



Smart Patch

Features

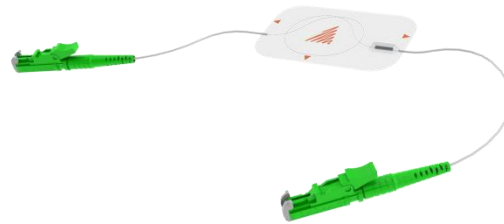
- Ultra High speed performance
- Rugged, permanent or temporarily weldable package
- Cable integrated with sensor package for fibre protection and strain relief
- Easy to install, relocate or replace
- Easy to daisy chain to other sensors

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Measurement of 3-dimensional strain on a structure's surface
- Load, torsion and vibration monitoring

Specifications

- Strain range $\pm 3000 \mu\text{strain}$
- Connectors E2000/APC or DMI/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Max tensile load tubing 5 N
- Min bend radius tubing 10 mm

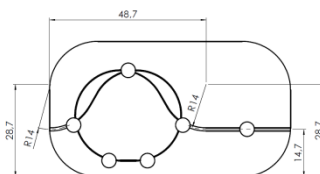


The Smart Patch consists of four sensors (three strain sensors and one temperature sensor) integrated in one fibre. The strain sensors are configured at a 60-degree angle to each other.

This rosette configuration gives the patch a wide range of applicability. The fibre with the sensors is embedded in a thin layer of glass reinforced epoxy, protecting the delicate fibre and giving it better handling qualities.

Outside the patch, the fibre is protected by tubing. At the end of each fibre, a reliable connector is attached for easy connection to the interrogator or other sensors. Last but not least, the patch is designed as a sticker, making it easy to install, relocate or replace on a wide variety of surfaces.

Dimensions



(dimensions in mm)

Models

- FBG-RT-FS-x** - 4 FBG sensors, full scale, 1 temperature compensator
- FBG-RT-HS-x** - 4 FBG sensors, half scale, 1 temperature compensator
- FBG-R-FS-x** - 3 FBG sensors, full scale
- FBG-R-FS-x** - 3 FBG sensors, half scale

(x is the number of connectors)



Smart Tape

Features

- Ultra High speed performance
- Rugged, permanent or temporarily weldable package
- Cable integrated with sensor package for fibre protection and strain relief
- Easy to install, relocate or replace
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Measurement of strain on a structure's surface

Specifications

- Strain range $\pm 3000 \mu\text{strain}$
- Connectors E2000/APC or DMI/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Max tensile load tubing 5 N
- Min bend radius tubing 10 mm



Smart tape shows the same design solutions as the patch due to similar requirements.

It consists of two integrated strain sensors in one fibre and has a connector at each side of the tape. It is packed in glass reinforced epoxy, which again makes it easy to handle, install and daisy-chain to other sensors.

Outside the patch, the fibre is protected by tubing. At the end of each fibre, a reliable connector is attached for easy connection to the interrogator or other sensors. Last but not least, the patch is designed as a sticker, making it easy to install, relocate or replace on a wide variety of surfaces.

Models

FBG-TT-QS1-x-y	- 2 FBG sensors, quarter scale 1
FBG-TT-QS2-x-y	- 2 FBG sensors, quarter scale 2
FBG-TT-QS3-x-y	- 2 FBG sensors, quarter scale 3
FBG-TT-QS4-x-y	- 2 FBG sensors, quarter scale 4

*(x is the distance between FBG's)
(y is the number of connectors)*



Custom made fibre

FBG fibre assemblies

Features

- Ultra High speed performance
- Fast, simple, repeatable installation
- Supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Core building block for fibre optic transducers for strain, temperature, displacement, pressure and acceleration

Specifications

- Strain range $\pm 3000 \mu\text{strain}$
- Connectors E2000/APC or DMI/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Max tensile load tubing 5 N
- Min bend radius tubing 10 mm



Custom made fibres consists of one or more (up to 8) integrated strain sensors in one fibre and has a connector at each side of the fibre. Any packaging is possible.

A versatility of possible sensor configurations exist. Aside from intrinsic sensing of direct strain any type of extrinsic sensor is thinkable for where it is possible to convert an environmental parameter to strain. These sensors can be developed for temperature, humidity, pressure, chemical detection, and many more.

By default the fibre is protected by tubing. At the end of each fibre, a reliable connector is attached for easy connection to the interrogator or other sensors.

