OUR COMPANY
Strain measurement for materials testing is our sole business at Epsilon.

Over forty years of experience have gone into the development of our products. At our facility in Jackson, Wyoming, we design and build extensometers for testing around the world.

Extensometers are available for testing almost all engineering materials, including metals, composites, plastics, ceramics, elastomers, geomaterials (e.g. rock, concrete, and asphalt), and biomaterials including bone. There are models for tiny and delicate samples, including relatively fine wire, up to massive metal samples and large rock cores. The huge variety of models covers nearly every type of test as well, including: tensile, compression, bend, fracture mechanics, and cyclic strain controlled tests like low cycle fatigue. Many of our extensometers are capable of relatively high frequency operation as well.

Why Epsilon?

- **World’s largest extensometer manufacturer:** Epsilon’s focus exclusively on extensometers and related items has led to this growth. With sales in more than 70 countries, we have become the recognized choice for testing laboratories around the globe.

- **Brodest product line anywhere:** 36 extensometer models available in many thousands of variations. Our focus on helping customers has led to the development of models to cover nearly any test method.

- **Expertise–in both testing and extensometers:** Epsilon has several degreed engineers, including engineers with advanced degrees or industry experience in materials, mechanical engineering, and electrical engineering. Our most senior engineer has over 39 years of experience designing extensometers and materials test equipment, as well as test method knowledge. We have engineers who have worked in test labs using extensometers. One engineer is dedicated to improving our quality systems. We have an in-house machine shop led by a tool and die maker with 45 years experience. The many technicians who build our products are also highly experienced.

- **Responsive–talk to our experts anytime:** When you call Epsilon, you can expect to talk to a degreed engineer with expertise in materials, testing and extensometers. You have access to this same expertise if you have technical questions or problems. If you contact us by email, we promise a quick response. If you ever need repairs, our service is prompt. We are here to help.

- **Unrivaled quality:** The technicians who build our devices understand the company’s commitment to quality. Every unit is checked by a quality control person before shipment. Epsilon is accredited by A2LA to the ISO/IEC 17025 international standard (General Requirements for the Competence of Testing and Calibration Laboratories) and certified by DNV to the ISO 9001 international quality management system standard. Epsilon uses a laser interferometer for increasing the accuracy of much of what we measure. This allows calibration of extensometer calibrators as well as extensometers. With an accuracy of 0.5 parts per million, it approaches the measurement accuracy of national standards. Our scope of accreditation and quality system certificates can be viewed on our website.
Interfacing

Epsilon extensometers
to test equipment.

All of Epsilon’s strain gaged transducers employ a full Wheatstone bridge design. They are powered by an excitation voltage, typically between 5 and 10 VDC. The output of the extensometer is proportional to the excitation. For this reason the calibrated output is often expressed as a mV/V value. An extensometer with a full scale span of 2.345 mV/V will have a full scale output of 23.450 mV if the excitation is 10V. This span data is provided by Epsilon on each extensometer test certificate.

All strain gaged sensors must be connected to some external electronics to provide readings. The electronics provide the excitation and normally amplifies the sensor’s output to a high level DC voltage. This resultant voltage is used for readout or control of the test machine. In digital systems the voltage output is converted via data acquisition hardware into engineering units of strain. In instances where a chart recorder or X-Y recorder is used, the output is set to easily yield a specified strain/cm on the graph.

When any new device like an extensometer is first used, the sensor must be calibrated with the electronics to ensure proper configuration. There are several ways to accomplish this. Generally the process is very straightforward. If your extensometer will be connected to an available strain channel in your test controller, Epsilon can normally supply the unit with the correct connector to plug directly in. For external data acquisition systems, a strain gaged signal conditioning module capable of providing the excitation is required. Often this is part of the data acquisition system. For systems that require high level inputs or for use with chart recorders and X-Y plotters, Epsilon offers optional signal conditioning electronics.
CALIBRATING EXTENSOMETERS WITH EXISTING ELECTRONICS

Required for any extensometer you buy, this process can be performed many ways, most of which are quite simple. The most common options are as follows:

**Using the Epsilon Shunt Calibration System**
As detailed on the Epsilon Shunt Calibration System page (p. 122), shunt calibration is a very quick and easy way to set your electronics, regardless of brand. Shunt calibration allows you to transfer Epsilon’s calibration to on-site electronics using a two point calibration line fit. The Epsilon Shunt Calibration System is included with all Epsilon strain-gaged extensometers and can also be retrofitted to older extensometers at Epsilon’s factory.

**With signal conditioning electronics from Epsilon**
All extensometers purchased with electronics from Epsilon are shipped as fully calibrated systems. The output from the system is set to exact values (typically ±10VDC), and is noted on the test certificate. No further calibration is required. Periodic recalibration can be performed by Epsilon.

**With an extensometer calibrator from Epsilon**
Epsilon’s digital electronic calibrators are the easiest to use units available. These calibrators provide an ideal way to perform calibrations if you have many extensometers. They allow you to check many data points along the curve for the highest accuracy. The 3590VHR calibrator meets the accuracy and resolution requirements for ASTM E83 Class B-1 for 6 mm gauge length and greater extensometers and ISO 9513 Class 0,5 over the full measuring range of the calibrator. Periodic recalibration of the calibrator can be performed by a third party calibration service or by sending the unit to Epsilon Technology.

**By calibration services such as the equipment manufacturer or independent calibration service**
Epsilon’s extensometers can be calibrated with test controls by any third party calibration service with the capability of calibrating extensometers. Many customers have their entire test machine re-calibrated annually by the service department of the manufacturer. This includes the load cell, extensometers and any other installed sensors. Most calibration services will have no difficulty calibrating Epsilon’s extensometers.
OUTSTANDING PERFORMANCE FEATURES IN EVERY MODEL

- Rugged construction withstands constant handling and mounting
- Most models may be left on through specimen failure
- Light weight to minimize specimen influence
- Most models operate in both tension and compression
- Most models are capable of being used in cyclic tests
- Low operating force, normally less than 40g, with many under 20g
- Easy to attach to specimens, with quick attach kits for most models
- Immersible in many non-conductive fluids
- Initial gauge length accurately established
- All come with foam lined case

Backed by many years of experience
Over forty years of experience in materials testing and extensometer design combine to provide the best performing extensometers in the industry. Epsilon’s experienced staff combined with our factory direct sales structure means if you have questions, you can speak with an expert to help resolve your issue. Our extensometers are the result of design refinements based on the experiences and inputs from customers over many years.

Full one year warranty on every extensometer
The warranty covers defects in materials or workmanship for a full year, excluding normal wear and damage from excessive force. Each unit is produced under stringent quality standards and is fully tested and calibrated. Certain items such as knife edges wear under normal circumstances and a spare pair is included. Should your extensometer require repair, Epsilon maintains a policy of quick response to keep your test lab running.

High accuracy, exceeding requirements of ASTM, ISO, and many other test standards
All of Epsilon’s extensometers are designed for very high accuracy, with performance significantly better than required by various testing standards. Epsilon’s extensometers adhere to the highest requirements of ASTM E83 and ISO 9513, where applicable. For all other units, linearities of better than 0.15% of full scale measuring range are commonly achieved.

All units ship with an ISO 17025 accredited test certificate. Each extensometer is individually calibrated using traceable electronics, with relevant data provided on the test certificate.

Highest quality and the best value
Epsilon’s entire line of extensometers were engineered for high performance during even the most demanding materials testing applications. They have the ruggedness needed for high volume testing labs, proven through years of customer use.

Epsilon extensometers are sold factory direct. Coupled with our innovative design, the result is substantial cost savings to your company, with world class performing products.

Unique dual flexure design combined with overtravel stops for ruggedness
Nearly all models use a dual flexure design, which protects the extensometer from undesired motions. This design isolates the sensing element from side forces and accelerations in dynamic tests. Nearly all out-of-plane errors are eliminated.

All standard axial extensometers may be left on through specimen failure
Integral mechanical stops protect the extensometer from damage when specimen failure occurs. The stops also prevent damage from mishandling.

Replaceable parts for added life and versatility
All models have easily replaceable knife edges (where applicable). An additional set is included in the spare parts kit. The standard knife edges are made from hardened tool steel for long life. The modular design of the extensometers allows easy replacement of damaged components.
We are all about service at Epsilon.

Each extensometer comes with a full, one year warranty. The warranty covers defects in materials or workmanship for a full year, excluding normal wear and damage from excessive applied force. Each unit is produced under stringent quality standards and is fully tested and calibrated before leaving the factory.

Certain items such as knife edges and ceramic rods wear under normal use, and a spare set is included. The modular design of the extensometers allows for easy replacement of damaged parts. Should your extensometer require repair, Epsilon maintains a policy of quick response to keep your test lab running.

Epsilon Technology takes pride in ensuring that our experts are available to speak with customers. If you have an issue you wish to discuss, please contact us with your questions.
Can Epsilon extensometers be left on through specimen failure?
Yes. All Epsilon standard extensometers are designed to withstand remaining on the sample through specimen failure. On certain materials, such as high strength metals, knife edges will wear out faster if the extensometer is left on through failure. A spare set of knife edges is included.

Will the extensometer be compatible with my existing electronics?
All extensometers in this catalog can easily be shipped with the mating connector already installed, so you can plug right in to your existing electronics. We stock connectors for every common brand of test machine.

The majority of Epsilon’s extensometers are strain gaged transducers which may be connected to most brands of materials testing controls. If your controls have the signal conditioning module for a strain gaged extensometer, we can supply the unit with the necessary connector to plug in directly. If you are using a data acquisition board to acquire test data, the extensometers can almost always be interfaced properly. A few of our extensometers use capacitive sensing technology or DVRT sensors, and these include the required electronics.

If your controls are designed for LVDT type extensometers only, we can provide the electronics to work with our extensometers. Available electronics are covered in this catalog. This is also ideal for older test machines, which may not have any extensometer electronics, allowing the output to run a chart recorder or plotter, or interface to a data acquisition board.

The Epsilon Shunt Calibration System helps make calibrating the electronics for the extensometer quick and easy. This also allows you to send your extensometer back to Epsilon for periodic recalibration. For further details on shunt calibration see page 122.

What electronics are needed?
Most of our extensometers are strain gage based sensors. They use a full Wheatstone bridge design. Functionally they require the same signal conditioning electronics used for any strain gaged transducer (load cell, pressure sensors, etc.). If you do not already have the electronics, Epsilon has signal conditioners available.

How do I decide what measuring range I need?
The selection of extensometer measuring range can depend on several factors including resolution of the signal conditioner, desired dynamic performance, space constraints, desired calibration class, ergonomics of the extensometer, and hanging weight on the specimen. The general rule is that for optimum performance in the elastic region (i.e., Young's modulus and yield strength measurements) a measuring range of 5% to 20% is typical. If there is a need to record strain at failure using the extensometer, the measuring range selected should provide sufficient travel including overage for outliers. Strain ranges of 20% to 50% are typical for many metallic materials, with more ductile materials requiring 50% to 100% strain range. Composites typically need no more than 10% to 20% strain range for measuring strain at failure.

Generally speaking, Epsilon’s extensometers will meet the higher levels of accuracy requirements in today’s standards, such as ASTM E83. You can thus be assured that reasonably accurate measurements at the low end of the range can still be made.

Why do I need an extensometer when I can get strain from crosshead displacement?
Measuring crosshead extension during a test does not just measure strain in a defined region of a test sample. It also measures machine deflection, load cell deflection, grip deflection, deflection of the part of the test sample outside the reduced section, and possible grip slippage. Strain is defined as the change in length divided by the initial length (gauge length). There is no defined initial length without an extensometer, and the change in length is not correctly measured due to the other deflections included in crosshead displacement.
What our customers have to say about us.

“I use Epsilon extensometers because they are rugged, well built and economical. I find their versatility to be their most appealing aspect. We interface them with several data acquisition systems as well as testing machines. We use them in traditional testing modes to non-traditional, stand alone applications. It's the versatility of these instruments that makes Epsilon extensometers a perfect fit for our test laboratory.”

RICK PEARSON
ANDERSON LABORATORIES, INC.

“Epsilon's products, technical support and service on repairs are very easy. We have never before experienced such a well organized company. We are in Austria, but it is much faster and easier to buy high temp extensometers via the US instead of from nearer European companies! The technical support is very good, since every question is answered in less than 24 hours! Other companies take weeks to answer – if they answer at all.”

MARTIN RIEDLER
Department Product Engineering
MONTANUNIVERSITÄT LEOBEN, AUSTRIA

“...I have been doing testing for over 15 years and have used Epsilon extensometers for more than seven years (3542 series). Your extensometers represent the best value for their cost in the industry. ...Since, we can “leave” the extensometer until break in most applications (because of the robust design), we can get invaluable information on the material evaluated. ...The response time in getting a new unit is by far the shortest in the industry.”

BRUNO BELANGER
President and CEO
BCOMTESTING, INC.

“...With the fastest repairs completed in less than two weeks (from the moment it was dispatched overseas from our factory to the moment it was received again). Our previous extensometer supplier never managed a turnaround in less than eight weeks. For a front line piece of equipment that is entirely unacceptable.”

MIKE DAVIES
CYTEC, UNITED KINGDOM

“...I really appreciate your product's simple and clever embedding solutions with high quality and technical performances.”

JOHN DINA
LABORATOR DINAMIC, ROMANIA

“... With the fastest repairs completed in less than two weeks (from the moment it was dispatched overseas from our factory to the moment it was received again). Our previous extensometer supplier never managed a turnaround in less than eight weeks. For a front line piece of equipment that is entirely unacceptable.”

MIKE DAVIES
CYTEC, UNITED KINGDOM

“We use Epsilon extensometers for their high quality, stability and ruggedness. When we do eventually damage an extensometer, Epsilon has, without fail, offered excellence of service we would like from all of our vendors. Epsilon has provided custom engineering support to maximize reliability after many cycles of specimen ruptures.”

SHAWN ARNETT
TEXAS RESEARCH INSTITUTE

“I have been really happy with all extensometers purchased from you: good quality, high precision, friendly.”

GREGORY BANAS
Senior Research Engineer
UNIVERSITY OF ILLINOIS

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Epsilon ONE Non-Contact Optical Extensometers

LE-05 and LE-15 Non-Contact Laser Extensometers
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 E6, 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 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.

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 tech – Innovative designs and factory direct sales.
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: < Ø0.020 µm (0.001")

Gage 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

- Instant Reset
- Always On, Always Real Time
- Automatic Mark Detection

See Epsilon ONE extensometer videos

Visit our website 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

**Range of Gauge Lengths and Maximum % Strain**

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Maximum Strain</th>
<th>Maximum Elongation</th>
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<tr>
<td>2 mm</td>
<td>&gt;1000%</td>
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<td>5%</td>
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**Range of Gauge Lengths and Maximum % Strain**

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<tr>
<th>Gauge Length</th>
<th>Maximum Strain</th>
<th>Maximum Elongation</th>
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<tbody>
<tr>
<td>2 mm</td>
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<td>5 mm</td>
<td>740%</td>
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<td>10 mm</td>
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<td>68%</td>
<td>17 mm</td>
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<tr>
<td>40 mm</td>
<td>5%</td>
<td>2 mm</td>
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**Range of Gauge Lengths and Maximum % Strain**

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<thead>
<tr>
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<th>Maximum Strain</th>
<th>Maximum Elongation</th>
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<tbody>
<tr>
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<td>40 mm</td>
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<tr>
<td>181 mm</td>
<td>5%</td>
<td>9 mm</td>
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**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. [See a Touch Interface demo](#)

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.
These extensometers are high precision non-contacting units for strain measurement in materials testing. They use a high speed laser scanner to measure the spacing between reflective tape strips on the sample. The measurement range is from 8 to 127 mm (0.3 to 5 inches) for the LE-05 and 8 to 381 mm (0.3 to 15 inches) for the LE-15. The gauge length is determined by the user. This allows high elongation measurements when shorter gauge lengths are used. The high resolution also allows accurate measurements of smaller strains.

Model LE-05 and LE-15 extensometers measure strain optically, without contacting the specimen, using laser diode technology. The extensometers are self-contained and portable. They may be interfaced with a variety of testing machines and data acquisition systems using the ±10V analog output or bi-directional RS-232 serial port. Operation may be local or remote. A digital display is included.

The scanning beam is always perpendicular to the specimen, unlike most laser extensometers. This eliminates errors when viewing through windows in chambers. It also minimizes sensitivity to the distance between the extensometer and the sample. Because the unit measures reflected light, no receiver is required behind the sample.

Easy to use.

The visible laser light is simply aimed at the specimen, which has small reflective tape strips set at the gauge length desired. The extensometer displays the actual measured gauge length. If desired, the zero button will offset the output to zero. As the specimen is tested, the display will then read the elongation directly.

The analog output and RS-232 interface are easily connected to existing controls or data acquisition systems.

The reflective tape can be used at temperatures up to 150 °C (300 °F). High temperature clip-on reflectors may be used as an alternate to tape reflectors. These are re-usable and available as an option. They are rated for use to 425 °C (800 °F).
Features

- Non-contacting optical design requires only reflective tape marks on the specimen, or clip-on reflectors
- Ideal for use in chambers-calibration not affected by aiming through viewing windows
- High resolution of 1 micron
- Full 127 mm (5 inch) or 381 mm (15 inch) measuring range allows high elongation measurements (e.g. 200% on a 1 inch gauge length)

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>LE-05: 8 to 127 mm (0.3 to 5 inches)</th>
<th>LE-15: 8 to 381 mm (0.3 to 15 inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Range:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Resolution:</td>
<td>LE-05: 0.001 mm (0.0001 inches)</td>
<td>LE-15: 0.01 mm (0.001 inches)</td>
</tr>
<tr>
<td>Linearity¹:</td>
<td>LE-05: ±0.01 mm (±0.0004 inches)</td>
<td>LE-15: ±0.04 mm (±0.002 inches)</td>
</tr>
<tr>
<td>Repeatability²:</td>
<td>LE-05: ±0.005 mm (±0.0002 inches)</td>
<td>LE-15: ±0.04 mm (±0.002 inches)</td>
</tr>
<tr>
<td>Max. Scan Rate:</td>
<td>100 scans/second</td>
<td></td>
</tr>
<tr>
<td>Target Distance:</td>
<td>Two selectable factory preset values between 254 and 457 mm (10 and 18 inches). Default values are: LE-05: 305 and 381 mm (12 and 15 inches) LE-15: 381 and 457 mm (15 and 18 inches)</td>
<td></td>
</tr>
<tr>
<td>Zero Suppression:</td>
<td>Reading may be set to zero anywhere in measuring range</td>
<td></td>
</tr>
<tr>
<td>Scan Line Orientation:</td>
<td>Vertical</td>
<td></td>
</tr>
<tr>
<td>Scan Averaging:</td>
<td>Moving window averaging over a selectable number of scans</td>
<td></td>
</tr>
<tr>
<td>Analog Output:</td>
<td>16 bit, ±10 VDC standard</td>
<td></td>
</tr>
<tr>
<td>Full Scale Ranges:</td>
<td>0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0, or 20.0 inches (model dependent) Optional 2.0, 5.0,10, 20, 50, 100, 200, or 500 mm (model dependent)</td>
<td></td>
</tr>
<tr>
<td>Digital Communications:</td>
<td>RS-232 serial communications, standard 3 wire</td>
<td></td>
</tr>
<tr>
<td>Selectable Baud Rate:</td>
<td>9600, 4800, 2400, or 1200</td>
<td></td>
</tr>
<tr>
<td>Display:</td>
<td>2 line, 16 character digital display, backlit LCD</td>
<td></td>
</tr>
<tr>
<td>Power Input:</td>
<td>115 VAC ±10%, 50/60 Hz standard</td>
<td>230 VAC ±10%, 50/60 Hz optional</td>
</tr>
<tr>
<td>Size:</td>
<td>LE-15: 668 L x 457 H x 196 W mm (27 L x 18 H x 7.7 W inches)</td>
<td></td>
</tr>
<tr>
<td>Weight:</td>
<td>LE-05: 4.5 kg (10 lbs), LE-15: 20.4 kg (45 lbs)</td>
<td></td>
</tr>
<tr>
<td>Mounting Provisions:</td>
<td>1/4-20 UNC tapped holes in base (4)</td>
<td></td>
</tr>
<tr>
<td>Laser Source:</td>
<td>Diode laser, 670 nm, &lt;1 mW maximum scanned output CDRH Certified Class II laser instrument</td>
<td></td>
</tr>
<tr>
<td>Options:</td>
<td>Consult factory for options like reflective clips for high temperature use</td>
<td></td>
</tr>
</tbody>
</table>

¹ Over optimum displacement range at calibrated distance
² Note: Specifications measured at 25 °C and 50% relative humidity.
General purpose extensometers for axial tensile, compression, and cyclic testing. Gauge lengths from 10 to 80 mm (and 0.5 to 2 inches) and full scale measuring ranges from 5% to 100% strain.

These extensometers are designed for testing a wide range of materials, including metals, plastics, composites and ceramics. All will perform both tension and compression strain measurement. The dual flexure design makes them very rugged and insensitive to vibrations, which permits higher frequency operation.

They come standard with Epsilon’s quick attach kit, making it possible to mount the extensometer on the test specimen quickly and easily with one hand. The quick attach kit can be removed, allowing mounting of the extensometer with springs or rubber bands.

Model 3542 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller, and Epsilon will equip the extensometer with a compatible connector wired to plug directly into the controller. For systems lacking the required electronics, Epsilon can provide a variety of solutions for signal conditioning and connection to data acquisition systems or other equipment.

For gauge lengths less than 20 mm (0.8 inches), Epsilon recommends the more compact Model 3442.

