



TECHNICAL BROCHURE



TM-EML Series A Single-Column Benchtop Universal Testing Machine



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GENERAL DESCRIPTION

The [TM-EML Series A – Single-Column Benchtop Universal Testing Machine \(50 N – 5 kN\)](#) is a next-generation electromechanical system designed for advanced research and routine quality-control applications. Combining precision, speed, and a compact footprint, the system provides a versatile platform for testing rubber, plastics, metals, composites, adhesives, films, foams, wires, and consumer products under tensile, compression, and flexural loads.



Intuitive System & Interface



Rapid Delivery



Fully Standards-Compliant



Turnkey Testing Packages



High ROI, Low Operation Costs



Reliable Support & Calibration

Force Capacity Options: 50 N (11.24 lbf), 100 N (22.48 lbf), 200 N (44.96 lbf), 500 N (112.40 lbf), 1 kN (224.80 lbf), 2 kN (449.61 lbf), 5 kN (1124.04 lbf)

Frame Configuration: Single-column, benchtop electromechanical frame with direct-drive servo system

Test Space: Single-zone vertical layout optimized for displacement accuracy and uniform load distribution

Typical Applications: Ideal for R&D testing, production verification, educational use, and quality assurance programs. Particularly suited for low-force precision testing and compact laboratory environments.

TYPICAL SPECIMENS

Designed for high-precision evaluation of modern materials, the TM-EML Series A supports a range of low- to medium-force specimens, including:

- Plastics, thin films, adhesives, foam, and packaging materials
- Thermoplastics and thermosets (ASTM D638, ISO 527)
- Elastomers and rubber compounds (ASTM D412, ISO 37)
- Composite materials, prepregs, and reinforced laminates
- Metallic wires, solder, and micro-scale metal components (ASTM E8, ISO 6892)
- Biocompatible and medical samples, such as sutures, films, and tissue substitutes
- Laminated paperboard, coated paper, and flexible packaging (ISO 1924, ASTM D882)
- Structural adhesives, bonding tapes, and sealants (ASTM D903, ISO 8510)



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- Soft and rigid foams (ISO 2439, ASTM D3574)
- Textiles, woven and non-woven fabrics, yarns, and geotextiles
- Consumer product components such as plastic clips, springs, and flexible displays
- Optical films, membranes, ultrathin coatings, and multilayer structures

KEY FEATURES OF THE TM-EML SERIES A UTM

The TM-EML Series A is engineered with advanced structural and control features to maximize performance, accuracy, and reliability in compact laboratory environments.

- **Compact, rigid load frame:** Sturdy, space-efficient single-column design optimized for benchtop use without compromising performance.
- **FEA-optimized structure:** Enhanced column and crosshead stiffness minimize deflection and maintain precise alignment under full load.
- **High-speed, low-vibration drive system:** A direct-drive electromechanical system with a strong belt allows the crosshead to move quickly at speeds of up to 2400 mm/min and return at up to 3000 mm/min while
- **Pre-loaded precision ball screws:** Axial preloading eliminates backlash, ensuring consistent force delivery and maintaining accuracy under cyclic or dynamic loading.
- **Linear motion guidance:** Dual precision guide rails maintain coaxial alignment across the full stroke, reducing lateral movement.
- **GenTest™ universal software:** Includes preloaded method templates for ASTM, ISO, GB/T, EN, DIN, and BS standards, with real-time graphing, step-by-step setup, and automated result calculation.
- **Digital closed-loop control system:** Integrated 24-bit controller operating at 1200 Hz enables accurate closed-loop control of force, displacement, and strain per ISO 7500-1 Class 0.5 and ASTM E4.
- **Automated limit monitoring:** Continuous real-time checks for crosshead travel, overload (103%), voltage, and temperature with hardware/software emergency stop logic.
- **Modular accessory compatibility:** Supports manual, pneumatic, and hydraulic grips; clip-on, laser, or video extensometers; temperature/humidity chambers; and torsional fixtures through a unified plug-in interface.
- **Safety-enhanced test space:** Optional transparent protective shields with interlock logic prevent motion when opened and resist debris from specimen failure.



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CONTROL SYSTEM

The TM-EML Series A incorporates a high-performance digital control unit designed to provide precise test execution, stable communication, and seamless system integration.