Development

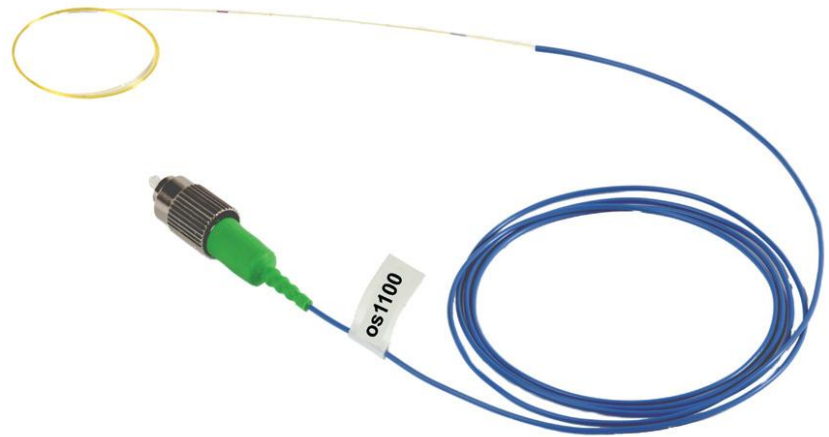
Technobis Fibre Technology is currently developing extrinsic sensors for applications concerning impact analysis for localization and identification, shape sensing for modal analysis, ultra-high speed structure health monitoring, etc.

Contact Technobis Fibre Technologies for more information on these sensor developments.



Single FBG

in polyimide coated fibre



Features

- Optional FC/APC connector and loose buffer tube for ease of handling
- Clearly marked FBG location
- Non metallic construction

Applications

- Fundamental optical element for fibre optic sensors for strain, temperature, displacement, pressure and acceleration
- Measurement of strain on a structure's surface
- Measurement of strain inside of a composite or laminate structure
- Proof of concept for FBG sensor applications
- Experimental mechanics evaluations requiring many sensors

Specifications

- Strain limit 5000 μ strain
- Connectors FC/APC
- Operating temperature -40 ... +120 °C
- Min bend radius tubing 17 mm

The os1100 Fibre Bragg Grating (FBG) is designed for use in fibre optic sensing applications. It is a single FBG centered in a two meter length of polyimide coated optical fibre. It may be used individually or can be spliced into an array of many FBG's.

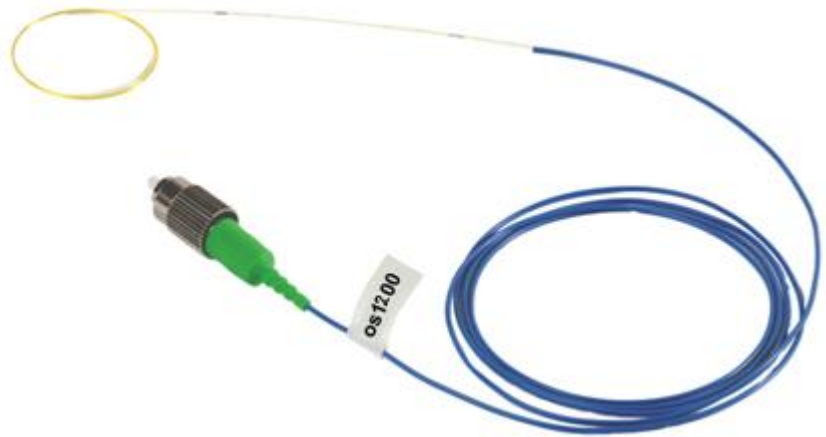
os1100's are available in dozens of distinct center wavelengths. Using different wavelengths allows multiplexing of dozens of FBG's on a single fibre. os1100's are used in applications ranging from basic experiments to construction of complex transducers containing one or more FBG's.

Advantages of FBG Sensor Technology

- Longevity – resistant to lightning, corrosion, EMI
- Passive – no spark hazard, no power at sensor
- Multiplexing – many sensors, few cables, long range
- Versatility – small size, sense many properties with one system
- Installation – weld, glue, embed, connect in series
- Calibration – none required by user
- Ruggedness – fatigue over 100 million cycles, wide temperature range



Serialized array of five FBG's in polyimide coated fibre



Features

- Optional FC/APC connector and loose buffer tube for ease of handling
- Clearly marked FBG locations
- Splice-free array
- Non metallic construction

Applications

- Fundamental optical element for fibre optic sensors for strain, temperature displacement, pressure and acceleration
- Measurement of strain on a structure's surface
- Measurement of strain inside of a composite or laminate structure
- Demonstration of FBG multiplexing
- Proof of concept for FBG sensor applications
- Experimental mechanics evaluations requiring many sensors

Specifications

- Strain limit 5000 μ strain
- Connectors FC/APC
- Operating temperature -40 ... +120 °C
- Min bend radius tubing 17 mm

The os1200 Fibre Bragg Grating (FBG) Array is designed for use in fibre optic sensing applications. It is a six meter long polyimide coated optical fibre with five FBG's spaced at one meter intervals.