For gauge lengths 100 mm (4 inches) or greater, see Model 3542L.

See the electronics section of this catalog for available signal conditioners and strain meters.

Extensometers for Composites Compression Testing
Models 3542 and 3442 extensometers can be furnished to clip directly onto composites compression fixtures, such as for ASTM D695. These use specially made quick attach kit wire forms for the test fixture. Consult the factory for specifics. Also see the Model 3442 miniature extensometer.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Applicable for testing to:
  - ISO 6892-1, 527-2, 527-4, 527-5, 10113
  - ASTM E8, E9, D3039, D638, A370, D3552, E517, E646
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- All models can measure in both tension and compression and can be used for cyclic testing.
- Standard quick attach kit allows one hand mounting to specimens.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
- All models have mechanical overtravel stops in both directions. Cable stops are used for overtravel protection where required. Epsilon’s cable stops are fully contained between the arms of the extensometer and do not hang below where they can interfere with fixturing—especially during compression testing.
- Hardened tool steel knife edges are easily replaced. A spare set comes with every extensometer.
- Gauge length adapter kits enable configuration of multiple gauge lengths with one extensometer.
- Replaceable arms and spacers for ease of repair.
- High and low temperature options extend operation from as low as -270 °C to +200 °C (-454 °F to 400 °F).
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Includes high quality foam lined case.

Specifications

| Excitation: | 5 to 10 VDC recommended, 12 VDC or VAC max. |
| Output: | 2 to 4 mV/V, nominal, depending on model |
| Linearity: | ±0.15% of full scale measuring range |
| Temperature Range: | Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F) |
| Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F) |
| Cable: | Integral, ultra-flexible cable, 2.5 m (8 ft) standard |
| Standard Quick Attach Kit: | Fits round samples up to 25 mm diameter (1.0 inch) and flats to 12 mm thick by 31 mm wide (0.5 inch by 1.25 inch) |
| Operating Force: | 30 g typical |

Options

- Quick attach kit wire forms for large specimens
- Adapter kits to change gauge lengths
- Connectors to interface to nearly any brand of test equipment
- Special coatings and stainless steel knife edges available for biomedical tests
- Specialty knife edges (see page 102)

Ordering Information

Model 3542 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td></td>
</tr>
<tr>
<td>-010M</td>
<td>10.0 mm</td>
</tr>
<tr>
<td>-012M</td>
<td>12.0 mm</td>
</tr>
<tr>
<td>-0125M</td>
<td>12.5 mm</td>
</tr>
<tr>
<td>-020M</td>
<td>20.0 mm</td>
</tr>
<tr>
<td>-025M</td>
<td>25.0 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>50.0 mm</td>
</tr>
<tr>
<td>-080M</td>
<td>80.0 mm</td>
</tr>
<tr>
<td>U.S.A.</td>
<td></td>
</tr>
<tr>
<td>-0050</td>
<td>0.500”</td>
</tr>
<tr>
<td>-0064</td>
<td>0.640”</td>
</tr>
<tr>
<td>-0100</td>
<td>1.000”</td>
</tr>
<tr>
<td>-0140</td>
<td>1.400”</td>
</tr>
<tr>
<td>-0200</td>
<td>2.000”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-LT</td>
</tr>
<tr>
<td>-ST</td>
</tr>
<tr>
<td>-HT1</td>
</tr>
<tr>
<td>-HT2</td>
</tr>
<tr>
<td>-LHT</td>
</tr>
</tbody>
</table>

1 Compressive ranges can be adjusted to higher values if required. Please contact Epsilon for your specific testing requirement.
2 Not available in 10 mm, 12.5 mm, or .50 inch gauge lengths.

Example: 3542-0100-020-LT: 1.000 inch gauge length, ±20% measuring range, low temperature option (-454 °F to 210 °F)
Small profile and ultra-light weight, these units are appropriate for testing small and delicate samples yet rugged enough for daily use on standard specimens. Ideal for strain measurement of wire specimens, sheet materials, and standard ASTM or ISO specimen geometries.

Excellent for low and high cycle fatigue testing.

Weighing as little as 8 grams, these miniature extensometers are designed to have very low operating force with minimal specimen influence. All use an improved version of Epsilon’s dual flexure design which makes them very rugged for their size. With a compact module that is 15.2 mm (0.6 inches) high, they will fit in the limited space between grips that is typical with small test samples. Gauge lengths can be as short as 3 mm or as long as 50 mm. A newly designed gage setting pin and assembly allows the gauge length to be set accurately and repeatably to ASTM and ISO requirements for all gauge lengths. Reengineered quick attach wire forms provide simple and secure specimen attachment. Wire forms for round and flat specimens are included, as well as knife edges in flat, 3-point, and vee configurations. The wire forms may be removed to enable mounting using elastic bands or springs. A tethering attachment point provides fall protection and enables counterbalancing of the extensometer’s weight when testing delicate specimens.

Model 3442 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller, and Epsilon will equip the extensometer with a compatible connector wired to plug directly into the controller. For systems lacking the required electronics, Epsilon can provide a variety of solutions for signal conditioning and connection to data acquisition systems or other equipment.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- Gauge length pin helps set gauge length accurately for all gauge length configurations.
- All models can measure in both tension and compression and can be used for cyclic testing.
- Mechanical overtravel stops in both directions.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
- Gauge length adapter kits enable configuration of multiple gauge lengths with one extensometer.
- Replaceable arms and spacers for ease of repair.
- High and low temperature options extend operation from as low as -270 °C to +200 °C (-454 °F to 400 °F).
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Includes high quality foam lined case.

Specifications

| Excitation: | 5 to 10 VDC recommended, 12 VDC or VAC max. |
| Output: | 2 to 4 mV/V nominal, depending on model |
| Linearity: | ≤±0.15% of full scale measuring range |
| Temperature Range: | Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F) Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F) |
| Cable: | Integral, ultra-flexible cable, 2.5 m (8 ft) standard |
| Standard Quick Attach Kit: | Fits round samples up to 13 mm (0.5 inch) diameter and flats up to 13 mm thick by 15 mm wide (0.5 inch by 0.6 inch); attach to larger specimens using rubber bands or springs (included) |
| Operating Force: | 10 to 20 g typical |

Options

Adapter kits to change gauge lengths
Connectors to interface to nearly any brand of test equipment
Special coatings and stainless steel knife edges available for biomedical tests
Specialty knife edges (see page 102)
Long gauge length extensometers with gauge lengths 100 mm (4 inches) or greater for tensile and compression testing. These units have been specially designed for long gauge length applications where low level strain measurements are required.

The dual flexure design makes the 3542L very rugged and insensitive to vibrations. These extensometers are designed for testing a wide range of materials including metals, plastics, composites and ceramics. Epsilon’s Model 3543 is recommended for applications requiring long gauge lengths and larger measuring ranges.

The Model 3542L comes standard with Epsilon’s quick attach kit, making it easy to mount the extensometer on the test specimen. The quick attach kit can be removed, allowing mounting of the extensometer with springs or rubber bands.

The 3542L extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

For gauge lengths less than 100 mm (4 inches), see Model 3542.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- All models can measure in both tension and compression and can be used for cyclic testing.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- Mechanical overtravel stops in both directions.
- Standard quick attach kit allows quick mounting to specimens.
- Hardened tool steel knife edges are easily replaced. A spare set comes with every extensometer.
- High and low temperature options extend operation from as low as -270 °C to +200 °C (-454 °F to +400 °F).
- Replaceable arms and spacers for ease of repair. This also allows changing the gauge length for different test requirements.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V, nominal, depending on model
Linearity: ≤0.15% of full scale measuring range
Temperature Range: Standard (-ST) is -40°C to +100°C (-40 °F to 210°F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Standard Quick Attach Kit: Fits round samples up to 25 mm diameter (1.0 inch) and flats to 12 mm thick by 31 mm wide (0.5 inch by 1.25 inch)
Operating Force: Depends on model configuration, less than 30 g typically

Options

Quick attach kit wire forms for large specimens
Adapter kits to change gauge lengths
Connectors to interface to nearly any brand of test equipment
Special coatings and stainless steel knife edges available for biomedical tests
Specialty knife edges (see page 102)

Ordering Information

Model 3542L Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

Gauge Length

<table>
<thead>
<tr>
<th>Metric</th>
<th>100.0 mm</th>
<th>150.0 mm</th>
<th>200.0 mm</th>
<th>250.0 mm</th>
<th>500.0 mm</th>
<th>600.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>4.000&quot;</td>
<td>6.000&quot;</td>
<td>8.000&quot;</td>
<td>10.000&quot;</td>
<td>20.000&quot;</td>
<td>24.000</td>
</tr>
<tr>
<td>METRIC</td>
<td>-002M</td>
<td>±2.5 mm</td>
<td>±6.0 mm</td>
<td>+12.5mn/-6.0mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.A.</td>
<td>-010T</td>
<td>±0.10&quot;</td>
<td>±0.25&quot;</td>
<td>±0.50&quot;/-0.25&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measuring Range

<table>
<thead>
<tr>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-LT -270 °C to 100 °C (-454 °F to 210 °F)</td>
</tr>
<tr>
<td>-ST -40 °C to 100 °C (-40 °F to 210 °F)</td>
</tr>
<tr>
<td>-HT1 -40 °C to 150 °C (-40 °F to 300 °F)</td>
</tr>
<tr>
<td>-HT2 -40 °C to 200 °C (-40 °F to 400 °F)</td>
</tr>
<tr>
<td>-LHT -270 °C to 200 °C (-454 °F to 400 °F)</td>
</tr>
</tbody>
</table>

Example: 3542L-200M-006M-ST: 200 mm gauge length, ±6.0 mm measuring range, standard temperature option (-40 °C to 100 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
This model is available in gauge lengths from 50 mm (2 inches) and larger, with measuring ranges up to 100 mm (4 inches). The unique design separates into two halves and the extensometer may be left on through specimen failure. These extensometers are widely used where long samples and large measuring ranges are required. They are ideal for testing steel re-bar, weld joints, and wire materials.

With over 15 years of proven reliability in the world’s most demanding testing environments, the Model 3543 extensometer is designed to survive in those applications where standard axial extensometers would not. Designed by Epsilon, the Model 3543 was created to survive specimen failure by separating into two halves, thus preventing permanent damage to the module body. During operation, the upper half of the extensometer pulls out of the main body. Tapered measuring beams activate strain gaged flexures within the unit. This unique design allows long measuring ranges, yet retains compatibility with electronics for strain gaged transducers. These models offer high accuracy and are light weight but rugged, with low operating force. They are tension only units.

The units have hardened tool steel knife edges. Standard quick attach wires provided with the extensometer work on flat specimens up to 12 x 31 mm (0.5 x 1.25 inch) and on rounds up to 25 mm (1 inch) diameter. Optional quick attach kit wire forms are available for use on larger samples. See Model 3542L for long gauge lengths with smaller measuring ranges.

The Model 3543 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- **Specifically designed to be left on through specimen failure.** The unit is designed so that the two halves of the extensometer come apart to prevent damage at specimen failure.

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.

- All standard units meet ASTM class B-2 requirements for accuracy.

- Rugged design for reliable testing.

- Standard quick attach kit for quick mounting to specimens.

- Hardened tool steel knife edges are easily replaced. A spare set comes with every extensometer.

- High temperature option extends operation to +150 °C (300 °F).

- Replaceable arms and spacers for ease of repair. The optional gauge length spacers allow the gauge length of the extensometer to be easily increased for different testing requirements.

- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.

- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.

Output: 2 to 4 mV/V nominal, depending on model

Linearity: ≤0.15% of full scale measuring range

Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)

(-40 °F to 210 °F)

Cable: Ultra-flexible cable 2.5 m, (8 ft) standard

Standard Quick Attach Kit: Fits round samples up to 25 mm diameter (1.0 inch) and flats to 12 mm thick by 31 mm wide (0.5 inch by 1.25 inch)

Operating Force: 125 g typical

Options

Quick attach kit wire forms for large specimens

Spacers to change gauge lengths

Connectors to interface to nearly any brand of test equipment

The 3543 is available with a twist option for use in applications where specimen twisting greater than 3° is expected. The 3543TW option can accommodate up to 15° of twist.

Geotextile clamps are an option for testing fabric and mesh specimens up to 200 mm wide – 3543GT

Specialty knife edges (see page 102)

ORDERING INFORMATION

Model 3543 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Intermediate and longer gauge lengths are easily attained by adding gauge length spacers.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.0 mm</td>
<td>-050M</td>
</tr>
<tr>
<td>100.0 mm</td>
<td>-100M</td>
</tr>
<tr>
<td>150.0 mm</td>
<td>-150M</td>
</tr>
<tr>
<td>200.0 mm</td>
<td>-200M</td>
</tr>
<tr>
<td>250.0 mm</td>
<td>-250M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>+25 mm</td>
<td>-025M</td>
</tr>
<tr>
<td>+50 mm</td>
<td>-050M</td>
</tr>
<tr>
<td>+100 mm</td>
<td>-100M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 °C to 100 °C</td>
<td>-ST</td>
</tr>
<tr>
<td>-40 °C to 150 °C</td>
<td>-HT1</td>
</tr>
</tbody>
</table>

Example: 3543-0800-400T-ST: 8.0 inch gauge length, +4 inch measuring range, standard temperature range (-40 °F to 210 °F)

See more extensometry at www.epsilon-tech.com

Contact us for your special testing requirements.

CERTIFIED
Designed for plastics, rubber and elastomer testing, these extensometers have very long measuring ranges. Their unique design allows testing to failure and minimizes interaction with the sample.

The main body of this unique extensometer remains stationary during testing, held in position by the adjustable magnetic base included. Only the very light, small traveling heads move as the sample elongates during a test. These attach to the sample with small spring clips. Each head pulls a cord out from the extensometer as the head moves.

These models use high precision, low friction potentiometers, and, as a result, have a wide range of factory selectable outputs. The extensometer is driven by an excitation voltage and has output proportional to the input. They can be provided with high level outputs (approximately 2-8 VDC) or ones that mimic strain gaged devices (2-4 mV/V). When set to mimic strain gaged extensometers, the Model 3800 can be used with virtually any signal conditioning electronics designed for strain gaged sensors. The potentiometers employ a hybrid wire wound around conductive plastic, which provides excellent long term stability. The output from the extensometer is readily interfaced with most existing test controllers and may be directly input to data acquisition systems and chart recorders.

Please let us know at the time of order what type of output and connector you require.
Features

- May be left on through specimen failure.
- The main body is stationary with only the lightweight traveling heads moving.
- Applicable for testing to ASTM D412.
- Comes with an adjustable magnetic base for easy mounting.
- Large measuring range to 500 mm (20 inches).
- Includes the Epsilon Shunt Calibration System (with units configured to mimic strain gaged sensors) for on-site electrical calibration.
- Includes high quality foam lined case.
- Low cost, high accuracy elastomer strain measurement.

Specifications

- Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
- Output: Either 2 to 8 VDC, depending on model (at 10 VDC input) or 2 to 4 mV/V, nominal, selectable at time of order
- Accuracy: ±1 mm (±0.040 inches)
- Resolution: 0.2 mm (0.008 inches) for all measuring ranges
- Temperature Range: -40 °C to 100 °C (-40 °F to 210 °F)
- Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
- Operating Force: 20 grams typical, each head

Options

Can be provided with either:
- High level outputs (approximately 2-8 VDC)
- Output that mimics strain gaged devices (2-4 mV/V nominal)
2 mV/V output for use with electronics designed for strain gaged sensors

Ordering Information

Model 3800 Available Versions: ANY combination of measuring ranges and gauge length listed below is available. Available in intermediate and larger gauge lengths on special order.

Gauge Length

<table>
<thead>
<tr>
<th>Metric</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-020M</td>
<td>20.0 mm</td>
</tr>
<tr>
<td>-025M</td>
<td>25.0 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>50.0 mm</td>
</tr>
<tr>
<td>U.S.A. -0100</td>
<td>1.000&quot;</td>
</tr>
<tr>
<td>U.S.A. -0200</td>
<td>2.000&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-250M</td>
<td>+250 mm</td>
</tr>
<tr>
<td>-500M</td>
<td>+500 mm</td>
</tr>
<tr>
<td>U.S.A. -100T</td>
<td>+10.000&quot;</td>
</tr>
<tr>
<td>U.S.A. -200T</td>
<td>+20.000&quot;</td>
</tr>
</tbody>
</table>

Model Number 3800-______-______

Example: 3800-0100-100T: 1.0 inch gauge length, +10 inches measuring range (+100% strain), temperature range of -40 °F to 210 °F

Visit our website at www epsilontech.com
Contact us for your special testing requirements.
High Temperature Furnace Extensometers

- **Model 3448**: High Temperature Self-Supporting Extensometers (1200 °C)
- **Model 3549**: High Temperature Hot Mountable Furnace Extensometers (1200 °C or 1600 °C)
- **Model 3648**: High Temperature Capacitive Extensometers (1200 °C or 1600 °C)
- **Model 7650A**: High Temperature, Extended Performance Capacitive Extensometers (1200 °C or 1600 °C)
- **Model 7642**: High Temperature Un-Cooled Extensometers (700 °C)

**High Temperature Axial Extensometers**

(Above 200 °C or 400 °F)
Designed for use with furnaces and induction heating systems, these extensometers use Epsilon’s exclusive, self-supporting design. A wide range of options cover most testing applications.

Epsilon developed this unique high temperature extensometer for testing metals, ceramics, and composites at the high temperatures produced by furnaces and induction heating systems. A combination of features make these extensometers easier to use and better in performance than other similar high temperature extensometers.

The units are held on the specimen by light, flexible ceramic fiber cords. These make the extensometer self-supporting on the specimen. No furnace mounting brackets are required. The side load on the test sample is greatly reduced because of the self-supporting design and light weight of the sensor. Most materials testing furnaces with a side cut-out for an extensometer will readily accept a Model 3448. For induction heating systems, a different ceramic cord placement allows the extensometer to easily pass between the coils.

The combination of radiant heat shields and convection cooling fins allow this model to be used at specimen temperatures up to 1200 °C (2200 °F) without any cooling. An optional tiny air fan does enhance stability at the highest temperatures and is recommended for the highest accuracy and for tests with small elongations. The fan comes with a magnetic base for support so it can be mounted at any convenient location near the extensometer. Fan cooling is not generally needed for induction heated systems. High purity alumina ceramic rods are used. These are available in lengths as required to fit your furnace. A spare set is included with every extensometer. Specify chisel, vee chisel or conical contact points as desired.

Most units operate equally well in tension and compression. Thus tensile, compression and cyclic tests like low cycle fatigue can all be performed with a single unit.

For vacuum furnaces, special models are available. Epsilon can also provide a radiant heat transfer cooled version. This requires that the extensometer module be surrounded by a water cooled enclosure with a front slot for the ceramic rods.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Mechanical overtravel stops in both directions.
- Most standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request. Rod length configurations can affect the final class rating.
- All units come with high purity alumina ceramic rods.
- Mounts with flexible ceramic fiber cords. Very simple to install, this Epsilon exclusive design eliminates the need for external support brackets. Low contact force does not vary during testing like some externally supported extensometers.
- Use without cooling to 1200 °C (2200 °F). Optional small fan improves stability at highest temperatures.
- Versions available for use in vacuum and controlled atmospheres. Radiant heat transfer cooled versions are available for these applications.
- May be used on nearly any furnace with side entry cut-out for extensometers. Alternate configuration available for insertion between coils of induction heaters.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Includes high quality foam lined case, a spare set of ceramic rods, and eight ceramic fiber cords.

Specifications

- Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
- Output: 2 to 4 mV/V, nominal, depending on model
- Linearity: ≤0.15% of full scale measuring range, depending on model
- Temperature Range: Ambient to 1200 °C max (2200 °F), all versions
- Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
- Contact Force: Adjustable, approximately 200 g depending on configuration
- Operating Force: 10 to 20 g typical

Options

Air cooling fan, add suffix -AC
Ceramic cord orientation for furnaces or induction heaters (specify)
Specify rod tip style desired; available choice are straight chisel, vee chisel, or conical tip

Ordering Information

Model 3448 Available Versions: ANY combination of gauge length and measuring range listed below is available, except as noted. Ceramic rod lengths are made to fit furnaces as required. Please provide furnace dimensions at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

Gauge Length

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>10.0 mm</th>
<th>25.0 mm</th>
<th>50.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td>-010M</td>
<td>-025M</td>
<td>-050M</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>0.500&quot;</td>
<td>1.000&quot;</td>
<td>2.000&quot;</td>
</tr>
</tbody>
</table>

Measuring Range

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>% STRAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>-005¹</td>
<td>±5%</td>
</tr>
<tr>
<td>-010</td>
<td>±10%</td>
</tr>
<tr>
<td>-020</td>
<td>+20%/-10%</td>
</tr>
<tr>
<td>-050</td>
<td>±50%/-10%</td>
</tr>
</tbody>
</table>

¹ For 10 mm and 0.5 inch gauge lengths, the 5% strain range is only available with short ceramic rods.

Example: 3448-0100-020: 1.000 inch gauge length, +20%/-10% measuring range, temperature range of -40 °F to 2200 °F

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
This model can be connected to the test sample in a few seconds.

With very low sensitivity to vibrations, this hot mountable unit is ideal for the demanding requirements of strain controlled, elevated temperature axial testing and other common test methods.

