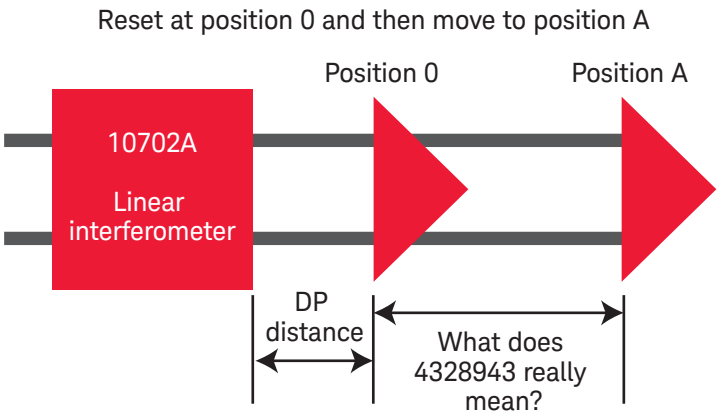
Product Fact Sheet

Keysight Laser Interferometer Systems Position Calculations

The Keysight Technologies, Inc. laser interferometer systems allow precise measurement and control of position. The fundamental output of these systems is an integer value, representing the number of uncompensated fractional wavelength counts corresponding to the change in optical distance between two optical components. It only takes some simple math to translate this abstract integer number into a value with real meaning to the user.



Position measurement setup

It could be 1337.617 µm, or 5350.469 µm, or something else depending on type of laser axis board used, the Comp Num and if there are changes during the measurement.

Key features

- High precision measurements, but output is an integer
- Simple math used to translate integer into a position in “human” units
- Should compensate for any dead path (DP) in the optical setup

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Calculating position from raw interferometer data

1. Fundamental position equation:

$$\text{Position} = \frac{\text{Comp Num} \times \text{Integer Counts} \times \text{Lambda}}{\text{Resolution Extension}^{1} \times \text{Optics Fold Factor}^{1}}$$

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

Example for Linear optics (Optics Fold Factor = 2) and N1231B electronics (Resolution Extension = 1024):

$$\text{Position} = \frac{0.99972870^{2} \times 4,328,943 \times 0.63299137\ \mu\text{m}}{1024 \times 2} = 1337.617\ \mu\text{m}$$

2. This is value for "Standard Air" at 20 °C, 50 %RH, and 760 mmHg (101.3250164 kPa). Actual Comp Num will vary with the environmental conditions.

2. Use fundamental equation twice to compensate for measured DP Distance (simulates move with 0 dead path):

$$\text{DP Distance} = \frac{\text{Initial Comp Num} \times \text{DP Counts} \times \text{Lambda}}{\text{Resolution Extension} \times \text{Optics Fold Factor}} \quad \text{solve for DP Counts}$$

$$\text{Position} = \frac{\text{Comp Num} \times (\text{Accumulated Counts} + \text{DP Counts}) \times \text{Lambda}}{\text{Resolution Extension} \times \text{Optics Fold Factor}} - \text{DP Distance}$$

Example for 25 mm Dead Path, Linear Optics, Standard Air at end but Comp Num was 2 ppm less at start:

$$\text{DP Counts} = \frac{25,000\ \mu\text{m} \times 1024 \times 2}{0.63299137\ \mu\text{m} \times 0.99972670} = 80,907,891\ \text{counts}$$

$$\text{Position} = \frac{0.99972870 \times (4,328,943 + 80,907,891) \times 0.63299137\ \mu\text{m}}{1024 \times 2} - 25,000\ \mu\text{m}$$

$$\text{Position} = 1337.667\ \mu\text{m}$$

Three-Year Warranty

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Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

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 Volume II, part number 05517-90086.

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

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