Each os1200 is built with five FBG's at standard center wavelengths. os1200's are used in applications ranging from basic experiments with FBG's to construction of complex transducers containing one or more FBG's.

Advantages of FBG Sensor Technology

- Longevity – resistant to lightning, corrosion, EMI
- Passive – no spark hazard, no power at sensor
- Multiplexing – many sensors, few cables, long range
- Versatility – small size, sense many properties with one system
- Installation – weld, glue, embed, connect in series
- Calibration – none required by user
- Ruggedness – fatigue over 100 million cycles, wide temperature range



FBG optical strain gage

Features

- Rugged, permanent weldable package (os3110)
- Rugged package fastens with same epoxy as conventional foil strain gage (os3120)
- Cable integrated with sensor package for fibre protection and strain relief
- Fast, simple, repeatable installation
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Core building block for fibre optic transducers for strain, temperature, displacement, pressure, and acceleration
- Measurement of strain on a structure's surface
- Experimental mechanics evaluations requiring many sensors

Specifications

- Strain limits $\pm 2500 \mu\text{strain}$
- Connectors FC/APC
- Operating temperature $-40 \dots +120 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm



os3110, Spot Weld



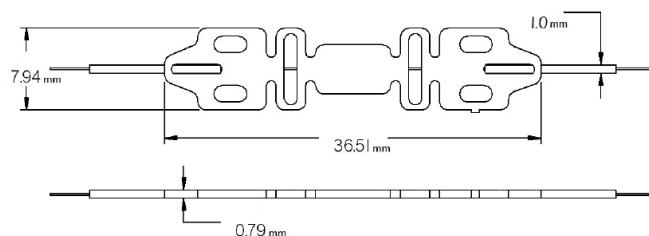
os3120, Epoxy Mount

The os3100 Optical Strain Gage is designed to make fibre handling easy and sensor installation fast and repeatable. It is based on fibre Bragg grating (FBG) technology.

The os3100's stainless steel carrier holds the FBG in tension and protects the fibre during installation. Since there are no epoxies holding the fibre to the carrier, long term stability is ensured by design.

In side by side comparisons with foil strain gages, the os3100 is equally sensitive and accurate, while providing for greater strain range and 100 times more fatigue life. The os3100 strain gage is qualified for use in harsh environments and delivers the many advantages inherent to all FBG based sensors.

Dimensions





Rugged FBG optical strain gage



Features

- Rugged, permanent weldable package
- Qualified to same rigorous standards used for comparable electronic strain gages
- Armored cable integrated with sensor package for fibre protection and strain relief
- Fast, simple, repeatable installation
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains and other complex structures
- Measurement of strain on a structure's surface
- Experimental mechanics evaluations requiring many sensors

Specifications

- Strain limits $\pm 2500 \mu\text{strain}$
- Connectors FC/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm

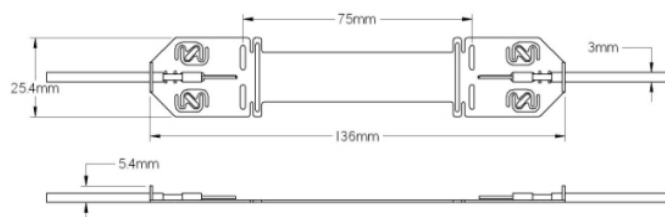
The os3150 is a rugged strain gage based on fibre Bragg grating (FBG) technology. Optimized for outdoor installations on steel structures, the os3150's stainless steel carrier holds the FBG in tension and protects the fibre during installation.

Since there are no epoxies holding the fibre to the carrier, long term stability is ensured by design. Armored cables lead to and from each gage, making both installation and fibre protection fast and easy.



The armored cable is compatible with connector protection fittings that protect splice-free series connections to strain, temperature, acceleration and other types of optical sensors.

