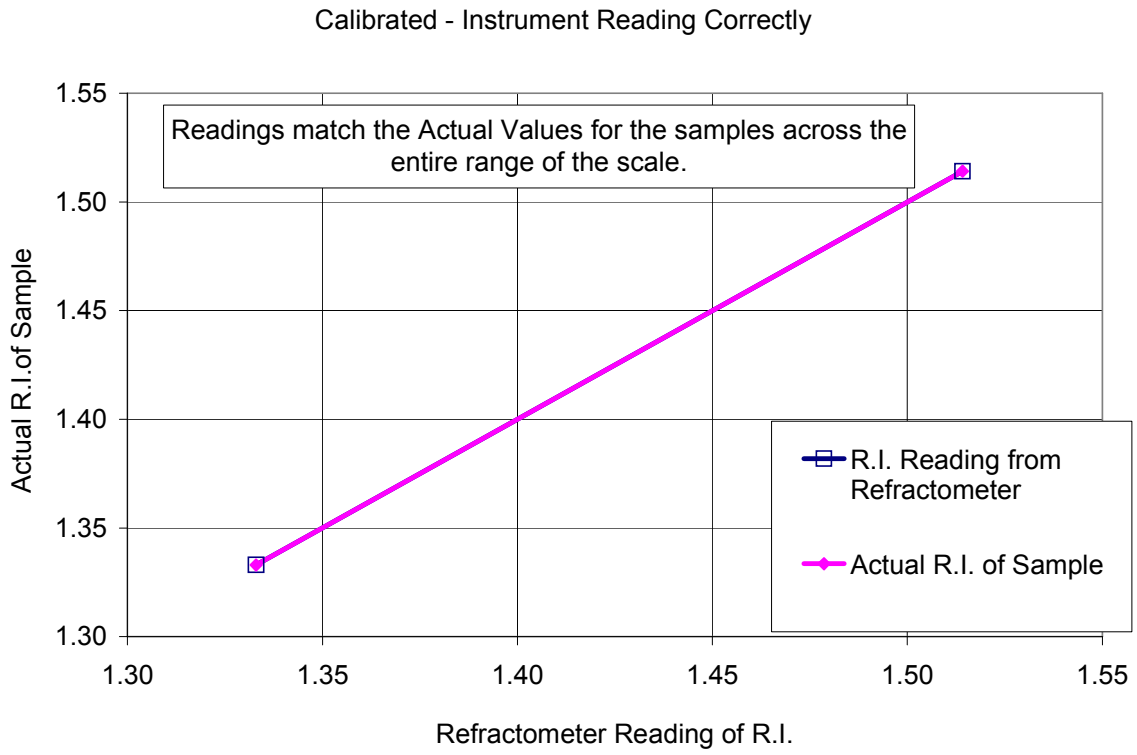
Technical Bulletin

REFRACTOMETER CALIBRATION

Calibration of a refractometer is the process of ensuring that the readings the instrument provides match known values throughout the reading range. This concept is evident in the following diagram.



There are two types of calibration available on most refractometers: a Set Point calibration (also known as a one-point, or water calibration), and a Span Point calibration (also known as a two-point calibration, though more points can be invloved).

A “Set Point” calibration shifts the entire reading scale of the refractometer up or down such that it will match water at 1.33299 Refractive Index. The shift is equal along the entire length of the scale.

A “Set-Point” calibration is typically performed with distilled water. Distilled water has a refractive index of 1.33299 at 20.00°C, with a temperature coefficient of –0.000091 (meaning it’s refractive index decreases by 0.000091 for every increase in temperature of 1°C). This Refractive Index is typically at the low end of the reading range of the refractometer. Please refer to the following diagram:

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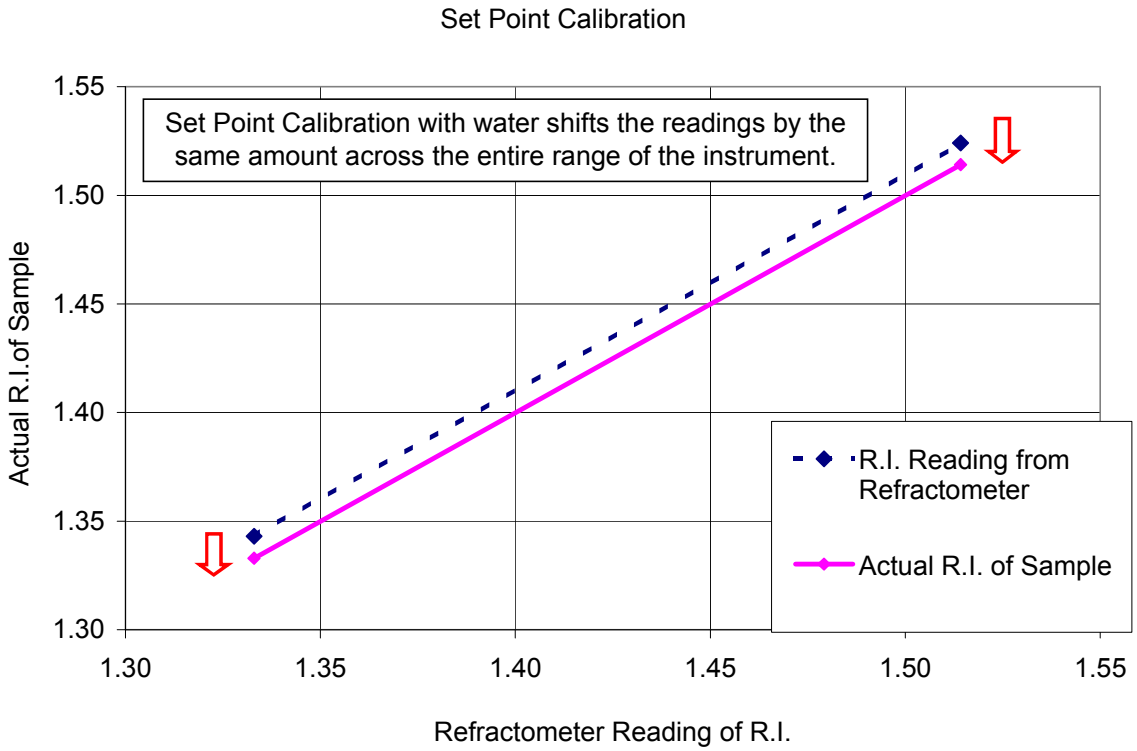

The second type of calibration that can be performed is a “Span” calibration. This typically involves performing a calibration to water at the low end of the scale (i.e. the “Set-Point” Calibration) and then calibrating the instrument to a known solution at the top or high end of the reading range. This would be necessary if quality control samples indicated that readings of samples above water were off, but water readings were correct. See the diagram below:

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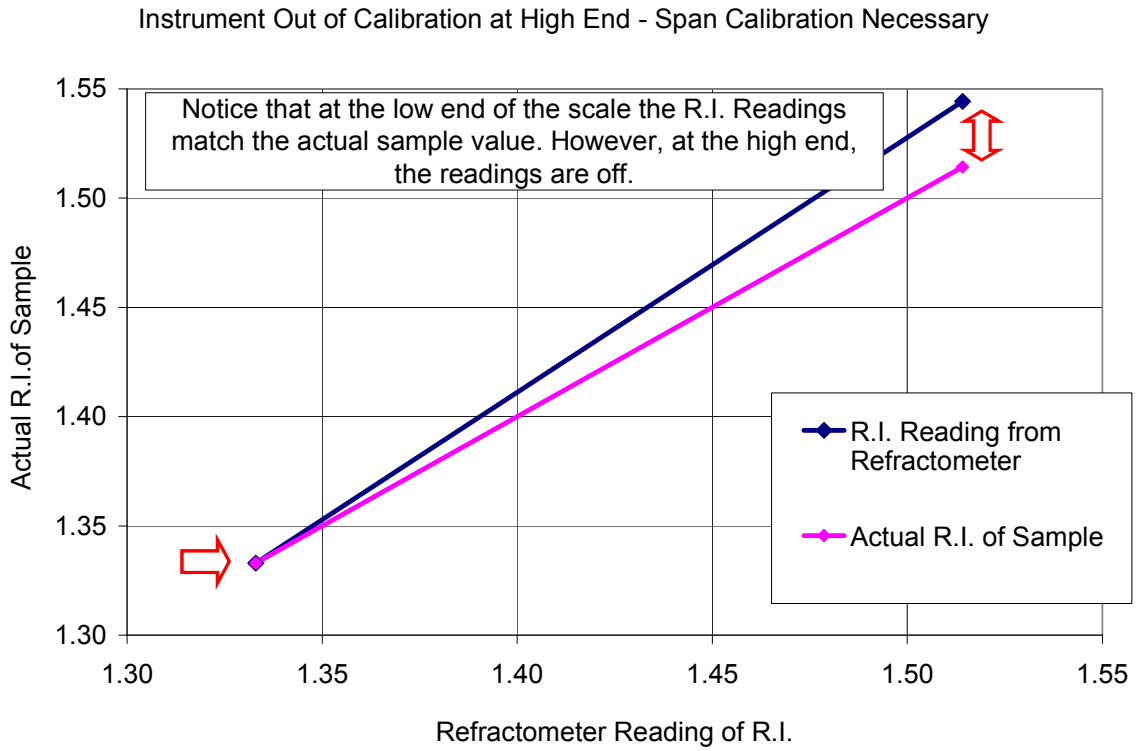