- **USB 2.0 Communication Interface:** Data transfer between the testing system and the host computer is managed through a reliable USB 2.0 connection operating at 12 Mb/s. The interface supports multiple communication modes (control, interrupt, bulk transfer, and real-time streaming), offering dependable speed, plug-and-play compatibility, and full electrical isolation.
- **Ethernet Connectivity (TCP/IP):** In addition to USB, the controller supports Ethernet-based communication through an integrated high-speed logic chip with complete TCP/IP protocol support. This configuration allows low-latency, high-throughput data transmission, making it ideal for distributed and remotely controlled testing environments.
- **Sampling and Acquisition Performance:** The system performs closed-loop sampling at 1200 Hz, synchronizing the acquisition of force, displacement, and extensometer signals. A six-channel analog input module with 24-bit resolution ensures high-accuracy, real-time signal capture and feedback.
- **Integrated Hardware Protection:** Embedded firmware continuously monitors voltage, current, overload status, motor temperature, and crosshead position. Both hardware- and software-level emergency-stop logic is implemented to guarantee safe operation under all test conditions.
- **Handheld Remote Console (Standard):** Each system includes a 3.5-inch full-color touchscreen handheld controller with an ergonomic silicone keypad and precision rotary dial. The unit allows:
 - Start and stop of test execution
 - Grip actuation
 - Crosshead movement and fine positioning
 - Return-to-origin function
 - Overload prevention and travel-limit logic
- **Optional Standalone Touchscreen PC:** An optional industrial-grade touchscreen PC can be mounted directly on the machine frame. This configuration enables full system operation without an external computer, improving portability and simplifying usage in educational, mobile, or multi-station testing environments.

OPTIMIZED STRUCTURAL RIGIDITY

The TM-EML Series A - Single-Column Benchtop Universal Testing Machine features a frame engineered for exceptional mechanical stiffness and long-term durability. The structure uses a strong dual-rail setup and a specially designed crosshead to reduce bending and movement during tough testing.



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The load frame integrates pre-loaded precision ball screws, dual linear-motion guide rails, and reinforced column supports, effectively reducing mechanical play and maintaining consistent alignment.

All structural interfaces, like load cell mountings, motor couplings, ball-screw joints, and crosshead contact points, are engineered for zero clearance under load, ensuring repeatable measurement accuracy during both static and cyclic testing.

The rigid construction guarantees long-term alignment stability even under repetitive or high-cycle testing, supporting accurate determination of modulus, yield strength, and failure characteristics.

ADVANCED DIRECT-DRIVE SERVO ACTUATION

The TM-EML Series A Universal Testing Machine incorporates a next-generation direct-drive servo transmission system engineered for exceptional speed, acceleration, and positional precision across all testing conditions.

The system replaces traditional gear reducers with a high-rigidity synchronous belt and servo motor assembly, which greatly increases mechanical efficiency while eliminating transmission backlash.

The crosshead achieves travel speeds of up to 2400 mm/min and return speeds reaching 3000 mm/min, significantly shortening cycle time and boosting throughput.

The direct-drive actuation system ensures highly responsive motion control, allowing precise performance in both low-speed tests—such as creep, stress relaxation, or modulus ramp procedures—and ultra-slow micro-displacement tests that demand extreme accuracy. Optimized acceleration and deceleration profiles make complex test programs, like multi-stage loading and rapid-ramp sequences, more responsive without losing positional accuracy or data integrity.

INTEGRATED SAFETY AND INTELLIGENT CONTROL ARCHITECTURE

The TM-EML Series A has a complete safety and control system that keeps both the operator and equipment safe while ensuring the system works quickly and efficiently.

- **Real-Time Collision Prevention:** Continuous monitoring of force feedback and motion data enables instant reaction to abnormal force spikes caused by specimen fracture or obstruction. The system immediately halts the crosshead to prevent load-cell overload or mechanical damage.
- **Overload Protection Logic:** A hardware-level stop is automatically activated at 103% of the rated capacity, safeguarding sensors and maintaining long-term reliability of critical components.



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- **Dual-Layer Position Limit Protection:** Both software-defined stroke limits and mechanical end-stop switches ensure controlled crosshead travel within safe operational boundaries.
- **Emergency Stop Circuitry:** Integrated emergency stop buttons allow the operator to instantly interrupt any movement during unexpected conditions.
- **Sensor Range Enforcement:** All analog input channels, like force, displacement, and extensometer, are checked continuously in real time to make sure Built-in range checking stops input signals that exceed the range and maintains measurement accuracy.
- **Integrated Auto-Calibration and Diagnostics:** The system supports automated self-diagnostic routines and internal load-cell verification, ensuring calibration accuracy and reducing maintenance downtime.
- **Handheld Controller Safety Functions:** The handheld remote includes safety-enhanced features such as grip lockout, overload prevention, and return-to-origin protection to reduce setup-related errors or misalignment.

