Fiber Optic Distance Sensor



Overview

The fiber-optic sensor measures distance, position and changes of position with an accuracy of just a few nanometers.

Key Takeaways

Fiber optic sensors measure distance with high precision using light transmitted through optical fibers, offering nanometer-level accuracy and flexibility in confined or harsh environments.

Working Principle

Fiber optic distance sensors operate by transmitting light through optical fibers and detecting changes in the reflected or interfered light to determine distance, position, or displacement. Advanced systems, such as those using white light interferometry, provide absolute distance measurements that are not lost if the measurement process is interrupted, unlike traditional laser interferometers. Detection methods include through-beam, reflective, retro-reflective, and definite-reflective configurations, each suited for different target types and distances.

Accuracy and Measurement RangeHigh-precision fiber optic sensors, like the FDM series, achieve nanometer-level resolution. For example, the FDM-1 and FDM-2 systems offer accuracies from 3 nm over ranges up to 1 mm, while the FDM-3 laser interferometer can measure up to 1 m with sub-nanometer resolution. These sensors can detect minute changes in position, expansion, drift, or vibrations, making them ideal for precision manufacturing and component alignment.

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Miniaturization and Integration

Fiber optic probes can be miniaturized to diameters as small as 50–80 µm, allowing measurements in tight or hard-to-reach spaces, such as microbores, narrow cavities, or microsystems where tactile sensors are impractical. The modular design allows the probe and evaluation unit to be positioned independently, facilitating integration into automated production lines and inline measurement systems.

Advantages

Electromagnetic immunity: Optical signals are unaffected by electromagnetic interference. Long-distance transmission: Minimal signal attenuation allows probes to be placed far from the evaluation unit. Chemical and environmental resistance: Suitable for harsh industrial or biomedical environments.

Non-contact measurement: Prevents damage to delicate components. High-speed and multipoint measurement: Enables real-time monitoring in production processes.

Applications

Fiber optic distance sensors are used in a wide range of fields: Industrial precision manufacturing: Component positioning, alignment, and vibration monitoring. Microsystems and microgear inspection: Measuring shapes and tolerances in confined spaces. Biomedical diagnostics: Endoscopic and minimally invasive measurements, including spectroscopy and tissue morphology.

Structural monitoring: Continuous measurement of highly stressed components. Fiber optic sensors combine high accuracy, miniaturization, and environmental robustness, making them a versatile solution for both industrial and biomedical distance measurement tasks.

Article Content

Accurate Distance Measurement | fionec fiber optics

The fiber-optic sensor measures distance, position and changes of position with an accuracy of just a few nanometers. Automatable calibration routines ensure that the values generated are reliable and

Optical distance sensors | Leuze

To meet these diverse needs, the operating principles of triangulation, propagation time measurement and phase measurement in different sensor sizes and

Sensors | fionec fiber optics

Whether fibre-optic distance measuring devices, miniaturised probes or environmental modules, find your suitable metrological solution!

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Obtaining Reconstruction Spectra of Acoustic Emission ...

Abstract A method is reported for reconstructing the amplitude–frequency characteristic (AFC) of the distributed fiber optic sensor (FOS) built into a polymer composite material (PCM),

Optical Fiber Sensors and Sensing Networks: Overview of the Main

Optical fiber sensors present several advantages in relation to other types of sensors. These advantages are essentially related to the optical fiber properties, i.e., small, lightweight,

Distributed Fiber Optic Temperature Sensor

What is a Distributed Fiber Optic Temperature Sensor? Yokogawa''s DTSX product family is engineered with a variety of fiber optic sensing cables that provide continuous temperature sensing for long

DTSX3000 Distributed Temperature Sensor

Unlike traditional electrical temperature measurement (thermocouples & RTD), the length of the fiber optic cable is the temperature sensor. Distributed temperature sensing can provide thousands of

FV-22P Fiber Optic Sensor,HD LED Dual Digital Display Optical Fiber ...

FV-22P Fiber Optic Sensor,HD LED Dual Digital Display Optical Fiber Amplifier,Long-Distance Optical Communications Diffuse Induction Photoelectric Switch (English Instruction Manual): Amazon :

NEW Autonics FD-420-05 M4 Fiber Optic Cable Sensor 40mm Diffuse ...

Description NEW Autonics FD-420-05 M4 Fiber Optic Cable Sensor 40mm Diffuse Reflective 2m UL CSA Sensing Performance: Provides a 40mm sensing distance for detecting objects as small as

E3X-NA11 Optical Fiber Amplifier, Optical Fiber

E3X-NA11 Optical Fiber Amplifier, Optical Fiber Amplifier Photoelectric Sensor Fiber Optic Sensor, for Relay Amplification, Long-Distance Optical Communications

77TG 2 Pcs Fiber Optic Lens Light Transmissive Long Length ...

Compatible Models: This light transmission lens is widely applicable for Keyence FU 77TZ 77V 77 7F 78 77G 77TG and more fiber optic sensors. Type: Long Detection Distance Type

FR6Y10 Fiber Optic Sensor,Diffuse Reflective Digital Fiber ...

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FR6Y10 Fiber Optic Sensor,Diffuse Reflective Digital Fiber Optic,1000mm Line Length,M6 Probe Sensor,Detection Distance 0-70MM Brand: BOJKEON ₹2,60442 Inclusive of all taxes

Enhancement of single-mode optical fiber quality factor ...

Two- fiber optic communication channels Bragg gratings are used, along with Optisystem software for simulations. It is widely used in a variety of optical communication systems, such as, dispersion

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FIBER-OPTIC SENSORS

Today, already with over 500 standard, application or customer specific fiber optic sensors, we take pride in working together with you to ensure the best performance fit for your application.

Development of fiber optic sensor technology

One approach to taking measurements in confined spaces is to use fiber optic distance sensors. The sensors offer great flexibility and are easy to integrate into

Fiber Optic Displacement Sensors

Standard single channel units include amplifier and sensor tip with 914 mm (3 Feet) long fiberoptic cable, require +12 VDC input power, and provide 0 to +5 volt analog output with DC - 20 KHz bandwidth.

fiber optic distance sensor

At their core, fiber optic distance sensors operate on a brilliantly simple principle: sending pulses or modulated beams of light down a hair-thin glass or plastic fiber and precisely measuring

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