The Model 3549 is a major advancement in the design of externally mounted, furnace extensometers. This new extensometer is designed to meet the stringent requirements of strain controlled testing as prescribed in ISO 6892, while introducing many new innovative features that help improve productivity with static testing applications (tension and compression testing) and long term testing such as low cycle fatigue and creep. The overall design reduces any influence from common lab environment vibrations. This unit also incorporates a new feature that allows the user to precisely set the contact force against the test specimen. This allows for even and repeatable contact force, limiting contact force induced errors. This extensometer mounts on a slide bracket (included) that can attach to the load frame of your test system; optional load frame mounting brackets are available. The gauge length for the 3549 is automatically set prior to mounting on the test specimen, which allows for hot mounting after thermal equilibrium has been reached.

The Model 3549 standard temperature version is made for use in split type materials testing furnaces to 1200 °C (2200 °F) and includes water-cooled bracketry. The high temperature option allows use to 1600 °C (2900 °F). These extensometers can be used in carousel systems for rapid high temperature testing.

The standard temperature version (to 1200 °C) is supplied with high purity alumina rods. The high temperature option is furnished with alpha grade silicon carbide rods. Rods are made to order to the length required for your furnace. Mounting brackets may be integrated with the furnace cut-out. Epsilon can also provide load frame mounting brackets to fit your test frame.

The Model 3549 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.
**Features**

- May be left on through specimen failure.
- Hot mountable and retractable.
- Designed for applications requiring greater than ±2.5 mm (±0.10 inches) full scale measuring range. For applications requiring smaller full scale ranges, see Model 7650A (page 30) or Model 3648 (page 28).
- Designed to meet the demanding requirements of strain controlled testing, such as required by ISO 6892, as well as more common testing. The 3549 is designed to isolate the strain sensing components from external vibrations.
- The gauge length is set automatically between each test with Epsilon’s unique auto-setting mechanism, which allows the device to be mounted to the sample in seconds.
- The low contact force is easily controlled through the included contact force setting assembly. This allows for easy, repeatable placement of the extensometer on subsequent specimens with the same amount of force.
- Innovative slide mount allows the extensometer to engage the specimen once the test temperature has been achieved.
- All models can measure in both tension and compression and can be used for cyclic testing.
- The gauge length of the 3549 can be easily adjusted to virtually any gauge length through the use of gauge length spacers.
- The 3549 is designed to be used in carousel systems or with single furnaces.
- Mechanical overtravel stops in both directions.
- All units come with either high purity alumina ceramic rods (1200 °C) or alpha grade silicon carbide rods (1600 °C).
- The 3549 includes quick attach connectors for the water cooling lines and the electrical connections, which allow for easy installation of the extensometer body.
- Most standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request. Rod length configurations can affect the final class rating.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Includes high quality foam lined case and a spare set of ceramic rods.

**Specifications**

- **Excitation:** 5 to 10 VDC recommended, 12 VDC or VAC max.
- **Output:** 1.5 to 2 mV/V nominal, depending on model
- **Linearity:** ±0.15% of full scale measuring range
- **Temperature Range:** Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
- **Cable:** Integral, ultra-flexible cable, 2.5 m (8 ft) standard
- **Contact Force:** Adjustable from 50 to 400 g
- **Operating Force:** <30 g typical

**Options**

- Model 2050 constant temperature water re-circulating bath
- High temperature option (-HT suffix) for use to 1600 °C
- Load frame mounting brackets
- Connectors to interface to nearly any brand of test equipment
- Specify rod tip style desired; available choices are straight chisel, vee chisel, or conical tip

**Ordering Information**

Model 3549 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

**Gauge Length**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td></td>
</tr>
<tr>
<td>-010M</td>
<td>10.0 mm</td>
</tr>
<tr>
<td>-025M</td>
<td>25.0 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>50.0 mm</td>
</tr>
<tr>
<td>U.S.A.</td>
<td></td>
</tr>
<tr>
<td>-0050</td>
<td>0.500&quot;</td>
</tr>
<tr>
<td>-0100</td>
<td>1.000&quot;</td>
</tr>
<tr>
<td>-0200</td>
<td>2.000&quot;</td>
</tr>
</tbody>
</table>

**Measuring Range**

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>% STRAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>-010</td>
<td>±10%</td>
</tr>
<tr>
<td>-020</td>
<td>+20%/-10%</td>
</tr>
<tr>
<td>-050</td>
<td>+50%/-10%</td>
</tr>
<tr>
<td>-100</td>
<td>+100%/-5%</td>
</tr>
</tbody>
</table>

**Temperature Range**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ST</td>
<td>Ambient to 1200 °C (Ambient to 2200 °F)</td>
</tr>
<tr>
<td>-HT</td>
<td>Ambient to 1600 °C (Ambient to 2900 °F)</td>
</tr>
</tbody>
</table>

1 Not available in 10 mm, 12.5 mm, or 0.5 inch gauge lengths.
2 Not available in 50 mm or 2 inch gauge lengths.

Example: 3549-025M-050-HT: 25 mm gauge length, +50%/-10% measuring range, high temperature option (room temperature to 1600 °C)
This model was designed for low strain applications for use with split type materials testing furnaces or induction heaters. It features very low specimen contact force and includes a slide bracket for mounting. Water cooling allows use to 1200 °C (2200 °F) standard or 1600 °C (2900 °F) with the high temperature option.

These extensometers use a high temperature capacitive sensor in combination with an innovative design to achieve high accuracy strain measurements in low measuring ranges not possible with other high temperature extensometers. They mount on a slide bracket (included) that can attach to the load frame of your test system; optional load frame mounting brackets are available. The overall design reduces any influence from common lab environment vibrations.

The standard temperature version (to 1200 °C) is supplied with high purity alumina rods. The high temperature option is furnished with alpha grade silicon carbide rods. Rods are made to order to the length required for your furnace. These units are made to order in many different gauge lengths and measuring ranges.

The extensometer comes with a signal conditioner. The output is an analog DC voltage, factory calibrated with the extensometer to 0 to ±10 VDC typically. They are readily interfaced with most existing test controllers and may be directly connected to data acquisition systems and chart recorders. Bringing the signal into a spare DC input channel (or external input) on the test controller allows the extensometer to be used for strain controlled tests like low cycle fatigue.
Features

- May be left on through specimen failure.
- Hot mountable and retractable.
- Designed for those applications requiring ±2.5 mm (±0.10 inches) full scale measuring range or less. For applications requiring greater measuring ranges, see Model 3549 (page 26).
- A signal conditioner and power supply included. Provides high level DC voltage output with exceptionally low noise (typical 0.1 mV on 10VDC output). Easily interfaced to test controllers, data acquisition boards, and chart recorders.
- Hot mountable and retractable.
- Shipped fully calibrated with electronics (traceable to NPL) with user specified voltage output.
- All models can measure in both tension and compression and can be used for cyclic testing.
- Mechanical overtravel stops in both directions.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request.
- Includes high quality foam lined case and a spare set of ceramic rods.
- Innovative slide mount allows the extensometer to engage the specimen once the test temperature has been achieved.
- Low strain range, high resolution versions available.

Specifications

Input: Includes power supply for your country (specify)
Output: User specified, +/-5 VDC or +/-10 VDC typical
Linearity: 0.15% of full scale measuring range (rod length dependent)
Temperature Range: Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Contact Force: Adjustable up to 150 g (30-50 g typically used)
Operating Force: <10 g typical

Options

Model 2050 constant temperature water re-circulating bath
High temperature option (-HT suffix) for use to 1600 °C
Load frame mounting brackets
Specify rod tip style desired. Available choice are:
- Straight chisel, vee chisel, conical tip

Model 2050 Constant Temperature Re-Circulation Bath

This bath provides the controlled temperature flow for water-cooled extensometers. Capable of cooling or heating the water, temperature is maintained within 0.1 °C. These units are ideal for obtaining the maximum stability of any water-cooled extensometer.

Ordering Information

Model 3648 Available Versions: ANY combination of gauge length and measuring range listed below is available, except as noted. Ceramic rod lengths are made to fit furnaces as required. Please provide furnace dimensions at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td></td>
</tr>
<tr>
<td>-010M</td>
<td>10.0 mm</td>
</tr>
<tr>
<td>-0125M</td>
<td>12.5 mm</td>
</tr>
<tr>
<td>-025M</td>
<td>25.0 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>50.0 mm</td>
</tr>
<tr>
<td>U.S.A.</td>
<td></td>
</tr>
<tr>
<td>-0050</td>
<td>0.500&quot;</td>
</tr>
<tr>
<td>-0100</td>
<td>1.000&quot;</td>
</tr>
<tr>
<td>-0200</td>
<td>2.000&quot;</td>
</tr>
</tbody>
</table>

Temperature Range

- ST Ambient to 1200 °C (RT to 2200 °F)
- HT Ambient to 1600 °C (RT to 2900 °F)

1 Please consult the factory for specific gauge length requirements.
2 ±2.5 mm (±0.10 inch) maximum allowable measuring range for any given gauge length.

Example: 3648-010M-003-ST: 10.0 mm gauge length, ±3.0% (±0.30 mm) measuring range, standard temperature option (room temperature to 1200 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
This high precision extensometer measures axial strains on specimens at temperatures up to 1600 °C (2900 °F). Compatible with materials testing furnaces or induction heating. May be used for strain-controlled, high frequency fatigue tests. Slide mounting system enables mounting to hot specimens in seconds.

Model 7650A extensometers measure strains with extremely high precision due to their design features and low strain range. All models are capable of tension and compression strain measurement, and may be used for fatigue testing under fully reversed load and strain conditions at frequencies up to 10 Hz.

All 7650A models mount rigidly on the load frame and incorporate slide mounting to bring the extensometer into contact with the specimen. The gauge length is set automatically before mounting on the test specimen, which allows for hot mounting after thermal equilibrium has been reached.

These units are specifically designed to provide high accuracy, high resolution measurements and perform high temperature fatigue testing at the highest possible frequencies. They incorporate capacitive sensors for low operating force and include electronics with programmable filtering and multi-point linearization for improved performance and accuracy. The overall design minimizes, and in many cases virtually eliminates, any influence from common lab environment vibrations.

These water-cooled extensometers are equipped with high purity alumina rods for specimen contact when testing to 1200 °C (2200 °F). Silicon carbide rods are used for the 1600 °C (2900 °F) high temperature option.

*The Model 7650A is often customized for specific test needs. Contact Epsilon for a configuration that matches your requirement.*
Features

- May be left on through specimen failure.
- Hot mountable and retractable.
- Self-setting gauge length with fine adjustment feature.
- All models can measure in both tension and compression and may be used for cyclic testing at test frequencies up to 10 Hz.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request.
- Ships fully calibrated with calibration that is traceable to NPL; voltage output may be user-specified (typically 0-10V).
- Excellent ambient vibration rejection; primary vibration mode >100 Hz typical.
- Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
- Includes high speed analog and digital outputs.
- Web-based user interface for setup and data acquisition.
- Selectable analog and digital filter options from 2 Hz to 3 kHz.
- Built-in calibration reference and auto-zero features.
- Multiple extensometer calibration files may be loaded for use with one controller.
- Can be used with specimens at elevated temperatures while only requiring room temperature calibration.
- Quick-disconnect water cooling fittings and signal cables.
- Includes high quality foam lined case and a spare set of rods.

Specifications

Analog Output: User specified, ±10VDC typical, ±10.8VDC rail
Digital Output: 24 bit high speed Ethernet output with built-in web interface
Cyclic Testing: up to 10 Hz, depending on test system and test amplitude
  Linearity: 11 point digital linearization, ≤0.1% FS typical linearity
  Hysteresis: ≤0.1% FS typical
Resolution: <75 PPM (0.0075%FS) RMS @ 4 kHz, <6PPM (0.006%FS) @ 100 Hz at gauge length
Filter: Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
Temperature Range: Standard (-ST) is to 1200 °C (RT to 2200 °F), optional (-HT) 1600 °C (RT to 2900 °F)
Sensor Cables: 2 m (6.5 ft) room temperature cables
Output Cables: Flexible 2.4 m (8 ft) analog output cables
Operating Force: <30 grams typical
Contact Force: <560 grams typical
Environment: Recommended for testing in dry air, inert / non-corrosive gases, or vacuum
Power: Includes power supply for your country

Options

- High temperature option (-HT suffix) for use to 1600 °C
- Load frame mounting brackets
- Bulkhead adapters for use in vacuum chambers
- Model 2050 constant temperature water re-circulating bath
- Connectors to interface to nearly any brand test equipment
- Specify rod tip style desired. Available choices: straight chisel, vee chisel, or conical.

Ordering Information

Ceramic rod lengths are made to fit furnaces as required. Provide furnace dimensions and electrical outlet type at time of ordering.
Requires external mounting brackets and 110 - 240VAC / 4W electrical power.
Water cooling is recommended; required for 1000 °C and above.
Other configurations are available with special order; please contact Epsilon to discuss your requirements.

Model Number 7650A-

Example: 7650A-025M-020M-ST: 25 mm gauge length, +2.0 / -1.0 mm measuring range, standard temperature range (room temperature to 1200 °C)
For use in environmental chambers where the entire extensometer must be exposed to elevated temperatures. These capacitive extensometers may be used up to 700 °C (1300 °F) without any cooling.

These extensometers use a high-temperature capacitive sensor and do not require any cooling. They will operate up to the maximum temperature limit of most environmental chambers used in materials testing. The Model 7642 is ideal for testing composites, metals and high temperature polymers in tensile, compression or cyclic testing. All units can be displaced in both compression and tension.

The extensometer is supplied with the advanced DT6229 controller. The standard output is 0-10VDC analog signal, factory calibrated with the extensometer. This system provides a number of functional enhancements, including high speed digital output, built in calibration and tare functions, analog and digital filters, and more.

The 7642 is readily interfaced with most existing test controllers, and may be directly connected to a data acquisition system or chart recorder, or directly to a PC. The 7642 may be used for strain controlled tests such as low cycle fatigue (LCF).
**Features**

- May be left on through specimen failure.
- Improved performance at high temperature.
- Reduced size and weight, and improved high frequency performance up to 100 Hz.
- Improved noise rejection.
- Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
  - Includes high speed analog and digital outputs
  - Intuitive web-based user interface for setup, calibration, and data acquisition
  - Built-in calibration reference and auto-zero features
  - Multiple extensometer calibration files may be loaded for use with one controller
  - Multiple temperature-specific calibrations may be stored
  - Selectable analog and digital filter options from 2 Hz to 3 kHz
- Ships fully calibrated with electronics with user specified voltage output. (traceable to NPL).
- All models can measure in both tension and compression and may be used for cyclic testing.
- Mechanical over-travel stops.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request.
- Hardened tool steel knife edges are easily replaced. A spare set comes with every extensometer.
- Includes high quality foam lined case and a spare set of knife edges.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.

**Specifications**

- **Analog Output:** User specified, +/-5 VDC or +/-10VDC typical, ±10.8VDC rail
- **Digital Output:** 24 bit high speed Ethernet output with built-in web interface
- **Linearity:** 11 point linearization, ±0.1% FS typical linearity
- **Resolution:** <55 PPM (0.006%FS) RMS @4 kHz, <8 PPM (0.0006%FS) @100 Hz
- **Cyclic Testing:** >25 Hz typical, up to 100 Hz with small travel units, @0.5 mm travel
- **Analog Filter:** Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
- **Temperature Range:** Ambient to 700°C (1300°F). Use up to 800 °C is possible – contact Epsilon for details. Wire forms may require periodic adjustment or replacement after long-term testing above ~600 °C.
  - **Temperature Sensitivity (Gain):** <100 PPM/°C (0.01%FS/°C) typical
  - **Temperature Sensitivity (Offset):** 20 PPM/°C (0.002%FS/°C) typical
- **Sensor Cable:** 0.7 m (2.5 ft) tri-axial high temperature cable, plus 1.5 m (5 ft) room temperature extension cable
- **Standard Quick Attach Kit:** Fits round samples up to Ø15 mm (0.60”). Fits flat samples up to 50 mm (2.0”) wide with thicknesses up to 6.35 mm (0.25”), and up to 19 mm (0.75") wide with thicknesses from 6.35 mm to 12.5 mm (0.25” to 0.50”)
- **Operating Force:** <100 g typical
- **Environment:** Recommended for elevated temperature testing in dry air, inert / non-corrosive gases, or vacuum
- **Power:** Includes power supply for your country (specify)

**Options**

- Gauge length adapter kits (for use at temperatures ≤ 300 °C (570 °F))
- Connectors to interface to nearly any brand test equipment
- Bulkhead adapters for vacuum chambers
- Dual-channel DT6229 controller available

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**Ordering Information**

Model 7642 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

**Gauge Length**

<table>
<thead>
<tr>
<th>METRIC</th>
<th>MEASURING RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-010M</td>
<td>10.0 mm</td>
</tr>
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</tr>
<tr>
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<tr>
<td>-050M</td>
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<tr>
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<tr>
<td>-0200</td>
<td>2.00”</td>
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<table>
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<tr>
<th>METRIC</th>
<th>MEASURING RANGE</th>
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</thead>
<tbody>
<tr>
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<td>+2.5/-0.5 mm*</td>
</tr>
<tr>
<td>-075M</td>
<td>+7.5/-1.5 mm**</td>
</tr>
<tr>
<td>-125M</td>
<td>+12.5/-1.5 mm**</td>
</tr>
</tbody>
</table>

**Example:** 7642-0100-030T: 1.00” gauge length, +0.30”/-0.05” measuring range

Visit [www.epsilontech.com](http://www.epsilontech.com) to see more extensometry Contact us for your special testing requirements.
For fracture mechanics studies, these COD gages are in compliance with standardized test methods, such as ASTM E1820 for determination of fracture toughness properties of metallic materials.

The Model 3541 is designed for determination of fracture mechanics parameters such as JIC, KIC, R-curve, fatigue crack growth rate (da/dN), and testing to standards such as E1820, E399, E647, etc. These COD gages conform to the requirements of E1820 (the replacement for E813 and E1737) for JIC and R-curve determination. Special configurations are available to meet the requirements of ASTM E399 for fracture toughness (please consult the factory for these configurations). In addition, the modified groove design complies with E1820 tests where greater stability and accuracy results from the sharper groove root. Clip-on gages are used for a variety of fracture mechanics tests, including compact tension, arc shaped, disk shaped, bend specimens or other specimen geometries in compliance with ASTM and other standards organization’s test methods. Clip-on gages can be used directly on test specimens where the knife edges are integral with the test specimen or, alternately, with optional bolt-on knife edges mounted on the test specimen.

Model 3541 crack opening displacement gages are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Fully enclosed gages are protected from accidental damage.
- All standard units meet ASTM E1820, ISO 12135, and ISO 9513 Class 0.5 requirements for accuracy. A test certificate for ASTM E1820 is included. Models are available in 2.5 and 4.0 mm (0.10 and 0.15 inch) measuring ranges for ASTM E399 accuracy requirements. A test certificate for ASTM E399 is included with those models.
- Sharp grooves per ASTM E1820, E813, and E399 for improved stability when mounted.
- For da/dN testing or pre-cracking, where maximum frequency (>50 Hz) is required, minimum measuring ranges are recommended.
- For KIC/JIC testing, maximum accuracy is achieved with the smallest measuring range and the largest gauge length that will perform the test.
- Maximum operating frequency may be from 5 Hz to >200 Hz depending on COD gage and test apparatus configurations.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Includes high quality foam lined case.

Specifications

Exitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.15% of full scale measuring range
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Operating Force: 9 to 14 N (2 to 3 lbs), depending on model

Options

Connectors to interface to nearly any brand of test equipment
Available in special versions, including setups for narrow grips or severe environments
Bolt on knife edges

Ordering Information

Model 3541 Available Versions: The following combinations of gauge length and measuring range listed below are available as standard, except as noted. All are available in any temperature range listed. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>-012M</td>
<td>12.0 mm</td>
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<tr>
<td>-020M</td>
<td>20.0 mm</td>
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<tr>
<td>US.A.</td>
<td></td>
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<tr>
<td>-0010</td>
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<tr>
<td>-0020</td>
<td>0.200&quot;</td>
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<tr>
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<td>0.475&quot;</td>
</tr>
<tr>
<td>-0050</td>
<td>0.500&quot;</td>
</tr>
<tr>
<td>-025M</td>
<td>+2.5 mm/-1.0 mm</td>
</tr>
<tr>
<td>-040M</td>
<td>+4.0 mm/-1.0 mm</td>
</tr>
<tr>
<td>-070M</td>
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</tr>
<tr>
<td>-100M</td>
<td>+10.0 mm/-1.0 mm</td>
</tr>
<tr>
<td>-120M</td>
<td>+12.0 mm/-2.0 mm</td>
</tr>
</tbody>
</table>

Special Model for Other Fracture Mechanics Testing

Special units are available for other fracture mechanics tests. For example, the photo to the right shows a gage for ASTM E1304, Standard Test Method for Plane-Strain (Chevron-Notch) Fracture Toughness of Metallic Materials. This example was produced for a 1 inch diameter bar, with 0.4 inches of measuring range. Its performance, design, and accuracy is an enhancement of the design recommended in E1304.
High temperature COD gages for use in split type materials testing furnaces with a slot for the ceramic rods. Water-cooled and furnace bracket mounted, these extensometers are for use to 1200 °C (2200 °F). The high temperature option allows use to 1600 °C (2900 °F). They are specifically designed for fracture mechanics testing.

These COD gages mount on a water-cooled bracket, which is mounted on the furnace side cut-out or with optional load frame support brackets. The standard temperature version (to 1200 °C) is supplied with high purity alumina rods. The high temperature option is furnished with alpha grade silicon carbide rods. Rods are made to order to the length required for your furnace. Mounting brackets may be integrated with the furnace cut-out. Epsilon can also provide optional load frame mounting brackets to fit your test frame. Contact edges on the test sample should be somewhat rounded (not sharp knife edges) for best performance with this model.

