TensileMill

TECHNICAL BROCHURE

TM-EML Series C
Dual-Column Benchtop
and Floor-Standing
Universal Testing System

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GENERAL DESCRIPTION

The TM-EML Series C - Dual-Column Benchtop and Floor-Standing Universal Testing System (5 kN - 50 kN) is an advanced electromechanical testing solution built for accurate and stable performance in everyday laboratory and industrial applications.

Equipped with a servo direct-drive system, an FEM-optimized dual-column frame, and a high-rigidity load structure, this model offers fast control response, minimal vibration, and reliable alignment under varying loads. It is designed for precise determination of elastic modulus, yield strength, tensile strength, and other key material properties.

The system handles tensile, compression, flexural, and cyclic tests and adapts easily for both standard and research-level testing. Its versatility and compact design make it suitable for laboratories working with metals, plastics, composites, rubbers, foams, and high-temperature materials.

Force Capacity Options: 5 kN, 10 kN, 20 kN, 25 kN, 30 kN, 50 kN (1124 - 11240 lbf)

Frame Configuration: Dual-column electromechanical frame available in benchtop or floor-standing layout with direct-drive servo control

Test Space: Single-space and dual-space configurations; extended-travel versions available for long specimens or special fixtures

Typical Applications: Suitable for quality control, R&D, and academic testing involving metals, polymers, and composite materials under static or cyclic loads

GET A QUOTE

TYPICAL SPECIMENS

The TM-EML Series C - Dual-Column Benchtop and Floor-Standing UTM is designed for the accurate testing of various standard and specialized specimens. Its configuration supports consistent measurement of strength, deformation, and elasticity parameters across different material types, including:

- Metals, stainless steels, and heat-resistant alloys
- Rubbers, elastomers, and flexible plastic materials
- Engineering polymers and reinforced composites

- Biodegradable plastics and thin, flexible electronic samples
- Foams, films, and other low-density materials
- Specimens used in research, aerospace, and educational testing environments
- Samples requiring detailed measurement of modulus, yield, and tensile characteristics

KEY FEATURES OF THE TM-EML SERIES C UNIVERSAL TESTING SYSTEM

The TM-EML Series C from TensileMill CNC is designed to provide high precision, stability, and efficiency in material testing. Its core features include:

- **User-Oriented Operation**: The GenTest™ software offers an intuitive, icon-based interface with touchscreen compatibility. It includes a large selection of preloaded ASTM, ISO, GB/T, and EN methods, step-by-step workflows, and real-time feedback for streamlined test setup and execution.
- **High Accuracy and Stability**: The system delivers Class 0.5 accuracy within 0.2-100% FS for 500 N-50 kN and 0.4-100% FS for 10 N-250 N ranges. Its built-in ball screws, specially designed dual-column frame, and servo-belt drive provide accurate control of loads with a speed and position accuracy of ±
- **Standards Compliance**: Certified to GB/T 16825.1, ISO 7500, and ASTM E4. It has a high-quality optical encoder and load cells that can easily connect and set up by themselves, providing very precise measurements.
- **Versatile Test Capabilities**: Supports a range of test methods, including ASTM D412, ASTM D638, ASTM D790, ISO 178, ISO 527, and ISO 604. Suitable for metals, plastics, composites, rubbers, biodegradable materials, and flexible electronics.
- **Ready-to-Use Components**: All standard grips, load cells, and fixtures are available from stock and NIST-traceable where applicable. Optional pneumatic and pressure-control systems are supported for enhanced usability.
- **Technical Support and Maintenance**: Includes TensileMill CNC's long-term product support program with calibration assistance, software updates, and technical servicing. The easily accessible controller and open-frame design simplify inspection and maintenance.
- **Integrated Safety Features**: Built-in overload protection (103%), mechanical limit switches, and real-time collision detection safeguard both equipment and operators. An optional full protection shield with interlock logic is available for additional safety during testing.

