FOT-L Temperature Sensors

Key Features

- Intrinsically safe
- Up to 300°C (572°F)
- High accuracy
- Miniature and rugged sensor

Applications

- Microwaves and RF
- Medical applications
- Nuclear environments
- In-situ process monitoring
- Harsh and hazardous environments
- High temperature environments
- Aerospace applications

The FOT-L-SD and FOT-L-BA are fi ber optic temperature sensors perfectly suited for harsh environmental conditions such as in cryogenics, nuclear, microwave, and strong RF applications. The FOT-L temperature sensors combine all the desired characteristics you would expect from the ideal sensor. These temperature sensors offer accuracy and reliability in extreme temperature and hostile environments.

Both FOT-L temperature sensors feature complete immunity to EMI and RFI, miniature size, built-in safety for hazardous environments, extreme temperature resistance, high precision, and resistance to corrosive environments.

Fiber optic technology provides intrinsic immunity to EMI and RFI. Fiber optic sensors are not electronically active and do not emit nor are they affected by any type of EM radiation, whether it is microwave, RF, or NMR.

Another important advantage of optical fi bers is the capability it provides to produce miniature components without compromising the physical characteristics of the bulk material. Optical fi ber is optimized in size to provide the smallest possible light path. Thanks to this advantage, fi ber optic sensors may feature tip diameters as small as 0.8 mm.

FISO's fi ber optic temperature sensors provide accurate, stable, and repeatable measurements. These measurements are based on variations of the refl ected light — when compared to the emitted light — due to thermal expansion of the highly stable glass used within the sensor.
The FOT-L-SD is sheathed with PTFE and has a temperature range from as low as −40°C up to 300°C (−40°F to 572°F).

The FOT-L-BA is designed with a much smaller diameter to provide an even faster response time, while withstand temperatures of up to 250°C.

All our temperature sensors are designed to work with FISO's line of signal conditioners.

The fi ber optic lead cable can be up to several meters long without affecting the quality or the accuracy of the results.

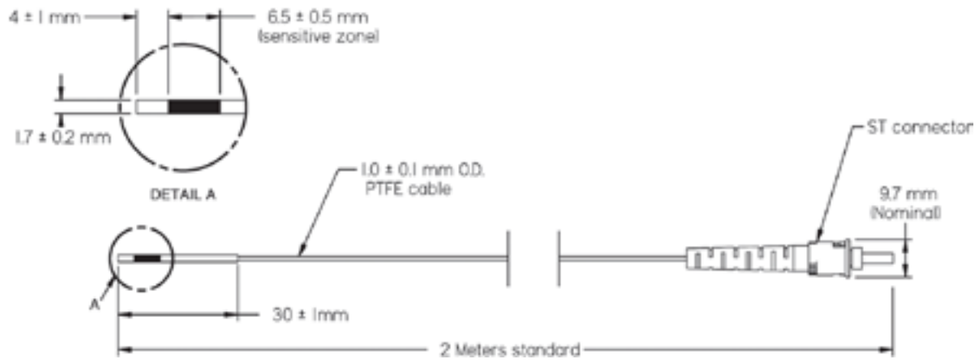
Specifications

Temperature range	
FOT-L-SD	−40°C to 300°C (−40°F to 572°F)
FOT-L-BA	−40°C to 250°C (−40°F to 482°F)
Resolution[1]	0.1°C
Accuracy[2]	±1°C
Response time	
FOT-L	≤1.5 second
FOT-L-BA	≤0.5 second
Connector type	ST connector

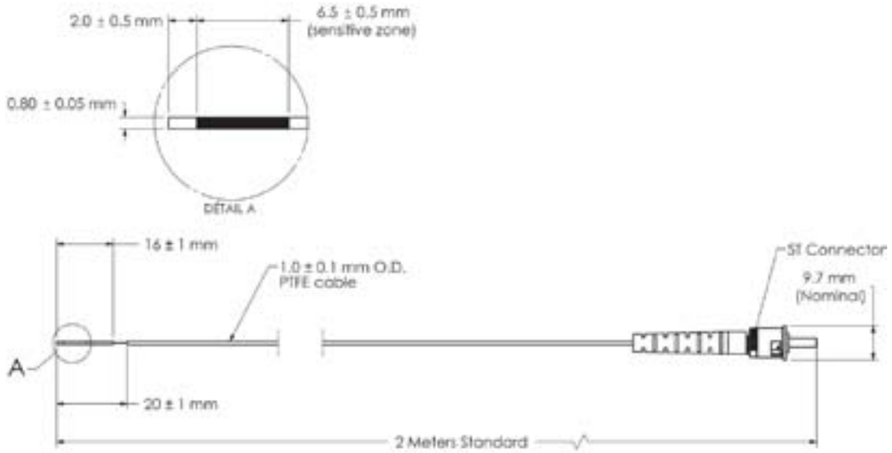
1. Signal conditioner dependent.
2. ±0.5°C is attainable when using a reduced temperature range of 20°C to 85°C (68°F to 185°F).

FOT-L Dimensions

FOT-L-SD Model



FOT-L-BA Model



FOT-M Temperature Sensor

Key Features

- Intrinsically safe
- Immune to EMI/RFI
- Up to 85°C (180°F)
- Accuracy of ±0.3°C
- Miniature and rugged sensor
- Fast response time

Applications

- Medical applications
- Industrial environments
- Harsh and hazardous environments
- MRI environment
- Immune to microwaves and RF

The FOT-M is a fi ber optic temperature sensor specifi cally designed for medical applications. The FOT-M temperature sensor combines all the desired characteristics you would expect from the ideal sensor. Its compact size, immunity to microwave and RF, resistance to corrosion, high accuracy and reliability make it the best choice for temperature measurements in harsh environments.

FISO's FOT-M fi ber optic temperature sensor features complete immunity to EMI and RFI, built-in safety for medical applications, and high accuracy for temperature measurement. The FOT-M temperature sensor provides the medical industry with higher fi delity temperature measurements for demanding applications, like MRI applications.

Since the FOT-M temperature sensor is designed to measure temperature under all conditions of EMI, humidity and vibration, the system delivers reliable temperature measurements under the most adverse situations. For those extreme conditions, the fi ber optic lead cable is available in different types.

