Shunt Calibration & Gain Optimization

Getting the best performance from your extensometer

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Calibration Overview

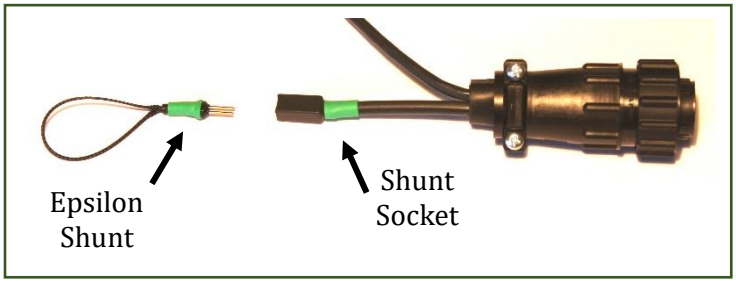
Epsilon's extensometers and other sensors are electro-mechanical *transducers*. The output of the extensometer is a raw analog voltage, proportional to the displacement and excitation voltage.

Conversion of this voltage output to a useful measurement with physical units occurs within the user's electronics system and software. Before using an extensometer, the controller electronics and extensometer must be calibrated together as a system. *Calibration* is the process of setting/defining the conversion from raw voltage to a measurement with physical units – sometimes called *Gain, Span,* or *Sensitivity*, depending on the nomenclature used by the manufacturer of the electronics.

> *If your measurement error is increasing or decreasing proportionally with displacement, you may need to adjust/repeat your calibration.*

Shunt Calibration

The process varies by manufacturer, but most controllers' software provide for two-point calibration using a zero point and a reference point. A common calibration method is *Shunt Calibration*. When the *Epsilon Shunt* is inserted, an electrical *Shunted Output* is produced which is equivalent to mechanically displacing the extensometer by the corresponding *Shunted Displacement*. This provides a convenient calibration method for users who do not have a mechanical extensometer calibrator such as Epsilon's 3590VHR. This method is generally much more accurate than calibrating using calipers or gage blocks.



The Shunted Displacement may be found on the Epsilon Test Certificate. This value has been factory-calibrated to provide the most accurate overall performance for your extensometer. Your Test Certificate may include multiple factory-calibrated Shunted Displacements optimized for different applications.

Detailed procedural instructions for shunt calibration are found in your *General Information Manual for Strain-Gaged Extensometers.*

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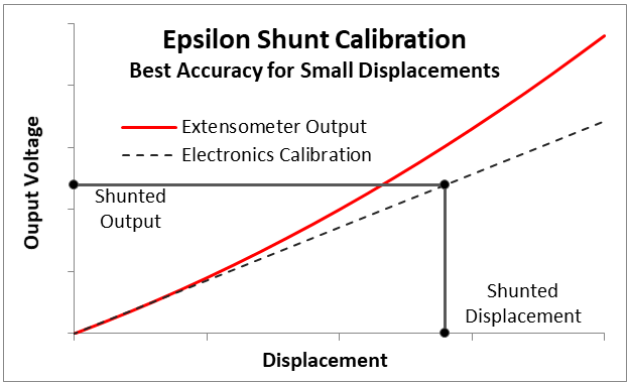
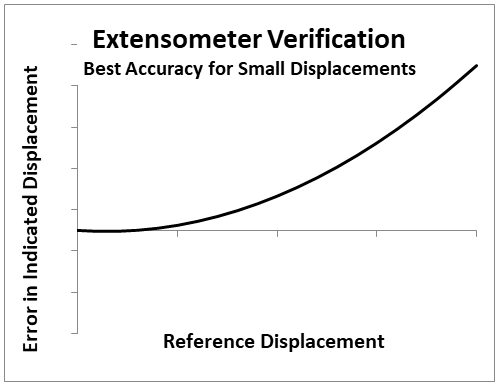
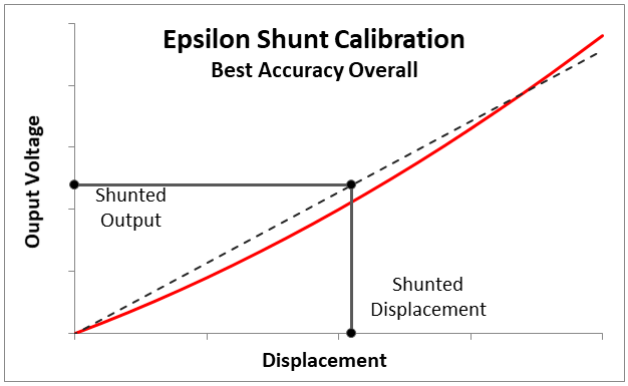
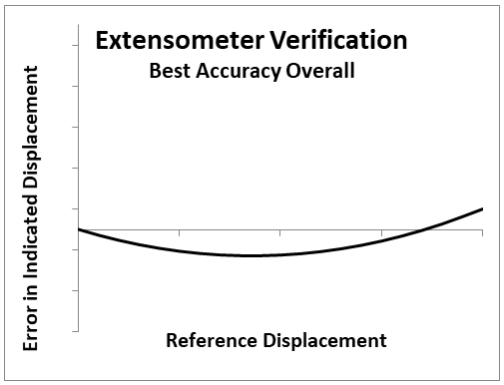
Optimizing Calibration Gain

Most extensometers have slightly nonlinear output. The calibration may be optimized to yield the best accuracy over a specific range, whether for tension and/or compression, or for large or small strain ranges. In this example, we see the results of two different *Shunt Calibrations* using *the Epsilon Shunt Calibration method* with the same *Shunted Output*. One is optimized for best accuracy over the full range of the sensor and the other for best accuracy for small displacements near zero.

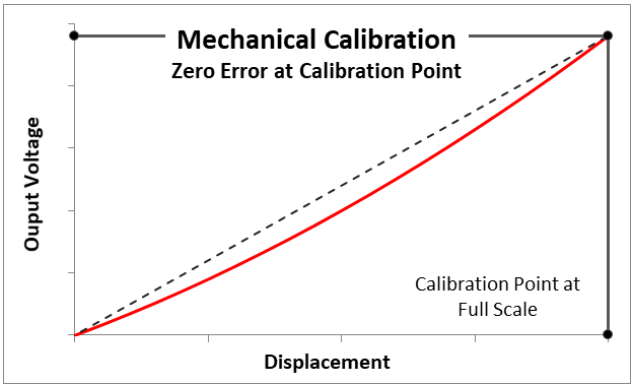


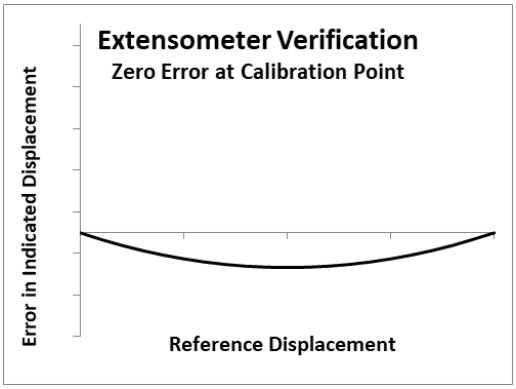






When a mechanical calibrator is used instead of the Epsilon Shunt, the reading error is zero at the calibration point. Any displacement in the extensometer's range can be used for the calibration point.





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