By adjusting the “Span” of the instrument, we shift the scale proportionally along it’s entire length. The “Set-Point” remains fixed and the remainder of the scale is adjusted around it increasing up to the “Span-Point”. See the following diagram:

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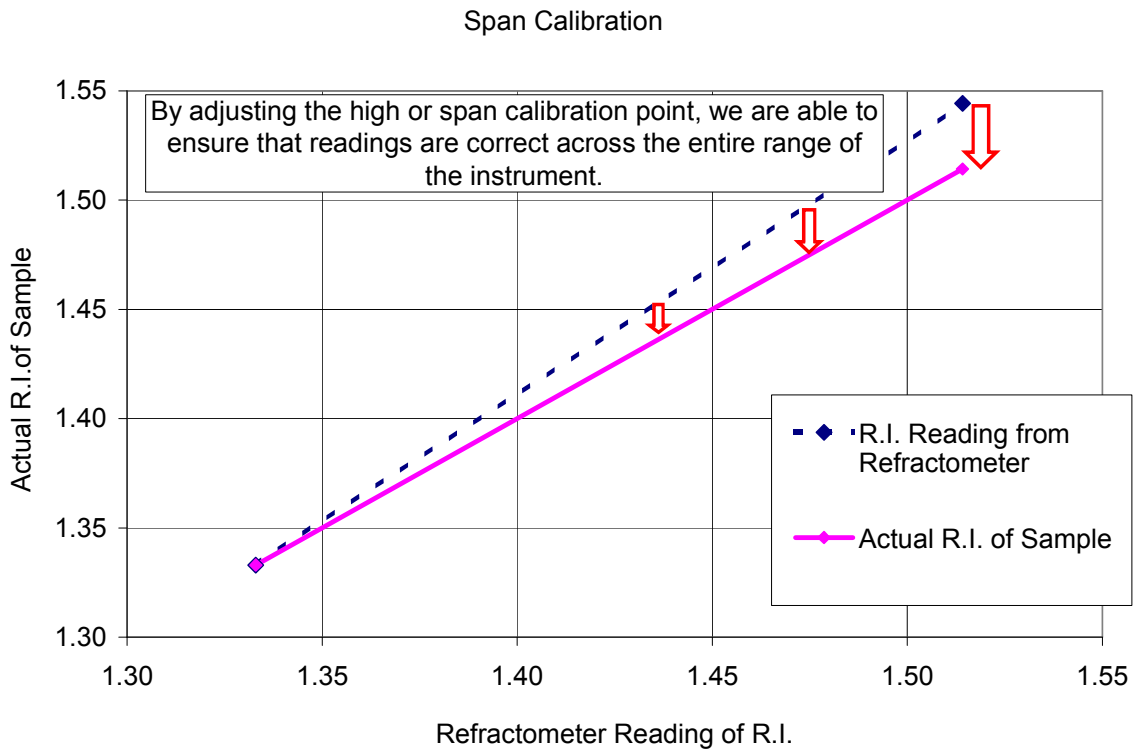

REFRACTIVE INDEX VERSUS CONCENTRATION

Calibration of a refractometer is typically performed with a Refractive Index standard. All refractometers actually read refractive index and temperature. These are then converted into a % Solids, ° Brix, or concentration reading based upon a formula, which is specific for the type of sample being read. The correlation between refractive index and concentration varies by sample type. For a better understanding of this concept, see the following diagram:

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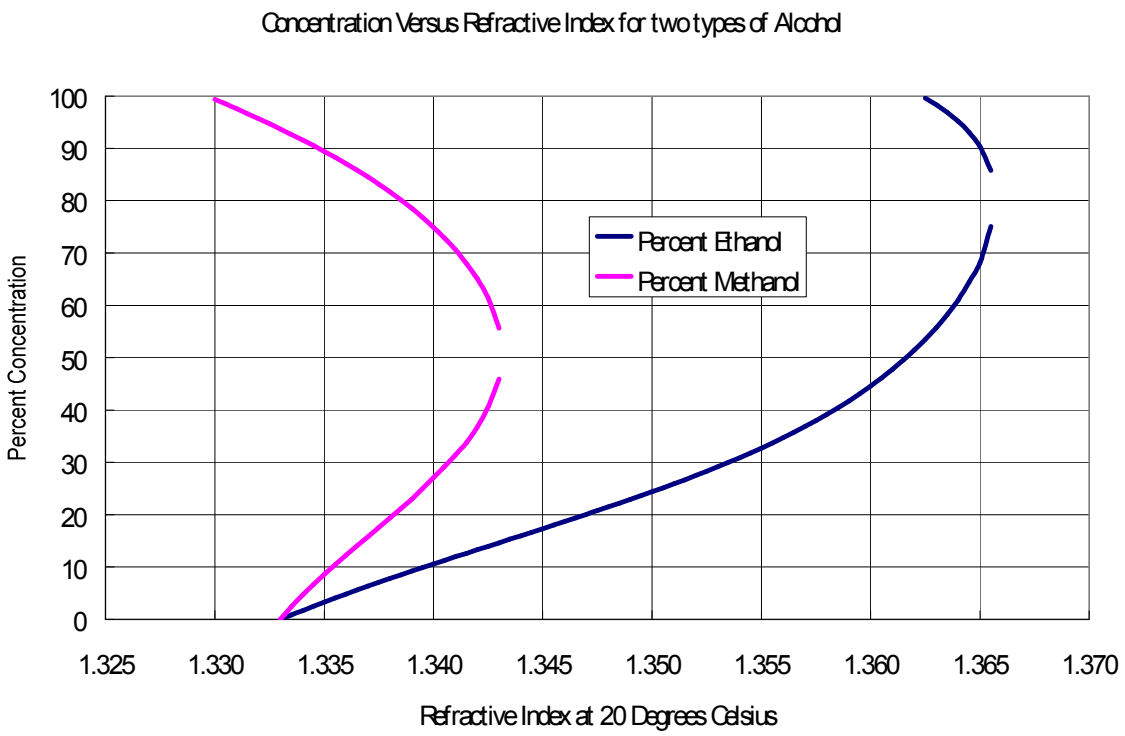

TEMPERATURE EFFECT ON READINGS

Temperature effects refractive index, and subsequently concentration readings. Generally, as temperature increases, refractive index decreases (and subsequent concentration readings decrease). This change in refractive index versus temperature is known as the Temperature Coefficient of the sample.

Temperature Coefficients are specific to the component being analyzed. The Temperature Coefficient of water is –0.000091, while that of the NIST certified oil (which comes with many Reichert refractometers) is –0.000412. Also, as the concentration of a solution increases, the Temperature Coefficient of the sample increases. See the following graph for more detail:

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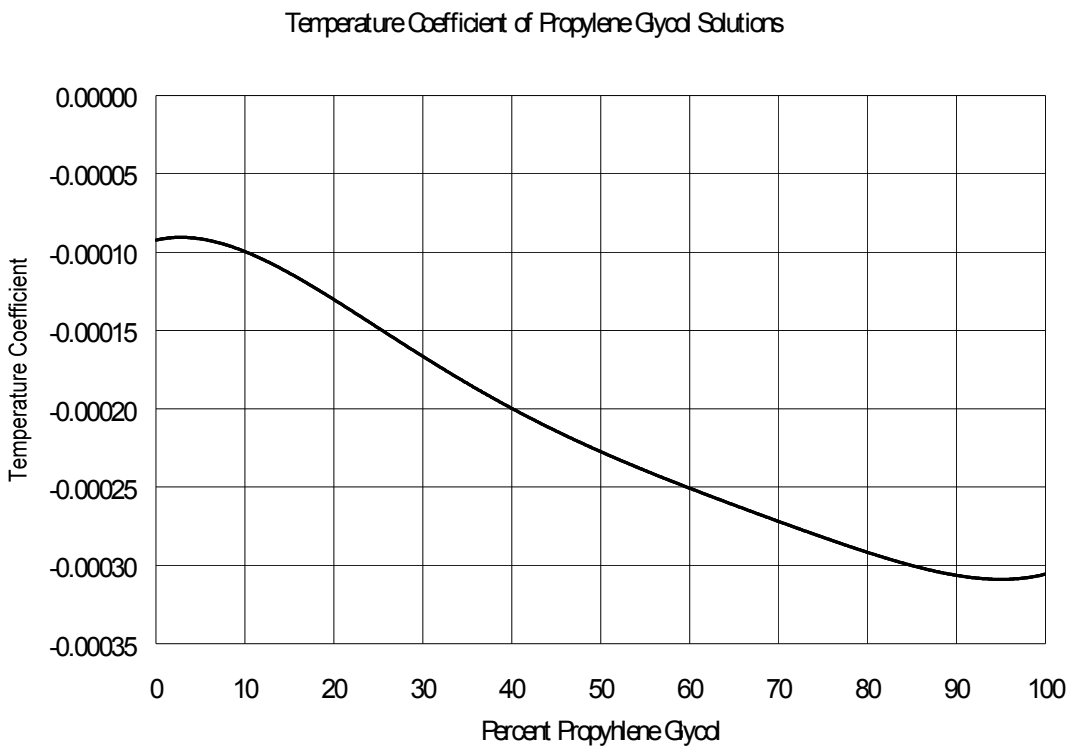

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