Fiber optic technology provides intrinsic immunity to EMI and RFI. Fiber optic sensors are not electronically active and do not emit nor are they affected by any type of EM radiation, whether it is microwave, RF, or NMR.

The FOT-M fi ber optic temperature sensor is based on proven Fabry-Perot interferometer technology. The sensor's unique design is based on defl ection measurement of a silicon diaphragm, as opposed to more conventional temperature measurement techniques. Changes in temperature create a variation in the length of the Fabry-Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of tem perature, EMI, humidity and vibration.

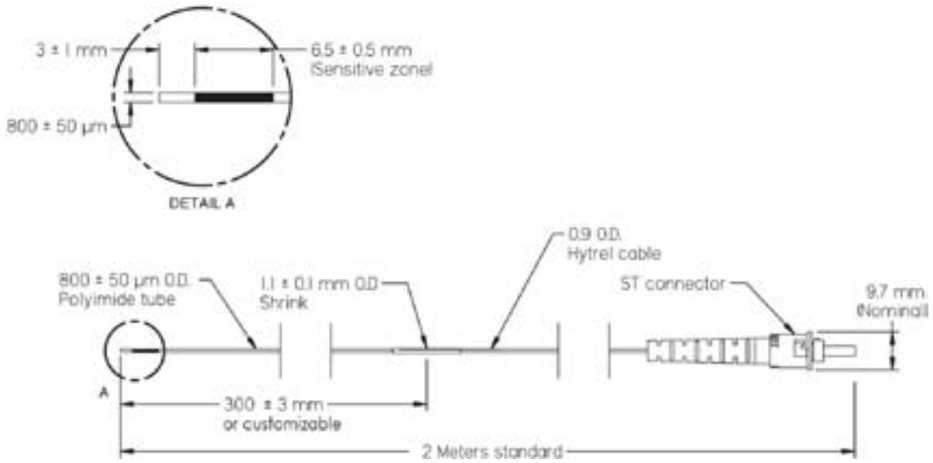
In addition to the advantages inherent to fi ber optic sensors, our white light interrogation technique assures highly accurate and reliable measurements. Through the use of a white-light cross-correlator, our signal conditioners are capable of astonishing performance, providing highly accurate and reliable measurements.

Specifications

Temperature range	20°C to 85°C (68°F to 185°F)
Resolution[1]	0.1°C
Accuracy	±0.3°C
Response time	Less than 750 ms
Connector type	ST connector

1. Signal conditioner dependent

FOT-M Dimensions



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FOP-C Pressure Sensor

Key Features

- Intrinsically safe
- Immune to EMI/RFI
- From 30 to 10 000 psi range
- Accuracy of 0.25%
- Lead cable up to 3 km

Applications

- Industrial environments
- In-situ process monitoring
- Harsh and hazardous environments
- High pressure environments
- Aerospace applications
- Oil well and natural gas pumping station
- Plastic injection molding & extrusion monitoring
- Food packaging

The FOP-C is a fi ber optic pressure sensor designed for general industrial appli cations in harsh and hazardous environments, where very high pressure con ditions can be found.

The FOP-C fi ber optic pressure sensor offers small size, high accuracy, immunity to EMI/RFI, and resistance to corrosive environments.

Research engineers in different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time that will provide accurate information on changes in pressure during the manufacturing process, the operation or throughout the lifetime of a product.

The use of the FOP-C pressure sensor allows a complete pressure analysis in the most challenging environments.

The FOP-C fi ber optic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor's unique design is based on non-contact defl ection measurement of a stainless steel diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry-Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity and vibration. The mechanical robustness is assured by the allwelded stainless steel construction, with no epoxy, sealing rubber, or any other sort of polymeric materials.

The FOP-C fi ber optic pressure sensor provides the industry with better and more reliable pressure measurements for existing applications, and with extended capabilities for new applications requiring high operating pressure ranges. With a pressure range of up to 10 000 psi, the FOP-C fi ber optic pressure sen sor is ideal for applications in any research and development fi eld where high pressure conditions can be found. For those extreme conditions, the fi ber optic lead cable is available in different types and may be delivered up to several kilo meters long.

Stainless steel (SS) alloys which are used to fabricate the FOP-C are the SS316L and SS17-4PH (diaphragm).

For a better tolerance to corrosion in salted water, the FOP-C can be completely manufactured in SS316L.