The Model 3548COD extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- All standard units meet existing ASTM E1820 requirements for accuracy. A test certificate is included.
- For KIC/JIC testing, maximum accuracy is achieved with the smallest measuring range and the largest gauge length that will perform the test.
- All units come with either high purity alumina ceramic rods (1200 °C) or alpha grade silicon carbide rods (1600 °C).
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Includes high quality foam lined case and a spare set of ceramic rods.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.15% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Operating Force: <30 g typical

Options

Load frame mounting brackets
High temperature option (-HT suffix) for use to 1600 °C
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3548COD Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Ceramic rod lengths are made to fit furnaces as required. Please provide furnace dimensions at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td></td>
</tr>
<tr>
<td>-005M</td>
<td>5.0 mm</td>
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<tr>
<td>-008M</td>
<td>8.0 mm</td>
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<td>12.0 mm</td>
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<td>0.300&quot;</td>
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<td>-0050</td>
<td>0.500&quot;</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>METRIC</td>
<td></td>
</tr>
<tr>
<td>-025M</td>
<td>+2.5 mm</td>
</tr>
<tr>
<td>-040M</td>
<td>+4.0 mm</td>
</tr>
<tr>
<td>-070M</td>
<td>+7.0 mm</td>
</tr>
<tr>
<td>-100M</td>
<td>+10.0 mm</td>
</tr>
<tr>
<td>-120M</td>
<td>+12.0 mm</td>
</tr>
<tr>
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</tr>
<tr>
<td>-100T</td>
<td>+0.100&quot;</td>
</tr>
<tr>
<td>-150T</td>
<td>+0.150&quot;</td>
</tr>
<tr>
<td>-200T</td>
<td>+0.200&quot;</td>
</tr>
<tr>
<td>-250T</td>
<td>+0.250&quot;</td>
</tr>
<tr>
<td>-500T</td>
<td>+0.500&quot;</td>
</tr>
</tbody>
</table>

Model Number 3548COD-____-____-____-____-____-

Temperature Range

- ST  Ambient to 1200 °C (Ambient to 2200 °F)
- HT  Ambient to 1600 °C (Ambient to 2900 °F)

1 Only available in small measuring ranges (rod length dependent).

Example: 3548COD-0050-200T-HT: 0.500 inch compressed gauge length, +0.20 inch measuring range, high temperature option (room temperature to 1600 °C (2900 °F))

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Designed for fracture mechanics testing in environmental chambers where the entire gage must be exposed to elevated temperatures.

These capacitive sensors may be used up to 700 °C (1300 °F) without any cooling.

These COD gages use a high-temperature capacitive sensor and do not require any cooling. They will operate up to the maximum temperature limit of most environmental chambers used in materials testing. The Model 7641 is ideal for determination of fracture mechanics parameters such as JIC, KIC, R-curve, fatigue crack growth rate (da/dN), and testing to standards such as E1820, E399, E647, etc. All units can be displaced slightly in compression for ease of installation.

The COD gage is supplied with the advanced DT6229 controller. The standard output is 0-10VDC analog signal, factory calibrated with the COD gage. This system provides a number of functional enhancements, including: high speed digital output, built in calibration and tare functions, analog and digital filters, and more.

The 7641 is readily interfaced with most existing test controllers, and may be directly connected to a data acquisition system or chart recorder, or directly to a PC. The 7641 may be used for strain controlled tests such as JIC.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features
- May be left on through specimen failure.
- Improved performance at high temperature.
- Improved noise rejection, resolution, and accuracy.
- Improved clearance with most clevis designs.
- Improved linearity and reduced stiffness.
- Reduced size and weight, and improved high frequency performance.
- All standard models are suitable for cyclic testing.
- >25 Hz is typical for 10mm GL and larger, up to 100 Hz for some configurations
- Typically limited by the user’s test apparatus, software settings, and filter selection
- Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
- Includes high speed analog and digital outputs
- Intuitive web-based user interface for setup, calibration, and data acquisition
- Built-in calibration reference and auto-zero features
- Multiple extensometer calibration files may be loaded for use with one controller
- Multiple temperature-specific calibrations may be stored
- Selectable analog and digital filter options from 2 Hz to 3 kHz
- Ships fully calibrated with electronics (traceable to NPL (UK)) with user specified voltage output.
- Mechanical over-travel protection.
- All standard units meet ASTM E1820, ASTM E399, ISO 12135, and ISO 9513 Class 1 requirements for accuracy. A test certificate for ASTM E1820 is included. ASTM E399 or ISO 12135 test certificates are available upon request.
- Durable stainless steel knife edges.
- Includes high quality foam lined case.
- Rugged, dual flexure design for strength and improved performance. The next-generation design enables cyclic testing at much higher frequencies.

Specifications
- Analog Output: User specified, +/-5 VDC or +/-10VDC typical, ±10.8VDC rail
- Digital Output: 24 bit high speed Ethernet output with built-in web interface
- Linearity: 11 point linearization, ±0.1% FS typical linearity
- Resolution: <55 PPM (0.006%FS) RMS @4 kHz, <6 PPM (0.0006%FS) @100 Hz
- Cyclic Testing: >25 Hz typical @10 mm GL, >10 Hz @5 mm GL
- Analog Filter: Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
- Temperature Range: Ambient to 700 °C (1300 °F). Use up to 800 °C is possible – contact Epsilon for details. Springs may require periodic adjustment or replacement after long-term testing above ~600 °C.
- Temperature Sensitivity (Gain): <100 PPM/°C (0.01%FS/°C) typical
- Temperature Sensitivity (Offset): 20 PPM/°C (0.002%FS/°C) typical
- Sensor Cable: 0.7 m (2.5 ft) tri-axial high temperature cable, plus 1.5 m (5 ft) room temperature extension cable
- Operating Force: 1-5 kg typical, depending on model
- Environment: Recommended for elevated temperature testing in dry air, inert / non-corrosive gases, or vacuum
- Power: Includes power supply for your country (specify)

Options
- Connectors to interface to nearly any brand test equipment
- Bulkhead adapters for vacuum chambers
- Bolt on knife edges for attachment to test specimens without machined attachment points

Ordering Information
Model 7641 Available Versions: ANY combination of gauge length and measuring range is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
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</tr>
<tr>
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<td>-0.20&quot;</td>
</tr>
<tr>
<td>-005M</td>
<td>-0.25&quot;</td>
</tr>
<tr>
<td>-006M</td>
<td>-0.40&quot;</td>
</tr>
<tr>
<td>-010M</td>
<td>-0.50&quot;</td>
</tr>
<tr>
<td>-012M</td>
<td>-0.75&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-025M</td>
<td>+0.25 mm *</td>
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<tr>
<td>-040M</td>
<td>+0.40 mm *</td>
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<tr>
<td>-060M</td>
<td>+0.60 mm **</td>
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<tr>
<td>-080M</td>
<td>+0.80 mm **</td>
</tr>
<tr>
<td>-100M</td>
<td>+1.00 mm **</td>
</tr>
<tr>
<td>-125M</td>
<td>+1.25 mm **</td>
</tr>
</tbody>
</table>

Example: 7641-010M-060M: 10.0 mm gauge length, +6.0 mm measuring range
Widely used for measuring deformations in three and four point bend tests, compression tests and a variety of general purpose deformations. These strain gaged devices come with a magnetic base for easy mounting.

Deflection is measured with a single arm with an attached spherical contact tip, similar to those on a dial indicator. The full bridge strain gaged construction provides an electrical output compatible with any electronics designed for a strain gaged transducer.

The magnetic base furnished with the gage can be mounted to the desired reference surface, whether flat or round. The tip can then be positioned to measure the deformation encountered during the test. The magnetic base can only be used for low and standard temperature testing. Elevated temperature testing requires additional support considerations.

All models feature a spring loaded arm that can break free in the event of excessive displacement, protecting the deflection gauge from damage. The upper arm exerts a small spring force against the specimen, which is sufficient to allow dynamic cyclic testing if desired, yet light enough in force to avoid influence on the test.

These units come standard with the arm set to measure downward deflections when oriented in the upright position. They can be used upside down or in any orientation. They may also be configured with the extensometer arm spring loaded downward. Specify this if desired. Note that the measuring ranges listed are total displacement.

The Model 3540 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

• Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
• General purpose deflection sensor covers many test requirements.
• Comes with an adjustable magnetic base for easy mounting.
• Spring loaded arm detaches to prevent damage from overtravel.
• Meets ASTM and ISO accuracy classes as follows:
  -001M, -004M, -006M, -005T, -015T, -025T:
    ASTM E2309 Class A
    ISO 9513 Class 1
  -012M, -025M, -050M, -050T, -100T, -200T:
    ASTM E2309 Class B
    ISO 9513 Class 2
    ASTM E83 Class C (assuming 50 mm gauge length per D790 and D6272)
• All standard units have linearity of 0.25% of FS or better.
• Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
• Rugged, dual flexure design for improved performance.
• Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V, nominal, depending on model
Linearity: ≤0.25% of full scale measuring range
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
  Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral ultra-flexible cable, 2.5 m (8 ft) standard
Operating Force: 50 g typical

Options

Connectors to interface to nearly any brand of test equipment
Arm orientation

Ordering Information

Model 3540 Available Versions: ANY combination of measuring range and temperature range listed below is available. Other configurations may be available with special order, please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td></td>
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<td>4.0 mm</td>
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<td></td>
<td>-006M</td>
<td>6.0 mm</td>
</tr>
<tr>
<td></td>
<td>-012M</td>
<td>12.0 mm</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>-005T</td>
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</tr>
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<td>-015T</td>
<td>0.150&quot;</td>
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<tr>
<td></td>
<td>-025T</td>
<td>0.250&quot;</td>
</tr>
<tr>
<td></td>
<td>-050T</td>
<td>0.500&quot;</td>
</tr>
<tr>
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<td>1.000&quot;</td>
</tr>
<tr>
<td></td>
<td>-200T</td>
<td>2.000&quot;</td>
</tr>
</tbody>
</table>

Temperature Range:

- LT -270 °C to 100 °C (-454 °F to 210 °F)
- ST -40 °C to 100 °C (-40 °F to 210 °F)
- HT1 -40 °C to 150 °C (-40 °F to 300 °F)
- HT2 -40 °C to 200 °C (-40 °F to 400 °F)
- LHT -270 °C to 200 °C (-454 °F to 400 °F)

1 Magnetic base not suitable for high temperature use: 50 °C (125 °F) max.

Example: 3540-012M-ST: 12.0 mm measuring range, standard temperature option (-40 °C to 100 °C)
3575 Transverse (Diametral) Extensometers

3475 Miniature Transverse Diametral Extensometers

3575AVG Sheet Metal r-Value Extensometers

Transverse and Diametral Extensometers
Designed for general purpose transverse or diametral strain measurement on axially loaded specimens. This model may be used simultaneously with the Model 3542 axial extensometer.

Self-supporting on the test sample, these extensometers will work on any width or diameter specimen from 0 to 25 mm (1 inch). They are commonly used for measurement of Poisson’s ratio, for transverse measurements with anisotropic materials like many composites and for sheet metal testing such as r-value determination. Most often they are used simultaneously with Epsilon’s axial extensometers.

These units easily clip onto the sample and are held in place with an integral spring. Rounded contact edges maintain the position on the specimen. All are high accuracy strain gaged units, compatible with most test controllers.

The Model 3575 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.

Shear Metal r-Value Determination with Models 3575 and 3542

The Model 3575 may be used simultaneously with a Model 3542 axial extensometer to measure r-value. Many researchers are now using only this single lateral measurement for their tests, rather than the older method using three manual measurements. An alternative unit with dual lateral measurements is the Model 3575AVG, which averages transverse readings over two locations.
Features

• May be left on through specimen failure.
• Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
• Suitable for measuring Poisson’s ratio per ASTM E132 with most materials and specimens.
• All models will measure both positive and negative displacements.
• Easy to mount, with integral springs to keep the extensometer on the sample.
• Self-supporting on the specimen.
• All standard units have linearity readings of 0.20% or better.
• Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
• Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
• Includes high quality foam lined case and spare set of tool steel knife edges.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Works with samples up to 25 mm (1 inch) width or diameter

Options

Connectors to interface to nearly any brand of test equipment
Specialty knife edges (see page 102)

Ordering Information

Model 3575 Available Versions: ANY combination of measuring range and temperature range listed below is available. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>±0.5 mm</td>
<td>-050M</td>
<td>±0.020&quot;</td>
</tr>
<tr>
<td>±1.0 mm</td>
<td>-100M</td>
<td>±0.050&quot;</td>
</tr>
<tr>
<td>±2.5 mm</td>
<td>-250M</td>
<td>±0.100&quot;</td>
</tr>
<tr>
<td>±3.0 mm</td>
<td>-300M</td>
<td>±0.150&quot;</td>
</tr>
<tr>
<td>±5.0 mm</td>
<td>-500M</td>
<td>±0.200&quot;</td>
</tr>
</tbody>
</table>

Model Number 3575-___-___-___-___

Example: 3575-050T-ST: ±0.050 inches measuring range, standard temperature option (-40 °F to 210 °F)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.

CERTIFIED
A miniature extensometer designed for general purpose transverse or diametral strain measurements on small or thin specimens.

May be used simultaneously with the Model 3442 miniature axial extensometers or the Model 3542 axial extensometers.

These very lightweight extensometers are self-supporting on the test sample. They are used for measuring transverse or diametral strain. Often they are used simultaneously with an Epsilon axial strain measuring extensometer to determine Poisson’s ratio. They also are used for characterizing materials with anisotropic properties, such as with many composite materials.

This model clips easily onto the sample with an integral spring to hold the unit in place. It can be adjusted to work on any size sample from 0 to 25 mm (1 inch) width or diameter. The Model 3475 has an arm thickness of only 3.81 mm (0.15 inches), and will work simultaneously with any axial extensometer having sufficient clearance between arms (not all versions of the 3442 miniature extensometer can be used). Large radius contacts prevent the unit from digging into the samples. This model utilizes Epsilon’s dual flexure design, allowing use in dynamic applications. All units have measuring ranges in both directions.

The Model 3475 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Suitable for measuring Poisson's ratio per ASTM E132 with most materials and specimens.
- All models will measure both positive and negative displacements.
- Easy to mount, with integral springs to keep the extensometer on the sample.
- Self-supporting on the specimen.
- All standard units have linearity readings of 0.20% or better.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V, depending on model
Linearity: ±0.020% of full scale measuring range
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft m) standard
Specimen Size: Works with samples up to 25 mm (1 inch) width or diameter

Ordering Information

Model 3475 Available Versions: ANY combination of measuring range and temperature range listed below is available. Other configurations may be available with special order, please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>±0.25 mm</th>
<th>±0.50 mm</th>
<th>±1.00 mm</th>
<th>±1.25 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC -025M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>METRIC -050M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>METRIC -100M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>METRIC -125M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA -010T</td>
<td>±0.010&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA -020T</td>
<td>±0.020&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA -040T</td>
<td>±0.040&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA -050T</td>
<td>±0.050&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Temperature Range

- LT -270 °C to 100 °C (-454 °F to 210 °F)
- ST -40 °C to 100 °C (-40 °F to 210 °F)
- HT1 -40 °C to 150 °C (-40 °F to 300 °F)
- HT2 -40 °C to 200 °C (-40 °F to 400 °F)
- LHT -270 °C to 200 °C (-454 °F to 400 °F)

Example: 3475-050M-LT: ±0.50 mm measuring range, low temperature option (-270 °C to 100 °C)

Options

Connectors to interface to nearly any brand of test equipment

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.

Epsilon Technology Corp.

Visit us on the web at www.epsilontech.com
Designed for measuring plastic strain ratio (r-value) in sheet metal testing, this extensometer averages the lateral strain at two locations. This model may be used simultaneously with the Model 3542 axial extensometer.

This extensometer is self-supporting on the sample. It has rounded contact edges which measure the sample at two locations. As the test sample is pulled, the contact edges follow the part of the sample they were mounted on, measuring lateral strain on the sample at the same location throughout the test. The extensometer has a single output, which is the average of the two lateral measurements.

These extensometers are used with a 2 inch or 50 mm gauge length Model 3542 extensometer, which measures the axial strain.

The Model 3575AVG extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure.
- Applicable for testing to ISO 10113 and ASTM E517.
- Single clip-on unit directly measures lateral strain as an average of two locations.
- Greatly speeds up testing and allows digital data collection as compared to manual measurements.
- Self-supporting on the specimen.
- Measuring range of 2.0 mm or 0.075 inches.
- All standard units have linearity readings of 0.15% or better.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Includes high quality foam lined case and spare set of tool steel knife edges.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ±0.15% of full scale measuring range
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Works with samples 9.5 to 25 mm (0.375 to 1.0 inch) width

Options

Connectors to interface to nearly any brand of test equipment
Specialty knife edges (see page 102)

Ordering Information

Model 3575AVG Available Versions: ANY combination of measuring range and temperature range listed below is available, except as noted.

Measuring Range

<table>
<thead>
<tr>
<th>Metric</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200M</td>
<td>2.0 mm</td>
</tr>
<tr>
<td>-075T</td>
<td>0.075&quot;</td>
</tr>
</tbody>
</table>

Temperature Ranges

- LT -270 °C to 100 °C (-454 °F to 210 °F)
- ST -40 °C to 100 °C (-40 °F to 210 °F)
- HT1 -40 °C to 150 °C (-40 °F to 300 °F)
- HT2 -40 °C to 200 °C (-40 °F to 400 °F)
- LHT -270 °C to 200 °C (-454 °F to 400 °F)

Example: 3575AVG-200M-LT, 2.0 mm measuring range, low temperature option (-270 °C to 100 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
3580 High Temperature Diametral Extensometers (1000 °C)

7675 High Temperature Transverse Extensometers (700 °C)
For transverse or diametral strain measurements at temperatures to 1000 °C (1832 °F). These extensometers may be used with furnaces having a side entry slot for an extensometer or with induction heating systems. They utilize a proprietary, rugged dual flexure design.

This model is for diametral strain measurement with furnace and induction heating systems. Quartz rods and water-cooling allow the unit to be used for high temperature testing of metals, ceramics and composites. With induction heating, this model often can be used without water-cooling.

When used in furnaces, the extensometer is often mounted directly to the furnace side cut-out. Optional load frame mounting brackets are available for supporting the extensometer in cases where furnace mounting is not possible. These optional mounts are used with induction heating or furnace systems.

The Model 3580 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

• May be left on through specimen failure.
• Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
• All standard units have linearity readings of 0.15% or better.
• Suitable for measuring Poisson’s ratio per ASTM E132 with most materials and specimens.
• High purity alumina ceramic rods (1200 °C) or alpha grade silicon carbide rods (1600 °C) are available.
• Versions available for use in vacuum environments (consult factory).
• Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
• Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
• Each unit comes with a spare set of quartz rods, universal water-cooled mounting bracket and a foam lined storage case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ±0.15% of full scale measuring range, depending on model
Temperature Range: Standard is -40 °C to +1000 °C (-40 °F to 1832 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Works with sample diameters from 4.5 to 16 mm (0.18 to 0.63 inch)
Contact Force: Adjustable, 100 to 300 g typical

Options

Special rods are available for large specimens
Ceramic rods for testing to 1200 °C or 1600 °C
Model 2050 constant temperature water re-circulating bath
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3580 Available Versions: ANY combination of measuring range and temperature range listed below is available. Quartz rod lengths are made to fit furnaces as required. Please provide furnace and specimen dimensions at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>Metric</th>
<th>US.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-050M</td>
<td>±0.50 mm</td>
<td>±0.020&quot;</td>
</tr>
<tr>
<td>-075M</td>
<td>±0.75 mm</td>
<td>±0.030&quot;</td>
</tr>
<tr>
<td>-150M</td>
<td>1.50 mm</td>
<td>0.060&quot;</td>
</tr>
<tr>
<td>-200M</td>
<td>2.00 mm</td>
<td>0.075&quot;</td>
</tr>
<tr>
<td>-500M</td>
<td>5.00 mm</td>
<td>0.200&quot;</td>
</tr>
</tbody>
</table>

1 Total measuring range in either tension or compression. Specify direction of extensometer measuring range when ordering.
2 Special order only.

Example: 3580-030T: ±0.030 inches measuring range, temperature range of -40 °F to 1832 °F

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Designed for transverse or diametral strain measurement in environmental chambers where the entire extensometer must be exposed to elevated temperatures. These capacitive extensometers may be used up to 700 °C (1300 °F) without any cooling.

These transverse extensometers use a high-temperature capacitive sensor and do not require any cooling. They will operate up to the maximum temperature limit of most environmental chambers used in materials testing. The Model 7675 is ideal for determination of Poisson’s ratio, and for characterization of anisotropic materials such as composites. All units can accommodate both positive and negative displacements. Model 7675 transverse extensometers are compatible with most Model 7642 high-temperature axial extensometers.

The 7675 is supplied with the advanced DT6229 controller. The standard output is 0-10VDC analog signal, factory calibrated with the extensometer. This system provides a number of functional enhancements, including high speed digital output, built in calibration and tare functions, analog and digital filters, and more.
Features

• May be left on through specimen failure.
• Self-supporting on specimen.
• Improved accuracy, resolution, and noise rejection at high temperature.
• Reduced size and weight, and improved high frequency performance.
• All standard models are suitable for cyclic testing, >25 Hz is typical.
• Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
  - Includes high speed analog and digital outputs
  - Intuitive web-based user interface for setup, calibration, and data acquisition
  - Built-in calibration reference and auto-zero features
  - Multiple extensometer calibration files may be loaded for use with one controller
  - Multiple temperature-specific calibrations may be stored
  - Selectable analog and digital filter options from 2 Hz to 3 kHz
• Ships fully calibrated with electronics (traceable to NPL (UK)) with user specified voltage output.
• Mechanical over-travel protection.
• Suitable for measuring Poisson’s ratio per ASTM E132 with most materials and specimens.
• Durable stainless steel knife edges.
• Includes high quality foam lined case.
• Rugged, dual flexure design for strength and improved performance. The next-generation design enables cyclic testing at much higher frequencies.

