

Article Overview

Fiber optic distance sensors are calibrated using precision positioning stages, reference targets, and controlled environmental conditions to ensure accurate and repeatable measurements.

Calibration Principles

Fiber optic distance sensors, including displacement sensors and Fiber Bragg Grating (FBG) sensors, require calibration to convert raw optical signals into precise distance measurements. Calibration ensures that the sensor output corresponds accurately to the physical displacement or distance of the target. Key factors include linear range, resolution, temperature stability, and alignment of the sensor relative to the target .

Equipment and Setup

- o Precision Positioning Stages: Linear stages such as ball bearing, crossed-roller, or air-bearing stages are used to move the target with high accuracy. Crossed-roller stages are preferred for sub-micron accuracy, while air-bearing stages minimize friction and vibration .
- o Reference Targets: Standard targets include specular mirrors or diffuse surfaces, mounted perpendicular to the sensor axis on a stable base, often granite, to minimize mechanical drift .
- o Environmental Control: Temperature and vibration control are critical, especially for high-precision sensors. Fiber optic cables should be supported to avoid strain on the probe during calibration .

Calibration Procedure

- o Sensor Alignment: Secure the sensor tip perpendicular to the target surface using a probe holder to maintain consistent measurement geometry .
- o Stage Movement and Data Collection: Move the target incrementally across the sensor's measurement range. Automated control programs can record sensor output at each position .
- o Data Analysis: Plot the sensor output versus the known target positions. Apply a best-fit regression line to generate a calibration curve, which defines the sensor's linear response and sensitivity .
- o Verification: Check the sensor's response against known standards for linearity, repeatability, and resolution. For FBG sensors, additional checks may include wavelength accuracy and strain response .

Standards and Documentation

Calibration should conform to recognized standards such as ISO/IEC 17025:2017 for laboratory traceability. Accredited calibration services provide documentation verifying that the sensor meets manufacturer specifications and NIST-traceable references . This ensures reliability for industrial, aerospace, or research applications.

Sensor-Specific Notes

- o Time-of-Flight (ToF) Sensors: Devices like the OPT3101 require on-chip calibration routines, including register configuration, temperature compensation, and timing adjustments, typically performed once per board .
- o FBG Sensors: Calibration may also involve bonding and packaging considerations, as the sensor's mechanical attachment affects strain transfer and measurement accuracy .

Best Practices

- o Minimize mechanical strain on fiber cables during calibration.
- o Maintain stable temperature and vibration-free conditions.
- o Use high-precision stages for sub-micron accuracy.
- o Document calibration results for traceability and future verification. By following these procedures, fiber optic distance sensors can achieve high accuracy, repeatability, and reliable performance across their operational range.

Application note describes how the MTI-2100 Fotonic Sensor uses fiber optics to performs displacement measurement in gaseous or

As one of the hotspots of sensing technology at present, optical fiber sensor has the characteristics of small size, anti

The calibration experiments and data analysis in this paper validate the stability of OFDR

Whether you're dealing with laser sources, LED sources, optical power sensors, or optical spectrum

We provide both accredited and traceable fiber optic calibration for a wide range of instruments either in our accredited laboratories

The precise calibration of the optical fiber strain sensor has great practical value in prolonging the survival rate of the sensor,

This paper review recent advances in Raman distributed optical fiber sensing in terms of temperature measurement

As the basic application of fiber optic sensing technology, strain measurement accuracy as a key index needs to be

Unlike traditional electrical temperature measurement (thermocouples & RTD), the length of the fiber

optic cable is the temperature

Abstract and Figures We propose, and demonstrate, the use of a fiber-optical measurement artefact as a metrological

Reflectance acquired with a multimode optical fiber probe can be related to optical properties of an investigated turbid

OPT3101 Distance Sensor System Calibration This user's guide details the calibration procedure for the OPT3101 device to get

MTI Instruments provides high-performance fiber optic sensors and probes engineered for applications requiring large measurement

Additionally, the calibration errors for the improved calibration method are discussed. The test results indicate that the

Fiber-optic current sensor (FOCS) technology offers intrinsic galvanic isolation, a wide linearity range, immunity to electromagnetic

To calibrate fiber optic sensors for strain measurement, start by understanding the basic principles of the sensor technology and

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