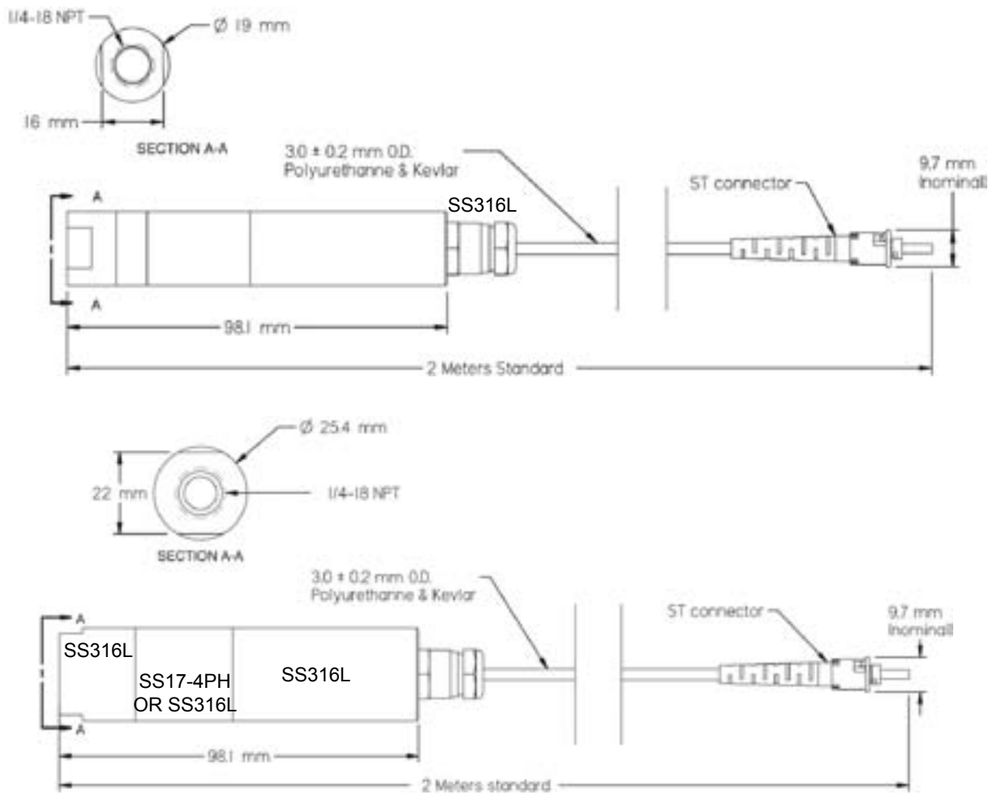
Specifications

Pressure range	From 30 psi to 10 000 psi (170 to 69 000 kPa)
Resolution[1]	0.00625% typical with averaging
Accuracy	0.25% of full scale
Connector type	ST connector (optional connector for long range applications)
Operating temperature	−20°C to 60°C (−4°F to 140°F)

1. Signal conditioner dependent.

FOP-C Dimensions

1000 psi and less

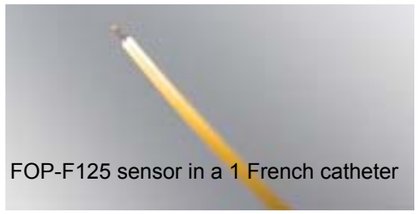


FOP-F125 Pressure Sensor

Applications

Medical

- Cardiology
- Neurology
- Anaesthesiology
- Pneumonology
- Gastroenterology
- Urology
- Gynecology
- Ophthalmology
- Electrosurgery
- Thermal therapy
- Preclinical studies
- MRI and other RFI environments



FOP-F125 sensor in a 1 French catheter

OEM products

- Custom design for embedment in diagnostic or therapeutic
- medical devices
- Automated manufacturing
- High volume – low cost available sensors
- Computerized product testing in assembly line

Key Features

- Ultraminiature sensor for in-situ pressure measurements
- Adhesive-free assembly: all-glass
- High performance and reliability
- High accuracy and repeatability
- Very low drift
- EM/RF/MW interference complete immunity
- Fast response time
- Sterilizable

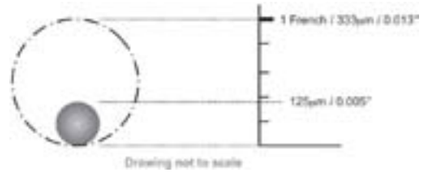
The FOP-F125 is the world's smallest pressure sensor. It has been especially designed and tested to fulfi ll the highest of medical performance requirements. Its applications range from human body fl uid pressure measurements – for intervention in hospital critical care units – to animal testing in high EMI environments. This product is designed to target high volume application where it will be customized to suit OEM-specifi c needs.

With a diameter of only 125 µm, the FOP-F125 is the smallest pressure sensor commercially available. This ultra-miniature sensor is manufactured directly at the tip of the optical fi ber using patent pending technologies suitable for mass production. This all-glass sensor assembled without the use of any adhesive is fully biocompatible and is suitable for integration in medical devices and in minimally invasive instrumented catheters.

The size and mounting fl exibility of the FOP-F125 provide the capability to embed the sensor within almost any confi guration of invasive diagnostic or therapeutic devices. The front-looking FOP-F125 allows in-situ measurements at locations unreachable to standard pressure sensors and eliminates the artefacts due to tissue contact that may be encountered with laterally mounted sensors.

The FOP-F125 high measurement resolution and precision, combined with a fast reading rate, are important characteristics when attempting to detect very quick and subtle pressure variations. It allows a clear defi nition of complex pressure waveforms, such as human arterial blood pressure variations generated by heart valve closure. Its long term reliability and low drift value make it the best sensor available for implantable equipment, such as intra-cranial, intravascular and intrauterine pressure monitoring devices.

The optical nature of the FOP-F125, makes the sensor immune to electromagnetic fi eld or radiofrequency interferences regularly encountered in operating rooms or MRI devices. The FOP-F125 fast response is also useful in determining pressure curve characteristics at faster paces, such as the ones encountered in small laboratory animals.



Specifications

Sensor diameter[1]	125 µm
Pressure range[2]	±300 mmHg
Accuracy [−25 to 125 mmHg]	±5 mmHg
Accuracy [−300 to +300 mmHg]	±8 mmHg
Resolution	<0.4 mmHg
Sensitivity thermal effect	0.1% / °C
Zero thermal effect	0.4 mmHg / °C
Proof pressure	600 mmHg
Operating temperature	10 – 50°C

1. Tolerances of ±2 µm
2. Relative to atmospheric pressure

Disclaimer

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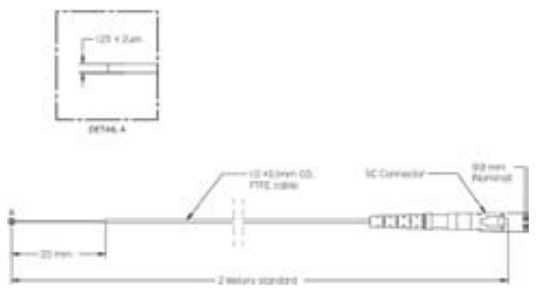
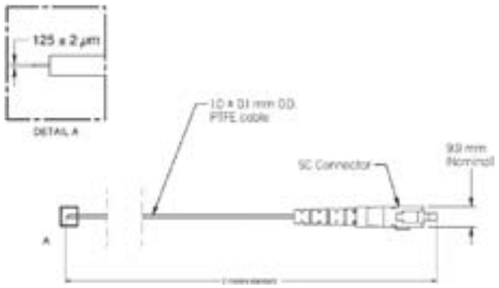
FOP-F125 Dimensions

FOP-F125-BA Model



FOP-F125-PK Model



FOP-M Pressure Sensor

Key Features

- Intrinsically safe
- Immune to EMI/RFI
- Up to 150°C (302°F)
- 0 to 1000 psi range

Applications

- Aerospace
- Defense
- Metallurgy
- Industrial in-situ process monitoring
- High temperature
- Harsh and hazardous environments
- High temperature environments
- Oil well and natural gas pumping station
- Plastic injection molding & extrusion monitoring
- Food packaging

The FOP-M is a fi ber optic pressure sensor designed mainly for applications where high temperature conditions can be found such as in aerospace and defense. It is also a useful tool for general industrial applications in harsh and hazardous environments.