OPTIONAL PROTECTION SHIELD

An optional protective enclosure is available, featuring a fully reinforced aluminum-alloy frame and high-impact polycarbonate panels. The enclosure is designed in compliance with international mechanical safety standards to maximize protection during critical test operations.

The integrated door-locking mechanism and software-linked interlock system prevent system movement while the enclosure door is open, minimizing injury risk and ensuring safe operation during high-force or repetitive testing cycles.

STREAMLINED OPERATION AND MAINTENANCE

The TM-EML Series A - Single-Column Benchtop Universal Testing Machine is made to be easy to use, requires little training for operators, and has simple maintenance.

- **User-Centered Software Workflow:** Powered by GenTest™ software, the system features a clean, icon-based interface optimized for clarity and ease of navigation. Preloaded method templates for ASTM, ISO, GB/T, and EN standards allow for quick setup, while the ability to drag and drop to create sequences and see real-time graphs makes both basic and complex testing easier.
- **Step-by-Step Configuration:** A guided test setup assists operators through each configuration stage, reducing user errors and ensuring uniform test execution across multiple operators and laboratories.
- **Instant Report Generation:** Automated calculation of key mechanical parameters, such as modulus, yield strength, and tensile strength, combined with one-click data export and batch-processing capabilities, simplifies reporting and quality documentation.



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- **Plug-and-Test Accessory Integration:** All extensometers, grips, fixtures, and environmental chambers easily connect using plug-in interfaces that are automatic. Accessories can be replaced without recalibration or manual adjustment, minimizing downtime and setup effort.
- **Accessible Maintenance Architecture:** The controller module is slide-mounted for quick service access, eliminating the need to disassemble the frame. Protective panels open easily for direct inspection or replacement of belts, motors, and sensors.
- **Dual Control Modes:** The system supports operation through both the handheld remote controller and the optional industrial touchscreen PC, allowing seamless switching between local and PC-based control, ideal for educational use, training setups, and production testing environments.

MECHANICAL AND ELECTRONIC ARCHITECTURE

The TM-EML Series A UTM has a carefully designed mechanical structure and advanced control electronics to provide consistent stability, repeatability, and accurate measurements in all testing situations.

- **High-Stiffness Linear Guide System:** Dual linear guide rails with integrated self-lubrication enhance lateral rigidity and guarantee smooth, low-friction crosshead travel. This setup reduces sideways movement and keeps everything aligned, which helps to lower measurement mistakes in applications that are sensitive to displacement and strain.
- **Low-Noise Synchronous Belt Drive:** The direct-drive system uses a high-precision synchronous belt that has been fine-tuned for speed, smoothness, and low vibration. The maintenance-free transmission provides efficient, backlash-free power transfer between the servo motor and actuator assembly.
- **Integrated Optical Encoder:** A high-resolution photoelectric encoder is embedded within the servo drive to capture real-time position feedback with 0.0133 μm resolution, supporting precise micro-displacement control across the full travel range.

LOAD CELL ASSEMBLY

The TM-EML Series A utilizes advanced, factory-calibrated load cells engineered for stability, linearity, and high sensitivity throughout the entire rated force range.

- **High-Precision Load Cells:** Each load cell features robust construction, minimal signal drift, and high linearity for accurate force measurement during both tensile and compression testing.
- **Overload and Lateral Force Protection:** Reinforced internal design and built-in protection logic shield the sensor from shock loads, side forces, and irregular specimen failures.
- **Bidirectional Testing Capability:** All load cells are designed for both tension and compression applications without the need for hardware reconfiguration.



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- **TEDS Auto-Recognition:** Equipped with IEEE 1451.4-compliant TEDS chips, the sensors support plug-and-play identification, eliminating manual calibration procedures.
- **Self-Calibration Ready:** The system includes internal verification functions to maintain long-term accuracy and traceability of measurement data.
- **Temperature Adaptability:** Operating range from -55°C to $+90^{\circ}\text{C}$ enables consistent performance in both ambient and environmental chamber testing.

CLOSED-LOOP CONTROLLER

The TM-EML Series A incorporates a responsive closed-loop controller designed for dynamic load applications and precise real-time control.

- **Adaptive Feedback Control:** A next-generation PID algorithm, optimized for the direct-drive servo system, ensures fast and accurate adjustment to varying material behavior and load patterns.
- **Smooth Transition Profiles:** Intelligent motion algorithms generate stable acceleration and deceleration curves, providing uniform control across low- and high-speed testing modes—ideal for metallic materials tested under both ambient and elevated temperatures.
- **Multi-Channel Data Acquisition:** Six synchronized analog channels and several digital inputs make it possible to collect extensometer, load, strain, and temperature data at the same time with millisecond-level synchronization.
- **Real-Time System Monitoring:** Continuous diagnostics track voltage, motor temperature, and signal integrity, ensuring safe operation during long-duration or cyclic tests.