Specifications

Analog Output: User specified, +/-5 VDC or +/-10VDC typical, ±10.8 VDC rail
Digital Output: 24 bit high speed Ethernet output with built-in web interface
Linearity: 11 point linearization, ≤0.1% of full scale typical
Resolution: ≤55 PPM (0.006%FS) RMS @4 kHz, ≤6 PPM (0.0006%FS) @ 100 Hz
Cyclic Testing: >25 Hz typical
Analog Filter: Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
Temperature Range: Ambient to 700 °C (1300 °F). Use up to 800 °C is possible – contact Epsilon for details. Springs may require periodic adjustment or replacement after long-term testing above -600 °C.
Temperature Sensitivity (Gain): <100 PPM/°C (0.01%FS/°C) typical
Temperature Sensitivity (Offset): 20 PPM/°C (0.002%FS/°C) typical
Sensor Cable: 0.7 m (2.5 ft) tri-axial high temperature cable, plus 1.5 m (5 ft) room temperature extension cable
Specimen Size: Fits round samples up to 25 mm (1.0 inch) diameter and flats to 25 mm (1.0 inch) wide
Operating Force: 1-2 kgf (30-60 oz) typical, depending on model
Environment: Recommended for elevated temperature testing in dry air, inert / non-corrosive gases, or vacuum
Power: Includes power supply for your country (specify)

Options

Reverse cable exit available
Connectors to interface to nearly any brand of test equipment
Bulkhead adapters for vacuum chambers
Dual-channel DT6229 controller
Specialty knife edges (see page 120)

Ordering Information

Model 7675 Available Versions: Available standard measuring ranges are listed below. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>-012M</td>
<td>±1.2 mm</td>
<td>±0.05&quot;</td>
</tr>
<tr>
<td>-025M</td>
<td>±2.5 mm</td>
<td>±0.10&quot;</td>
</tr>
</tbody>
</table>

*Preferred configuration

Example: 7675-025M: ±2.5 mm measuring range

Visit our website at www epsilontech com
Contact us for your special testing requirements.

MODEL 7675 EXAMPLE
3542 RA Averaging Axial Extensometers

3442 RA1 Miniature Averaging Axial Extensometers

3544 Circumferential Extensometers

3909 Extensometers for Simple Performance Testing of Asphalt

3910 Extensometers for Creep Compliance and Tensile Strength Testing of Asphalt

3911 Extensometers for Indirect Tensile Testing of Asphalt

3975 Extensometers for Diametral Rock and Concrete Testing

Rock, Concrete and Asphalt Extensometers
Designed primarily for compressive strength tests on rock, concrete and other large compression samples, this model measures axial strain on opposite sides of the test specimen, and the output is an average of the two readings. Gauge lengths from 25 to 200 mm (1 to 8 inches) and measuring ranges from 1.2 to 6 mm (0.050 to 0.250 inches) are available.

The Model 3542RA is available in a variety of configurations. All are self-supporting on the specimen and mount very easily. For tests where a single diameter specimen is typically used, the fixed diameter Model 3542RA1 is recommended. For applications where a continuously adjustable diameter extensometer is required, the Model 3542RA2 is available. The standard configuration for this model allows it to work on samples from 50 mm to 150 mm (2 inches to 6 inches). If desired, the two readings can be independent, providing two outputs. Many rock tests are done in tri-axial pressure vessels. Epsilon has versions for use in oil to 1360 bar at 200 °C (20,000 psi at 400 °F). These will fit in unusually small inside diameter vessels. For small diameter specimens, we suggest the Model 3442RA1 averaging axial extensometer.

All Model 3542RA extensometers are designed so they may be used together with the Model 3544 circumferential or Model 3975 diametral extensometer. Epsilon’s rock extensometers can withstand the punishment of daily, high volume testing. Some units have been used for several thousand tests without damage. The conical point contacts included with the extensometer are made from tungsten carbide.

The Model 3542RA extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.

The Model 3542RA1 extensometer with 50 mm gauge length

The Model 3542RA2 dual averaging rock and concrete extensometer
Features

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- High accuracy, averaging output or optional dual independent outputs.
- The 3542RA1 is configured for a single diameter size (customer specified), and the 3542RA2 works on sample diameters from 50 mm to 150 mm (2 inches to 6 inches). Special configurations of the 3542RA2 will allow for smaller diameter sizes.
- Easy mounting, attaches with integral springs.
- Self-supporting on the specimen.
- May be used simultaneously with Model 3544 circumferential extensometers or Model 3975 diametral extensometer.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is -40 °C to 100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to 200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Wide range of specimen sizes available, including AX, BX, NX and larger, to 200 mm (and 8 inches) diameters standard (larger sizes on special order)
Operating Force: <30 g typical per side

Options

Fixed or variable diameter configurations  
Dual, independent outputs  
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3542RA Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Test specimen diameter(s) must be specified at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

Model Number 3542RA

<table>
<thead>
<tr>
<th>Diameter Type 1</th>
<th>Fixed</th>
<th>Adjustable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Gauge Length

**METRIC**
- 025M: 25.0 mm
- 050M: 50.0 mm
- 080M: 80.0 mm
- 100M: 100.0 mm
- 150M: 150.0 mm
- 200M: 200.0 mm

**U.S.A.**
- 0100: 1.000”
- 0200: 2.000”
- 0300: 3.000”
- 0400: 4.000”
- 0500: 5.000”
- 0600: 6.000”
- 0800: 8.000”

Measuring Range

**METRIC**
- 120M: ±1.2 mm
- 250M: ±2.5 mm
- 600M: ±6.0 mm

**U.S.A.**
- 050T: ±0.050”
- 100T: ±0.100”
- 250T: ±0.250”

Measuring Range

**METRIC**
- 025M: 120 °C to 300 °C (-149 °F to 572 °F)
- 050M: 150 °C to 300 °C (-238 °F to 572 °F)
- 080M: 200 °C to 300 °C (-392 °F to 572 °F)
- 100M: 250 °C to 300 °C (-466 °F to 572 °F)
- 150M: 300 °C to 300 °C (-542 °F to 572 °F)
- 200M: 350 °C to 300 °C (-662 °F to 572 °F)
- 0100: 600 °C to 300 °C (1092 °F to 572 °F)

**U.S.A.**
- -050T: 600 °C to 300 °C (1092 °F to 572 °F)
- -100T: 1200 °C to 300 °C (2192 °F to 572 °F)
- -250T: 1800 °C to 300 °C (3272 °F to 572 °F)

1 Additional diameter configurations are available with special order.

Example: 3542RA1-100M-600M-ST: Fixed size, 100 mm gauge length, 6.0 mm measuring range, standard temperature option (-40 °C to 100 °C)

2” or 50 mm gauge length

MODEL 3542RA1 EXAMPLE

6” gauge length, to fit samples from 2” to 6” in diameter

MODEL 3542RA2 EXAMPLE
With gauge lengths of 25 and 50 mm (1 and 2 inches) and measuring ranges of 1.2 and 2.5 mm (0.050 and 0.100 inches), the Model 3442RA1 was designed for applications where tensile or compressive strength tests on small rock, concrete and other small compression samples is desired.

Axial strain is measured on opposite sides of the test specimen and the output is an average of the two readings. The Model 3442RA1 is available in a variety of configurations for samples 50 mm (2 inches) or smaller in diameter. All are self-supporting on the specimen and mount very easily. The conical point contacts included with the extensometer are made from tungsten carbide. If desired, the two outputs can be independently configured, providing two readings. Epsilon has versions for use in oil to 1360 bar at 200 °C (20,000 psi at 400 °F). These units will fit in small inside diameter vessels.

For large diameter specimens, we suggest one of the Model 3542RA averaging axial extensometers.

The Model 3442RA1 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- High accuracy, averaging output or optional dual independent outputs.
- Designed for smaller diameter specimens.
- Easy mounting, attaches with integral springs.
- Self-supporting on the specimen.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ±0.20% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Operating Force: <30 g typical per side

Options

Dual independent outputs
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3442RA1 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. Test specimen diameter(s) must be specified at the time of order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>METRIC</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>-025M</td>
<td>±0.125 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>±0.25 mm</td>
</tr>
<tr>
<td>-0100</td>
<td>±0.050”</td>
</tr>
<tr>
<td>-0200</td>
<td>±0.100”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-LT</td>
</tr>
<tr>
<td>-ST</td>
</tr>
<tr>
<td>-HT1</td>
</tr>
<tr>
<td>-HT2</td>
</tr>
<tr>
<td>-LHT</td>
</tr>
</tbody>
</table>

Example: 3442RA1-0200-050T-ST: 2.0 inch gauge length, 0.050 inch measuring range, standard temperature option (-40 °F to 210 °F)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Designed for concrete and rock compression testing or for compression tests on other large samples. This model may be used simultaneously with the Model 3542RA axial extensometers.

Circumferential extensometers measure the change in circumference as the sample is compressed. This is considered by many researchers to be a more accurate way to determine diametral strain, since the measurement is taken over the entire material inside the circumference.

A high precision, custom roller chain with special rollers mounts the extensometer to the specimen. As the specimen diameter enlarges during the test, the chain causes the extensometer to expand. The unit is self-supported on the sample with integral springs. Links are easily added or removed to adjust for different size specimens. A mechanical adjustment allows the output to be set to zero. A breakaway device protects the extensometer in the event of specimen rupture. Often rock specimens are tested in tri-axial pressure cells. Versions of the Model 3544 are available to fit inside the vessel and operate in oil environments at up to 1360 bar at 200 °C (20,000 psi at 400 °F).

The Model 3544 is the best choice for large diametral strains in large compression samples. Epsilon’s diametral rock and concrete extensometer, the Model 3975, is recommended for small strain measurements such as Poisson’s ratio.

The Model 3544 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Adapts to a wide range of specimen sizes by adding or removing chain links.
- Self-supporting on the specimen.
- May be used simultaneously with Model 3542RA axial extensometers.
- Versions available for use in tri-axial confining pressure cells, at high pressures and temperatures.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance.
- Includes high quality foam lined case.

Specifications

- **Excitation:** 5 to 10 VDC recommended, 12 VDC or VAC max.
- **Output:** 2 to 4 mV/V nominal, depending on model
- **Linearity:** ≤0.25% of full scale measuring range
- **Temperature Range:** Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
  Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
- **Cable:** Integral, ultra-flexible cable, 2.5 m (8 ft) standard

Options

- Horizontal, vertical or user convertible orientations
- Connectors to interface to nearly any brand of test equipment

CERTIFIED

Ordering Information

Model 3544 Available Versions: Any combination of diameter range, measuring range and temperature range is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Diameter Range</th>
<th>METRIC</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-100M</td>
<td>50 mm to 100 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-150M</td>
<td>50 mm to 150 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-200M</td>
<td>50 mm to 200 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.A. -0400</td>
<td>2.00&quot; to 4.00&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0600</td>
<td>2.00&quot; to 6.00&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0800</td>
<td>2.00&quot; to 8.00&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Circumferential Measuring Range | METRIC | |
|---------------------------------|--------|
| -020M                           | +2.0 mm |
| -030M                           | +3.0 mm |
| -060M                           | +6.0 mm |
| -120M                           | +12.0 mm|
| U.S.A. -080T                    | +0.080" |
| -125T                           | +0.125" |
| -250T                           | +0.250" |
| -500T                           | +0.500" |

**Model Number 3544-__-__-__-__**

**Example:** Model 3544-200M-120M-ST: 50 mm to 200 mm diameter range, +12 mm measuring range, standard temperature option (-40 °C to 100 °C)

- **Temperature Range**
  - LT: -270 °C to 100 °C (-545 °F to 210 °F)
  - ST: -40 °C to 100 °C (-40 °F to 210 °F)
  - HT1: -40 °C to 150 °C (-40 °F to 300 °F)
  - HT2: -40 °C to 200 °C (-40 °F to 400 °F)
  - LHT: -270 °C to 200 °C (-545 °F to 400 °F)

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Designed for measuring axial displacements in the simple performance tests prescribed by NCHRP Report 465, and determining dynamic modulus of hot mix asphalt per AASHTO TP062.

These extensometers are typically mounted as two axial modules with independent outputs capable of measuring specimen deformations in two locations, but they can be mounted as a single unit or up to four on a sample. They quickly clip onto gauge points mounted per the test requirements.

Magnets at each end of the extensometer snap instantly in place on the steel gage points glued to the test sample. The quick attachment is most advantageous when testing preconditioned samples that are heated or cooled, since the extensometers can be mounted before the sample changes temperature appreciably. For units intended to be used inside tri-axial cells, extensometers are available with modules rotated 90°.

The standard Model 3909 has full scale measuring range of 0.5 mm (0.020 inches). Gage points are included with the extensometers and optional gluing fixtures are available. Two standard 3909 units can be converted to the Model 3910 with the purchase of optional gauge length adapters.

The Model 3909 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Model 3909 for simple performance testing per NCHRP Report 465, and determining dynamic modulus of hot mix asphalt per AASHTO TP062.
- Easy mounting, attaches with magnets, which allows dynamic testing to 40 Hz.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- All standard units have linearity readings of 0.20% or better.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for improved performance.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard is -40 °C to +100 °C (-40 °F to +210 °F)
Cable: Integral, flexible Teflon® cable, 2.5 m (8 ft) standard
Operating Force: <30 g typical

Options

Gauge length adapters
Gluing fixture for gage points
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3909 Available Versions: Available in intermediate and larger gauge lengths on special order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-070M</td>
<td>70 mm</td>
<td>2.75”</td>
</tr>
<tr>
<td>-076M</td>
<td>76 mm</td>
<td>3.00”</td>
</tr>
<tr>
<td>-100M</td>
<td>100 mm</td>
<td>4.00”</td>
</tr>
</tbody>
</table>

Example: 3909-0300: 3.00 inch gauge length with a full scale measuring range of 0.020 inches

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Contact us for your special testing requirements.
Designed to meet many of the needs for testing asphalt core samples in 100 and 150 mm diameters (4 and 6 inch). The unit meets test method requirements for strain measurement developed under the U.S. Federal Highways SHRP program.

These extensometers are for creep compliance, tensile strength testing and dynamic resilient modulus testing. They are single integral, bi-axial units which measure both lateral and vertical deformations. They quickly clip onto gage points mounted per the test requirements. They mount much faster and easier than other types.

Two units are typically required, with one extensometer mounting to each side of the test specimen. They are changeable from the 1 inch centers used for 4 inch diameter specimens, to the 1.5 inch centers used for 6 inch diameter samples using optional gauge length adapters. Magnets at each end of the extensometer snap instantly in place on the steel gage points glued to the test sample. The quick attachment is most advantageous when testing pre-conditioned samples that are heated or cooled, since the extensometers can be mounted before the sample changes temperature appreciably.

The standard Model 3910 has full scale measuring range of 0.5 mm (0.020 inches). Gage points are included with the extensometers and optional gluing templates are available. This model can be converted to the Model 3909 with optional gauge length adapters.

The Model 3910 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

• Model 3910 for creep compliance, resilient modulus, and tensile strength for testing per AASHTO T322.
• Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
• Easy mounting, attaches with magnets, which allows dynamic testing to 40 Hz.
• All standard units have linearity readings of 0.20% or better.
• Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
• Rugged, dual flexure design for improved performance.
• Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard is -40 °C to +100 °C (−40 °F to +210 °F)
Cable: Integral, flexible Teflon® cable, 2.5 m (8 ft) standard
Operating Force: <30 g typical

Options

Gauge length adapters
Gluing template for gage points
Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 3910 Available Versions: Available in intermediate and larger gauge lengths on special order. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>METRIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>-025M</td>
<td>25 mm</td>
</tr>
<tr>
<td>-038M</td>
<td>38 mm</td>
</tr>
<tr>
<td>-050M</td>
<td>50 mm</td>
</tr>
<tr>
<td>-076M</td>
<td>76 mm</td>
</tr>
<tr>
<td>-100M</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0100</td>
<td>1.000&quot;</td>
</tr>
<tr>
<td>-0150</td>
<td>1.500&quot;</td>
</tr>
<tr>
<td>-0200</td>
<td>2.000&quot;</td>
</tr>
<tr>
<td>-0300</td>
<td>3.000&quot;</td>
</tr>
<tr>
<td>-0400</td>
<td>4.000&quot;</td>
</tr>
</tbody>
</table>

Model Number 3910-

Example: 3910-0100: 1.000 inch gauge length with a full scale measuring range of 0.020 inches

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Designed to meet many of the needs for testing asphalt core samples in 100 and 150 mm diameters (4 and 6 inch). It meets test method requirements for strain measurement developed under the U.S. Federal Highways SHRP program.

For indirect tensile testing, such as for resilient modulus, these extensometers measure the lateral deformation of specimens. They are self-supporting on the sample and clip on in seconds. The traditional way this deformation has been measured was prone to errors caused by slight rocking of the sample as it is loaded. The self-supporting design of the Model 3911 eliminates this problem. This unit will handle the dynamic pulse requirements of resilient modulus testing.

The speed of mounting makes test set-up much faster than with the older method. The pivot mounting used ensures that the specimen contact pads meet the often uneven asphalt surface as well as possible. The measuring range options available allow a wide range of testing, yet can easily measure the sometimes very small displacements required.

The Model 3911 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Model 3911 indirect tensile extensometer for asphalt, for testing per AASHTO TP31 and ASTM D4123.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Easy mounting with built-in breakaway feature should specimen fracture.
- All standard units have linearity readings of 0.20% or better.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for improved performance.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on the model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard is -40 °C to +100 °C (-40 °F to +210 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Adjustable to fit both 100 mm and 150 mm (4 inch and 6 inch) diameter specimens

Ordering Information

Model 3911 Available Versions: Consult factory for additional ranges.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-076M</td>
<td>+0.76 mm</td>
<td>-0003</td>
</tr>
<tr>
<td>-150M</td>
<td>+1.50 mm</td>
<td>-0006</td>
</tr>
<tr>
<td>-200M</td>
<td>+2.00 mm</td>
<td>-0008</td>
</tr>
</tbody>
</table>

Model Number 3911-_______

Example: 3911-150M: +1.50 mm measuring range

Options

Connectors to interface to nearly any brand of test equipment

CERTIFIED
Designed for accurate measurement of small diametral strains such as those required to determine Poisson’s ratio of rock, concrete and asphalt samples. The units are designed to be used in conjunction with the Model 3542RA axial averaging extensometer.

Self-supporting on the test sample, these extensometers will work on standard sized diameter samples, but special configurations are available upon request. They are designed for use in testing for Poisson’s ratio and for applications where accurate diametral measurements with low strains are required.

The Model 3975 is the best choice for small diametral strains in large compression samples. Epsilon’s circumferential extensometer, the Model 3544, is recommended for large strain measurements. These units are easily attached to the sample, and rounded contact edges maintain the position on the specimen.

The Model 3975 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

• Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
• All standard units have linearity readings of 0.20% or better.
• Easy mounting, attaches with integral springs.
• Self-supporting on the specimen.
• Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
• Rugged, dual flexure design for improved performance.
• Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
       Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard

Options

Additional frames for larger or smaller diameter samples
Connectors to interface to nearly any brand of test equipment

ORDERING INFORMATION

Model 3975 Available Versions: Consult factory for additional ranges. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

Measuring Range

<table>
<thead>
<tr>
<th>METRIC</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-076M</td>
<td>+0.76 mm</td>
</tr>
<tr>
<td>-150M</td>
<td>+1.50 mm</td>
</tr>
<tr>
<td>-200M</td>
<td>+2.00 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U.S.A.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-0003</td>
<td>+0.030”</td>
</tr>
<tr>
<td>-0006</td>
<td>+0.060”</td>
</tr>
<tr>
<td>-0008</td>
<td>+0.080”</td>
</tr>
</tbody>
</table>

Model Number 3975-_______-_______

Temperature Range

- LT -270 °C to 100 °C (-454 °F to 210 °F)
- ST -40 °C to 100 °C (-40 °F to 210 °F)
- HT1 -40 °C to 150 °C (-40 °F to 300 °F)
- HT2 -40 °C to 200 °C (-40 °F to 400 °F)
- LHT -270 °C to 200 °C (-454 °F to 400 °F)

Example: 3975-0008-ST: +0.080 inches measuring range, standard temperature option (-40 °C to 100 °C)

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Contact us for your special testing requirements.
This all-purpose averaging axial extensometer is used in tension or compression to measure Young’s modulus, offset yield, and strain to failure. It is compact and lightweight. Gauge length is set automatically for fast specimen mounting.

The Model 3442AVG is optimized for high-accuracy tension and compression testing. It measures strain simultaneously on opposite sides of the specimen to average out specimen misalignment while measuring axial strain. The averaging capability is useful for measuring Young’s modulus per ASTM E111, properties of composite materials per ISO 527 and ASTM D3039, and compression of metals per ASTM E9. It is compact, lightweight, and may be used through specimen failure with most materials. It is fatigue rated and may be used in strain control.

The extensometer sets its gauge length automatically when it is mounted on the specimen. This feature improves repeatability, reduces operator errors and saves time. Just mount the extensometer and it will be at its gauge length and ready for testing.

