Epsilon ONE high-precision optical extensometers measure axial strain with industry-leading resolution, accuracy, and speed.

Innovative Instant Reset, Always On and Laser Alignment features maximize performance and increase testing throughput.

Epsilon ONE optical non-contact extensometers perform high-accuracy, high-resolution, non-contacting axial strain and displacement measurement. These extensometers are suitable for testing high-modulus materials such as metals and composites, high-elongation materials, thin or delicate specimens, cyclic fatigue, strain controlled testing, deflectometer applications, and measuring crack opening displacements. Strain or extension is measured and output in real time.

Epsilon ONE’s high resolution and ISO 0.5 / ASTM B-1 accuracy classes make it suitable for non-contact measurement of a wide range of strain values, from very small strains required to measure modulus of metals, composites, ceramics and CMCs through elastomers and everything in between.

Class-leading accuracy and resolution are achieved by Epsilon’s comprehensive optical path optimization, a unification of several optical technologies and signal processing algorithms. Ultra-high camera resolution, real-time data rates up to 3000 Hz, minimization of optical error sources, and signal processing techniques provide high strain resolution and accuracy with the lowest noise. No other system on the market combines all of these technologies.

The Laser-Assist Alignment System provides an instant alignment and distance spot check. Epsilon ONE will project pre-aligned laser lines on the specimen before the test, revealing any misalignment. During the test, high precision telecentric lenses on the PT models eliminate errors due to out-of-plane movements – a common source of errors for many video extensometers. Epsilon ONE arrives factory calibrated – there are no calibration grids or gauge length bars, saving a great deal of time.

The system sets up for new specimen types in minutes and requires very little training or skill to use. The desktop user interface software and optional Touch Interface provide continuous digital readouts and status information.

Epsilon ONE was designed for the fastest specimen cycle times. Auto-start repetitive tests without any software interaction; Epsilon ONE is always running, and its Instant Reset and Automatic Mark Detection eliminate software start/stop interactions common with video extensometers.

Epsilon ONE fits all types of materials testing machines. The system may be used with environmental chambers that are equipped with a window – contact Epsilon.

Epsilon ONE is patent pending.
Features

- Always on, always ready: Unlike DIC systems, software interactions are unnecessary when running repetitive tests.
- Always real-time: Post-processing is never required, even at the highest data rates.
- Faster throughput with Instant Reset: Auto-start repetitive tests without touching the extensometer or software.
- Reliable, automatic mark detection: Robust tracking of bright or dark marks beyond 1000% strain and speeds >1500 mm/second.
- Laser Assist Alignment System: Provides an instant visual spot-check for specimen alignment and optics positioning.
- Precision Telecentric Design: Epsilon ONE's telecentric lenses prevent common sources of error. See the Tech Note at www.epsilontech.com
- Fully factory calibrated: Epsilon calibrates using the industry’s most comprehensive process to correct for scaling, skew, lens distortion, and uneven lighting. A2LA accredited factory calibration, traceable to the SI; no grids or bars are required for calibration.
- Cleaner workspace: No need for an additional computer and monitor; the included Software User Interface has very low resource requirements and can run on the test machine’s computer.
- Optional Touch Interface: Access and control the Epsilon ONE without a computer.
- Retractable high-stiffness mounting: Industry-leading ease-of-use while maintaining maximum dynamic range and vibration rejection.
- Selectable multi-line specimen marking: Automatically identify and report the region of highest strain concentration, in real time.
- Wide range of selectable filter and optical settings enable high performance with many different materials and specimens.
- Faster Testing: Save time with industry-leading 200+ Hz dynamic range and automatic gain compensation filters.
- Admin/User Modes: Define, save and reload settings for specific specimens and test methods, then lock them in User Mode.
- Real-time digital output: High-speed data stream including APIs for control and status, and examples for automation and integration.
- Better Strain Control: Built-in high speed 16-bit analog output; not susceptible to unpredictable cyclic bias errors typical of DIC systems.
- Strain Metrics: Report strain measures using five finite or small strain theories.
- Applicable for testing with many ISO and ASTM standards, including:
  - ISO 6892-1, 527-2, 527-4, 527-5
  - ASTM E8, E9, D3039, D638, A370, D3552, E646
- Turn-key: Each base package includes
  - Optics Package with laser-assist alignment system
  - Lighting Module
  - Sensor Controller
  - Mounting Interface Subassembly
  - Specimen Marking Kit
  - Cables and software
- Includes high quality foam lined case.
- Patent pending.

