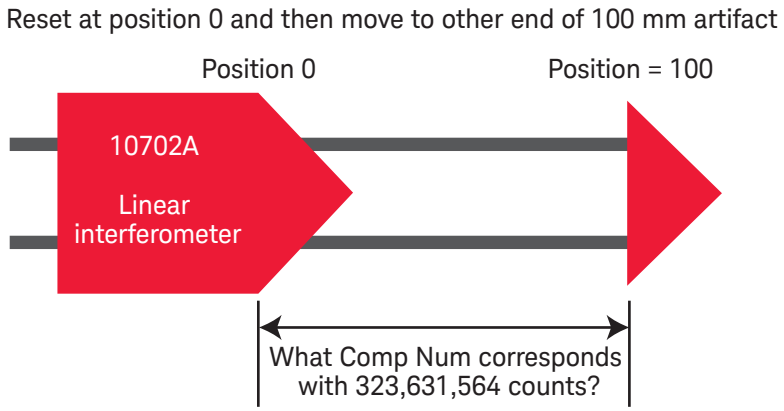
Product Fact Sheet

Keysight Laser Interferometer Systems Compensation Number Calculations

The Keysight Technologies, Inc. laser interferometer systems require compensation when used in an air environment. Several ways exist to obtain a compensation number (Comp Num). One is to use the Modified Edlén equation with pressure, temperature, and humidity sensors. Another is to measure an artifact with a known fixed length using a laser measurement axis, and calculate a Comp Num from the raw data. A third is to track changes with a Wavelength Tracking Interferometer (WTI). Note that this method requires an initial compensation value from one of the other two methods.



Artifact measurement setup

Key features

- Operation in air requires compensation
- Use environmental sensors and modified Edlén equation to get Comp Num
- Translate reading from artifact measurement into initial Comp Num
- Translate readings from WTI axis into real time Comp Num

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1. Rearrange position equation[1] to calculate Initial Comp Num from artifact measurement:

$$\text{Initial Comp Num} = \frac{\text{Artifact Length} \times \text{Resolution Extension}^2 \times \text{Optics Fold Factor}^2}{\text{Integer Counts} \times \text{Lambda}}$$

1. Refer pub# 5991-0329EN.
2. Values depend on axis board and optics type used. See pub# 5990-8206EN and 5990-9943EN.

Example using 100 mm artifact with Linear optics (optics fold factor=2) and N1231B electronics (Resolution Extension = 1024):

$$\text{Initial Comp Num} = \frac{100{,}000\ \mu\text{m} \times 1024 \times 2}{323{,}631{,}564 \times 0.63299137\ \mu\text{m}} = 0.99972670$$

2. Use fundamental equation twice, along with Initial Comp Num, to calculate Comp Num from WTI axis data:

$$\text{Etalon Length} = \frac{\text{Initial Comp Num} \times \text{Preset Counts} \times \text{Lambda}}{\text{Resolution Extension} \times \text{Optics Fold Factor}}$$

solve for Preset Counts

$$\text{Comp Num} = \frac{\text{Etalon Length} \times \text{Resolution Extension} \times \text{Optics Fold Factor}}{(\text{Accumulated Counts} + \text{Preset Counts}) \times \text{Lambda}}$$

Example with 5.0137” (127.34798 mm) WTI (optics fold factor of 4) and 2 ppm change in environmental conditions:

$$\text{Preset Counts} = \frac{127347.98\ \mu\text{m} \times 1024 \times 4}{0.63299137\ \mu\text{m} \times 0.99972670} = 824{,}276{,}519$$

$$\text{Comp Num} = \frac{127347.98\ \mu\text{m} \times 1024 \times 4}{(-1649 + 824{,}276{,}519) \times 0.63299137\ \mu\text{m}} = 0.99972870$$

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For more details on configuring, setting up, and using Keysight laser interferometer systems, please obtain the Keysight Laser and Optics User’s Manual Volume I and II, part number 05517-90086.

For online information on Keysight laser interferometers, please visit:
www.keysight.com/find/lasers

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