This extensometer’s output can be configured in two ways: with a single output for average strain measurement, or with separate outputs for measuring strain separately on opposite sides of the specimen with two strain channels. The configuration with two outputs can be used during test setup or during the test to measure specimen bending (strain uniformity) caused by misalignment or specimen machining imperfections.

Due to its compact size, the 3442AVG is not compatible with transverse extensometers. To measure Poisson’s ratio, the Model 3442AVG may be used in combination with a transverse adhesively bonded strain gage, or other other extensometers may be used such as Model 3560BIA or Model 3542 in combination with Model 3575.

Model 3442AVG extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller, and Epsilon will equip the extensometer with a compatible connector wired to plug directly into the controller. For systems lacking the required electronics, Epsilon can provide a variety of solutions for signal conditioning and connection to data acquisition systems or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- May be left on through specimen failure with most materials.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0,5 test certificates are available upon request.
- Simple clip-on mounting with automatic gauge length setting.
- Smaller than other averaging extensometers - fits in narrow spaces.
- Measures average strain in both tension and compression, and can be used for cyclic testing.
- Measures opposite sides of the specimen to average out misalignment.
- When configured with separate strain outputs, can be used to calculate average strain and % bending.
- Knife edge mounting allows mounting on round or flat specimens - much easier to mount than designs using conical points, especially on thin flat specimens and round specimens.
- All models have mechanical overtravel stops in both directions. Hardened tool steel knife edges are easily replaced. A spare set comes with every extensometer.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance. Much stronger than single flexure designs, this also allows cyclic testing at higher frequencies.
- Includes high quality foam lined case and spare set of tool steel knife edges.

Specifications

| Excitation: | 5 to 10 VDC recommended. 12 VDC or VAC max. |
| Output: | 2 to 4 mV/V nominal, depending on model |
| Linearity: | ≤0.15% of full scale measuring range, depending on model |
| Temperature Range: | Standard (-ST) is -40 °C to +100 °C (−40 °F to 210 °F) Optional (-LHT) is -270 °C to +200 °C (−454 °F to 400 °F) |
| Cable: | Integral, ultra-flexible cable, 2.5 m (8 ft) standard |
| Specimen Size: | Works with samples 0.25 to 25 mm (0.01 to 1.0 inch) width or diameter |
| Operating Force: | 30 to 50 g typical |
| Cyclic Testing: | 50 to 100 Hz typical |

Options

One averaged output or two separate left/right outputs
Connectors to interface to nearly any brand of test equipment
Expanded temperature ranges from -270 °C to +200 °C (−454 °F to +400 °F)

Ordering Information

Model 3442AVG Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available. Specify one or two outputs when ordering. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-010M 10.0 mm</td>
<td>-005M ±0.50 mm</td>
</tr>
<tr>
<td>-0125M 12.5 mm</td>
<td>-010M ±1.00 mm</td>
</tr>
<tr>
<td>-025M 25.0 mm</td>
<td>-025M ±2.50 mm/-1.00 mm</td>
</tr>
<tr>
<td>-050M 50.0 mm</td>
<td>U.S.A.</td>
</tr>
<tr>
<td>-0050 0.500&quot;</td>
<td>-002T ±0.020&quot;</td>
</tr>
<tr>
<td>-0100 1.000&quot;</td>
<td>-005T ±0.050&quot;</td>
</tr>
<tr>
<td>-0200 2.000&quot;</td>
<td>-010T +0.100&quot;/-0.050&quot;</td>
</tr>
</tbody>
</table>

Model Number 3442AVG - _ _ _ _ _ _ _ _ - _ _

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
A single integral unit provides simultaneous lateral (transverse) strain and averaged axial strain measurement. The unit is also available as an averaged axial extensometer alone.

This extensometer is ideally suited for testing anisotropic materials such as advanced composites as well as for general purpose tests like determining Poisson’s ratio. The Model 3560BIA uses a design unique to Epsilon, where the knife edges remain parallel during the displacement. This approach greatly reduces crosstalk between axes and allows use on round or flat specimens with equal ease.

These extensometers are very easy to mount. Integral springs hold the unit on the test sample. The parallel multiple flexure design makes these units very durable.

The Model 3560AVG reads axial strain only as a single averaged output. It may also be supplied with two independent outputs, one measurement from each side of the specimen. This set-up is most commonly required when an indication of specimen bending is desired. The second version, the Model 3560BIA, includes both the averaged axial strain and the transverse strain. Again, this may also be configured as dual independent axial readings, which results in a three channel extensometer.

The Model 3560 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
**Features**

- Multiple sets of dual flexures and mechanical stops allow testing through failure and provide a rugged unit.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request. All standard units have linearity readings of 0.15% or better in the transverse direction.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for improved performance.
- Includes high quality foam lined case and spare set of tool steel knife edges.
- Knife edge mounting and parallel displacement allows mounting on round or flat specimens. Much easier to mount than designs using conical points (especially on thin flat specimens and round ones).
- Self-supporting on the specimen.
- High accuracy and minimal crosstalk between channels.

**Specifications**

- **Excitation:** 5 to 10 VDC recommended, 12 VDC or VAC max.
- **Output:** 2 to 4 mV/V, depending on model
- **Linearity:** ≤0.15% of full scale measuring range, depending on model
- **Temperature Range:** Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
  Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
- **Cable:** Integral, ultra-flexible cable, 2.5 m (8 ft) standard
- **Specimen Size:** Works with samples 2.5 to 25 mm width or diameter (0.1 to 1 inch)
- **Operating Force:** 30 to 50 g typical
- **Crosstalk:** Less than 0.5%

**Options**

- Connectors to interface to nearly any brand test equipment
- Adapters to fit larger specimens
- Specialty knife edges (see page 102)

---

**Ordering Information**

Model 3560 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available.

<table>
<thead>
<tr>
<th>Model Number 3560-</th>
<th>METRIC</th>
<th>Measuring Range</th>
<th>Measuring Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% AXIAL STRAIN</td>
<td>TRANSVERSE MEASURING RANGE</td>
</tr>
<tr>
<td></td>
<td>-010M</td>
<td>-005&lt;sup&gt;1&lt;/sup&gt;</td>
<td>±5%</td>
</tr>
<tr>
<td></td>
<td>-025M</td>
<td>-010&lt;sup&gt;2&lt;/sup&gt;</td>
<td>±10%</td>
</tr>
<tr>
<td></td>
<td>-050M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50.0 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.A.</td>
<td>-0050&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.500&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0100</td>
<td>1.000&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0200&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.000&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Temperature Range**

- -LT -270 °C to 100 °C (-454 °F to 210 °F)
- -ST -40 °C to 100 °C (-40 °F to 210 °F)
- -HT1 -40 °C to 150 °C (-40 °F to 300 °F)
- -HT2 -40 °C to 200 °C (-40 °F to 400 °F)
- -LHT -270 °C to 200 °C (-454 °F to 400 °F)

1 10 mm and 0.5 inch gauge lengths are only available in 10% axial measuring ranges.
2 50 mm and 2.0 inch gauge lengths are only available in 5% axial measuring ranges.
3 If the gauge length is ordered in mm units, then the transverse measuring range will be in mm. If the gauge length is ordered in inch units, then the transverse measuring range will be in inches.

Example: 3560-BIA-010M-010-HT2: 10.0 mm gauge length, ±10% axial strain measuring range, ±1.0 mm transverse measuring range, HT2 option (-40 °C to 200 °C)

Visit our website at [www.epsilontech.com](http://www.epsilontech.com)
Contact us for your special testing requirements.
Designed for simultaneously measuring axial and torsional deflections on specimens tested in axial/torsional machines.

The Model 3550 extensometer is most often used on round specimens tested in bi-axial test machines capable of simultaneous axial and torsional loading. The extensometer is often customized for particular applications. All units are capable of bi-directional displacement, so they may be used for cyclic testing under fully reversed loading conditions. The standard sized model is self-supporting on the specimen, and works on specimens from 9.5 to 25.4 mm (0.375 to 1.000 inches). The conical point contacts included with the extensometer are made from tungsten carbide. Their unique design directly measures the surface shear strain angle, which allows operation on a wide range of specimen diameters without changing calibration.

All models are designed specifically to minimize crosstalk between axes and to provide high accuracy measurements. All feature the dual flexure design common to other Epsilon extensometers.

Available options cover temperature ranges from -270 °C to 200 °C (the standard temperature range is -40 °C to 100 °C). Both inch and metric versions are available. A wide range of gauge length and measuring ranges are available. Because these transducers are often used for specialized tests, contact Epsilon with your specific test needs.

The Model 3550 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Standard units meet existing ASTM class B-1 requirements for accuracy in axial measuring range. A calibration certificate is included. ISO 9513 class 0.5 calibrations are available upon request. All standard units have linearity readings of 0.20% or better in torsion.
- Self-supporting on the specimen.
- Cyclic testing may be performed at up to 2 Hz.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for strength and improved performance - much stronger than single flexure designs.
- Includes high quality foam lined case.

Specifications

- Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
- Output: 2 to 4 mV/V, nominal, depending on model
- Linearity: ≤0.15% of full scale measuring range, depending on model
- Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
  Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
- Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
- Operating Force: <30 g typical
- Crosstalk: Less than 0.5%

Options

Connectors to interface to nearly any brand test equipment
Model 3590AT axial/torsional calibrator (see page 118)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.

Epsilon’s axial/torsional extensometer was designed to directly measure the shear strain, γ shown in the figure. This design allows the correct determination of the shear strain without having to know the radius of the specimen being tested, R₁.

The shear strain is related to the angle of twist (a commonly referenced parameter in torsion testing), φ, by the following relationship:

\[ \gamma = R₁ \frac{d\phi}{dL} \]

For extensometers that measure φ directly instead of γ, corrections need to be made for every different specimen diameter tested and for axial strain to correctly determine the shear strain.

The example to the left shows the variation of the angle of twist versus a change in specimen diameter relative to the constant resulting shear strain.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Axial Gauge Length</th>
<th>Axial Strain</th>
<th>Torsional Shear Strain Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>3550-025M-005-002-ST</td>
<td>25 mm</td>
<td>±5%</td>
<td>±2°</td>
</tr>
<tr>
<td>3550-025M-005-003-ST</td>
<td>25 mm</td>
<td>±5%</td>
<td>±3°</td>
</tr>
<tr>
<td>3550-025M-010-002-ST</td>
<td>25 mm</td>
<td>±10%</td>
<td>±2°</td>
</tr>
<tr>
<td>3550-0100-010-002-ST</td>
<td>1 inch</td>
<td>±10%</td>
<td>±2°</td>
</tr>
</tbody>
</table>

- ST temperature range is -40 °C to 100 °C (-40 °F to 210 °F), but -HT1, -HT2, -LT, and -LHT options are also available. This unit is built to order; contact Epsilon for a unit specific to your testing requirements.
Simultaneously measures axial and torsional strains at high temperatures on specimens tested in axial/torsional machines. For use with materials testing furnaces or induction heating up to 1600 °C (2900 °F). May be used for bi-axial strain controlled fatigue. Slide mounting system enables mounting to hot specimens in seconds.

Model 7650 extensometers are primarily used on round specimens tested in bi-axial test machines capable of simultaneous axial and torsional loading. All models are capable of bi-directional displacement in both axes and may be used for strain-controlled fatigue testing under fully reversed load and strain conditions at frequencies up to 10 Hz.

All 7650 models mount rigidly on the load frame and incorporate slide mounting to bring the extensometer into contact with the specimen. The gauge length is set automatically before mounting on the test specimen, which allows for hot mounting after thermal equilibrium has been reached.

These units are specifically designed to minimize crosstalk between axes and to provide high accuracy, high resolution measurements. They incorporate capacitive sensors for low operating force and include electronics with programmable filtering and multi-point linearization for improved performance and accuracy. The overall design minimizes, and in many cases virtually eliminates, any influence from common lab environment vibrations.

These water-cooled extensometers are equipped with high purity alumina rods with conical rod tips for specimen contact when testing to 1200 °C (2200 °F). Silicon carbide rods are used for the 1600 °C (2900 °F) high temperature option.

The Model 7650 is often customized for specific test needs. Contact Epsilon for a configuration that matches your requirement.
Features

- Hot mountable and retractable.
- Self-setting gauge length with fine adjustment feature.
- All models can measure in both tension and compression and may be used for cyclic testing at test frequencies up to 10 Hz.
- Standard units meet ASTM class B-1 requirements for accuracy (axial). A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request.
- Ships fully calibrated with calibration that is traceable to NPL; voltage output may be user-specified (typically 0-10V).
- Excellent ambient vibration rejection; primary vibration mode >100 Hz typical
- Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
- Includes high speed analog and digital outputs.
- Web-based user interface for setup and data acquisition.
- Selectable analog and digital filter options from 2 Hz to 3 kHz.
- Built-in calibration reference and auto-zero features.
- Multiple extensometer calibration files may be loaded for use with one controller.
- Can be used with specimens at elevated temperatures while only requiring room temperature calibration.
- Quick-disconnect water cooling fittings and signal cables.
- Includes high quality foam lined case and a spare set of rods.

Specifications

- Analog Output: User specified, ±10VDC typical, ±10.8VDC rail
- Digital Output: 24 bit high speed Ethernet output with built-in web interface
- Cyclic Testing: Up to 10 Hz, depending on test system and test amplitude
  - Linearity: 11 point digital linearization, ±0.1% FS typical linearity
  - Hysteresis: ≤0.1% FS typical
  - Crosstalk: ≤0.2% FS typical at ±1° shear with 25 mm diameter specimen and 12.5 mm gauge length
- Resolution: <75 PPM (0.0075%FS) RMS @ 4 kHz, <6 PPM (0.0006%FS) @ 100 Hz at gauge length
- Filter: Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
- Temperature Range: Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
  - Sensor Cables: 2 m (6.5 ft) room temperature cables
  - Output Cables: Flexible 2.4 m (8 ft) analog output cables
  - Specimen Size: Fits most round specimen diameters
- Test Frame Layout: Accommodates test frames with torsional actuator located above or below specimen
- Operating Force: <30 grams typical
- Contact Force: ≤560 grams typical
- Environment: Recommended for testing in dry air, inert / non-corrosive gases, or vacuum
- Power: Includes power supply for your country

Options

- High temperature option (-HT suffix) for use to 1600 °C
- Load frame mounting brackets
- Bulbhead adapters for use in vacuum chambers
- Model 3590AT axial/torsional calibrator (see page 118)
- Model 2050 constant temperature water re-circulating bath
- Connectors to interface to nearly any brand test equipment

Epsilon’s axial/torsional extensometer was designed to directly measure the shear strain, γ shown in the figure. This design allows the correct determination of the shear strain without having to know the radius of the specimen being tested, R₁.

The shear strain is related to the angle of twist (a commonly referenced parameter in torsion testing), φ, by the following relationship:

\[ \gamma = R₁ \frac{d\phi}{dL} \]

For extensometers that measure φ directly instead of γ, corrections need to be made for every different specimen diameter tested and for axial strain to correctly determine the shear strain.

The example to the left shows the variation of the angle of twist versus a change in specimen diameter relative to the constant resulting shear strain.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Axial Gauge Length</th>
<th>Axial Strain</th>
<th>Torsional Shear Strain Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>7650-0125M-025M-020-ST</td>
<td>12.5 mm</td>
<td>+2.5 mm/-0.5 mm</td>
<td>±2.0°</td>
</tr>
<tr>
<td>7650-025M-025M-010-ST</td>
<td>25.0 mm</td>
<td>+2.5 mm/-0.5 mm</td>
<td>±1.0°</td>
</tr>
</tbody>
</table>

Temperature Range
- Room temperature to 1200 °C (2200 °F) - ST
- Room temperature to 1600 °C (2900 °F) - HT

Other configurations are available, such as ±1.5 mm axial measuring range - please contact Epsilon to discuss your requirements. Up to ±4° torsional measuring range is available (gauge length dependent), and up to 3 mm of axial measuring range is available.

Ceramic rod lengths are made to fit furnaces as required. Specify specimen diameter, load frame configuration, furnace dimensions, and electrical outlet type at time of ordering.

Requires external mounting brackets and 110 - 240VAC / 4W electrical power. Water cooling is recommended; required for 1000 °C and above.

Visit our website at www.epsilontech.com

Contact us for your special testing requirements.
Simultaneously measures in-plane bi-axial strains at high temperatures on specimens tested in X-Y bi-axial machines. For use with materials testing furnaces or induction heating up to 1600 °C (2900 °F). May be used for bi-axial strain controlled fatigue. Slide mounting system enables mounting to hot specimens in seconds.

Model 7651 extensometers measure combined in-plane strains in flat cruciform specimens tested in machines capable of simultaneous X and Y (perpendicular) axial loading and on standard flat samples tested in pure tension. All models are capable of bi-directional displacement in both axes and may be used for strain-controlled fatigue testing under fully reversed load and strain conditions at frequencies up to 10 Hz.

All 7651 models mount rigidly on the load frame and incorporate slide mounting to bring the extensometer into contact with the specimen. The gauge length is set automatically before mounting on the test specimen, which allows for hot mounting after thermal equilibrium has been reached.

These units are specifically designed to eliminate crosstalk between axes and to provide high accuracy, high resolution measurements. They incorporate capacitive sensors for low operating force and include electronics with programmable filtering and multi-point linearization for improved performance and accuracy. The overall design minimizes, and in many cases virtually eliminates, any influence from common lab environment vibrations.

These water-cooled extensometers are equipped with high purity alumina rods with conical rod tips for specimen contact when testing to 1200 °C (2200 °F). Silicon carbide rods are used for the 1600 °C (2900 °F) high temperature option.

The Model 7651 is often customized for specific test needs. Contact Epsilon for a configuration that matches your requirement.
Features

• Hot mountable and retractable.
• Self-setting gauge length with fine adjustment feature.
• All models can measure in both tension and compression and may be used for cyclic testing at test frequencies up to 10 Hz.
• Standard units meet ASTM class B-1 requirements for accuracy. A test certificate is included. ISO 9513 class 0.5 test certificates are available upon request.
• Ships fully calibrated with calibration that is traceable to NPL; voltage output may be user-specified (typically 0-10V).
• Excellent ambient vibration rejection; primary vibration mode >100 Hz typical
• Digital controller and power supply included. Provides high level DC voltage output with low noise. Easily interfaced to test controllers, data acquisition boards and chart recorders.
• Includes high speed analog and digital outputs.
• Web-based user interface for setup and data acquisition.
• Selectable analog and digital filter options from 2 Hz to 3 kHz.
• Built-in calibration reference and auto-zero features.
• Multiple extensometer calibration files may be loaded for use with one controller.
• Can be used with specimens at elevated temperatures while only requiring room temperature calibration.
• Quick-disconnect water cooling fittings and signal cables.
• Includes high quality foam lined case and a spare set of rods.

Specifications

Analog Output: User specified, ±10VDC typical, ±10.8 VDC rail
Digital Output: 24 bit high speed Ethernet output with built-in web interface
Cyclic Testing: up to 10 Hz, depending on test system and test amplitude
Linearity: 11 point digital linearization, ±0.1% FS typical linearity
Hysteresis: ≤0.1% FS typical
Crosstalk: none
Resolution: <75 PPM (0.0075%FS) RMS @ 4 kHz, <6PPM (0.0006%FS) @ 100 Hz at gauge length
Filter: Selectable 100 Hz analog and 2 Hz - 3 kHz digital filters
Temperature Range: Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
Sensor Cables: 2 m (6.5 ft) room temperature cables
Output Cables: Flexible 2.4 m (8 ft) analog output cables
Specimen Size: Fits any flat cruciform or axial-only test specimen with a test area larger than the extensometer GL
Operating Force: <30 grams typical
Contact Force: <560 grams typical
Environment: Recommended for testing in dry air, inert / non-corrosive gases, or vacuum
Power: Includes power supply for your country

Options

High temperature option (-HT suffix) for use to 1600 °C
Load frame mounting brackets
Bulkhead adapters for use in vacuum chambers
Model 2050 constant temperature water re-circulating bath
Connectors to interface to nearly any brand test equipment

Ordering Information

Ceramic rod lengths are made to fit furnaces as required. Specify load frame configuration, loading axis orientation, furnace dimensions, and electrical outlet type at time of ordering.
Requires external mounting brackets and 110 - 240VAC / 4W electrical power.
Water cooling is recommended; required for 1000 °C and above.
Other configurations are available with special order; please contact Epsilon to discuss your requirements.

Example: 7651-025M-020M-ST: 25 mm gauge length, +2.0 / -1.0 mm measuring range, standard temperature range (room temperature to 1200 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
3565 Bolt Extensometers for Proof Load Testing

3567 Extensometers for Testing Rebar Couplers, Splices, and Sleeves

4013 Averaging Extensometers for ASTM D5656 Shear Tests

3421 Sandwich Core Shear and Rigid Cellular Plastic Shear Testing Extensometers

4030 Submersible Extensometers
The Model 3565 uses hard conical points to contact the bolt at the center of the head and at the bottom. It is fully adjustable for different length bolts ranging from 25 mm (1 inch) in length to 150 mm (6 inches) standard. Extension beams are available for longer bolts. The standard maximum measuring range is 1.25 mm (0.05 inches). Generally, on longer bolts this extensometer will be self-supported without requiring any centering marks or punch marks on the bolt. For shorter bolts these marks may be required. If the conical pins are sharp, marks are often not needed even on the shortest bolts.

The extensometer has a zero adjustment screw to adjust the length between the contact pins. This is used to set the output voltage to zero, which corresponds to the correct starting position for the test. It also includes a breakaway lower arm. In the event a bolt should fail, the breakaway arm snaps free, helping to prevent damage to the extensometer. This is easily re-installed. In the event that bolt failures are likely during a test, it is recommended the user attach a cord around the upper part of the beam and tie the other end to the test frame to prevent the extensometer from falling. The conical point contacts included with the extensometer are made from tungsten carbide.

