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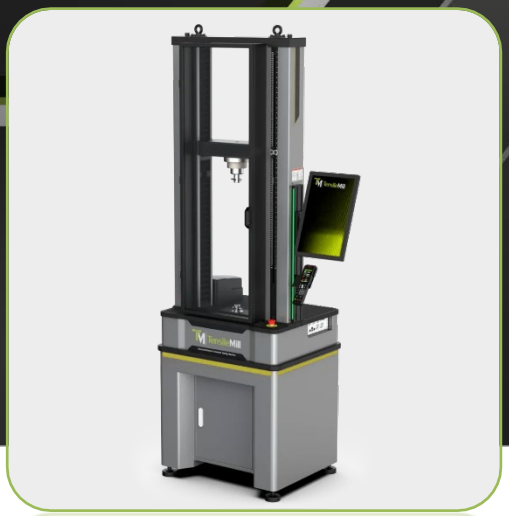
TECHNICAL BROCHURE



TM-EML Series B
Dual-Column Benchtop
Universal Testing Machine

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GENERAL DESCRIPTION

The TM-EML Series B - Dual-Column Benchtop Universal Testing Machine (100 N - 10 kN) is a compact electromechanical system built for accurate and repeatable testing in both laboratory and production environments. It is specifically engineered for evaluating composites, polymers, high-strength metals, and advanced materials that require stable and precise load control.

The system features a servo direct-drive transmission, dual precision guide columns, and an FEM-optimized crosshead design. Together, these components provide high stiffness, low vibration, and consistent alignment during testing. This combination enables reliable tensile, compression, and flexural performance evaluation for materials such as rubber, plastics, foams, films, soft metals, and composite structures.

Force Capacity Options: 100 N, 200 N, 500 N, 1 kN, 2 kN, 5 kN, 10 kN (22.5 - 2248 lbf)

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

Test Space: Single vertical test area with rigid guide columns for precise crosshead control

Typical Applications: Used in research, education, and quality control for tensile, compression, and bending tests on elastomers, thermoplastics, metals, composites, and flexible materials requiring high measurement precision.

GET A QUOTE

TYPICAL SPECIMENS

The TM-EML Series B system is designed to handle a variety of materials used in modern research and industrial testing. Its precision control and stable frame configuration make it suitable for testing the following specimen types:

- Rubber, elastomers, and flexible polymer films (ASTM D412, ISO 37, ISO 1184)
- Engineering plastics and composite materials (ASTM D638, ISO 527, ISO 604)
- Thin metal sheets, soft alloys, and wires (ASTM E8, ISO 6892-1, GB/T 228)
- High-strength alloys and prepreg samples (ASTM E21, ISO 7500)
- Flexible electronics, micro-components, and precision assemblies
- Adhesives, foams, and lightweight structural materials (ASTM D790, ISO 178)
- Textiles, biomaterials, and other soft or flexible consumer materials

KEY FEATURES OF THE TM-EML SERIES B UNIVERSAL TESTING MACHINE

The TM-EML Series B combines precise mechanics with modern digital control, ensuring reliable and accurate results for research and production testing.

- **Dual-Column Benchtop Design**: Compact dual-column electromechanical frame ensures high stability and accuracy for both low- and mid-capacity material testing applications.
- **FEM-Optimized Frame**: Rigid guidance columns with preloaded linear bearings maintain precise alignment under load, improving repeatability and reducing system deflection.
- **Servo Direct-Drive System**: High-speed synchronous belt drive allows crosshead speeds up to 2400 mm/min, delivering smooth motion, low noise, and maintenance-free operation.
- **Precision Ball Screws**: Preloaded ball screws minimize backlash and mechanical play, ensuring consistent performance during cyclic and long-duration tests.
- **High-Resolution Position Control**: Integrated photoelectric encoder achieves 0.011 µm resolution, supporting highly accurate strain rate control down to 0.00007 s^{-1}.
- **Closed-Loop Control**: A high-tech 24-bit digital controller with a 1200 Hz feedback rate keeps force, movement, and extensometer signals
- **Comprehensive Safety Logic**: Automatic overload stop at 103% capacity, force spike detection, collision prevention, and mechanical limit switches protect both the specimen and load cell.
- **GenTest™ Software Platform**: Simplifies test setup and analysis with preloaded ASTM, ISO, GB/T, and EN methods, real-time graphing, recalculation, and voice-assisted operation.
- **Accessory Compatibility**: Integrates seamlessly with extensometers, thermal chambers, pneumatic grip controllers, and temperature sensors. TEDS-enabled recognition allows plug-and-play operation.
- **Handheld Remote Console**: Equipped with a 3.5-inch color touchscreen and fine-adjustment wheel for precise crosshead movement, grip control, and quick access to test functions.
- **Optional Add-ons**: Includes an ergonomic workbench (31.2 x 25.9 x 26.6 in / 793 x 658 x 675 mm), full-protection safety enclosure with interlock, industrial touchscreen PC, and pneumatic grip pressure unit.