REAL-TIME DATA VISUALIZATION AND GRAPHING

- **Dynamic Graphing:** During testing, the software displays live force–displacement, stress–strain, and time-based curves updated at 1200 Hz acquisition frequency.
- **Customizable Layouts:** Users can configure graph styles, zoom levels, axis scaling, and overlays to suit specific analysis needs.
- **Automatic Markers:** Yield points, modulus zones, breakpoints, and extensometer triggers are automatically detected and labeled during or after testing.
- **Batch Curve Comparison:** Multiple specimen results can be displayed and analyzed together to evaluate consistency, detect outliers, and generate statistical summaries.
- **Data Export Options:** All graphs and raw datasets can be exported in multiple formats, including CSV, Excel, PDF, PNG, and SVG, supporting flexible post-test reporting and analysis.

INTEGRATED CONTROL INTERFACES

The TM-EML Series A supports multiple control and interaction modes, providing operators with ergonomic, efficient, and flexible access to all machine functions. Whether used in research, production, or training environments, these interfaces streamline test execution, setup, and safety management.



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HANDHELD REMOTE CONTROLLER – INCLUDED AS STANDARD

The compact, magnetically mountable handheld controller features a fully integrated 3.5-inch full-color touchscreen display that allows direct interaction with test parameters and live system feedback.

- **Ergonomic Interface:** Equipped with silicone-coated keys and a precision rotary wheel, the controller allows fine manual positioning of the crosshead. Operators can perform incremental movements, return-to-origin operations, or precise specimen alignment before testing.
- **Real-Time Feedback:** Force, displacement, and system status are displayed in real time, reducing the need to monitor the PC screen during setup or test execution.
- **Core Control Functions:**
 - Start/Stop test
 - Return-to-home position
 - Manual jog control (up/down)
 - Grip open/close control (if pneumatic grips installed)
 - Specimen protection logic preventing excessive preload during setup
- **Flexible Communication Modes:**
 - **Direct Mode:** Operates as a standalone control unit communicating directly with the controller.
 - **PC-Synchronized Mode:** Functions as a secondary input device for software-guided workflows through GenTest™.

OPTIONAL INDUSTRIAL TOUCHSCREEN PC

An optional industrial-grade all-in-one touchscreen PC can be mounted directly on the load frame, enabling fully independent test execution without requiring an external computer.

- **GenTest™ Software Integration:** The industrial PC comes preloaded with the full GenTest™ software suite, providing access to all standard testing methods, custom sequence creation, real-time graphing, analytics, and automatic report generation.
- **Touch Interface:** The multi-touch display supports gestures such as tap, drag, pinch-to-zoom, and swipe for efficient navigation and fast data review. Test curves, parameters, and results are interactively accessible for smooth workflow control.
- **Industrial Build Quality:**
 - Shock-absorbing housing for vibration resistance
 - Sealed front panel for dust and moisture protection
 - Optional vibration isolation mounts
 - Multiple USB ports for peripherals such as printers, barcode scanners, and data storage devices



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OPTIONAL PNEUMATIC GRIP CONTROL MODULE

For systems equipped with pneumatic grips, an optional digital pressure control module provides programmable grip force management with real-time feedback.

- **Pressure Control and Regulation:** Air pressure is adjustable through a digital interface, allowing precise control based on specimen characteristics. This prevents both under-clamping (sample slippage) and over-clamping (surface deformation).
- **Dual Gripping Channels:** Upper and lower grips can be controlled independently, supporting precise synchronization and safe sample handling.
- **Integrated Safety Logic:**
 - Grip actuation is disabled unless the test area is confirmed safe.
 - Pre-pressure locking and relief functions maintain grip stability during test initiation.
- **Compact Design:** The module can be rack-mounted near the testing system or attached directly to the frame. Quick-connect pneumatic fittings allow rapid changeover of grip types.
- **Visual Display:** A real-time pressure monitor and status indicators enhance user awareness and reduce the chance of setup errors.

GENTEST™ SOFTWARE

The GenTest™ software included with the TM-EML Series A delivers an intuitive, efficient, and user-oriented testing environment. Designed with a modern interface and logical layout, it provides seamless control, visualization, and analysis of test data for all standard and customized applications.