The Model 3565 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- All standard units have linearity readings of 0.20% or better.
- Breakaway arm to help prevent extensometer damage in the event of bolt failure.
- Self-supporting on the bolt specimen typically without the need for centering or punch marks.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for improved performance.
- Includes high quality foam lined case.

Specifications

**Excitation:** 5 to 10 VDC recommended, 12 VDC or VAC max.
**Output:** 2 to 4 mV/V, nominal, depending on model
**Linearity:** ≤0.20% of full scale measuring range, depending on model
**Temperature Range:** Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
**Cable:** Integral, ultra-flexible cable, 2.5 m (8 ft) standard
**Throat Depth:** Model 3565: up to 56.4 mm (2.22 inches)
Model 3565E: up to 97.8 mm (3.85 inches)

Options

Connectors to interface to nearly any brand of test equipment
Gauge length extension adapters

ORDERING INFORMATION

Model 3475 Available Versions: ANY combination of measuring range and temperature range listed below is available. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

| Measuring Range  | METRIC       | -125M  | +1.25 mm
|------------------|--------------|--------|-----------
|                  | U.S.A.       | -050T  | +0.050”   |

Model Number 3565-___-___
Model Number 3565E-___-___

Model 3565: throat depth up to 56.4 mm (2.22 inches)
Model 3565E: throat depth up to 97.8 mm (3.85 inches)

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>-LT</th>
<th>-270 °C to 100 °C (-454 °F to 210 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-ST</td>
<td>-40 °C to 100 °C (-40 °F to 210 °F)</td>
</tr>
<tr>
<td></td>
<td>-HT1</td>
<td>-40 °C to 150 °C (-40 °F to 300 °F)</td>
</tr>
<tr>
<td></td>
<td>-HT2</td>
<td>-40 °C to 200 °C (-40 °F to 400 °F)</td>
</tr>
<tr>
<td></td>
<td>-LHT</td>
<td>-270 °C to 200 °C (-454 °F to 400 °F)</td>
</tr>
</tbody>
</table>

Example: 3565-125M-HT2: +1.25 mm measuring range, high temperature option (-40 °C to 200 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Extensometers for measuring elongation of rebar coupler, splice, and sleeve assemblies. Use for tension, cyclic, slip, and differential elongation tests.

The Model 3567 extensometer may be used for ASTM A1034 testing to measure strain and elongation during tension testing of rebar splice assemblies consisting of rebar and rebar couplers, coupling sleeves and splices. The extensometer measures strain through yield and may be used for tension, cyclic, slip, and differential elongation tests.

The extensometer may be left on through failure and includes suspension points for fall protection. It is designed to automatically release from the rebar splice assembly when the extensometer reaches full scale extension at 12.5 mm (0.5 inches), typically after specimen yield. The extensometer is suspended by a tether after it is released from the specimen. The upper arm incorporates mechanical stops that protect the extensometer from over travel.

The unit is self-supporting and mounts to the rebar using attachment collars above and below the coupler. The collars simply clamp on without any need for rebar surface preparation. Collars are available to work with all common rebar and coupling / splice sizes, including 6 – 60 mm (#2 – #18J) diameter rebar. Extensometer gauge length may be adjusted to any value from 95 mm – 675 mm (3.74 – 26.6 inches) with the standard model, and optionally up to 975 mm (38.4 inches).

The Model 3567 consists of two simultaneous, separate measurements which are averaged to measure axial elongation. A configuration that uses three separate measurements for improved test accuracy is optional.

Model 3567 extensometers may also be used for tension testing of un-spliced rebar. For labs that mainly test un-spliced rebar, the Model 3543 extensometer incorporates efficiency and durability features specifically designed for that application.

Model 3567 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller and Epsilon will equip the extensometer with compatible connectors that are wired to plug directly into the controller. For systems lacking the required electronics, Epsilon can provide a variety of solutions for signal conditioning and connection to data acquisition systems, chart recorders, or other equipment.
Features

- Specifically designed to be left on through specimen failure – extensometer automatically releases from the rebar splice assembly upon reaching the full scale of the extensometer.
- One system may be used for all common rebar and coupling / splice sizes, including 6-60 mm (#2-#18J) diameter rebar.
- Replaces homemade clip gages and LVDTs with a reliable, repeatable solution.
- Durable system includes these features:
  - A tether suspends the extensometer after automatic release and provides fall protection
  - The extensometer’s upper arm has integral stops to protect it from over travel
- Exceeds ASTM A1034 requirements for extensometer accuracy; meets ASTM class B-1 and ISO 9513 class 0.5 accuracy requirements.
- Averages two or three measurements for accurate and repeatable measurements.
- Extension bars enable gauge lengths up to 975 mm (38.4 inches).
- Replaceable components for ease of repair.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Includes high quality foam lined case.

Specifications

| Excitation: | 5 to 10 VDC recommended, 12 VDC or VAC max. |
| Output: | 2 to 4 mV/V |
| Linearity: | ≤0.15% of full scale measuring range |
| Temperature Range: | Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F) |
| Cable: | Integral, ultra-flexible cable, 2.5 m (8 ft) standard |
| Specimen Size: | Rebar diameter 8 – 36 mm (#3 – #11) standard, 6 – 60 mm (#2 – #18J) optional; coupler diameter up to 102 mm (4.0 inches) |
| Gauge Length: | 95 – 675 mm (3.74 – 26.6 inches) standard, up to 975 mm (38.4 inches) optional |

Options

Gauge length adapters may be added for gauge lengths over 675 mm (26.6 inches) to extend the maximum gauge length to 975 mm (38.4 inches)

Collars for 6 – 14 mm (#2 - #4) and 32 – 60 mm (#10 - #18J) diameter rebar are optional;
collars for 8 – 36 mm (#3 – #11) diameter rebar are included standard

Average of two or three separate measurements

Average output at a single connector, or separate outputs and connectors for each measurement to enable subsequent averaging

Connectors to interface to nearly any brand of test equipment

Ordering Information

Specify your required range of rebar diameters, range of extensometer gauge lengths, number of measurements (two or three), output at a single connector or multiple connectors, and connector type at time of ordering.

Model 3567 Available Versions: ANY combination of gauge length, measuring range and temperature range listed is available, except as noted. Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Gauge Length</th>
<th>METRIC</th>
<th>95 to 675 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-675M</td>
<td>95 to 675 mm</td>
<td></td>
</tr>
<tr>
<td>-975M</td>
<td>95 to 975 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>+12.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0125M</td>
<td></td>
<td>+12.5 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>U.S.A.</th>
<th>+0.500”</th>
</tr>
</thead>
<tbody>
<tr>
<td>-050T</td>
<td></td>
<td>+0.500”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Measurements</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>

Example: 3567-3-675M-0125M-ST, 3 measurements, 95 - 675 mm gauge length, +12.5 mm measuring range, standard temperature range (-40 °C to 100 °C)
Designed specifically for performing tests in accordance with ASTM D5656, Standard Test Method for Thick-Adherend Metal Lap-Shear Joints for Determination of the Stress-Strain Behavior of Adhesives in Shear by Tension Loading. The deformation is measured on opposite sides of the test specimen and the output is an average of the two readings.

The Model 4013 extensometer meets the requirements of ASTM D5656 for measuring the strain properties of an adhesive in shear. It uses different contact point spacing compared to the extensometer shown in D5656. This makes it much easier to mount and eliminates the slippage problems associated with the design shown in the ASTM standard. The Model 4013 is available with all of Epsilon’s temperature configurations. It has a 3.0 mm (0.12 inches) full scale measuring range. The conical point contacts included with the extensometer are made from tungsten carbide.

The Model 4013 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller. The signal conditioning electronics for the extensometer is typically included with the test machine controller or may often be added. In this case the extensometer is shipped with the proper connector and wiring to plug directly into the electronics. For systems lacking the required electronics, Epsilon can provide a variety of solutions, allowing the extensometer output to be connected to data acquisition boards, chart recorders or other equipment.

See the electronics section of this catalog for available signal conditioners and strain meters.
Features

- High accuracy, averaging output (optional dual independent outputs).
- Meets the requirements of ASTM D5656.
- Easy mounting, attaches with an integral spring.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Rugged, dual flexure design for improved performance.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V nominal, depending on model
Linearity: ≤0.20% of full scale measuring range, depending on model
Temperature Range: Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to +200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard

Options

Connectors to interface to nearly any brand of test equipment

Ordering Information

Model 4013 Available Versions: ANY combination of measuring range and temperature range listed below is available, except as noted.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>U.S.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-005M</td>
<td>0.5 mm</td>
<td>-025T</td>
</tr>
<tr>
<td>-010M</td>
<td>1.0 mm</td>
<td>-050T</td>
</tr>
<tr>
<td>-030M</td>
<td>3.0 mm</td>
<td>-125T</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>-LT</td>
</tr>
<tr>
<td>-ST</td>
</tr>
<tr>
<td>-HT1</td>
</tr>
<tr>
<td>-HT2</td>
</tr>
<tr>
<td>-LHT</td>
</tr>
</tbody>
</table>

Example: 4013-005M-ST: 0.5 mm measuring range, standard temperature range (-40 °C to 100 °C)

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Contact us for your special testing requirements.

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EPSILON TECH—World class quality at substantial savings.
For measuring shear properties of sandwich cores and rigid cellular plastics. The simple clip-on design attaches in seconds and provides repeatable test results.

Model 3421 extensometers measure shear strain of foam and honeycomb sandwich cores, as well as rigid cellular plastics. These extensometers can be used to measure shear modulus, 2% offset shear strength, and stress-strain curves prior to specimen failure. The extensometer may be used to measure strain through specimen failure with specimen fixturing to limit out-of-plane expansion. The Model 3421 may also be used for sandwich core shear fatigue testing.

The Model 3421 is applicable for testing to the following standards:

- ASTM C273 Shear Properties of Sandwich Core Materials
- ASTM C394 Shear Fatigue of Sandwich Core Materials
- ISO 1922 Rigid cellular plastics -- Determination of shear strength
- DIN 53294 Testing of sandwiches; shear test
- EN 12090 Determination of Shear Behavior of Thermal Insulation Products (single specimen test only)

The extensometer mounts to the test specimen’s loading plates. It attaches to the specimen in seconds and can be used with tension or compression test fixture loading. The extensometer is adjustable to work with a range of specimen thicknesses and widths, and includes a built-in scale for setting it to the specimen width.

To use the extensometer, the test operator clips it onto the specimen by squeezing two pads, placing the extensometer against the side of the specimen, and releasing the pads. The extensometer is self-supporting and no further adjustments are necessary. It is removed before failure by unclipping.

Model 3421 extensometers are strain gaged devices, making them compatible with any electronics designed for strain gaged transducers. Most often they are connected to a test machine controller and Epsilon will equip the extensometer with a compatible connector wired to plug directly into the controller. For systems lacking the required electronics, Epsilon can provide a variety of solutions for signal conditioning and connection to data acquisition systems, chart recorders, or other equipment.
Features

- Replaces homemade extension gages and LVDTs with a reliable, repeatable solution.
- Simple clip-on design attaches in seconds.
- May be left on through specimen failure when fixturing is used to constrain thickness expansion of the specimen.
- Meets ASTM C273 requirements for extensometers.
- Includes the Epsilon Shunt Calibration System for on-site electrical calibration.
- Extensometer measuring arm has mechanical overtravel stops for durability.
- Replaceable components for ease of repair.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Includes high quality foam lined case.

Specifications

Excitation: 5 to 10 VDC recommended, 12 VDC or VAC max.
Output: 2 to 4 mV/V
Accuracy: ±5.0 mm/±0.200" measuring ranges:
- ±0.003 mm for displacement values <0.3 mm
- ±1.0% of reading for displacement values ≥0.3 mm
- ±2.5 mm/±0.100" measuring ranges:
- ±0.015 mm for displacement values <0.3 mm
- ±0.5% of reading for displacement values ≥0.3 mm
Temperature Range: Standard (-ST) is -40 °C to 100 °C (-40 °F to 210 °F)
Optional (-LHT) is -270 °C to 200 °C (-454 °F to 400 °F)
Cable: Integral, ultra-flexible cable, 2.5 m (8 ft) standard
Specimen Size: Thickness (including core and both loading plates): 20-75 mm (0.8–3.0 inches); width: 40 mm (1.5 inch) minimum, 50-150 mm (2-6 inches) typical

Options

Connectors to interface to nearly any brand of test equipment

Ordering Information

Other configurations may be available with special order; please contact Epsilon to discuss your requirements.

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>METRIC</th>
<th>±2.5 mm</th>
<th>±5.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S.A.</td>
<td>±0.100&quot;</td>
<td>±0.200&quot;</td>
</tr>
</tbody>
</table>

Model Number 3421-__ __ __ -_

Temperature Range

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>-270 °C to 100 °C (-454 °F to 210 °F)</td>
</tr>
<tr>
<td>ST</td>
<td>-40 °C to 100 °C (-40 °F to 210 °F)</td>
</tr>
<tr>
<td>HT1</td>
<td>-40 °C to 150 °C (-40 °F to 300 °F)</td>
</tr>
<tr>
<td>HT2</td>
<td>-40 °C to 200 °C (-40 °F to 400 °F)</td>
</tr>
<tr>
<td>LHT</td>
<td>-270 °C to 200 °C (-454 °F to 400 °F)</td>
</tr>
</tbody>
</table>

Example: 3421-050M-ST: ±5.0 mm measuring range, standard temperature range (-40 °C to 100 °C)

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.
Submersible extensometer designed for performing tests in water, saline solutions, and other liquids compatible with the materials of construction.

The Model 4030 extensometer uses a special LVDT-like sensor to measure strains on samples submersed in water or other compatible liquids. The unit is provided with the signal conditioning electronics. The extensometer is a semi-custom design, which is available in smaller measuring ranges up to 5 mm (0.2 inches). Clip-on (COD) style designs are also available.

These are made entirely of stainless steel with Teflon cables. They can also be supplied with ceramic knife edges and heat shrink tubing over the quick attach kit wires, to eliminate any galvanic corrosion issues with test samples.

Contact Epsilon or email sales@epsilontech.com for help with configuring a system to meet your test needs.
Features

• Signal conditioner and power supply included. Easily interfaced to test controllers, data acquisition boards, and chart recorders.

• Shipped fully calibrated with electronics (traceable to NIST) with user specified voltage output.

• Includes high quality foam lined case.

Specifications

Input: Includes power supply for your country (specify)
Output: User specified, +/-5 VDC or +/-10 VDC typical
Linearity: ≤1.0% of full scale measuring range, depending on model

Temperature Range: -40 °C to +100 °C (-40 °F to 210 °F)
Cable: 0.45 m (1.5 ft), multistranded, shielded, SS reinforced, Teflon® insulated

Standard Quick Attach Kit: Fits round samples up to 12 mm diameter (0.5 inch) and flats to 12 mm thick by 12 mm wide (0.5 inch by 0.5 inch)

Environment: Submersible in water and other liquids compatible with materials of construction

Visit our website at www.epsilontech.com
Contact us for your special testing requirements.

EPSILON TECH—Broadest product range with unrivaled quality.
A small sampling of custom and modified extensometers manufactured and built at Epsilon.

Sometimes the test requires a completely custom design. Often, though, special test needs can be accommodated by modifications to existing standard models. If you have special requirements and do not see it in our catalog, please contact us to discuss your application.

3561 Biaxial
Custom biaxial extensometer for plane strain measurement in sheet metal testing. This unique design contacts the test sample from one side only, as needed for a very wide sample. Used for formability testing.

3561 High Temperature Biaxial
Special high temperature biaxial extensometer for cruciform test samples at 1200 °C (induction heated). This extensometer uses ceramic rods and is capable of measuring very small strains.

Bulge Test
Special biaxial extensometer for limiting dome height bulge tester for sheet metal formability testing. Simultaneous X and Y strain measurements are taken.
Fretting Fatigue Slip Sensor
Custom sensor for fretting fatigue test system. Measures very small fret slip amplitudes at frequencies up to 60 Hz. Capacitive sensor with full scale displacement of 100 microns.

High Temperature Bend Extensometer
High temperature bend fixture and 3 point bend deflection sensor for bend tests up to 1000 °C. Capacitive sensor allows very small full scale measurement of 100 microns. Includes radiant furnace, fixtures and controlled atmosphere chamber.
All of the following knife edges will fit all models of Epsilon extensometers that use knife edges. The exceptions are high temperature units that use ceramic rods, specialty extensometers that require conical point contacts, asphalt extensometers, clip-on gages, and deflectometers.

Standard Knife Edges
PART NO. 350210-01
Produced from hardened tool steel, these knife edges are used for a wide range of applications, and can be used on both round and rectangular shaped specimens. These are the standard knife edges supplied with most Epsilon extensometers.

Dual Bevel Knife Edges
PART NO. 350210V2-01
Produced from high toughness tool steel. These knife edges are used in applications where the standard knife edges may experience excessive chipping, such as on very hard metals. They are also ideal for high modulus composites. The dual bevel design and tougher material of construction provides a greater resistance to damage during testing. These knife edges are also recommended for biomedical testing (especially bone) where stability of the contact point can be compromised due to the softness of the test specimen. The dual bevel edge prevents slight output shifts on the sample that can result from the standard knife edges biting into the sample.

Ceramic Knife Edges
PART NO. 350210C2-01
These knife edges are typically used in low cycle fatigue applications on hard metals where metallic knife edges would likely experience undue wear. They are also used on the submersible Model 4030 extensometer to prevent galvanic corrosion between the extensometer and the test specimen.

Hardened Stainless Steel
PART NO. 350210-02
These knife edges are designed to be used in environments where additional strength and corrosion resistance is required. Primary applications are in biomedical testing where the knife edges may be exposed to saline solutions.

Three-Point Contact Knife Edges
PART NO. 354299
These knife edges were designed for use on flat specimens. They ensure stable contact on flat test samples due to 3-point contact.

Extended Knife Edges
PART NO. 350210EXT-01
Knife edges for applications where the additional length is required, such as where the grips are very close together. Longer lengths are available on special order.

Rounded Knife Edges
PART NO. 350210-BLUNT
Knife edges designed for use on transverse extensometers and applications where blunt edges are required. These are primarily used on transverse or diametral extensometers, such as the 3575, 3575AVG and 3675.

Vee Knife Edges
PART NO. 9903-01-01
Designed for use on round specimens. Due to the contact point variation that can occur between specimens of different diameters, units with these knife edges must be calibrated with posts of equal diameter. On extensometers with longer arm lengths, errors created by this discontinuity are not so pronounced, but on units with shorter arm lengths, this must be taken into consideration. The primary advantage is self-centering on the test sample.
The SGA series signal conditioners are ideal for cyclic and high speed testing where no display is needed. Available in single and dual channel versions, they provide the signal conditioning electronics needed for a strain gage based extensometer.

The SGA has adjustable excitation voltage and a high accuracy amplifier to provide a high level DC voltage output. An offset adjustment potentiometer is easily accessible on the front panel.

The output is ideal for direct connection to data acquisition boards or test controllers which require high level voltage or current inputs.

All models are supplied with a universal power supply and adapters for your country: specify regional adapters when ordering. A 2.5 m (8 ft) output cable is included to connect to external systems. Calibration with an extensometer (for each channel) is included.

**Specifications**

- **Zero Adjustment**
  - Knob(s): On front panel. Fine (±5% FS) and coarse. (±80% FS) adjustment ranges
  - Selectable
- **Output Ranges:** ±5V, ±10V*, 0-10V, 0-20 mA, etc.
- **Bridge Excitation:** 5V or 10V* DC
- **Bridge Sensitivity Range:** 0.06 to 30.0 mV/V
- **Linearity:** 0.03% FS typical
- **Filtering:** 8 settings, 1-5000 Hz, plus secondary 800 Hz filter. 1 kHz* default
- **Operating Temperature Range:** -10 to +50 °C
- **Zero Temperature Coefficient:** 0.009%/C (90 ppm/°C)
- **90 Day Output Stability:** ~330 ppm
- **Output Noise:** 10-100 µV (1-100 ppm), depending on filter, DAQ, and gain. 50 µV typical
- **Input Power:** 100-240 VAC, 50-60 Hz. Specify regional power plug type required. Includes: power supply, connection for extensometer(s), output cable(s) and calibration with extensometer

*default setting

**Model SGA Available Versions:**
- Model SGA-1 Single channel signal conditioner
- Model SGA-2 Dual channel signal conditioner
Designed as an inexpensive solution for static mechanical testing

where no digital display is required.

The DSC is a digital signal conditioner with analog output. All calibration is handled by software via an RS232 connection. The sampling rate is well suited for typical tensile tests. They provide all the signal conditioning electronics needed for a strain gage based extensometer. The DSC has an excitation voltage of 5 VDC and a high accuracy amplifier to provide high level DC voltage output. The unit includes a tare button to zero output at the start of every test and a shunt button for periodic verification of the output.

The output is well suited for direct connection to data acquisition boards which require a high level DC input voltage. It will also connect directly to chart recorders or test controllers. For computer based controls, it allows the extensometer data to be acquired by the data acquisition software.

All models include a power cord for your country. A 2.5 m (8 ft) output cable is included to connect to external systems. Calibration with an extensometer is included in the pricing.