CONTROL SYSTEM

The TM-EML Series B features a high-performance digital control unit developed for precise motion control, stable communication, and full system integration in laboratory and industrial testing environments.

- **Communication and Connectivity**: The controller supports both USB and Ethernet (TCP/IP) communication. A built-in high-speed logic chip allows for quick and reliable data transfer using the full TCP/IP protocol, making it easy to connect to networks and operate remotely in setups with multiple stations.
- **Sampling and Data Acquisition**: The control system operates with a 1200 Hz closed-loop sampling rate, ensuring synchronized force, displacement, and extensometer input. Six analog input channels with 24-bit resolution provide high-accuracy signal capture and real-time feedback for precise test execution.
- **Hardware and Firmware Protection**: Embedded firmware continuously monitors voltage, current, overload, motor temperature, and crosshead travel limits. Both hardware and software layers implement emergency stop logic, protecting the system from overloading and unexpected motion errors.
- **Handheld Remote Console (Standard)**: The included 3.5-inch color touchscreen console combines a silicone keypad and fine-tuning rotary wheel for precise manual control. Operators can start or stop tests, move the crosshead, control grips, or return the system to its home position. The remote works in two modes: direct connection to the controller or synchronized operation with the PC software, providing full redundancy and flexibility.

OPTIMIZED STRUCTURAL RIGIDITY

The TM-EML Series B testing frame is built for long-term stiffness and precise alignment under varying loads. A dual-rail frame with FEA-optimized crosshead design minimizes deflection and mechanical play, maintaining exceptional stability during tensile, flexural, or compression testing.

- Preloaded precision ball screws and dual linear motion guides reduce vibration and mechanical clearance.
- Load cell, motor coupling, and crosshead interfaces are machined for zero-clearance contact under load, ensuring accuracy in both static and dynamic applications.
- Reinforced column supports maintain consistent geometry even during repetitive or high-cycle tests.

ADVANCED DIRECT-DRIVE SERVO ACTUATION

The TM-EML Series B employs a direct-drive servo system for fast and precise movement with minimal mechanical loss. A high-rigidity synchronous belt connects the servo motor to the actuator, replacing traditional gear reducers to improve energy efficiency and eliminate backlash.

- Crosshead speed up to 2400 mm/min for short-cycle and high-throughput tests.
- Smooth control range allows both high-speed operation and ultra-slow creep or modulus ramp tests.
- Adaptive acceleration profiles improve responsiveness in multi-stage loading procedures.
- The system provides stable control even during sudden specimen fracture or variable load transitions.

INTELLIGENT SAFETY AND CONTROL ARCHITECTURE

The TM-EML Series B integrates a multi-layer safety and monitoring system designed to protect both the operator and equipment while maintaining smooth and reliable machine performance during every test cycle.