Designed to operate in high-temperature conditions, the FOP-M pressure sensor offers immunity to EMI/RFI, a small size, reliable measurements under harsh conditions, high accuracy, and resistance to corrosive environments.

Research engineers in aerospace, defense, and different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time. This will provide accurate information on changes in pressure during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FOP-M pressure sensor allows a complete pressure analysis in the most challenging environments, especially those characterized by high temperatures.

The FOP-M fi ber optic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor's unique design is based on defl ection measurement of a silicon diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry-Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity and vibration.

This pressure sensor provides the industry with better and more reliable pressure measurements for existing applications, and with extended capabilities for new applications requiring high operating temperature ranges.

With a temperature range of up to 150°C (302°F), the FOP-M fi ber optic sensor is ideal for applications in any research and development fi eld where high temperature conditions can be found. For those extreme conditions, the fi ber optic lead cable is available in different types and may be delivered up to several kilometers long.

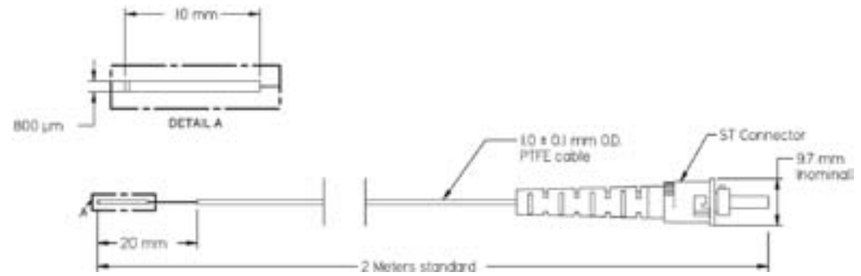
Specifications

Pressure range	0–5 psi, 0–50 psi, 0–150 psi, 0–1000 psi
Resolution[1]	<0.2% of full scale
Accuracy[2]	±0.5% of full scale
Connector type	ST connector
Operating temperature	−20°C to 150°C (−4°F to 302°F)

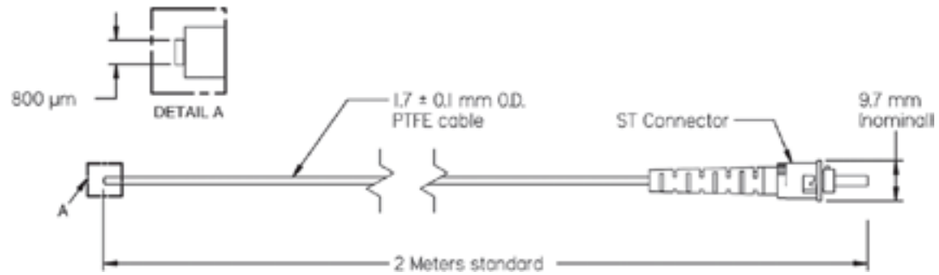
1. Signal conditioner dependent.
2. Atmospheric pressure dependent.

FOP-M Dimensions

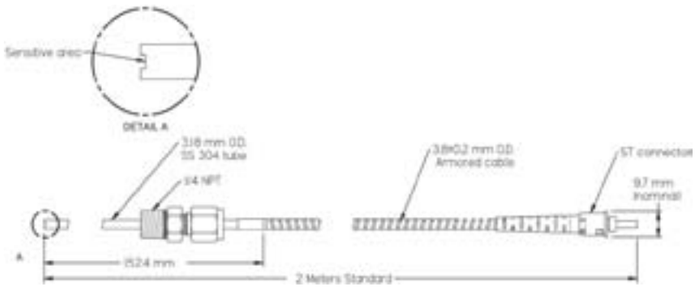
FOP-M-BA Model



FOP-M-PK Model



FOP-M-NP Model



FOP-MA Acoustic Pressure Sensor

Key Features

- Miniature size
- All-optic
- Immune to EMI/RFI
- High resolution
- Frequency response up to 30 kHz

Applications

- Acoustics
- Microphone
- Automotive
- Aerospace
- Aerodynamics

The FOP-MA is a fi ber optic pressure sensor designed for use in acoustics or microphone applications or whenever a very sensitive pressure sensor is needed. It features high frequency response and a high sensitivity to detect slight pressure variations under the most adverse conditions.

The FOP-MA acoustic pressure sensor offers small size, high accuracy, immunity to EMI/RFI, and resistance to corrosive environments.

Research engineers in the acoustics fi eld may now measure acoustic phenomena on transportation vehicles and other structures. Low profi le, high-sensitivity sensors are ideal for applications such as automotive and aerospace wind tunnel testing, aerodynamic testing and analysis, aircraft cabin and cockpit noise testing, and acoustic fatigue testing on airframes. They may also improve process and product technology by monitoring the performance of specifi c properties over time to provide accurate information on changes in pressure during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FOP-MA acoustic pressure sensor allows a complete pressure ana lysis in the most challenging environments.

FISO has developed the FOP-MA pressure sensor as a result of its efforts to satisfy the most demanding applications. This fully optical pressure sensor has extremely small dimensions, is tolerant to cable bending and totally insensitive to high levels of electromagnetic (EMI) and radio frequency (RFI) interferences, whose effects have typically plagued critical pressure measurements until now. The device offers a resolution as low as 0.0075 psi, frequency response up to 30 kHz and can operate from −20°C to 150°C.

The FOP-MA fi ber optic acoustic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor’s unique design is based on non-contact defl ection measurement of a silicon diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry-Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity and vibration.

