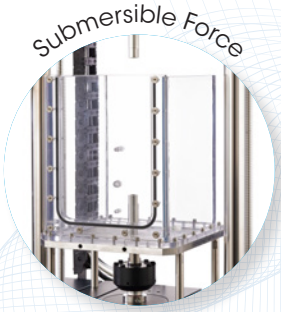
Optional sensors can achieve optimal measurement of the test sample behavior under many conditions, including low force, submersible testing, and direct strain measurement. Using these sensors is made very easy on the ElectroForce Apex 1 Instrument with SmartSwap Technology.







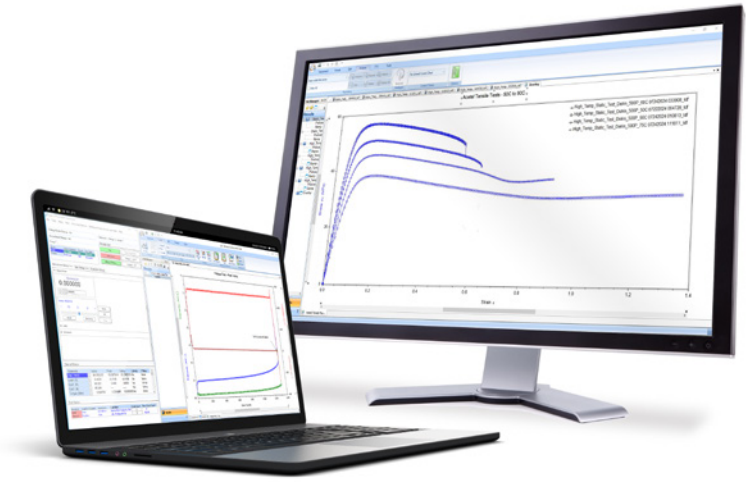




Confident Data Acquisition

With the ElectroForce Apex 1 Instrument, data acquisition and analysis are automatically configured based on your test parameters, allowing critical data to be captured without overloading your computer or analysis tools.

Automatic configurations reduce sample waste and repeated testing by preventing lost data and misconfigured data acquisition settings.



The new ElectroForce Apex 1 Instrument user interface combines WinTest instrument control software and TRIOS software to enhance test execution with seamless data viewing and analysis. TRIOS enables a user to view and analyze data, reducing the need for other analysis tools and offering faster results.

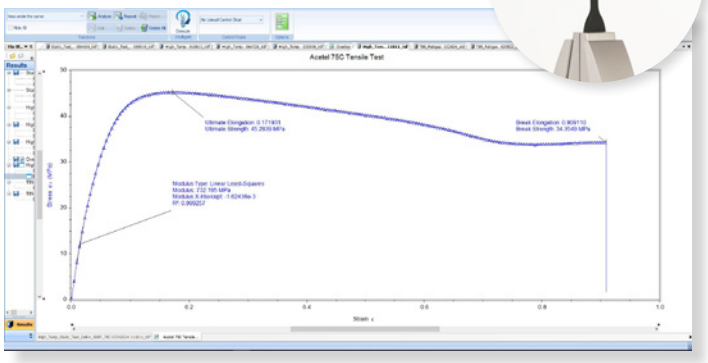
- Intelligent Data Acquisition (DAQ) settings (based on test conditions) can be used as recommended or adjusted by the operator.
- Final data reduction is completed at the end of the experiment to help ensure that more insightful data is available and enhance insights from your testing time.
- Built-in TRIOS Software tools allow easy browsing and analysis of data with default data displays according to test type being performed
- Peak-valley data is automatically generated based on the test and sample, reducing the need to pre-define sensitivity and risk losing data.

Streamlined Monotonic Test Analysis

Monotonic tests are easily executed with our streamlined workflow and automated data analysis. ElectroForce Apex 1 Technology enables the user to measure a material's modulus, yield strength and many other properties with limited operator input; only sample dimensions and basic test information are required to run a test, reducing or eliminating the need to set up data acquisition, tune the control system, or manually analyze the data.

Material properties can be reviewed seconds after test completion. Intelligent Analysis analyzes monotonic test data and quickly reports elastic modulus, yield strength, ultimate strength, and additional properties, including customization for your material and test goals.

Analysis capabilities for ASTM D638, ASTM E8, ASTM D790, ISO 527 and other international standards are included and can be adjusted for your specific needs.



