

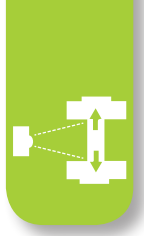
# Epsilon ONE

Video Non-Contact Extensometer

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# Epsilon ONE



*Breakthrough performance • Easy to use • Works with any material testing machine*

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.

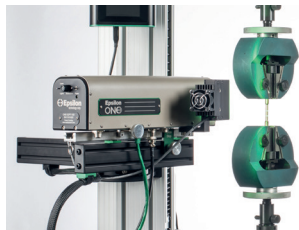
Class-leading accuracy and resolution are achieved by Epsilon's comprehensive optical path optimization, a unification of several optical technologies and signal processing algorithms. Ultra-high camera resolution, real-time data rates up to 3000Hz, minimization of optical error sources, and signal processing 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 eliminate errors due to

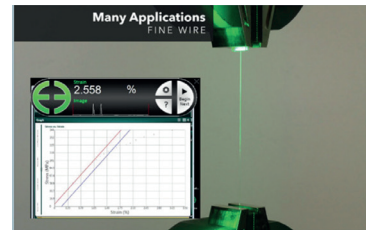


## Applications

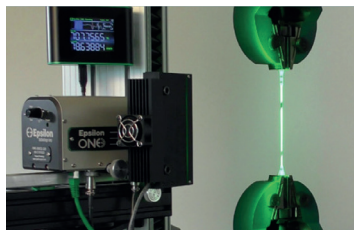
**Composites,  
Metals,  
Ceramics**



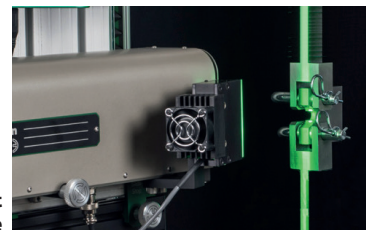
**Foil, Wire,  
Polymer Films**

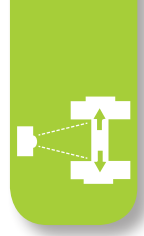


**Plastics,  
Elastomers**



**Non-Contact  
COD Gage**





Epsilon ONE - Model ONE-78mm FoV System with carbon fiber composite specimen

out-of-plane movements – on low strain materials and components. 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 Tinius Olsen.

Epsilon ONE is patent pending.

## Key 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.
- 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.



# ADVANTAGES

## Resolution, Accuracy, Speed

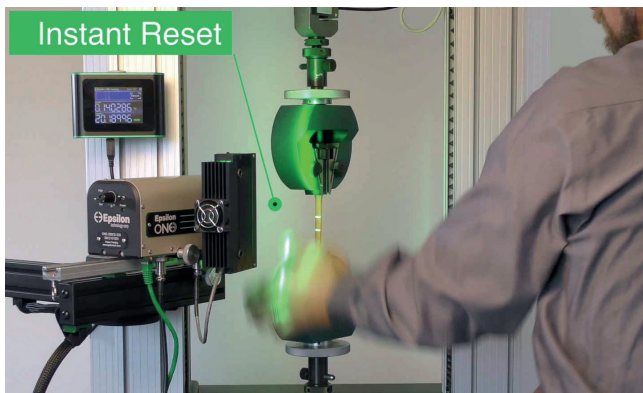
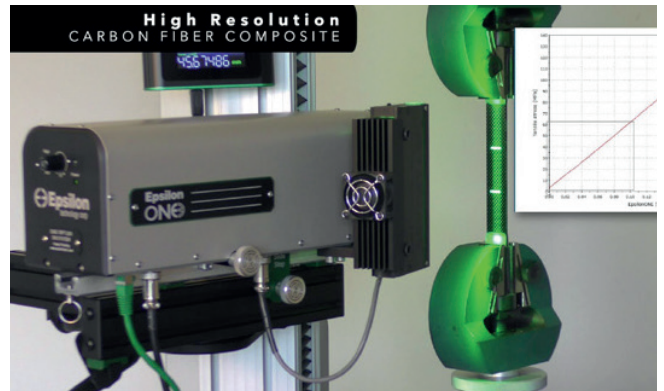
Epsilon ONE's performance is a result of optics and algorithm technologies that combine for high resolution, data rates and accuracy:

Resolution:  $<0.2 \mu\text{m}$  RMS typical at 1 Hz;  $<0.5 \mu\text{m}$  at 10 Hz;  $<5 \text{ nm}$  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  $\geq 10 \text{ mm}$

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.



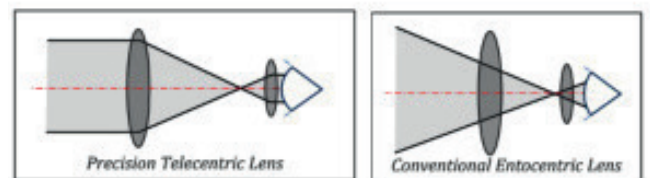
## Always On, Always Real Time

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 3000Hz.