ADVANCED CONTROL AND COMMUNICATION SYSTEM

The TM-EML Series C uses a precise digital control system that guarantees accurate operation, reliable communication, and smooth interaction among the system parts.

- **High-Performance Control Unit**: The control system manages real-time force, position, and strain feedback with exceptional accuracy, maintaining steady performance during both static and dynamic testing.
- **Dual Connectivity Options**: In addition to USB, the controller supports Ethernet (TCP/IP) communication through a dedicated high-speed logic processor. This enables fast and reliable data transfer for networked or remote-controlled laboratory environments.
- **High-Speed Data Acquisition**: The system operates at a closed-loop frequency of 1200 Hz, synchronizing force, displacement, and extensometer channels with 24-bit signal resolution across six analog inputs. This allows precise monitoring and adaptive feedback for every test cycle.
- **Built-In System Protection**: Embedded firmware continuously monitors overload, voltage, temperature, and position limits. Both software and hardware emergency-stop mechanisms are implemented to protect the machine and operator from abnormal conditions.
- **Handheld Control Console (Standard)**: A compact, magnetic-mount remote unit with a 3.5-inch color touchscreen allows convenient test operation. The ergonomic interface includes silicone keys and a precision rotary wheel for:
  - Test start and stop
  - Crosshead up/down contro
  - Grip open/close (if equipped)
  - Return-to-origin function
  - Overload and misalignment prevention

The console can function independently or in sync with the PC, giving operators flexibility for local or computer-based control.

REINFORCED STRUCTURAL DESIGN AND FRAME STABILITY

The TM-EML Series C Dual-Column UTM is built on a rigid dual-column frame engineered for maximum stiffness and long-term alignment. The structure is improved using finite element analysis (FEA) to reduce bending, shaking, and movement when applying loads.

- **Precision Dual-Rail Frame**: High-strength columns and a reinforced crosshead design maintain alignment under load, ensuring accurate results for modulus, yield, and tensile strength testing.
- **Preloaded Ball Screws and Guide Rails**: Dual linear guides and preloaded precision ball screws provide smooth, stable motion and minimize mechanical play during testing.

- **Zero-Backlash Interfaces**: All connection points, like load cell mounts and motor couplings, are made to fit tightly together, which helps ensure consistent results for both steady and repeated
- **Long-Term Stability**: The frame maintains mechanical integrity even during extended or high-frequency test cycles.

HIGH-SPEED DIRECT-DRIVE SERVO SYSTEM

The TM-EML Series C uses an advanced servo-driven direct transmission system that provides precise speed control and fast response across all testing conditions.

- **Efficient Synchronous Belt Design**: The drive eliminates traditional gear reducers, improving mechanical efficiency and reducing backlash.
- **Extended Speed Range**: Crosshead speeds reach up to 2400 mm/min, increasing productivity and reducing test cycle times.
- **Ultra-Low Speed Control**: The system supports precise motion control for creep, relaxation, and other low-strain-rate tests.
- **Optimized Acceleration Profiles**: Smooth motion transitions enhance performance during multi-stage and high-speed ramp procedures.

INTEGRATED SAFETY AND SMART CONTROL

A multi-level safety and control framework protects both the operator and equipment while maintaining responsiveness during testing.

- **Collision Detection**: Real-time force monitoring automatically stops movement if abnormal force changes occur, preventing damage to the specimen or load cell.
- **Overload Protection**: Automatic stop at 103% of rated capacity safeguards sensitive components.
- **Dual Limit Protection**: Combines software-based and mechanical limit switches to define safe movement boundaries.
- **Emergency Stop Circuitry**: Dedicated emergency controls immediately halt operation when triggered.
- **Sensor Range Monitoring**: All input channels are monitored to prevent overrange conditions.
- **Controller Safety Logic**: The handheld unit includes grip lockout, overload prevention, and return-to-origin features to avoid misalignment.

OPTIONAL SAFETY ENCLOSURE

An optional protection shield is available for laboratories prioritizing operator safety and containment. The enclosure includes a reinforced aluminum alloy frame with polycarbonate panels and a door interlock system that disables motion when opened.

