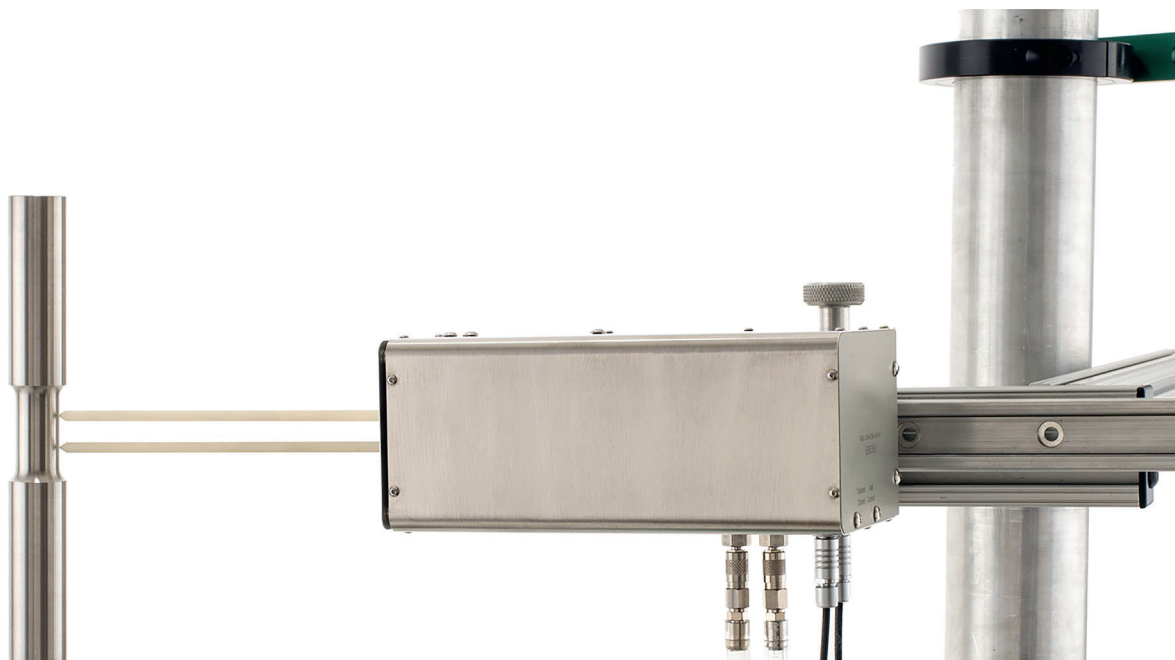


## High Temperature Axial / Torsional Extensometer Series 7650 up to 1600 °C

for simultaneous measuring axial deflection and torsional strain at temperatures up to 1200°C or 1600°C and frequencies up to 10 Hz on specimens tested in axial / torsional machines.

This accurate capacitive high temperature extensometer measure and can control axial deflection and torsional strain with a single extensometer at high temperatures in combination with high temperature furnaces or induction heating systems. The model 7650 extensometers are primarily used on round specimens tested in bi-axial test machines that are capable of simultaneous axial and torsional loading. All of the models are capable of bi-directional displacement in both axes and can be used for strain-controlled fatigue testing under completely reversed load and strain conditions at frequencies ranging up to 10 Hz.

These water cooled extensometers with its measurement system completely housed to reduce temperature disturbances by airflow minimize thermal drifts and provides accurate long-term stability.



The 7650 extensometer models mount rigidly on the load frame and incorporate slide mounting to move the extensometer into contact with the specimen.

The gauge length is set automatically before the extensometer is mounted on the test specimen, which enables hot mounting after thermal equilibrium has been realized.

These extensometers are specifically designed to reduce crosstalk between axes and to provide high resolution, high accuracy measurements. They incorporate capacitive sensors for low operating force. It also includes electronics with multi-point linearization and programmable filtering for enhanced performance and accuracy. The overall design reduces, and in many cases almost eliminates, any influence from common lab environment vibrations.

The model 7650 extensometers are water-cooled and 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. These extensometers are often tailored for specific test needs. We can be contacted for a specific configuration to match the user's equipment.