## 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 or grips move out of the testing axis ("out of plane") during the test. Conventional entocentric lenses, which are widely used by other manufacturers of non-contact extensometers, cannot match this performance.



## Optics Packages

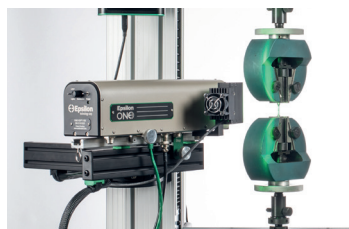
**ONE-78mm FoV System**  
Premium Precision  
Telecentric Optics



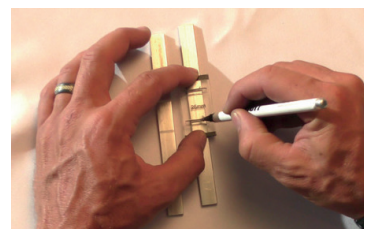
**ONE-200mm FoV System**  
Conventional Entocentric  
Optics

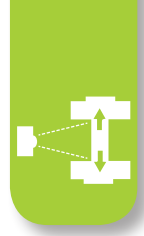


**ONE-52mm FoV System**  
Precision Telecentric Optics



Specimen marking is simple and fast. Templates and paint pens are included with every Optics Package

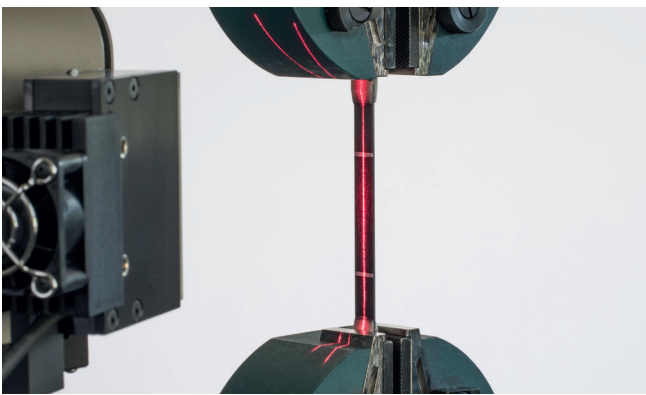




## Laser Assist Alignment System

Setup is faster and more robust with the Laser Assist Alignment System. Epsilon ONE's built-in factory aligned lasers provide two functions:

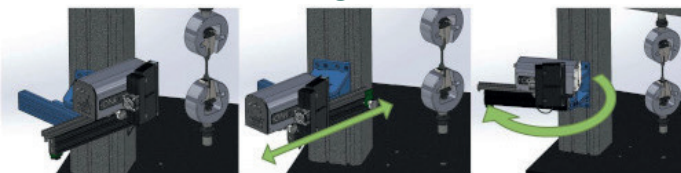
- Spot-checking specimen alignment
  - Setting distance to the specimen - eliminates the need for calibration grids or gauge length bars
- Epsilon ONE is factory calibrated - just set the distance to the specimen, set your controller to take Epsilon ONE's calibrated  $\pm 10V$  input, and start testing.



### Key Features continued

- **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 AP Is 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.

### Ease of Use is Designed In



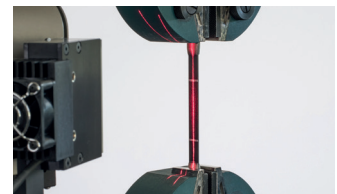
#### Rigid load frame mounting

Linear retraction and swing away features



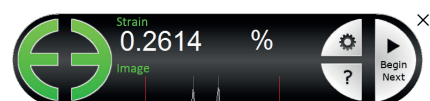
#### Instant Reset

Instant reset  
Always on, Always real time  
Automatic mark detection



#### Laser assist alignment system

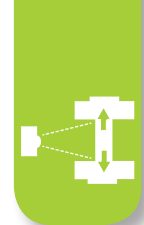
- Specimen alignment spot check
- Eliminates calibration grids and bars