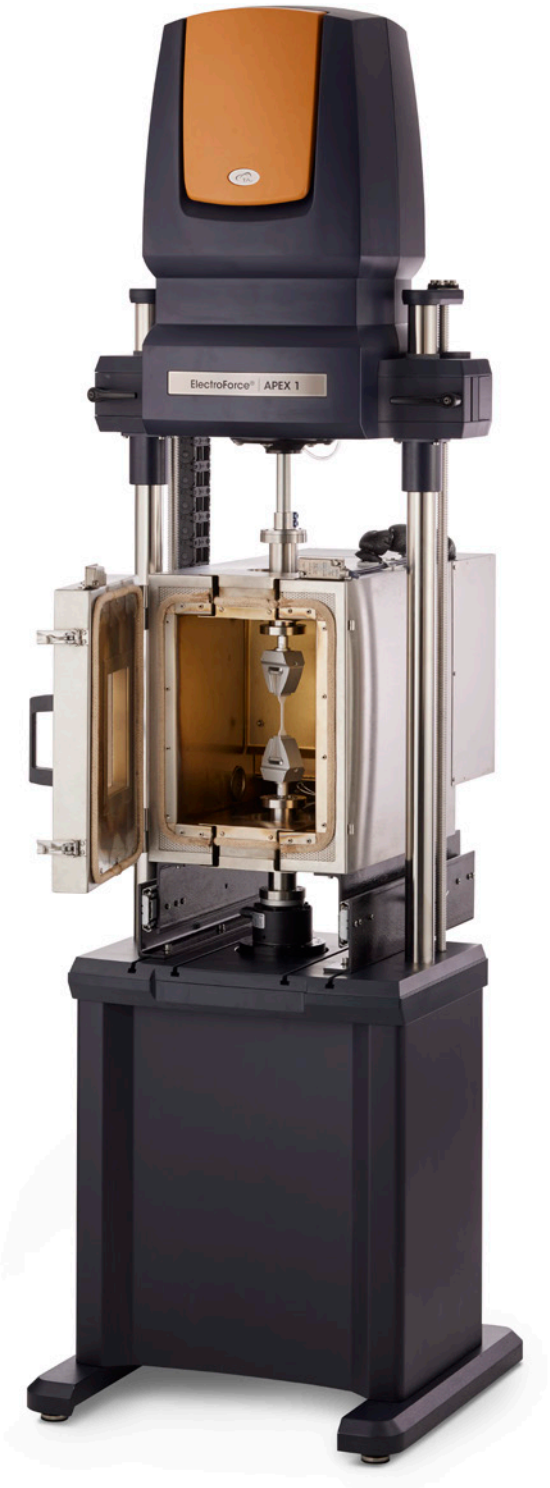
Accelerated Training and Test Execution

Minimal training is required on the ElectroForce Apex 1 Instrument due to the simple operation and integrated ease-of-use features. Operators will gain confidence quickly with features that increase precision and accelerate test completion, while reducing the possibility of operator errors.

ElectroForce Apex 1 Instrument supports users with:

- Guided workflows specific to the test type to reduce inputs required to execute tests
- Automated data acquisition to help ensure data is properly recorded
- Next-generation TuneIQ to automate control modes and help eliminate operator initiated tuning process
- Test parameter traceability, captured from test setup to the final TRIOS Software data file
- Default TRIOS Software data displays to automatically show the data you want to see
- Sophisticated data viewing and analysis tools get to conclusions faster

Specification	ElectroForce Apex 1 Instrument
Force Rating – Dynamic	± 1000N
Force Rating – Static/RMS (continuous)	Static/RMS – ± 710N
Dynamic Displacement	100mm
Linear Velocity	0.05 micrometer/sec – 2.5 m/s
Frequency Range – Fatigue	.00001 - 100Hz
Torsion Motor Option	
Rotation	Multi-turn 62 revolutions
Torque Rating	
Torque Rating - Dynamic	± 14 N-m
Torque Rating - Static/RMS (continuous)	± 14 N-m
Environmental Options	
Oven Options	150 to 350 ˚C
Fluid/Saline Bath Options	Ambient to 40 ˚C



Waters™ | TA Instruments™

tainstruments.com

January 2025 MT00004EN Rev. A