Dimensions





Rugged FBG optical strain gage

with temperature compensation



Features

- Rugged, permanent weldable package
- Temperature compensation sensor integrated inside
- Close proximity of strain FBG to temperature FBG improves accuracy of strain measurement
- Armored cable integrated with sensor package for fibre protection and strain relief
- Fast, simple, repeatable installation
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Measurement of strain on a structure's surface
- Experimental mechanics evaluations requiring many sensors

Specifications

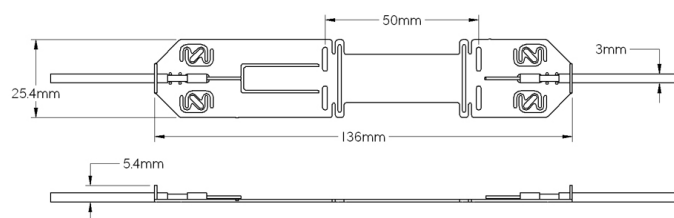
- Strain limits $\pm 2500 \mu\text{strain}$
- Connectors FC/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm

The os3155 is a rugged strain gage with integrated temperature compensation. Both strain and temperature compensation measurements are based on fibre Bragg grating (FBG) technology.

Optimized for outdoor installations on steel structures, the os3155's stainless steel carrier holds the FBG in tension and protects the fibre during installation. Since there are no epoxies holding the fibre to the carrier, long term stability is ensured by design.

The design is similar to the os3150 rugged strain gage but the os3155 includes a second FBG which provides active temperature compensation. The benefits of this approach include both more accurate temperature compensation and lower-cost installation.

Dimensions





FBG optical strain gage

non-metallic

Features

- Cable integrated with sensor package for fibre protection and strain relief
- Self adhesive backing for simplified installation process
- Non metallic construction
- Fast, simple, repeatable installation
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Core building block for fibre optic transducers for strain, temperature, displacement, pressure, and acceleration
- Measurement of strain on a structure's surface
- Experimental mechanics evaluations requiring many sensor

Specifications

- Strain limits $\pm 5000 \mu\text{strain}$
- Connectors FC/APC
- Operating temperature $-40 \dots +60 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm

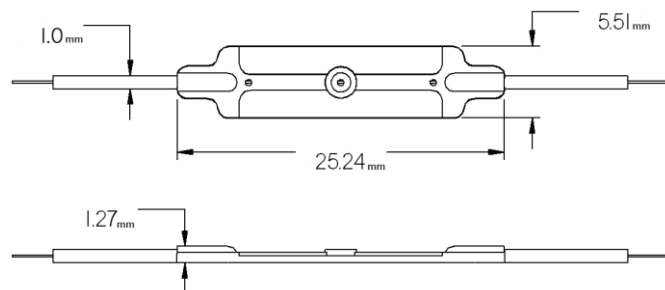


The os3200 Non-metallic Optical Strain Gage is designed to make fibre handling easy and sensor installation fast and repeatable.

The os3200 has a self adhesive backing that holds the sensor body in place and protects the FBG while epoxy is injected. The epoxy encapsulates the FBG and bonds it to a structure's surface.

Installation time is just a few minutes. Measurements can be taken after the epoxy cures in 24 hours at room temperature.

Dimensions





Strain / displacement sensor

Long gage length

Features

- Temperature compensation sensor integrated inside. Also available without temperature compensation
- Cable integrated with sensor package for fibre protection and strain relief
- Fast, simple, repeatable installation
- Connector protection fittings available for harsh environment
- Armored fibre cable and rugged sensor package
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Measurement of strain on a structure's surface
- Measurement of relative temperature for compensation of strain measurements

Specifications

- Strain limits $\pm 2500 \mu\text{strain}$
- Connectors FC/APC
- Operating temperature $-40 \dots +80 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm



Mounting options:

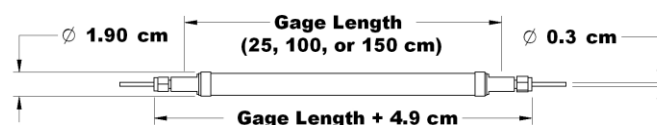


Connector Protection Fitting

The os3600 Long Gage Strain Sensor measures average strain over the length of the gage while providing active temperature compensation. Each end of an os3600 is attached to a structure via rigid brackets that are either welded, bolted, or grouted to the surface of a steel, concrete, or carbon composite structure. The os3600 is designed to also be embeddable in concrete.