#### Simple user interface

- software interface
- touch interface

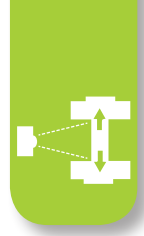




# SPECIFICATION

SPECIFICATION	
Field of View:	50 - 200 mm FoV Optics Packages; other ranges available – contact Tinius Olsen
Real-Time Data Rate:	300-3000 Hz; includes image frame rate, analog output, and digital output
Strain Outputs:	Analog Output: $\pm 10V$ , 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:	$<0.2 \mu m$ RMS typical at 1 Hz; $<0.5 \mu m$ at 10 Hz; $<1 \mu m$ at 100 Hz; $<5 \text{ nm}$ 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 $\geq 10 \text{ mm}$ gauge length
Absolute Accuracy:	$< \pm 1 \mu m$ or 0.2% of value, not exceeding $\pm 5 \mu m$ with Precision Telecentric Optics
Minimum Specimen Size:	$< \varnothing 20 \mu m$ (0.001")
Gauge Length:	2 mm minimum, $\geq 4x$ specimen width or diameter recommended; for smaller sizes contact Epsilon
Maximum Elongation:	$>1000\%$ , limited by field of view and gauge length
Maximum Tracking Speed:	$>1500 \text{ mm/second}$ (90,000 mm/minute)
Cyclic Testing:	$>200 \text{ Hz}$ 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: $<1000 \mu m$ (0.040") for ONE-PT-xx $<25 \mu m$ (0.001") for ONE-CE-xx *Understand this specification before you purchase any optical extensometer
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, 900x550 minimum display, one serial or USB port
OPTIONS	
	Mounting Systems for testing machine base mount, T-slot column mount, or cylindrical column mount
	EPONE-000-0006 Touch Interface
	Light Beam Interlock
	Customized specimen marking templates
	Connectors to interface to nearly any brand of test equipment

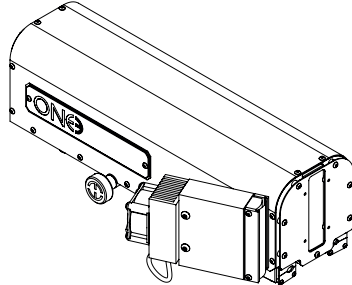
# ORDERING INFORMATION



## Epsilon ONE Optical Extensometer Systems

### Model Number EPONE-000-0000

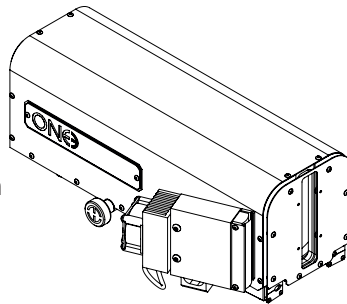
- Premium performance, precision telecentric lens
- 78mm field of view and 200 mm working distance
- Any gauge length between 2 mm and 65mm - see table for the estimated maximum tensile elongation for a specific gauge length



Range of Gauge Lengths and Maximum % Strain		
Gauge Length	Maximum Strain	Maximum Elongation
2mm	>1000%	66mm
5mm	>1000%	63mm
10mm	580%	58mm
12mm	470%	56mm
20mm	240%	48mm
25mm	170%	43mm
50mm	35%	18mm
65mm	5%	3mm

### Model Number EPONE-000-0002

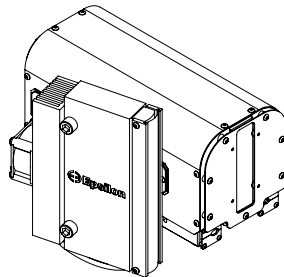
- precision telecentric lens
- 52mm field of view and 150 mm working distance
- Any gauge length between 2 mm and 40mm - see table for the estimated maximum tensile elongation for a specific gauge length



Range of Gauge Lengths and Maximum % Strain		
Gauge Length	Maximum Strain	Maximum Elongation
2mm	>1000%	40mm
5mm	740%	37mm
10mm	320%	32mm
12mm	250%	30mm
20mm	110%	22mm
25mm	68%	17mm
40mm	5%	2mm

### Model Number EPONE-000-0003

- 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 181mm - see table for the estimated maximum tensile elongation for a specific gauge length



Range of Gauge Lengths and Maximum % Strain		
Gauge Length	Maximum Strain	Maximum Elongation
2mm	>1000%	188mm
12mm	>1000%	178mm
25mm	660%	165mm
50mm	280%	140mm
75mm	150%	115mm
100mm	90%	90mm
150mm	25%	40mm
181mm	5%	9mm

### 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: **EPONE-000-0006**

### High-Stiffness Mounting Systems

Epsilon ONE is a high-precision optical extensometer and requires rigid load frame mounting.

Model Number **EPONE-000-0004** High stiffness mounting system for T-slotted ST series testing machine frame

Model Number **EPONE-000-0005** Universal base mounting system for SL testing machine frames

Example: **EPONE-000-0000**, **EPONE-000-0004** and **EPONE-000-0006** = Precision Telecentric Lens, 78 mm Field of View, mounting for T-slots on the column of an ST testing machine frame and the Touch Interface.



The first name in materials testing



# Epsilon ONE

Video Non-Contact Extensometer

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Noida, UP, India • Shanghai, PR China

Tinius Olsen