- **Real-Time Collision Detection**: Continuous monitoring of force and displacement data allows the system to instantly recognize abnormal spikes, such as specimen fracture or fixture obstruction. Crosshead movement stops automatically to protect the load cell and mechanical components from damage.
- **Overload Protection**: The system activates a hardware-level stop when the applied load reaches 103% of the rated capacity. This feature safeguards the integrity of sensors and the drive assembly during testing of high-strength materials.
- **Dual Position Limit System**: Both mechanical end-stops and programmable digital limits define safe movement boundaries. This dual protection approach prevents overtravel while allowing flexible setup for different specimen sizes and fixtures.
- **Emergency Stop and Power Interruption Control**: Dedicated emergency stop buttons are positioned on the frame and controller, allowing immediate test interruption. The control logic ensures a safe system shutdown even in cases of sudden power failure or voltage fluctuation.
- **Sensor Input Protection**: All active input channels, including force, displacement, and extensometer, feature built-in range monitoring to prevent signal saturation or invalid readings during testing.
- **Handheld Controller Safety Functions**: The standard remote controller includes grip lockout, overload prevention, and an automatic return-to-origin function. These built-in safety layers prevent accidental operation and support safe alignment procedures.

OPTIONAL PROTECTION SHIELD

To keep operators safer, the TM-EML Series B can have a complete protective cover made of strong aluminum and tough polycarbonate panels.

The enclosure includes an electronic interlock system that automatically disables motion when the door is open. Its robust structure is designed in compliance with international mechanical safety standards, making it particularly suitable for high-force or high-throughput laboratory environments.

STREAMLINED OPERATION AND MAINTENANCE

The TM-EML Series B Universal Testing Machine is engineered for simplified operation and long-term reliability, allowing laboratories to perform daily testing routines efficiently while minimizing maintenance effort and operator training time.

- **User-Focused Software Interface**: The GenTest™ platform provides a clean, icon-based interface designed for intuitive navigation. Preloaded templates for ASTM, ISO, GB/T, and EN standards enable rapid test setup, while drag-and-drop test configuration and live graphical output make both routine and advanced testing straightforward.
- **Step-by-Step Test Configuration**: A guided test setup process allows operators to define test sequences with clear prompts, minimizing input errors and improving repeatability across users and laboratories.
- **Automated Reporting and Data Export**: One-click data export simplifies documentation and compliance. The system automatically calculates key results such as modulus, yield strength, and tensile strength, and supports batch processing for multiple test datasets.
- **Accessible Maintenance Design**: The control unit is slide-mounted for quick removal, allowing maintenance or calibration without disassembling the machine. Belt, motor, and sensor components can be accessed through quick-release protective covers, reducing downtime.
- **Flexible Dual Operation Modes**: Operators can control the system either through the standard handheld remote console or the optional industrial touchscreen PC. Both interfaces remain synchronized, providing flexibility for training, research, and production environments.

MECHANICAL AND ELECTRONIC ARCHITECTURE

The TM-EML Series B UTM is built with a precision-engineered mechanical frame and advanced electronic control system, providing high stability, repeatability, and measurement accuracy across all test conditions.

PRECISION LOAD FRAME

The testing frame is designed to maintain precise axial alignment and smooth crosshead motion, ensuring accurate displacement and strain readings during every test.

- **High-Stiffness Linear Guide System**: Dual linear guide rails with self-lubricating bearings deliver exceptional lateral rigidity and straight, low-friction crosshead movement. This minimizes off-axis deviation and reduces measurement errors in displacement-sensitive applications.
- **Low-Noise Synchronous Belt Drive**: The direct-drive transmission uses a high-performance synchronous belt designed for low vibration and high-speed operation. It requires no routine maintenance and ensures consistent, quiet power transfer between the servo motor and actuator assembly.
- **Integrated Optical Encoder**: A high-resolution photoelectric encoder embedded within the servo system provides real-time position feedback, achieving micro-displacement resolution of 0.0133 µm for highly accurate control.

LOAD CELL ASSEMBLY

The TM-EML Series B is equipped with precision-engineered load cells that combine durability with high linearity and sensitivity, ensuring accurate readings throughout the force range.