This enclosure meets international mechanical safety standards and is ideal for high-force or repetitive testing environments requiring maximum operational safety.

SIMPLIFIED OPERATION AND MAINTENANCE

The TM-EML Series C Universal Testing System from TensileMill CNC is built for easy, everyday use in labs that need accuracy and speed. Its design minimizes setup time, simplifies training, and makes routine maintenance quick and accessible.

- **Intuitive Software Interface**: The GenTest™ platform offers a simple, icon-based layout with built-in templates for ASTM, ISO, GB/T, and EN standards. Drag-and-drop test setup and real-time graphical monitoring make both standard and custom testing easy to manage.
- **Guided Test Configuration**: Step-by-step workflow guidance allows operators to configure test sequences accurately and maintain consistency across multiple users or departments.
- **Automated Reporting**: The software automatically calculates parameters such as modulus, yield point, and tensile strength. Results can be exported instantly in multiple formats for documentation or compliance review.
- **Service-Friendly Design**: The control module is mounted on an accessible track system, allowing maintenance without full disassembly. Quick-release protective covers make it easy to inspect belts, motors, and sensors.
- **Flexible Control Options**: The system supports both handheld and PC-based operation. The touchscreen PC option enables fully synchronized testing, ideal for both research and production environments.

MECHANICAL AND ELECTRONIC SYSTEM ARCHITECTURE

The TM-EML Series C - Dual-Column Benchtop and Floor-Standing UTM has a sturdy frame and advanced electronics to provide accurate and stable testing in any situation.

PRECISION LOAD FRAME

The TM-EML Series C frame is built for precision and mechanical durability, minimizing vibration and misalignment even during demanding load applications.

- **High-Stiffness Linear Guide Rails**: Dual self-lubricating rails provide exceptional lateral stiffness and smooth vertical motion of the crosshead, maintaining accurate alignment for strain- and displacement-sensitive testing.
- **Quiet Synchronous Belt Drive**: The maintenance-free direct-drive belt system ensures smooth, low-vibration power transfer between the servo motor and actuator, maintaining speed accuracy and motion uniformity.

- **High-Resolution Optical Encoder**: Integrated within the servo system, the encoder provides precise position tracking with a micro-displacement resolution of 0.0133 μm, ensuring accurate control across all testing speeds.

LOAD CELL ASSEMBLY

The load cell assembly is designed for precision and long-term reliability across tensile, compression, and cyclic test modes.

- **Factory-Calibrated Load Cells**: Deliver high stiffness and linear response across the full capacity range, minimizing drift during extended testing.
- **Built-In Protection**: Internal logic safeguards the sensor from overload, side forces, or sudden specimen breaks.
- **Bidirectional Testing Capability**: Supports both tensile and compression tests without mechanical adjustments.
- **TEDS Auto-Recognition**: IEEE 1451.4-compliant load cells allow automatic detection and configuration, removing the need for manual setup.
- **Self-Calibration Function**: The machine supports in-system load verification to maintain long-term accuracy.
- **Wide Temperature Range**: Operational from −55 °C to +90 °C, making it suitable for both standard and temperature-controlled environments.

ADVANCED CLOSED-LOOP CONTROL SYSTEM

The closed-loop controller provides fast and stable response through intelligent feedback and high-frequency data processing.

- **Adaptive PID Feedback**: A next-generation control algorithm ensures smooth and responsive operation for materials with varying stress-strain behaviors.
- **Smooth Control Transitions**: Precision speed ramps and transition logic maintain consistent results for both low-speed and high-speed testing applications.
- **Multi-Channel Data Collection**: Six analog channels and multiple digital inputs support extensometers, strain gauges, and temperature sensors for synchronized signal acquisition with millisecond accuracy.

LIVE DATA VISUALIZATION AND ANALYSIS

Real-time graphing and visualization tools give operators a clear view of test performance and material behavior.

