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 axial/torsional extensometer

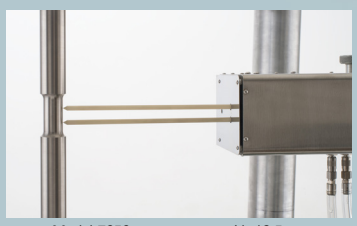
Model 7650 extensometers are primarily used on round specimens tested in bi-axial test machines capable of simultaneous axial and torsional loading. All models are capable of bi-directional displacement in both axes and may be used for strain-controlled fatigue testing under fully reversed load and strain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

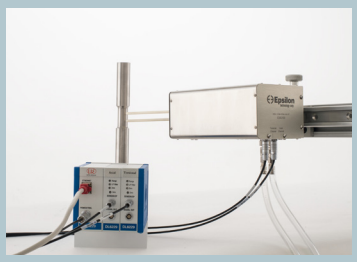
These units are specifically designed to minimize crosstalk between axes and to provide high accuracy, high resolution measurements. They incorporate capacitive sensors for low operating force and include electronics with programmable filtering and multi-point linearization for improved performance and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

These liquid-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.

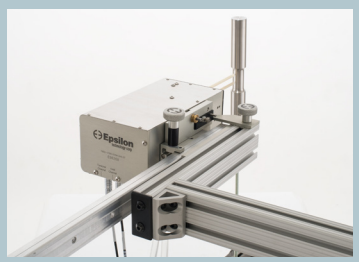
The Model 7650 is often customized for specific test needs. Contact Epsilon for a configuration that matches your requirement.



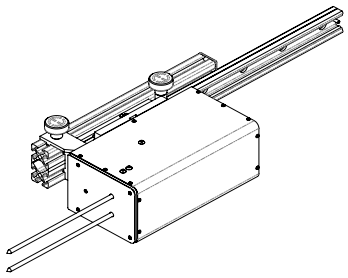
Model 7650 extensometer with 12.5 mm gauge length



Model 7650 extensometer with Model DT6229 two-channel signal conditioner



Model 7650 bi-axial extensometer 7650-0125M-025M-040-ST



MODEL 7650 EXAMPLE

Features

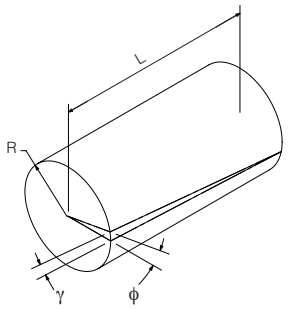
- Hot mountable and retractable.
- Self-setting gauge length with fine adjustment feature.
- All models can measure in both tension and compression and may be used for cyclic testing at test frequencies up to 10 Hz.
- Ships fully calibrated with calibration that is traceable to NPL; voltage output may 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 liquid cooling fittings and signal cables.
- Includes high quality foam lined case and a spare set of rods.

Specifications

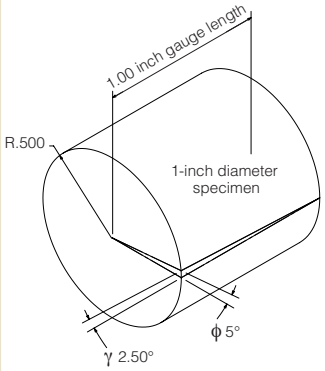
Analog Output:	User specified, ±10VDC typical, ±10.8VDC rail
Digital Output:	24 bit high speed Ethernet output with built-in web interface
Accuracy:	Standard configurations meet ASTM E83 class B-1 and ISO 9513 class 0,5 requirements for accuracy (axial). A test certificate is included. All standard units have linearity of 0.10% full scale measuring range or better in the torsional channel.
Linearity:	11 point digital linearization, ≤0.2% FS typical linearity
Hysteresis:	≤0.2% FS typical
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
Specimen Size Range:	Fits most round specimens; diameter ≥10 mm recommended
Cyclic Testing:	Up to 10 Hz, depending on test system and test amplitude
Test Frame Layout:	Accommodates test frames with torsional actuator located above or below specimen
Temperature Range:	Standard (-ST) is to 1200 °C (2200 °F), optional (-HT) 1600 °C (2900 °F)
Environment:	Recommended for testing in dry air, inert / non-corrosive gases, or vacuum
Operating Force:	<30 grams typical
Contact Force:	<560 grams typical
Sensor Cables:	2 m (6.5 ft) room temperature cables
Output Cables:	Flexible 2.4 m (8 ft) analog output cables
Coolant Interface:	Two barbed hose fittings for 1/8" (3.2 mm) ID coolant hoses
Specimen Size:	Fits most round specimens; diameter ≥10 mm recommended
Power:	Includes power supply

Options

High temperature option (-HT suffix) for use to 1600 °C
Load frame mounting brackets
Bulkhead adapters for use in vacuum chambers
Model 3590-TORSION Torsion Calibrator Accessory (see page 120)
Model EPS170 constant-temperature recirculating chiller - *see the Options tab on the web page for important details about liquid cooling requirements*
Connectors to interface to nearly any brand of test equipment



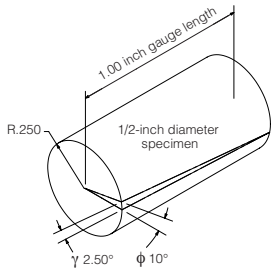
Epsilon's axial/torsional extensometer was designed to directly measure the shear strain, γ shown in the figure. This design allows the correct determination of the shear strain without having to know the radius of the specimen being tested, R_1.



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

$$\gamma = R_1 \frac{d\phi}{dL_1}$$

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.

Model Number	Axial Gauge Length	Axial Strain	Torsional Shear Strain Angle
7650-0125M-025M-040-xx	12.5 mm	+2.5 mm/-0.5 mm	±4.0°
7650-0125M-015M-040-xx	12.5 mm	+1.5 mm/-1.5 mm	±4.0°
7650-025M-025M-020-xx	25.0 mm	+2.5 mm/-0.5 mm	±2.0°
7650-025M-015M-020-xx	25.0 mm	+1.5 mm/-1.5 mm	±2.0°

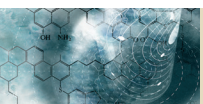
Temperature Range ("-xx" above):
Room temperature to 1200 °C (2200 °F) -ST
Room temperature to 1600 °C (2900 °F) -HT

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 / 15W electrical power. Liquid cooling is recommended; required for 800 °C and above.

CE CERTIFIED

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



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