- **High-Precision Load Cells** - Factory-calibrated for stiffness, minimal signal drift, and linear performance across full load capacity.
- **Overload and Lateral Force Protection** - Reinforced structure and built-in logic protect sensors from shock loads, side forces, and off-center specimen breaks.
- **Bidirectional Capability** - Supports both tensile and compression tests without reconfiguration.
- **TEDS Auto-Recognition** - IEEE 1451.4-compliant load cells enable plug-and-play setup and automatic calibration detection.
- **Self-Calibration Support** - Internal verification functions maintain accuracy between calibration intervals.
- **Extended Temperature Operating Capability** - Operates reliably from -55 °C to +90 °C, making it suitable for environmental chamber testing.

CLOSED-LOOP CONTROLLER

The advanced closed-loop controller manages all real-time test operations, combining adaptive feedback, high-frequency sampling, and intelligent data visualization.

- **Adaptive Feedback Control** - A refined PID algorithm optimized for the direct-drive servo system provides rapid response and stable control under varying load conditions.
- **Smooth Transition Profiles** - Smart ramping and control-smoothing algorithms ensure consistent performance from ultra-slow strain-rate tests to high-speed operations.

- **Multi-Channel Acquisition** - Six synchronized analog channels and multiple digital inputs allow integration with extensometers, strain gauges, temperature sensors, and other peripherals.
- **Real-Time Graphing** - The system continuously updates synchronized force-displacement, stress-strain, and time-based graphs at 1200 Hz, providing instant visual feedback.
- **Customizable Data Visualization** - Operators can adjust zoom levels, scaling, and overlays for in-depth comparative analysis or batch evaluation.
- **Export Options** - Test data and curves can be exported in CSV, Excel, PDF, PNG, or SVG formats for documentation and analysis.

INTEGRATED CONTROL INTERFACES

The TM-EML Series B Universal Testing Machine is designed to support multiple control and interaction modes, giving operators ergonomic, flexible, and efficient access to all essential functions. Whether used in production, research, or training environments, these interfaces simplify test setup, execution, and safety management.

HANDHELD REMOTE CONTROLLER (STANDARD)

The compact, magnetically mountable remote handset features a 3.5-inch full-color touchscreen for direct interaction with key test parameters and live status monitoring.

- **Ergonomic Interface**: Equipped with silicone-coated buttons and a fine-resolution rotary wheel for precise manual control of crosshead movement. Operators can jog the crosshead, execute return-to-origin commands, and fine-tune alignment before clamping specimens.
- **Real-Time Feedback**: The display provides continuous updates on force, displacement, and system state, reducing the need to alternate focus between the handset and computer screen.
- **Primary Control Functions**:
  - Start/Stop test
  - Return-to-home position
  - Manual crosshead jog (up/down)
  - Grip open/close control (for pneumatic systems)
  - Specimen protection logic to prevent excessive preload
- **Dual Communication Modes**: Operates in direct mode via embedded logic or in PC-synchronized mode as a secondary input device for software-guided workflows.

OPTIONAL INDUSTRIAL TOUCHSCREEN PC

An all-in-one industrial touchscreen PC can be mounted directly on the testing frame, allowing full standalone operation without an external computer.

- **GenTest™ Software Preloaded** - Provides immediate access to standard and custom test libraries, real-time analytics, graphical visualization, and automated reporting tools.
- **Touch-Optimized Interface** - Supports intuitive multi-touch gestures such as tap, drag, and pinch-to-zoom, allowing quick navigation through graphs, results, and settings.
- **Industrial Durability** - The unit features a shock-absorbing enclosure, sealed surface against dust and moisture, and optional vibration-isolation mounts for demanding environments.
- **Expanded Connectivity** - Multiple USB ports allow integration with printers, barcode scanners, or peripheral automation systems.

OPTIONAL WORKBENCH

The optional workbench enhances operator convenience and test preparation efficiency. With dimensions of 31.2 x 25.9 x 26.6 in (793 x 658 x 675 mm), it provides a stable workspace for mounting small fixtures, handling specimens, and organizing accessories such as grips and tools—helping maintain a clean and efficient laboratory setup.

OPTIONAL PNEUMATIC GRIP CONTROL MODULE

For pneumatic gripping systems, an optional digital control unit for grip pressure enables programmable, consistent clamping force for improved specimen handling and protection.