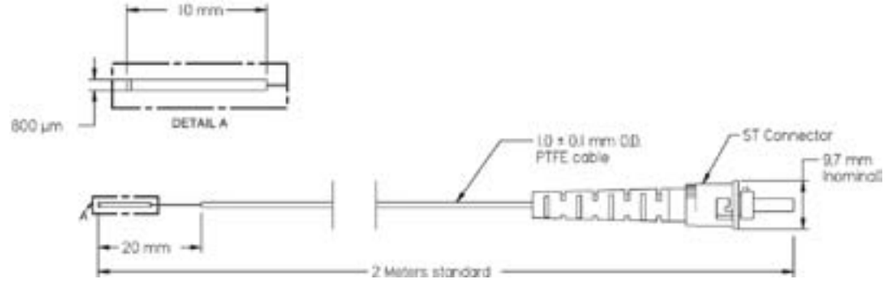
Specifications

Pressure range	0–2 psi
Resolution[1]	0.0075 psi
Accuracy[2]	±1% of full scale
Frequency response[3]	Up to 30 kHz
Connector type	ST connector
Operating temperature	−20ºC to 150ºC (−4°F to 302°F)

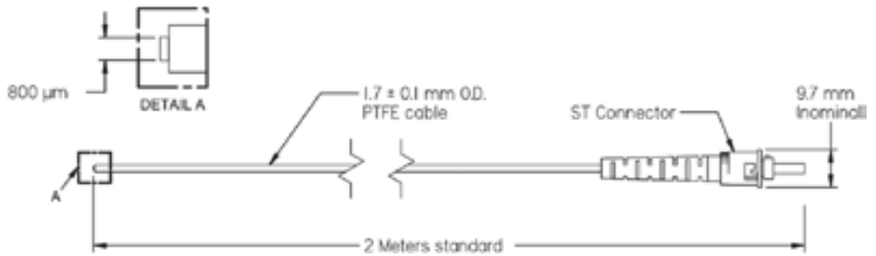
1. Signal conditioner dependent.
2. Relative to atmospheric pressure.
3. Maximum achieved with a Veloce 50 signal conditioner.

FOP-MA Dimensions

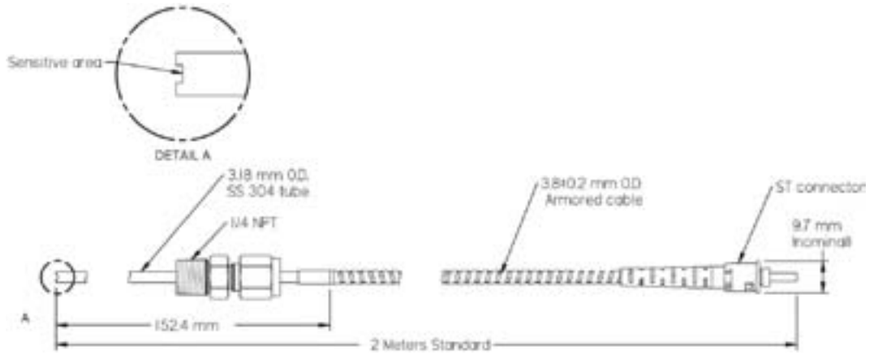
FOP-MA-BA Model



FOP-MA-PK Model



FOP-MA-NP Model



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FOP-MH

High-Temperature Pressure Sensor

Key Features

- Designed to operate in extreme temperature conditions, where standard sensors fail
- Operating temperature up to 450°C (842°F)
- Intrinsically safe
- Immune to EMI/RFI

Applications

- Aerospace
- Defense
- Metallurgy
- Industrial in-situ process monitoring
- High temperature steam
- Harsh and hazardous environments
- High temperature environments
- Oil well and natural gas pumping station
- Plastic injection molding & extrusion monitoring
- Food packaging

The FOP-MH is a fi ber optic pressure sensor designed mainly for applications where extreme temperature conditions can be found such as aerospace and defense. It is also a useful tool for general industrial applications in harsh and hazardous environments.

Designed to operate in extreme temperature conditions, where standard sensors fail, the FOP-MH pressure sensor offers immunity to EMI/RFI, a small size, reliable measurements under harsh conditions, high accuracy, resistance to corrosive environments, and high endurance to extreme temperatures.

Research engineers in aerospace, defense, and different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time that will provide accurate information on changes in pressure during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FOP-MH pressure sensor allows a complete pressure analysis in the most challenging environments, especially those characterized by high temperatures.

The FOP-MH fi ber optic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor's unique design is based on defl ection measurement of a silicon diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry-Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity and vibration. The mechanical robustness is assured by the epoxy-free, all glass construction.

This new pressure sensor provides the industry with better and more reliable pressure measurements for existing applications, and with extended capabilities for new applications requiring high operating temperature ranges.

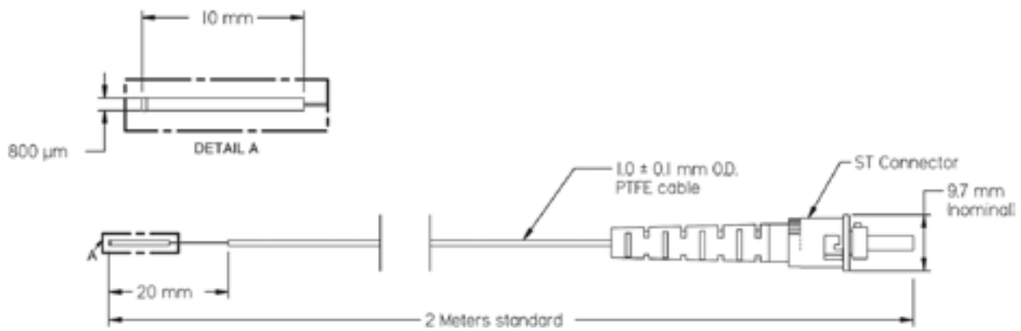
With a temperature range of up to 450°C (842°F), the FOP-MH fi ber optic sensor is ideal for aerospace and defense applications, and any other fi eld where extreme temperature conditions can be found.

