FIBER OPTIC STRAIN GAUGE

GEOKON®

MODEL FP4000

Model FP4000 Fiber Optic Strain Gauge.

APPLICATIONS

The Model FP4000 Fiber Optic Strain Gauge is designed to measure strain in or on:

- Tunnel linings
- Bracing
- Struts
- Bridges
- Containment vessels
- Reinforcing bars

OPERATING PRINCIPLE

The GEOKON fiber optic strain gauges are designed for use in environments where it may be difficult to use conventional types of strain gauges because of space considerations, high levels of electrical interference or where intrinsic safety is an issue. Measurements of dynamic events are also possible with these gauges and the requisite dataloggers. The strain gauges have a very low coefficient of thermal expansion and can be used to measure both mechanical and thermomechanical strains in a variety of different materials.

CONSTRUCTION

The gauge comprises a Fiber optic cable with a miniature Fabry-Perot strain sensor which is embedded into a composite carbon fiber laminate made of uniaxial fibers to form a highly stable sensor. The version for bonding to steel has a roughened surface (on the adhesive side) while the version for embedding into concrete has roughened surfaces on both faces and scalloped edges for optimum keying into the concrete mix. The adhesive used for bonding is a two-component, room temperature curing, methacrylate, especially formulated for bonding to metals.

ADVANTAGES AND LIMITATION

The FP4000 Strain Gauge is immune to EMI, RFI and voltage surges (lightning). It is insensitive to transverse strains, capable of signal transmission over long distances and suitable for both static and dynamic measurements. For optimum accuracy it is recommended that the Model FP4700 Fiber Optic Temperature Sensor, of similar construction, be installed alongside the Strain Gauge to provide for precise temperature measurements (and compensation). The FP4000 Strain Gauge can also be used for measuring strains on "older," dry and intact concrete surfaces. However, it may not be suitable for measurements on fresh or wet concrete surfaces, mainly due to the uncertainties of the epoxy bonding technique.

READOUT

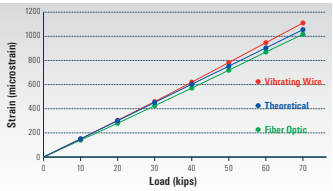
The readout device recommended for basic field measurements is the Pico Sens single channel battery operated handheld signal conditioner. Where multiple gauges are to be monitored the Field Sens Multi-channel, signal conditioner is recommended. Readouts capable of dynamic measurements up to 1000 Hz are also available.

TEST RESULTS

The following tests were conducted to verify the performance of the Model FP4000.

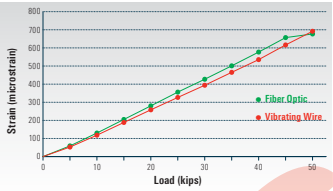
Steel Bar Tension Load Test

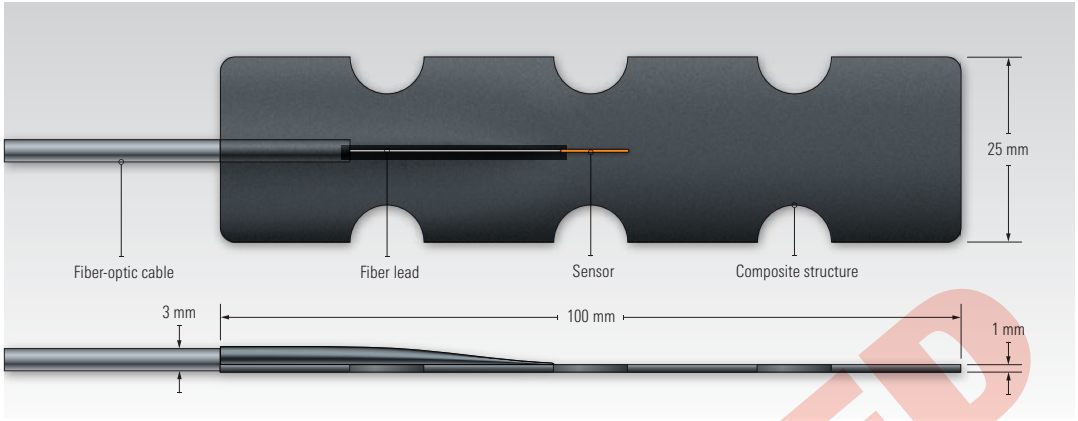
Two FP4000 Strain Gauges were mounted onto opposite faces of a 1.5" × 1.5" steel bar, and two Model 4000 VW Strain Gauges onto the two remaining faces. The bar was then subjected to incremental loads and the strain values recorded at each increment.



Concrete Cylinder Compression Load Test

Tests were carried out on a FP4000 Strain Gauge embedded inside a concrete cylinder (6" diameter × 12" length) alongside a Model 4202 VW Strain Gauge. The cylinder was loaded in 5000 lb. increments and the strain values recorded at each increment.





The Model FP4000 components and dimensions.

TECHNICAL SPECIFICATIONS

	FP4000-1.0	FP4000-2.5	FP4000-5.0
Standard Ranges	–1000 to +1000 με	–2500 to +2500 με	–5000 to +5000 με
Resolution	0.15 με	0.30 με	0.50 με
Gauge Factor Accuracy [1]	±3% F.S.	±3% F.S.	±10% F.S.
Temperature Sensitivity	0.85-1.22 με/°C		
Transverse Strain Sensitivity	transverse strain insensitive		
Temperature Operating Range	–40 °C to +80 °C		
EMI/RFI Susceptibility	complete immunity		
Cable Length [2]	1.5 m (standard)		
Optical Connector	SC (standard)		
Signal Conditioner Compatibility	all Opsens WLPI signal conditioners		
Dimensions (L × W × H)	100 × 25 × 1 mm		

[1] The accuracy of the OSP sensors is determined by sample testing of controlled batches at the factory. The manufacturing technique results in the spans shown above and is confirmed by actual strain tests performed on samples from batch lots.
[2] Other cable lengths available on request.

GEOKON | TRUSTED MEASUREMENTS

GEOKON
48 Spencer Street
Lebanon, NH 03766 • USA

www.geokon.com
e: info@geokon.com
p: +1 · 603 · 448 · 1562

GEOKON is an
ISO 9001:2015
registered company