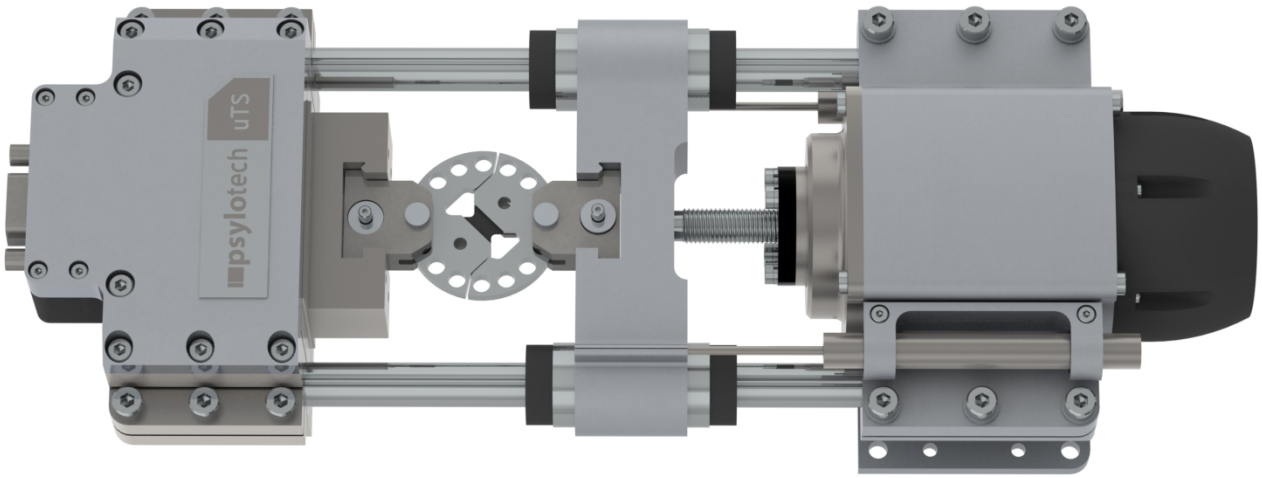
www.psylotech.com

1616 Payne St.
Evanston, IL 60201
(847) 328-7100
info@psylotech.com



µTS Differentiated vs. Alternative Products

The µTS offers the most sophisticated motion control of any microscope-compatible universal load frame, enabling novel experimental studies with digital image correlation (DIC).

Containing Out-of-Plane Displacement

Optical microscopes have great potential for high magnification digital image correlation, but they also have a notoriously small depth of field, preventing effective DIC. Psylotech's µTS prevents out of plane motion, enabling well focused, high magnification image capture, readily achieving the optical resolution of light during mechanical loading. Mechanically, this is accomplished though 1/high precision machining, 2/minimized tolerance stack-up and 3/careful attention to loading symmetry. With a precisely machine sample, three microns out-of-plane motion have been achieved in ramp testing up to the full capacity of the load frame.

Ball Screw Actuator

Compared to lead screw arrangements commonly found in competitive instruments, the µTS incorporates a direct drive ball screw. The ball screw's low friction improves motion control. Moreover, the direct-drive actuator has no gearbox, reducing both system inertia and maintenance.

Speed

Alternative lead screw systems are typically limited to a narrow range of speeds, maybe spanning one order of magnitude. The direct drive µTS ball screw covers 9 orders of magnitude in speed. It

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can move as fast as a macro sized servohydraulic load frame or as slow as one nanometer per minute. High speed enables versatility for more types of testing, including:

- Rate dependent studies
- Step load tests, such as creep or stress relaxation
- Effective load control
- Fatigue

Displacement Sensor

The standard µTS is capable of 2.5 nm closed loop control from a 25 mm stroke. Such control is possible from a large stroke ball-screw actuator, because the feedback sensor measures displacement downstream of the screw in the load train.

Incorporating proprietary high resolution sensing technology, this sensor is pitch and yaw compensated, measuring displacement directly on the specimen axis. Alternative systems rely on screw pitch and a rotary displacement sensor, or they use an off-axis linear encoder and ignore the small pitch or yaw inevitable in real-world experiments that then show up as false displacement readings.

Load Cell Resolution

The µTS load cell leverages proprietary Psylotech technology with 400 mV/V sensitivity compared to 2 mV/V from strain gauged alternatives typically found in universal load frames. The increased sensitivity means about 100x higher resolution, enabling multiple force scale experiments. For example, the stock 1.6 kN load cell can be used on tests where one would normally use a 16 N load cell. Similarly, an available 100N cell can be used as a low compliance, high safety factor 1 N cell.

Dual Moving Cross-heads

Large deformations can cause a specific area of interest to exit the microscope's field of view during an experiment. Some competitive instruments implement opposing left/right handed screws to mitigate this problem, but such a configuration exacerbates he centering problem for beam bending samples. Also, what happens when the area of interest is not in the center of the sample?

The µTS can be configured with a secondary positioning stage. The actuator of the secondary stage is slaved to the main system actuator such that any ratio of motion can be achieved. Relative cross-head motion is not tied to 50/50, and even beam bending samples can be maintained within the field of view.

Psylotest Control Software

The µTS control software is written in LabVIEW. It features test-segment specific digital filtering and integrated camera triggering, simplifying data and DIC image coordination. Advanced users have the option to modify the program source code to integrate external systems.