Specifications

Pressure range	0–150 psi, 0–1000 psi, 0–3000 psi[1] 0–50 psi[2]
Resolution[3]	0.1% of full scale
Accuracy[4]	±1% of full scale
Connector type	ST connector
Operating temperature	−20ºC to 450ºC (−4ºF to 842ºF)[5]

1. At a temperature range of −20ºC to 450ºC
2. At a temperature range of −20ºC to 300ºC
3. Signal conditioner dependent.
4. Relative to atmospheric pressure.
5. For the following pressure ranges: 0–150 psi, 0–1000 psi, 0–3000 psi

FOP-MH Dimensions



FOP-M High Pressure Sensor

Key Features

- Designed to operate in high pressure ranges, where standard sensors fail
- Intrinsically safe
- Immune to EMI/RFI

Applications

- Aerospace
- Defense
- Metallurgy
- Industrial in-situ process monitoring
- High temperature
- Harsh and hazardous environments
- High temperature environments
- Oil well and natural gas pumping station
- Plastic injection molding & extrusion monitoring
- Food packaging

The FOP-M High Pressure is a fi ber optic pressure sensor designed mainly for applications where high pressure conditions can be found such as in aerospace and defense. It is also a useful tool for general industrial applications in harsh and hazardous environments.

Designed to operate in high-pressure conditions, where standard sensors fail, the FOP-M High Pressure sensor offers immunity to EMI/RFI, a small size, reliable measurements under harsh conditions, high accuracy, and resistance to corrosive environments.

Research engineers in aerospace, defense, and different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time that will provide accurate information on changes in pressure during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FOP-M High Pressure sensor allows a complete pressure analysis in the most challenging environments, especially those characterized by high pressure levels.

The FOP-M High Pressure fi ber optic pressure sensor is based on proven Fabry- Perot interferometer technology. The sensor's unique design is based on defl ection measurement of a silicon diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry- Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity, and vibration.

This pressure sensor provides the industry with better and more reliable pressure measurements for existing applications, and with extended capabilities for new applications requiring high operating pressure ranges.

With a pressure range of up to 5000 psi, the FOP-M High Pressure fi ber optic sensor is ideal for applications in any research and development fi eld where high pressure conditions can be found. For those extreme conditions, the fi ber optic lead cable is available in different types and may be delivered up to several kilometers long.

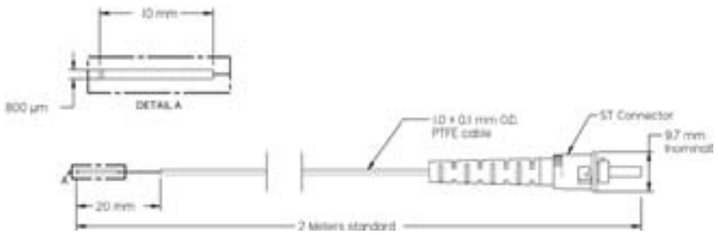
Specifications

Pressure range	0–3000 psi; 0–5000 psi
Resolution[1]	<0.5% of full scale
Accuracy[2]	<2% of full scale
Connector type	ST connector
Operating temperature	−20°C to 150°C (−4°F to 302°F)

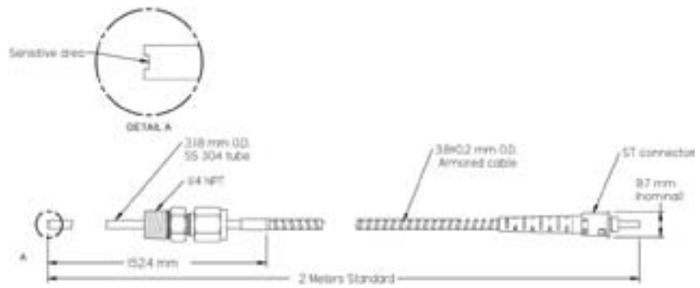
1. Signal conditioner dependent.
2. Relative to atmospheric pressure.

FOP-M High Pressure Dimensions

FOP-M-BA Model



FOP-M-NP Model



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FOP-MS Pressure Sensor

Key Features

- “Side-looking” sensor designed to fi t where standard sensors cannot
- Intrinsically safe
- Immune to EMI/RFI

Applications

- Aerospace
- Industrial in-situ process monitoring
- Defense
- Metallurgy
- Plastic injection molding & extrusion monitoring

The FOP-MS is a fi ber optic pressure sensor designed for general industrial applications. Designed to fi t where standard sensors cannot, FISO’S sidelooking fi ber optic pressure sensor features complete immunity to EMI and RFI and offers built-in safety for hazardous environments.

The FOP-MS sensor is designed to provide pressure measurements when a vertical instrumentation with a standard fi ber optic sensor is not possible, whether it is due to space restriction or design constraint.

The FOP-MS pressure sensor offers small size, high accuracy, and resistance to corrosive environments with a high temperature range.

Research engineers in different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time to provide accurate information on changes in pressure during the manufacturing process or throughout the lifetime of a product. The use of the FOP-MS pressure sensor allows a complete pressure analysis in the most challen ging environments.

The FOP-MS fi ber optic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor’s unique design is based on non-contact defl ection measurement of a silicon diaphragm, as opposed to more conventional stress measurement techniques. Pressure creates a variation in the length of the Fabry-Perot cavity and the fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, humidity and vibration.

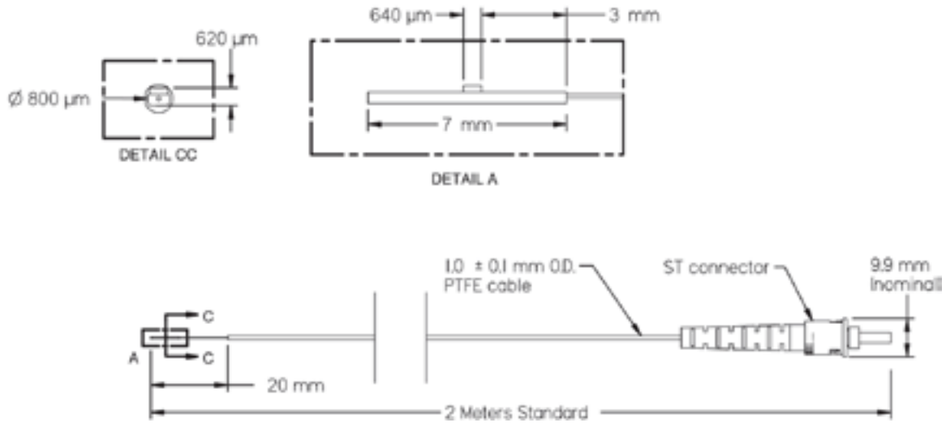
This new side-looking pressure sensor provides the industry with highly reliable pressure measurements for existing applications, and with extended capabilities for new applications. In addition to the advantages inherent to fi ber optic sensors, our white light interrogation technique assures highly accurate and reliable measurements.