A rugged, steel-shielded body, armored cables, and connector protection fittings enable measurements that can continue for the entire lifespan of a structure. Two FBG's are well protected inside the os3600 body. One FBG measures strain, and the other provides for integrated temperature compensation. Since there are no epoxies holding the fibre to the carrier, long term stability is ensured by design.

Dimensions





Temperature compensation gage

Features

- Fast response time
- Cable integrated with sensor package for fibre protection and strain relief
- Rugged, permanent weldable package
- Fast, simple, repeatable installation
- Designed specifically for temperature compensation of os3100 and os3200 strain gages
- Connections for weld, epoxy, or screw attachment to structure
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Measurement of relative temperature for compensation of strain measurements

Specifications

- Temperature sensitivity $\sim 28.9 \text{ pm}/^\circ\text{C}$
- Connectors FC/APC
- Operating temperature $-40 \dots +120 \text{ }^\circ\text{C}$
- Min bend radius tubing 17 mm

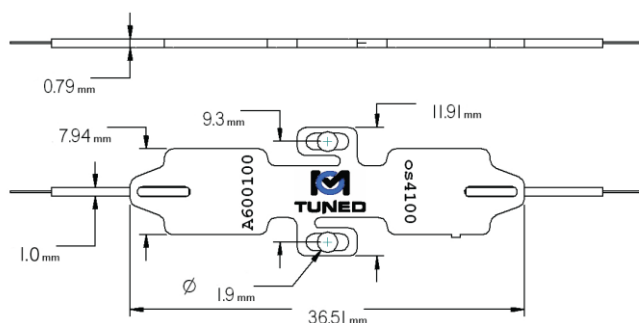


The os4100 is specifically designed to provide temperature compensation data for strain measurements from FBG based strain gages installed on the same structure.

Because its installation procedure is similar to the os3100 Optical Strain Gage, it is a convenient choice for compensation of the os3100. It is also compatible with the os3200 Optical Strain Gage. The os4100 Temperature Compensation Sensor is designed to make fibre handling easy and sensor installation fast and repeatable. It is based on fibre Bragg grating (FBG) technology.

The os4100's stainless steel carrier holds the FBG in tension and protects the fibre during installation. Since there are no epoxies holding the fibre to the carrier, long term stability is ensured by design. The universal attachment feature on the os4100 carrier design allows fastening by weld, epoxy or screw.

Dimensions





Temperature probe

Features

- Fast response time
- Cable integrated with sensor package for fibre protection and strain relief
- Fast, simple, repeatable installation
- Connector protection fittings available for harsh environments
- Calibrated for high absolute accuracy
- Capable of measuring from -200 to +275 degrees C

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Core building block for fibre optic transducers for strain, temperature, displacement, pressure, and acceleration
- Measurement of absolute temperature on a structure's surface

Specifications

- Temperature sensitivity ~10 pm/°C
- Connectors FC/APC
- Operating temperature -40 ... +120 °C (or)
- Operating temperature -200 ... +275 °C
- Min bend radius tubing 17 mm



The os4200 Temperature Probe is a family of gages designed to make fibre handling easy and sensor installation fast and repeatable. The os4200's body is a sealed, stainless steel tube that protects the FBG.

Options include packages that operate like conventional thermocouples with armored cables and protected connectors, and small probes that provide the user with both installation flexibility and sub-second response time.

In side by side comparisons with conventional thermocouples, the os4200 is equally sensitive and accurate, while providing for much faster response, wider operating range, no calibration, and less noise. The os4200 Temperature Probe is qualified for use in harsh environments and delivers the many advantages inherent to all FBG based sensors.



Temperature sensor

Features

- Fast response time
- Cable integrated with sensor package for fibre protection and strain relief
- Non metallic construction
- Fast, simple, repeatable installation
- Connector protection fittings available for harsh environments
- Calibrated for high absolute accuracy
- Double ended design supports multiplexing of many sensors on one fibre

Applications

- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures
- Core building block for fibre optic transducers for strain, temperature, displacement, pressure and acceleration

Specifications

- Temperature sensitivity ~ 10 pm/°C
- Connectors FC/APC
- Operating temperature $-40 \dots +120$ °C (or)
- Operating temperature $-40 \dots +250$ °C
- Min bend radius tubing 17 mm



os4310 - Single Ended & Double Ended Sensors



os4330 - Non-metallic Epoxy Mount



os4350 - Armored Cable, Flange Mount



Connector Protection Fitting

The os4300 Non-metallic Temperature Sensor is a family of gages designed to make fibre handling easy and sensor installation fast and repeatable. It is based on fibre Bragg grating (FBG) technology. The os4300's body is a sealed, alumina ceramic tube that protects the FBG. Since there are no epoxies holding the fibre to the tube, long term stability is ensured by design.