- **Precision Pressure Regulation** - Operators can adjust and maintain exact air pressure levels through a digital control interface, preventing both slippage and over-compression.
- **Dual-Channel Control** - Independent actuation of upper and lower grips ensures accurate synchronization during clamping sequences.
- **Built-In Safety Logic** - Grip actuation is disabled unless the test space is confirmed safe. Pre-pressure locking and automatic pressure relief mechanisms maintain grip stability during test initiation.
- **Compact Mounting Design** - The module can be rack-mounted or attached directly to the machine frame, with quick-connect fittings allowing rapid changeover of grip types.
- **Visual Feedback Display** - Real-time pressure and grip status indicators support operator awareness and minimize setup errors.

GENTEST™ SOFTWARE

The TM-EML Series B Universal Testing Machine is powered by the latest version of GenTest™ Software, featuring an intuitive and streamlined interface that simplifies every stage of test preparation, execution, and analysis. The layout offers logical function grouping, consistent design language, and optimized navigation for both horizontal and vertical displays, with automatic resolution scaling across various screen sizes.

GenTest™ includes a wide selection of preloaded testing protocols compliant with ASTM, ISO, GB/T, and EN standards. These are organized into modular groups by application type, allowing efficient configuration for diverse materials and industries. Custom test procedures can be created and modified to match specific research or production needs.

The software integrates with an extensive range of external devices, such as video extensometers, temperature chambers, pneumatic grip controllers, and strain measurement sensors. A modular accessory management system connects each device to the current test process, making sure everything works well together and fits with complicated arrangements.

- **Preloaded Standards**: Includes ASTM, ISO, GB/T, and EN methods with ready-to-use templates for tensile, compression, and flexural tests.
- **Custom Test Design**: Fully editable test sequences, parameters, and calculations for specialized applications.
- **Real-Time Visualization**: Displays synchronized force-displacement and stress-strain curves with up to 12 configurable data channels.
- **Instant Reporting**: One-click export to CSV, Excel, or PDF with custom templates and integrated statistics.
- **Accessory Integration**: Seamless connectivity with extensometers, thermal chambers, pneumatic grips, and sensors.
- **Sample Protection & Safety**: Built-in pre-test validation, overload monitoring, and intelligent clamping pressure control.
- **Multi-Language & Unit Support**: Real-time language switching and automatic metric/imperial conversion.

TECHNICAL SPECIFICATIONS

Model	TM-EML Series B Dual-Column Benchtop Universal Testing Machine
Force Capacity	0.1 kN (22.5 lbf) / 0.2 kN (45 lbf) / 0.5 kN (112 lbf) / 1 kN (225 lbf) / 2 kN (450 lbf) / 5 kN (1124 lbf) / 10 kN (2248 lbf)
Frame Type	Desktop
Test Space	Single-zone configuration
Max Crosshead Speed	2000 mm/min
Min Crosshead Speed	0.00005 mm/min
Return Speed (Max)	2400 mm/min
Position Resolution	0.011 µm
Vertical Crosshead Travel (H)	42.9 in (1090 mm)
Test Width (W)	16.5 in (420 mm)
Dimensions (W x D x H)	30.3 x 25.2 x 66.9 in (770 x 640 x 1700 mm)
Frame Stiffness, kN/mm	50 kN/mm
Weight	595 lbs (270 kg)
Power Supply	1 kW

Model	TM-EML Series B Dual-Column Benchtop Universal Testing Machine
Voltage	Single-phase AC 220 V ±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	±0.2% of set speed
Position Accuracy	±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
Single-Channel Data Sampling Rate	1200 Hz
Control Frequency	1200 Hz
Environmental and Operational Conditions	

Model	TM-EML Series B Dual-Column Benchtop Universal Testing Machine
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

ALIGNMENT DEVICE ADD-ON

The TM-EML Series B - Dual-Column Benchtop Universal Testing Machine (100 N - 10 kN / 22.5lbf - 2248lbf) 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 ≤ 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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