Specifications

Pressure range	0–5, 0–50, 0–150, 0–1000 psi
Resolution [1]	0.1% of full scale
Accuracy [2]	±0.5% of full scale
Connector type	ST connector
Operating temperature	−20°C to 150°C (−4°F to 302°F)

1. Signal conditioner dependent.
2. Relative to atmospheric pressure.

FOP-MS Dimensions



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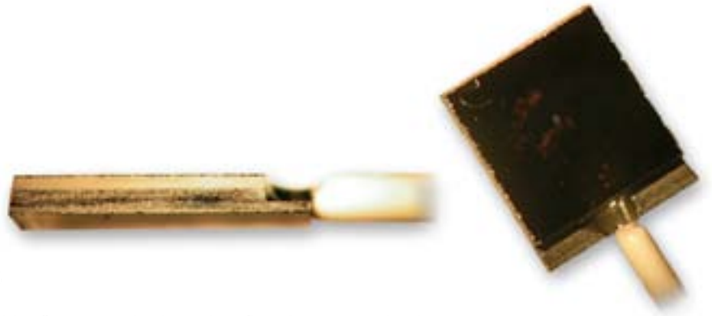
FOP-MSL
Side-Looking Pressure Sensor



Key Features

- “Side-looking” sensor designed to fi t where standard sensor cannot
- Easy-to-install, due to its larger surface area
- Intrinsically safe
- Immune to EMI/RFI

Applications

- Aerospace
- Industrial in-situ process monitoring
- Defense
- Metallurgy
- Plastic injection molding & extrusion monitoring

The FOP-MSL is a fi ber optic pressure sensor designed for general industrial applications. Designed to fi t where standard sensors cannot, FISO’S sidelooking fi ber optic pressure sensor features complete immunity to EMI and RFI and offers built-in safety for hazardous environments.

The FOP-MSL pressure sensor is designed to provide pressure measurements when a vertical instrumentation with a standard fi ber optic sensor is not possible, whether it is due to space restriction or design constraint.

The FOP-MSL pressure sensor offers small size, high accuracy, and resistance to cor rosive environments with a high temperature range.

Research engineers in different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time that will provide accurate information on changes in pressure during the manufacturing process or throughout the lifetime of a product. The use of the FOP pressure sensor allows a complete pressure analysis in the most challenging environments.

The FOP-MSL fi ber optic pressure sensor is based on proven Fabry-Perot interferometer technology. The sensor’s unique design is based on non-contact defl ection measu rement of a silicon diaphragm, as opposed to more conventional stress measure ment techniques. Pressure creates a variation in the length of the Fabry- Perot cavity and our fi ber optic signal conditioners can consistently measure the cavity length with high accuracy under all adverse conditions of temperature, EMI, hu midity and vibration.

Easy to install on smooth surfaces due to its larger surface area, this new sidelooking pressure sensor provides the industry with highly reliable pressure measurements for existing applications, and with extended capabilities for new applications.

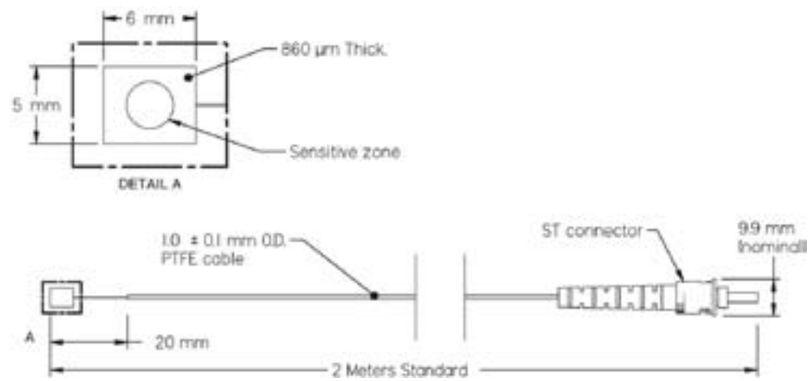
In addition to the advantages inherent to fi ber optic sensors, our white light interrogation technique assures highly accurate and reliable measurements.

Specifications

Pressure range	0–50, 0–1000 psi
Resolution [1]	0.1% of full scale
Accuracy [2]	±0.5% of full scale
Connector type	ST connector
Operating temperature	−20°C to 150°C (−4°F to 302°F)

1. Signal conditioner dependent.
2. Relative to atmospheric pressure.

FOP-MSL Dimensions



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EFO Strain Sensor

Key Features

- Immune to EMI/RFI/Lightning
- Intrinsically safe
- Static/dynamic response
- High sensitivity and resolution of 0.01% of full scale
- Signal transmitted over long distances
- No interference due to fi ber bending
- Absolute measurements in engineering units

Applications

- Dams
- Bridges
- Tunnel linings
- Nuclear power plants
- Buildings
- High performance and reactive powder concrete
- Corrosive environments
- High EMI/RFI environments

The EFO is a fi ber optic strain sensor especially designed to be embedded in concrete, ideal for composite material engineering research and civilengineering applications such as monitoring stresses in structural members of buildings, bridges, tunnel linings and supports during and after construction.

Smart structures are now possible thanks to FISO's EFO fi ber optic strain sensor. The deployment of sensors within the structure, whether it is a bridge or a dam, provides accurate information on changes in load and strains in reinforced concrete and mass concrete. Measuring strain in tunnel linings and supports is also possible with the EFO fi ber optic strain sensor.

The EFO is a 70 mm long sensor designed to be embedded in concrete. The sensor is based on a unique fi ber optic strain sensor which constitutes a breakthrough in fi ber optic sensing. It consists of a stainless steel body, with two fl anges for better adherence to concrete. The intrinsic Fabry-Perot strain sensor is bonded in a very small diameter longitudinal hole located in the center of the steel body. Intrinsically safe, it is immune to EMI, RFI, and lightning. It allows static/dynamic measurement and can deliver signal transmitted over long distances with no interference due to fi ber bending.