- **Dynamic Graphing**: Displays force-displacement, stress-strain, and time-dependent curves updated at 1200 Hz.

- **Interactive Chart Tools**: Zoom, pan, and focus on key regions such as break points or yield transitions.
- **Curve Comparison**: Overlay and compare multiple sample curves to assess consistency and detect outliers.
- **Data Export Options**: Save test results and visuals in CSV, Excel, PDF, PNG, or SVG formats for easy reporting and analysis.

INTEGRATED CONTROL AND ACCESS INTERFACES

The TM-EML Series C Universal Testing System offers various ways for operators to control and interact with the system, making it easy to run tests in labs, production areas, or training settings. Each interface is designed for precision handling, ergonomic comfort, and operational safety.

STANDARD HANDHELD CONTROL CONSOLE

Each TM-EML Series C system comes with a small handheld controller that can be attached with magnets and has a 3.5-inch color touchscreen for easy access to machine functions and live test monitoring

- **Ergonomic Layout**: Silicone-coated buttons and a fine rotary wheel allow precise manual crosshead positioning, easy specimen alignment, and quick return-to-origin control.
- **Live Status Display**: Real-time force, displacement, and system information appear on-screen, allowing operators to monitor test conditions without switching views.
- **Core Control Functions**:
  - Start/Stop test
  - Return to home position
  - Manual crosshead jog (up/down)
  - Grip open/close control (if equipped with pneumatic system)
  - Specimen protection logic to avoid excessive preload
- **Flexible Communication**: Operates in either direct mode via onboard logic or synchronized mode with the PC interface for seamless coordination with GenTest™ software.

OPTIONAL INDUSTRIAL TOUCHSCREEN PC

An optional all-in-one touchscreen PC can be mounted directly on the testing frame, providing full standalone operation without the need for an external workstation.

- **Preloaded GenTest™ Software**: Gives access to standard and customizable testing libraries, live data graphing, analytics, and report generation.
- **Touch-Optimized Interface**: Supports intuitive gestures—tap, drag, zoom, and scroll—offering a simplified user experience for both new and experienced operators.

- **Rugged Construction**: Shock-resistant enclosure with sealed, dust- and moisture-protected surfaces. Optional vibration isolation mounts ensure stable operation.
- **Extended Connectivity**: Multiple USB ports for data export, peripheral devices, or barcode scanners enhance workflow automation and traceability.

OPTIONAL ERGONOMIC WORKBENCH

The optional workbench provides a dedicated workspace for test preparation and accessory storage. With dimensions of 31.2 x 25.9 x 26.6 in (793 x 658 x 675 mm) (L x D x H), it offers a sturdy, organized layout for mounting small fixtures or handling specimens, improving overall laboratory efficiency.

OPTIONAL PNEUMATIC GRIP CONTROL MODULE

For users who often perform tensile or compression tests with pneumatic grips, the system can include an optional digital module to control air pressure.

- **Precision Pressure Control**: Digital adjustment of air pressure ensures accurate and repeatable clamping, preventing both slippage and material deformation.
- **Independent Dual Channels**: Allows separate control of upper and lower grips for synchronized or staged operations.
- **Built-In Safety Logic**:
  - Grip movement is locked unless the test area is clear and the system is in a safe state.
  - Pre-pressure locking maintains grip force during test initiation.
- **Compact and Accessible Design**: The module can be rack-mounted or attached directly to the frame, featuring quick-connect air fittings for easy grip changes.
- **Visual Indicators**: Real-time pressure and grip status display provides clear feedback to minimize setup errors and improve operator safety.

GENTEST™ SOFTWARE

The GenTest™ Software delivers a refined, efficient, and intuitive testing experience for universal testing systems. Its modern interface is designed for both simplicity and precision, supporting horizontal and vertical orientations with automatic scaling to fit any display setup. The software offers strong testing control and smart data processing, making it easier for operators to conduct tests quickly and accurately while following international standards like ASTM, ISO, GB/T, and EN.