**Specifications**

- Automatic recognition of up to 3 extensometers after initial set-up
- Multiple extensometers may be calibrated with one DSC
- Accuracy: 0.01% of full scale ±1 digital count
- Analog output with capability of 0 to ±10 VDC output
- Operating temperature range: 0 to 50 °C
- Front panel tare button to zero output at the start of every test
- 60 readings per second update rate
- Includes power cord, connector for extensometer(s), output cable and calibration with extensometer
- Input power: 110 VAC, 60 Hz, Optional 240 VAC, 50 Hz

See more extensometer signal conditioners at [www.epsilontech.com](http://www.epsilontech.com)

Contact us for your special testing requirements.
Designed as an inexpensive solution for static mechanical testing

where a digital display is required.

The DSC-DD is a digital signal conditioner with analog output. All calibration is handled by software via an RS232 connection. The sampling rate is well suited for typical tensile and compression tests. They provide all the signal conditioning electronics needed for a strain gage based extensometer. The DSC-DD has an excitation voltage of 5 VDC and a high accuracy amplifier to provide high level DC voltage output. The unit includes a tare button to zero output at the start of every test and a shunt button for periodic verification of the output.

The output is well suited for direct connection to data acquisition boards which require a high level DC input voltage. It will also connect directly to chart recorders or test controllers. For computer based controls, it allows the extensometer data to be acquired by the data acquisition software.

All models include a power cord for your country. A 2.5 m (8 ft) output cable is included to connect to external systems. Calibration with an extensometer is included in the pricing.

**Specifications**

- Automatic recognition of up to 3 extensometers after initial set-up
- Multiple extensometers may be calibrated with one DSC
- 6 digit display in engineering units such as percent strain or displacement
- Accuracy: 0.01% of full scale ±1 digital count
- Analog output with capability of 0 to ±10 VDC output
- Operating temperature range: 0 to 50°C
- Front panel tare button to zero output at the start of every test
- 60 readings per second update rate
- Includes power cord, connector for extensometer(s), output cable and calibration with extensometer
- Input power: 110 VAC, 60 Hz, Optional 240 VAC, 50 Hz
Designed for general purpose testing, these conditioners are available with one or two channels, and can be used as full system replacements for older test systems. This provides a low cost way to obtain the data for stress-strain plots. The automatic recognition feature allows multiple extensometers to be calibrated individually on one meter.

The DSM-Plus is ideal for customers who own several extensometers. When a configured extensometer is plugged in, the meter automatically recognizes it. It is also possible to calibrate the same extensometer in multiple ranges. For example, it is frequently convenient to calibrate an extensometer to a range of 10% of the full scale measuring range to allow greater sensitivity for tests at small strains.

The dual channel version is very useful for tests which require two strain readings, such as measurement of Poisson’s ratio or r-value tests on sheet metal samples. It also is a low cost solution to upgrading older test systems. One channel is used for strain and the other for the force reading from a load cell. The USB, RS232, and analog outputs make computerized data acquisition simple.

**Specifications**

- Automatic recognition of up to 20 extensometers after initial set-up
- Accuracy: 0.01% of full scale ±1 digital count
- 6 digit display in engineering units such as percent strain or displacement
- Analog output with capability of 0 to ±10 VDC output
- Common mode rejection: 115dB
- Operating temperature range: 0 to 50 °C
- Front panel tare button to zero output at the start of every test
- 60 readings per second update rate
- Includes power cord, connector for extensometer(s), output cable and calibration with extensometer
- Input power: 110 VAC, 60 Hz, Optional 220 VAC, 50 Hz
- Optional second channel allows for second extensometer to be used simultaneously or load and strain to be measured simultaneously for a low cost solution to obtaining stress-strain plots for older machines

Model DSM-Plus Available Options:
Second channel for strain or load cell

Model DSM-Plus high accuracy digital strain meter

Model DSM-Plus two channel high accuracy strain meter with two Model 3542s
The DSCUSB provides USB plug-and-play capability to any strain gauged extensometer. They are useful when you wish to acquire data directly to your computer without the need for a controller. Provides an inexpensive solution for digitally recording extensometer output.

The DSCUSB is a signal conditioner that provides a digital interface to a computer via USB. This allows direct data capture without the need for additional acquisition electronics or an input channel on your controller. Calibration of an extensometer is handled within the DSCUSB with up to 7 linearization points and output readings in the desired units (mV/V, mm, inches, strain). The simple software interface displays the current value as well as providing a trend chart and data logging capabilities.

If you wish to interface the DSCUSB with your existing software solution, the DSCUSB can be controlled using a set of ASCII commands through its virtual COM port.

A USB cable is included with the DSCUSB.

**Specifications**

- Power supply: USB powered (5V)
- Excitation voltage: 5V
- Temperature stability: <5ppm/°C
- A/D resolution: 16 Million counts (24 bits)
- Effective resolution: 200,000 counts @ 1Hz; 120,000 counts @ 10Hz; 50,000 counts @ 100Hz
- Data rate: 1-200 samples/second, 9 settings
- Selectable low pass filter
- Capture software included
- ASCII command set available for custom software development
- Multiple DSCUSBs may be used simultaneously for multiple channel measurements

CERTIFIED
3590 VHR Very High Resolution Digital Electronic Calibrators

3590 Digital Electronic Calibrators

3590AT Axial/Torsional Digital Electronic Calibrators
Epsilon's very high resolution calibrator features 20 nanometers (0.8 microinches) resolution and has 50 mm (2 inches) of measuring range.

The 3590VHR is provided with software to display the calibrator readings and optional netbook PC or digital display. The 3590VHR calibrator meets the accuracy and resolution requirements for ASTM E83 Class B-1 for a 6 mm gauge length and greater extensometers and ISO 9513 Class 0.5 over the full measuring range of the calibrator.

The 3590VHR uses a coarse adjustment screw for large displacements, coupled with a fine adjustment screw that allows fine adjustment to within approximately 0.025 microns (about 1 micro inch). When it comes time to calibrate your extensometers, these calibrators are easier to use and faster than any others on the market. They have enough measuring range to calibrate nearly all extensometers, and enough resolution to calibrate units with low measuring ranges.

The software is included and provides readouts in millimeters or inches. The autozero function is a great help in calibrating. Just activate it to start readings from zero. The digital display reduces operator error.

A wide range of adapters are available. The calibrator comes with smooth round adapters of 9.52 mm diameter (0.375 inches). For special adapters, contact Epsilon. For very long gauge length extensometers, an optional extension post is available. The calibrator is provided with a calibration traceable to NPL (UK standards organization).
Features

- Scale calibration traceable to NIST.
- System fully calibrated traceable to NPL (UK standards organization).
- Software for Windows based PC provided, a PC with a USB port is required.
- Readings taken on the PC with included software may be save to a data file.
- Uses the same adapters as the model 3590 and 3590HR calibrators.
- Provided with a foam lined case for storage.
- Optional Netbook PC or stand-alone digital readout display.

SPECIFICATIONS

Measuring Range: 50 mm (2 in) Maximum displacement

Maximum Range: 125 mm (0-5 in) (Maximum gauge length + displacement)*

Accuracy: ±0.19 µm (±7.5 µin) over any 0.12 mm (0.00475 inch) range

Meet ASTM E83 Class B-1 for a 6 mm gauge length and greater extensometers and ISO 9513 Class 0.5 over the full measuring range of the calibrator

Resolution: 20 nm (0.8 µin)

Temperature Range: 18 °C to 28 °C (64 °F to 82 °F) operation**, -10 °C to 60 °C (14 °F to 140 °F) storage

Relative Humidity: <90% (Non-condensing)

Connectivity: USB 2.0 interface, self-powered

Adapters: Ø9.52 mm (0.375 inch) adapter set included*

EMC Compliance: BS EN 61326-1: 2006

Environmental: EU Directive 2011/65/EU (RoHS)

Weight: 3.6 kg (8 lbs) (standard configuration)

Adapters: Ø9.52 mm (0.375 inch) adapter set included*

EMC Compliance: BS EN 61326-1: 2006

Environmental: EU Directive 2011/65/EU (RoHS)

*Other options available upon request

**Recommended range

Options

Digital readout display

Optional extensometer adapter sets, extension posts, and horizontal configuration kit:

3590-01 Smooth, round 6.35 mm (0.25 inch) diameter adapters
3590-02 Adapters for flat specimens
3590-3549 Adapters for Model 3549
3590-3648 Adapters for Model 3648
3590-03 Adapters for clip-on fracture mechanics gages
3590-04 Transverse extensometer adapters (Model 3560BA)
3590-11 Transverse extensometer adapters (Models 3575AVG, 3575, 3475, 3580, 3565, 3911 and 3975)
3590-11-KIT Horizontal conversion kit for transverse extensometers – consists of legs for horizontal configuration, additional springs, and 3590-11 adapters; enables verification of transverse extensometers in the orientation that will be used for testing, as required by some calibration and verification standards
3590-06 Adapters for large averaging extensometers (Models 3542RA and 3442RA1)
3590-05 Circumferential adapters for Model 3544
3590-4013 Shear adapters for Model 4013
3590-3421 Shear adapters for Model 3421
3590-07 100 mm (4 inch) extension post for long gauge length extensometers
3590-55-10 250 mm (10 inch) extension post for long gauge length extensometers
3590-55-24 600 mm (24 inch) extension post for long gauge length extensometers

Custom – contact Epsilon for adapters to fit Models 7650A, 7650, 7651, and 3567

Note: Model 3590VHR and 3590 calibrators include 9.52 mm (0.375 inch) diameter smooth round adapters

With Epsilon high resolution systems, you are assured compliance.

When looking for a calibrator to meet ASTM and ISO specifications, the accuracy of the device is key for compliance, which is why full system calibration is essential to meet ISO 9513 and ASTM E83 requirements.

CERTIFIED

Standards Labs in most countries have signed a Mutual Recognition Arrangement CIPM MRA. This includes the NPL in the UK, NIST in the USA and many others. This makes them effectively traceable to each other. Services of the NPL are equivalent to those offered by NIST and are recognized by NIST through this agreement of reciprocity. www.bipm.org/en/cipm-mra/
Epsilon’s standard calibrator features 0.001 mm (50 microinches) resolution and has 50 mm (2 inches) of measuring range. The autozero button and digital display greatly simplify calibration of extensometers. The 3590 calibrator is useful for extensometer calibration and verification with test systems.

When it comes time to calibrate your extensometers, these calibrators are easier to use and faster than any others on the market. They have enough measuring range to calibrate nearly all extensometers.

The digital display reads mm and changes to inches at the touch of a button. The autozero button is a great help in calibrating. Just press the button to start readings from zero. The digital display reduces operator error.

A wide range of adapters are available. The calibrator comes with smooth round adapters, of 9.52 mm diameter (0.375 inches). For special adapters, contact Epsilon. For very long gauge length extensometers, an optional extension post is available. An option is available for digital SPC output for interfacing with PCs. The calibrator is provided with a calibration traceable to NPL (UK standards organization).
### Features
- Digital display
- Autozero button simplifies readings
- Adapters and extension posts available for nearly any extensometer
- Foam lined case for storage included
- System fully calibrated traceable to NPL (UK standards organization)

### SPECIFICATIONS

**Measuring Range:** 50 mm (2 in) Maximum displacement

**Maximum Range:** 125 mm (0-5 in) (Maximum gauge length + displacement)*

- **Accuracy:** ±0.004 mm/25 mm (±0.00015 in/in)
- **Resolution:** 0.001 mm (50 µin)

**Temperature Range:** 18 °C to 28 °C (64 °F to 82 °F) operation**, -10 °C to 60 °C (14 °F to 140 °F) storage

**Relative Humidity:** <90% (Non-condensing)

**Power Supply:** 2x SR44 Batteries (included), ~2 year life

- **Adapters:** Ø9.52 mm (0.375”) adapter set included*
- **Environmental:** EU Directive 2011/65/EU (RoHS)

* Other options available upon request

**Recommended range

### OPTIONS

Optional extensometer adapter sets, extension posts, and horizontal configuration kit:

- **3590-01** Smooth, round 6.35 mm (0.25 inch) diameter adapters
- **3590-02** Adapters for flat specimens
- **3590-3549** Adapters for Model 3549
- **3590-3648** Adapters for Model 3648
- **3590-03** Adapters for clip-on fracture mechanics gages
- **3590-04** Transverse extensometer adapters (Model 3560BIA)
- **3590-11** Transverse extensometer adapters (Models 3575AVG, 3575, 3475, 3590, 3565, 3911 and 3975)
- **3590-11-KIT** Horizontal conversion kit for transverse extensometers – consists of legs for horizontal configuration, additional springs, and 3590-11 adapters; enables verification of transverse extensometers in the orientation that will be used for testing, as required by some calibration and verification standards
- **3590-06** Adapters for large averaging extensometers (Models 3542RA and 3442RA1)
- **3590-05** Circumferential adapters for Model 3544
- **3590-4013** Shear adapters for Model 4013
- **3590-3421** Shear adapters for Model 3421
- **3590-07** 100 mm (4 inch) extension post for long gauge length extensometers
- **3590-55-10** 250 mm (10 inch) extension post for long gauge length extensometers
- **3590-55-24** 600 mm (24 inch) extension post for long gauge length extensometers

Custom – contact Epsilon for adapters to fit Models 7650A, 7650, 7651, and 3567

Note: Model 3590VHR and 3590 calibrators include 9.52 mm (0.375 inch) diameter smooth round adapters

Standards Labs in most countries have signed a Mutual Recognition Arrangement CIPM MRA. This includes the NPL in the UK, NIST in the USA and many others. This makes them effectively traceable to each other. Services of the NPL are equivalent to those offered by NIST and are recognized by NIST through this agreement of reciprocity. [www.bipm.org/en/cipm-mra/](http://www.bipm.org/en/cipm-mra/)

Visit our website at [www.epsilontech.com](http://www.epsilontech.com) Contact us for your special testing requirements.
Epsilon’s axial/torsional calibrator features 0.001 mm (50 microinches) resolution, and has 50 mm (2 inches) of measuring range axial and torsional rotation where 1.27 mm (0.050 inch) of linear motion equates to 1° angle of twist. The autozero button and digital display greatly simplify calibration of extensometers. The 3590AT calibrator is designed to be used with the Model 3550 and 7650 axial/torsional extensometers.

The digital display reads mm and changes to inches at the touch of a button. The autozero button is a great help in calibrating. Just press the button to start readings from zero. The digital display reduces operator error.

Features

- 0.001 mm (50 microinches) resolution
- ±0.004 mm/25 mm (±0.00015 in/in) accuracy
- Full 50 mm (2 inches) axial measuring range
- Digital display
- Autozero button simplifies readings

- Foam lined case for storage included
- System fully calibrated traceable to NPL (UK standards organization)

The 3590AT can be converted into a standard Model 3590 calibrator with the optional 3590AT-3590 adapter.

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ESCS  Epsilon Shunt Calibration System

Calibration References

VREF Modules
Designed to allow Epsilon’s extensometer calibration to be easily transferred to a customer’s electronics, the Epsilon Shunt Calibration System is available for any strain-gaged extensometer.

What is shunt calibration?
The Epsilon Shunt Calibration System provides an easy way to calibrate an extensometer and signal conditioning electronics without using a mechanical calibrator. Shunt calibration enables performing on-site electrical calibration with nearly all types of controllers and electronics. It also makes it easy to periodically “spot check” the calibration of the electronics, which will help ensure that the extensometer and electronics are calibrated correctly.

Note that the Epsilon Shunt Calibration System does not replace the need for on-site verification using a mechanical extensometer calibrator. On-site verification is required by many labs and testing standards.

Which extensometers include the Epsilon Shunt Calibration System?
The Epsilon Shunt Calibration System is included with every new Epsilon strain-gaged extensometer. Customers who would like Epsilon to add the Epsilon Shunt Calibration System to an existing extensometer that does not have it can send the extensometer to Epsilon for re-calibration. Epsilon will install the Epsilon Shunt Calibration System, perform a calibration, and return the retrofitted extensometer with a new Epsilon Test Certificate.

How does shunt calibration work?
The Epsilon Shunt Calibration System is used for two-point calibrations.

The first point is the extensometer’s gauge length.

The second point is the shunt calibration point. When the Epsilon Shunt is plugged into the Shunt Connector, the shunt resistor, which is located in the Shunt Connector, is electrically connected across one arm of the extensometer’s Wheatstone bridge. The result is that the extensometer’s output is electrically set to a known calibration point without having to mechanically displace the extensometer’s arms. The known calibration point is shown on the extensometer’s Test Certificate as the Shunted Reading, which was set at Epsilon using traceable mechanical calibrators and an accredited ISO 17025 calibration process.

To complete the shunt calibration, the signal conditioning electronics or software are adjusted so that the extensometer’s readout matches the Shunted Reading shown on the extensometer’s Test Certificate.

Using the Epsilon Shunt Calibration System is a simple two-step process.

1. Set the extensometer to its gauge length and zero its output. This sets point 1 in the example graph.

2. Plug the Epsilon Shunt into the Shunt Connector and adjust the signal conditioning electronics or software so that the extensometer’s readout matches the Shunted Reading on the extensometer’s Test Certificate. This sets point 2 in the example graph.

That’s all it takes.
This process works for almost any combination of strain-gaged extensometer and signal conditioning electronics or software. It works even if the test controls have their own internal shunt calibration capability. It is useful for digital test machine controllers, analog controllers, data acquisition systems and stand-alone extensometer signal conditioning electronics.

Additionally, periodic recalibration of the extensometer may be accomplished by sending the extensometer to Epsilon for recalibration service.

Contact Epsilon about recalibration and Epsilon Shunt Calibration System retrofits.
10V calibration reference for high level devices.

Like the shunt calibration module for strain gaged extensometers, the VREF module is used to transfer Epsilon’s calibration to a customer’s electronics. VREF works with Epsilon’s Model 3648 high temperature capacitive extensometers, and is compatible with both the 3603 and 3604 signal conditioners. The high-precision 10V reference in the VREF module ensures calibrations are spot on every time. One VREF module may be used to calibrate several high level output extensometers by using the 10V extension value for each extensometer.

Calibration only requires these simple steps:
1. With the VREF module connected to the testing machine’s strain channel input, set VREF to 0V and zero the testing machine’s strain channel. This is the zero reference.
2. Set VREF to 10V and calibrate the full scale extensometer value on the testing machine’s strain channel. This is the calibrated full scale.
3. If your testing machine requires returning to 0V after setting full scale, set VREF back to 0V and zero the testing machine’s strain channel.
4. Reconnect the extensometer’s signal conditioner to the testing machine and you’re ready to go.

That’s all it takes.
EPSILON is accredited by A2LA to the ISO/IEC 17025 international standard and certified by DNV to the ISO 9001 international quality management system standard.

The proven compliance with these standards demonstrates the accuracy and consistency of our measurements and calibrations and represents our commitment to quality.

To receive accreditation to ISO/IEC 17025 international standard, our laboratory has conducted comprehensive testing and documentation of all of our processes and ensured that the uncertainty in our measurements is both documented and reduced to the lowest amount possible. During the accreditation process, the robustness of our quality system is evaluated as well as our laboratory’s technical proficiency to make measurements to our stated degree of accuracy.
Epsilon Technology’s A2LA accreditation scope covers all measurements made during calibration. This means that all calibration stands and extensometers sold with electronics come with a fully accredited calibration that you can rely upon to be accurate and traceable. If you are buying an extensometer to use with existing electronics you are still receiving an accredited calibration, however, you will need to calibrate your system as a whole. If you have any questions about this, please do not hesitate to contact us.

To become certified to ISO 9001, we further documented our processes starting in the design and development phase and following the product through manufacturing, calibration and shipment with a strong focus on quality throughout. These improvements to our quality management system allow us to better track ways to improve our products and services and continue to provide our customers with products to fulfill their materials testing needs.

Our certificates and scope of accreditation can be viewed on our website at: www.epsilontech.com/accreditations-and-certifications.
1. Limited Warranty

Epsilon warrants all products of our manufacture ("Products") to be free of defects in materials or workmanship for a period of one year from date of shipment. This warranty covers both parts and labor. Epsilon reserves the right to determine if defects are covered by warranty. This warranty does not cover items subject to wear. Specifically, this does not cover knife edges or ceramic rods. Upon return of item (shipping prepaid) for repair, Epsilon will determine whether the item is covered by warranty, and repair or replace it at our option.

The warranty period for any product is not extended from its original date by virtue of having been repaired or replaced under the original warranty.

2. Other Limits

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Epsilon does not warrant against damages or defects arising out of improper or abnormal use or handling of the Products; against defects or damages arising from improper installation (where installation is by persons other than Epsilon), against defects in products or components not manufactured by Epsilon, or against damages resulting from such non-Epsilon made products or components. Epsilon passes on to Buyer the warranty it received (if any) from the maker thereof of such non-Epsilon made products or components. This warranty also does not apply to products upon which repairs have been effected or attempted by persons other than pursuant to written authorization by Epsilon.

3. Exclusive Obligation

THIS WARRANTY IS EXCLUSIVE. The sole and exclusive obligation of Epsilon shall be to repair or replace the defective products in the manner and for the period provided above. Epsilon shall not have any other obligation with respect to the products or any part thereof, whether based on contract, tort, strict liability or otherwise. Under no circumstances, whether based on this Limited Warranty or otherwise, shall Epsilon be liable for incidental, special, or consequential damages.

4. Other Statements

Epsilon's employees or representatives' ORAL OR OTHER WRITTEN STATEMENTS DO NOT CONSTITUTE WARRANTIES, shall not be relied upon by Buyer, and are not a part of the contract for sale or this limited warranty, unless agreed to in writing by a corporate officer of Epsilon.

5. Entire Obligation

This Limited Warranty states the entire obligation of Epsilon with respect to the Products. If any part of this Limited Warranty is determined to be void or illegal, the remainder shall remain in full force and effect.
Strain measurement for materials testing is our only business at Epsilon.