Advantages

What sets Epsilon ONE apart?

Resolution, Accuracy, Speed

Epsilon ONE's performance is a result of optics and algorithm technologies that combine for high resolution, data rates and accuracy:

- Resolution: <0.2 µm RMS typical at 1 Hz; <0.5 µm at 10 Hz; <5 nm in low strain rate applications; typical resolution at selected filter settings.

Real-time data rate: 300-3000 Hz

Extensometer Accuracy Class: ISO 9513 Class 0.5 and ASTM E83 Class B-1 or better, typical, for gauge lengths ≥10 mm

As a result, Epsilon ONE is equipped with the accuracy and fine resolution required to measure modulus, offset yield, stress-strain curves, and strain at failure for all high-modulus materials.

Always On, Always Real Time

Epsilon ONE overcomes one of the biggest barriers to widespread use of non-contact extensometers: too many steps when using them. Epsilon ONE is always running and measuring strain or searching for marks using its Automatic Mark Detection. As soon as marks are detected, Epsilon ONE is measuring strain in real time. Epsilon ONE doesn’t have to be started and stopped for each specimen like most video extensometers and DIC systems, and strain output is always in real time at data rates up to 3000 Hz.

Telecentric Design

Many applications involve specimens that straighten or grips that are free to align under tensile loading. Unlike conventional lenses, telecentric lenses are insensitive to potential inaccuracies caused by these out-of-plane motions. With a telecentric lens, the image of the test specimen seen by the camera’s sensor is the same size even if the specimen moves closer to the Optics Package or further away.

The benefit: full strain measurement accuracy is maintained even if the specimen moves closer to the Optics Package or further away.

Conventional entocentric lenses, which are widely used by other manufacturers of non-contact extensometers, cannot match this performance.

Laser Assist Alignment System

Setup is faster and more robust with the Laser Assist Alignment System. Epsilon ONE’s built-in factory aligned lasers provide two functions:
- Spot-checking specimen alignment
- Setting distance to the specimen - eliminates the need for calibration grids or gauge length bars

Epsilon ONE is factory calibrated - just set the distance to the specimen, set your controller to take Epsilon ONE’s calibrated ±10V input, and start testing.

Epsilon ONE's performance is a result of optics and algorithm technologies that combine for high resolution, data rates and accuracy:

- Resolution: <0.2 µm RMS typical at 1 Hz; <0.5 µm at 10 Hz; <5 nm in low strain rate applications; typical resolution at selected filter settings.

Real-time data rate: 300-3000 Hz

Extensometer Accuracy Class: ISO 9513 Class 0.5 and ASTM E83 Class B-1 or better, typical, for gauge lengths ≥10 mm

As a result, Epsilon ONE is equipped with the accuracy and fine resolution required to measure modulus, offset yield, stress-strain curves, and strain at failure for all high-modulus materials.
Epsilon ONE Optical Non-Contact Extensometers, continued

Specifications

Field of View: 50 - 200 mm FoV Optics Packages; other ranges available – contact Epsilon
Real-Time Data Rate: 300-3000 Hz; includes image frame rate, analog output, and digital output
Strain Outputs:
  Analog Output: ±10V, short-protected, selectable units and range; includes 2.4 m (8 ft) shielded output cable
  Digital Output: 16-64 bit over RS232 with selectable units & data type; 2900 strain readings per second
Typical data rate @32 bits; includes 1.8 m (6 ft) shielded null modem cable
Resolution: <0.2 µm RMS typical at 1 Hz; <0.5 µm at 10 Hz; <1 µm at 100 Hz; <5 nm in low strain rate applications; typical resolution at selected data rates. Resolution is a function of the data rate and filter settings.
Extensometer Accuracy Class: ISO 9513 Class 0.5 and ASTM E83 Class B-1 or better typical at ≥10 mm gauge length
Absolute Accuracy: <1 µm or 0.2% of value, not exceeding ±5 µm with Precision Telecentric Optics
Minimum Specimen Size: < Ø20 µm (0.001”)
Gauge Length: 2 mm minimum, ≥4x specimen width or diameter recommended; for smaller sizes contact Epsilon
Maximum Elongation: >1000%, limited by field of view and gauge length
Maximum Tracking Speed: >1500 mm/second (90,000 mm/minute)
Cyclic Testing: >200 Hz cyclic test frequency, waveform independent
Strain Control: Suitable for monotonic and cyclic strain control applications
Out-of-Plane Sensitivity*: Allowable out-of-plane motion for ISO 9513 Class 0.5 @15 mm gauge length and ASTM E83 Class B-1:
  <1000 µm (0.040”) for ONE-PT-xx
  <25 µm (0.001”) for ONE-CE-xx
*Understand this specification before you purchase any optical extensometer – see the Tech Note at www.epsilontech.com
Power Supply: 100-240 VAC, 50-60 Hz, 100W, IEC 320 C14 receptacle. Specify plug type when ordering.
System Environment: 10-40°C (50-100°F), for use and storage; 20-80% relative humidity non-condensing environments
Host PC (optional): Requires Windows 7 or 10 PC, 900×550 minimum display, one serial or USB port