Three packaging options provide for installation that mimics that of conventional thermocouples with armored cables and protected connectors, and small sensors that provide the user with both installation flexibility and sub second response.

In side by side comparisons with conventional thermocouples, the os4300 is equally accurate, while providing for much faster response, wider operating range, no calibration, and less noise. The os4300 temperature sensor is qualified for use in harsh environments and delivers the many advantages inherent to all FBG based sensors.



Temperature sensing cable

Features

- Lower cost and faster response time than Raman and Brillouin systems
- Customizable sensor number and spacing
- Armored fibre cable and rugged sensor package integrated into a single assembly
- Calibrated for high absolute accuracy
- High tensile strength for long life in harsh environments

Applications

- Fire, flooding, and performance monitoring for power transmission and other service tunnels and conduits
- Fire and condition monitoring in rail and highway tunnels
- Leak detection and flow assurance for pipelines
- Mine safety monitoring

Specifications

- Temperature sensitivity ~ 10 pm/°C
- Connectors FC/APC
- Operating temperature $-40 \dots +100$ °C (or)
- Min bend radius tubing 17 mm

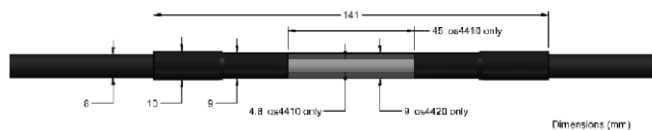


The os4400 Temperature Sensing Cable is a multipoint temperature sensor. Discrete points along a rugged cable are used to simultaneously measure temperature with sub degree Celsius accuracy over a wide range of temperatures.

Several os4400 cables can be multiplexed to cover hundreds of sensing points over kilometers of cable runs. Unlike some other distributed optical measurement techniques, the os4400, coupled with the proper interrogation instrument, provides NIST traceable temperature measurements and fast acquisitions from one to one thousand times per second.

Because the sensing points in one cable are connected in series, installation is less expensive and less cumbersome than wiring dozens of separate electronic gage networks. In side-by-side comparisons with conventional thermocouples, the os4400 is equally accurate, while providing for faster response, with no need for calibration, and no EMI issues. The os4400 temperature sensing cable is qualified for use in harsh environments and delivers the many advantages inherent to all Fibre Bragg Grating (FBG) based sensors.

Dimensions





Accelerometer

Features

- Qualified to same rigorous standards applied to comparable electronic strain gages
- Cable integrated with sensor package for fibre protection and strain relief
- Standard threaded connection to structure for fast, simple, repeatable installation
- Available mounting block for two and three axis applications
- Armored fibre cable and rugged sensor package

Applications

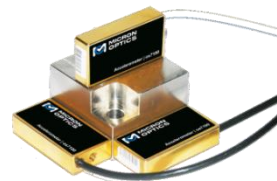
- Measurement of acceleration on large structures from DC to low frequencies
- Continuous lifetime health monitoring of bridges, dams, buildings, tunnels, ships, aircraft, trains, and other complex structures

Specifications

- Temperature sensitivity ~16 pm/g
- Frequency range DC to 300 Hz
- Connectors FC/APC
- Operating temperature -40 ... +80 °C (or)
- Min bend radius tubing 17 mm
- Dimensions 38 x 9 x 19 mm



os7100 - Single Axis Accelerometer



os7100 - Three Axis Accelerometer

The os7100 is a fibre optic accelerometer based on Fibre Bragg Grating (FBG) technology. Optimized for large structures and long term measurements, the os7100 measures accelerations from DC up to a few hundred Hertz.

Like most conventional accelerometers, the os7100 can be attached to a structure using a standard threaded connection, and is available in one, two or three axis configurations. A rugged, sealed metallic body, armored cables, available weatherproof junction boxes and connector protection fittings make the os7100 ideal for outdoor installations on exposed structures.

For low frequency signals, the os7100 yields measurements that are as accurate and stable as conventional accelerometers and offers the added benefits of EMI immunity and lightning/corrosion resistance that are needed for long term outdoor installations. Additionally, the os7100 is inherently compatible with FBG based strain and temperature sensors, thereby enabling comprehensive fibre-based sensing networks.