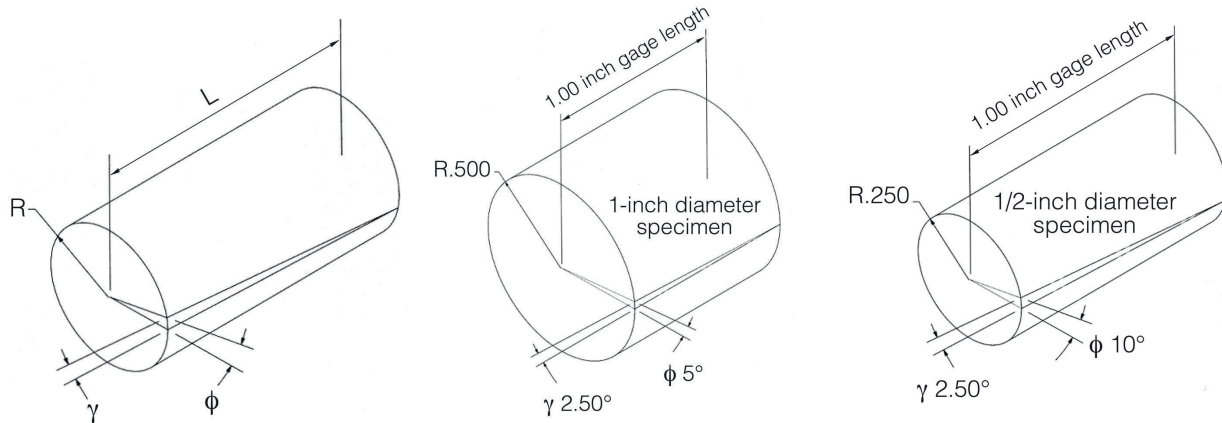
### The application range includes:

- High Temperature static to cyclic axial/torsional testing including reverse loading.
- Fatigue testing up to 10 Hz
- Can be used also for single axial or torsional measurements.

# w+b Materials Testing Systems

The Series 7650 was designed to directly measure the shear strain,  $\gamma$ , shown in the left figure below. 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),  $\phi$ , by the following relationship:  $\gamma = R1 (d\phi / dL1)$ .

For extensometers that measure  $\phi$  directly instead of  $\gamma$ , corrections need to be made for every different specimen diameter tested and for axial strain to correctly determine the shear strain. The two examples below show the variation of the angle of twist versus a change in specimen diameter relative to the constant resulting shear strain.



## Features

- Standard units meet ISO 9513 class 0.5 and ASTM class B-1 requirements for accuracy (axial)
- Self-setting gauge length with fine adjustment feature
- Hot mountable and retractable
- Delivers fully calibrated with calibration that is traceable to NPL; voltage output can be user-specified (typically 0 - 10 V)
- All models can measure in both tension and compression and can be used for cyclic testing at test frequencies up to 10 Hz
- Superior ambient vibration rejection; primary vibration mode >100 Hz typical
- Includes high speed analog and digital outputs
- Includes power supply and digital controller. Provides high level DC voltage output with low noise. Easily interfaced to data acquisition boards, test controllers, and chart recorders
- Multiple extensometer calibration files can be loaded for use with one controller
- Built-in calibration reference and auto-zero features
- Web-based user interface for setup and data acquisition
- Selectable analogue and digital filter options from 2 Hz to 3 kHz

## Available Rod Tip Styles



**STRAIGHT CHISEL**  
Flat and round specimens



**VEE CHISEL**  
Round specimens



**CONICAL TIP**  
Flat specimens

- Straight Chisel: Most versatile, since they can be used with round for flat specimens
- Vee chisel: For round specimens
- Conical Chisel: For flat specimens

## Important Note

Liquid cooling is recommended for all elevated temperature tests to obtain the best measurement accuracy and retain the validity of a room temperature calibration when the specimen temperature is >540 °C (1000 °F). Cooling is necessary to prevent extensometer damage for testing in the range of ~800-1600 °C (1500-2900 °F).

# w+b Materials Testing Systems

## Specification:

Cyclic testing:	Up to 10 Hz, depending on test system and test amplitude
Linearity:	11 point digital linearization, $\leq 0.1\%$ FS typical linearity (axial and torsional)
Hysteresis:	$\leq 0.1\%$ FS typical
Filter:	Selectable 100 Hz analog and 2 Hz – 3 kHz digital filters
Analog output:	User specified, $\pm 10$ VDC typical, $\pm 10.8$ VDC rail
Digital output:	24 bit high speed Ethernet output with built-in web interface
Resolution:	$< 75$ PPM (0.0075%FS) RMS @ 4 kHz, $< 6$ PPM (0.0006%FS) @ 100 Hz at gauge length
Sensor cables:	2 m (6.5 ft) room temperature cables
Output cables:	Flexible 2.4 m (8 ft) analog output cables
Power:	Includes power supply for the user's country
Operating force:	$< 30$ grams typical
Specimen size range:	Fits most round specimen diameters
Crosstalk:	$\leq 0.2\%$ FS typical at $\pm 1^\circ$ shear with 25 mm diameter specimen and 12.5 mm gauge length
Environment:	Recommended for testing in vacuum, dry air, or inert/non-corrosive gases
Test frame layout:	Accommodates test frames with torsional actuator located above or below specimen
Contact force:	$< 560$ grams typical

## Technical Data

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 us to discuss your requirements.

## Model Number 7650 - - - -

Gauge Length	
0125M	12.5 mm
-025M	25.0 mm

Measuring Range:			
	Axial Strain		Torsional Shear Strain Angle
025M	+2.5 mm/-0.5 mm	020	$\pm 2.0^\circ$
025M	+2.5 mm/-0.5 mm	010	$\pm 1.0^\circ$

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

## Options:

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