Options

Mounting Systems for testing machine base mount, T-slot column mount, or cylindrical column mount
ONE-TI-1 Touch Interface
ONE-LBI-1 Light Beam Interlock
Customized specimen marking templates
Connectors to interface to nearly any brand of test equipment

Certified

Ease of Use is Designed In

Rigid Load Frame Mounting
Linear Retraction and Swing Away features

Instant Reset
Always On, Always Real Time
Automatic Mark Detection

See Epsilon ONE extensometer videos

Visit our website at www.epsilontech.com
Ordering Information

The Epsilon ONE system includes an Optics Package, lighting, Laser Assist Alignment System, Sensor Controller, cables, mounting interface, standard specimen marking kit and software. The included user interface software will run on your testing machine’s existing computer.

Select an Optics Package that meets your range of gauge length and elongation requirements. Start with the largest gauge length that you will need and determine which Optics Packages have enough elongation range for that gauge length. Repeat this process for the smaller gauge lengths in your range of applications. Telecentric lenses are superior to conventional lenses, especially for applications involving strain measurements ~<2%. Learn more about telecentric lenses at www epsilontech.com.

Epsilon ONE will work with any gauge length that is within the stated range for the Optics Package. Indicated maximum tensile strain values are approximate. Learn more about gauge length and measuring range at www epsilontech.com.

Epsilon ONE Optical Extensometer Systems

Model Number ONE-78PT - System

- Premium performance, precision telecentric lens
- 78 mm field of view and 200 mm working distance
- Any gauge length between 2 mm and 65 mm - see table for the estimated maximum tensile elongation for a specific gauge length

Model Number ONE-52PT - System

- Precision telecentric lens
- 52 mm field of view and 150 mm working distance
- Any gauge length between 2 mm and 40 mm - see table for the estimated maximum tensile elongation for a specific gauge length

Model Number ONE-200CE - System

- Conventional entocentric lens – suitable for high elongation applications and for measuring strain values of ~<2% or greater; suitable for smaller strains in some applications
- 200 mm field of view and 220 mm working distance
- Any gauge length between 2 mm and 181 mm - see table for the estimated maximum tensile elongation for a specific gauge length

Touch Interface (Optional)

The optional full-color Touch Interface provides all functions necessary to set up and use an Epsilon ONE system. May be mounted on the column of the testing machine near the Epsilon ONE.  

Model Number: ONE-TI-1

High-Stiffness Mounting Systems

Epsilon ONE is a high-precision optical extensometer and requires rigid load frame mounting. Other configurations than the ones shown below are available – contact Epsilon. Further details are in the Epsilon ONE Mounting System Selection Guide at www epsilontech.com.

Model Number ONE-MS-01 For testing machines with integral T-slots on the column
Model Number ONE-MS-02 Universal base mounting for all testing machines
Model Number ONE-MS-03 For servohydraulic or electrodynamic testing machines with cylindrical columns
Model Number ONE-MS-04 For servohydraulic or electrodynamic testing machines with cylindrical columns (no swing-away feature)

Example: ONE-78PT-System, ONE-MS-01, and ONE-TI-1: Precision Telecentric Lens, 78 mm Field of View, mounting for T-slots on the column of the testing machine, and the Touch Interface.