- **User-Friendly Interface:** Clean, flat design optimized for both horizontal and vertical screens with automatic scaling and integrated numeric input for touchscreen operation.
- **Preloaded Test Standards:** Includes ready-to-use templates for ASTM, ISO, GB/T, and EN standards, organized by test type for quick selection.
- **Customizable Methods:** Users can modify or create new test procedures to match unique materials and testing requirements.
- **Real-Time Monitoring:** Displays live force, displacement, strain, and time data with synchronized graph updates at 1200 Hz frequency.
- **Data Visualization:** Interactive graphs with zoom, overlay, and curve comparison tools support detailed analysis.
- **Post-Test Analysis:** Built-in recalculation tools enable users to adjust parameters and automatically reprocess results.
- **Automatic Data Export:** One-click export of raw and processed data in CSV, Excel, PDF, and image formats.
- **Accessory Integration:** Fully compatible with extensometers, chambers, pneumatic grip controllers, and other devices through a modular connection system.



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- Comprehensive Safety and Diagnostics: Monitors overloads, position limits, and environmental conditions in real time.
- Report Customization: Configurable templates with company branding, watermarking, and statistical summaries.
- Multi-Language Support: Allows real-time language switching without restarting the software.

TECHNICAL SPECIFICATIONS

Model	TM-EML Series A – Single-Column Benchtop Universal Testing Machine
Force Capacity	0.01 kN (2.2 lbf) / 0.05 kN (11.2 lbf) / 0.1 kN (22.5 lbf) / 0.5 kN (112 lbf) / 1 kN (225 lbf) / 2.5 kN (562 lbf) / 5 kN (1124 lbf)
Frame Type	Desktop
Test Space	Single-zone configuration
Max Crosshead Speed	2400 mm/min
Min Crosshead Speed	0.00005 mm/min
Return Speed (Max)	3000 mm/min
Position Resolution	0.0133 μ m
Vertical Crosshead Travel (H)	960 mm
Test Width (W)	100 mm
Dimensions (W $\times$ D $\times$ H)	22.8 $\times$ 20.5 $\times$ 62.2 in (580 $\times$ 520 $\times$ 1580 mm)



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Model	TM-EML Series A – Single-Column Benchtop Universal Testing Machine
Frame Stiffness, kN/mm	10 kN/mm
Weight	238 lbs (108 kg)
Power Supply	600 W
Voltage	Single-phase AC 220 V $\pm 10\%$, 50 Hz / 60 Hz
Common Parameters	
Accuracy	Class 0.5
Force Range	500 N – 5 kN (0.2% – 100% FS) 10 N – 250 N (0.4% – 100% FS)
Calibration Standard	GB/T 16825.1, ISO 7500 (Class 0.5), ASTM E4
Speed Accuracy	$\pm 0.2\%$ of set speed
Position Accuracy	$\pm 0.2\%$ of set position
Force Resolution	1 / 600000 FS
Extension Resolution	1 / 600000 FS
Strain Accuracy	Better than GB/T 228, ISO 6892-1, ASTM E8, ASTM E21
Safety Protection	Overload protection (103% of rated force), position limit, over-voltage protection



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Model		TM-EML Series A – Single-Column Benchtop Universal Testing Machine
Single-Channel Sampling Rate	Data	1200 Hz
Control Frequency		1200 Hz
Environmental and Operational Conditions		
Working Temperature		+5 °C to +40 °C
Storage Temperature		-25 °C to +55 °C
Relative Humidity		At 20 °C, +10% to 90%, non-condensing
Maximum Operating Altitude		2000 meters
Motor Type		AC servo motor
Ball Screw		Pre-loaded
Position Measurement		Optical encoder



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ALIGNMENT DEVICE ADD-ON

The Electro Mechanical Universal Testing System (50 N – 5 kN / 11.24lbf - 1124.04lbf) by TensileMill CNC can be improved with a special alignment device that will help you meet the meticulous demands of modern testing laboratories. To enhance your testing capabilities and achieve NADCAP readiness, we offer a specialized alignment fixture designed to optimize equipment performance.

This advanced fixture allows for fine-tuning the coaxiality of our testing system. After an initial coarse adjustment, our high-precision coaxiality meter and detection system help achieve a coaxiality of $\leq 5\%$, ensuring compliance with ASTM E1012 and NASM 1312B standards - key requirements for NADCAP accreditation.

Key Features:

- **Precision Alignment:** Minimizes errors for more consistent results.
- **Multi-Purpose Use:** Suitable for tensile, compression, bending, and shearing tests.
- **Enhanced Reliability:** Delivers accurate and repeatable test outcomes.

Integrating this alignment fixture with the TensileMill CNC Universal Testing System gets your lab / business [NADCAP](#) ready. This ensures the highest level of compliance, accuracy, and performance available today.



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