A large library of preloaded test methods allows users to begin testing immediately, while customizable workflows enable the creation of unique procedures for specialized materials or research applications. The modular accessory management system automatically identifies connected devices, like extensometers, temperature chambers, pneumatic grips, or strain sensors, making sure everything works together smoothly and in sync during tests.

Its key functional advantages include:

- **User Interface and Navigation**: Clean, flat design with clear structure and touchscreen optimization for fast and intuitive operation.
- **Preloaded and Custom Test Methods**: Includes ready-to-use protocols for common tests and the ability to create custom methods with full parameter control.
- **Real-Time Data Visualization**: Displays synchronized stress-strain, force-displacement, and time graphs with zoom, scaling, and overlay tools for in-depth analysis.
- **Automated Reporting and Export**: One-click report generation in PDF, Excel, and CSV formats with configurable templates and result summaries.
- **Integrated Safety and Sample Protection**: Monitors and controls test conditions to prevent overload, misalignment, or premature sample failure.
- **Multi-Language and Dual-Unit Support**: Offers metric and imperial units with instant conversion and real-time language switching for global usability.

TECHNICAL SPECIFICATIONS

Model	TM-EML Series C Dual-Column Benchtop and Floor-Standing Universal Testing Machine
Force Capacity	5 kN (1124 lbf) / 10 kN (2248 lbf) / 20 kN (4496 lbf) / 25 kN (5618 lbf) / 30 kN (6744 lbf) / 50 kN (11,240 lbf)
Frame Type	Desktop
Test Space	Single-space configuration
Max Crosshead Speed	900 mm/min
Min Crosshead Speed	0.00005 mm/min
Return Speed (Max)	1500 mm/min
Position Resolution	0.01 µm

Model	TM-EML Series C Dual-Column Benchtop and Floor-Standing Universal Testing Machine
Vertical Crosshead Travel (H)	39.4 in (1000 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)
Height with Touch Screen (A1)	53.1 in (1350 mm)
Frame Stiffness, kN/mm	180 kN/mm
Weight	816 lbs (370 kg) - single space 926 lbs (420 kg) - dual space
Power Supply	1.5 kW
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

Model	TM-EML Series C Dual-Column Benchtop and Floor-Standing Universal Testing Machine
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	
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

Model	TM-EML Series C Dual-Column Benchtop and Floor-Standing Universal Testing Machine
Ball Screw	Pre-loaded
Position Measurement	Optical encoder

DIMENSIONAL SPECIFICATIONS AND DRAWING REFERENCES

Frame Type	Dimensions (W x D x H)	Crosshead Travel (H)	Test Width (W)	Touch Screen Height (A1)
Standard (single-space)	30.3 x 25.2 x 66.9 in (770 x 640 x 1700 mm)	39.4 in (1000 mm)	16.5 in (420 mm)	53.1 in (1350 mm)
Standard (dual-space)	30.3 x 25.2 x 69.3 in (770 x 640 x 1760 mm)	35.4 in (900 mm)	16.5 in (420 mm)	53.1 in (1350 mm)
Extended 300 mm (single-space)	30.3 x 25.2 x 78.7 in (770 x 640 x 2000 mm)	51.2 in (1300 mm)	16.5 in (420 mm)	53.1 in (1350 mm)
Extended 300 mm (dual-space)	30.3 x 25.2 x 81.1 in (770 x 640 x 2060 mm)	47.2 in (1200 mm)	16.5 in (420 mm)	53.1 in (1350 mm)
Extended 600 mm (single-space)	30.3 x 25.2 x 90.6 in (770 x 640 x 2300 mm)	63.0 in (1600 mm)	16.5 in (420 mm)	53.1 in (1350 mm)
Extended 600 mm (dual-space)	30.3 x 25.2 x 92.9 in (770 x 640 x 2360 mm)	59.1 in (1500 mm)	16.5 in (420 mm)	53.1 in (1350 mm)

ALIGNMENT DEVICE ADD-ON

The TM-EML Series C - 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.

GET A QUOTE