The sensor can be used with different types of concrete, including conventional, high performance and powder reactive concrete.

The EFO embedded strain sensor is usually set into concrete structures in one of two ways: it can be cast directly into the wet mixture or encapsulated into a concrete briquette which is then cast into the wet mixture. It is also possible to set the sensor into hardened concrete by grouting it – or the briquette containing it – into a pre-drilled hole. The EFO strain sensor will not affect concrete properties and performance.

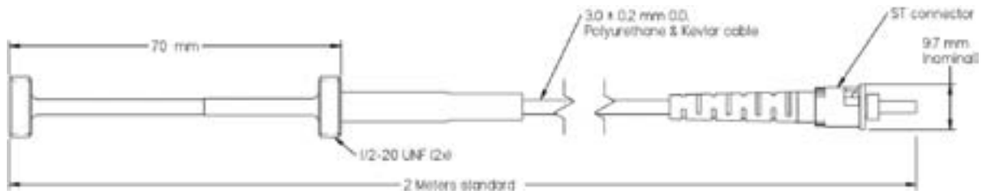
The EFO fi ber optic strain sensor withstands harsh chemical environments and offers ruggedness and fl exibility for today's concrete characteristics monitoring requirements.

Specifications

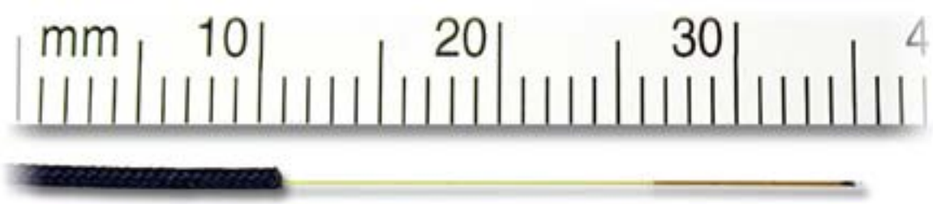
Strain range	±1000με, ±1500με, ±2000με, ±3000με
Resolution [1]	0.01% of full scale
Transverse sensitivity	<0.1% of full scale
Connector type	ST connector
Operating temperature	−40°C to 85°C (−40°F to 185°F)

1. Signal conditioner dependent.

EFO Dimensions



FOS-N Strain Sensor



Applications

- Torque measurement
- New material research and development
- Civil engineering
- Tunnel linings
- Nuclear power plants
- Structural health monitoring
- Corrosive environments
- High EMI/RFI environments

Key Features

- Immune to EMI/RFI/lightning
- Intrinsically safe
- Static/dynamic response
- High sensitivity and resolution: 0.01% full scale
- Signal transmitted over long distances
- No interference due to cable bending
- Absolute measurements in engineering units

The FOS-N is a fi ber optic strain sensor, ideal for composite material engineering research and civil-engineering applications such as structural health monitoring of buildings, bridges, tunnel linings and supports.

The FOS-N strain sensor offers small size, high accuracy, immunity to EMI/RFI, and resistance to corrosive environments with a high temperature range.

Manufacturers, civil structure designers, and research engineers may now improve structure technology by developing and testing composite materials in a range of applications. The capability to monitor the performance of new materials and structures is crucial to evaluate them objectively. Monitoring specifi c properties over time will help improve the safety and durability of civil structures. The deployment of sensors within a structure, whether it is a bridge or a dam, provides accurate information on changes in strains in the structure. Monitoring stresses in structural members of buildings, bridges, tunnel linings and supports during and after construction is also possible with the FOS-N fi ber optic strain sensor. The use of the FOS-N strain sensor allows a complete stress/strain analysis in the most challenging environments.

Based on proven Fabry-Perot interferometer technology, FISO's fi ber optic strain sensors are the best choice for high performance strain measurements. The technology upon which are based the FOS-N strain sensor and the compatible monitoring system provide absolute strain measurements at very long distances without affecting the reliability of the readings.

The FOS-N strain sensor is not sensitive to any pulling or manipulation of the incoming fi ber. This feature is advantageous when the sensor is embedded into com posite materials.

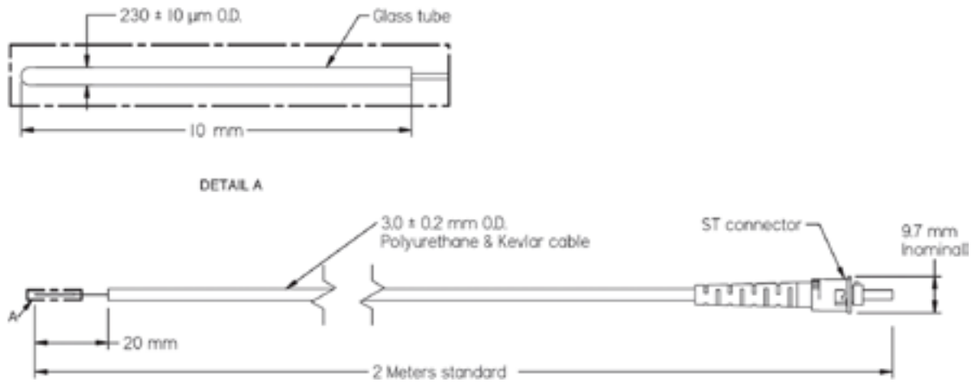
The FOS-N fi ber optic strain sensor withstands harsh chemical environments and offers ruggedness and fl exibility for today's high-performance composite material research and civil structure monitoring requirements.

Specifications

Strain range	±1000 με, ±2500 με, ±5000 με
Resolution[1]	0.01% of full scale
Transverse sensitivity	<0.1% of full scale
Connector type	ST connector
Operating temperature[2]	−40°C to 250°C (−40°F to 482°F)
Glass tube dimensions	±1000 με: 10 mm ; ±2500 or ±5000 με: 8.5 mm

1. Signal conditioner dependent.
2. Adhesive dependent. Installation over 200°C (392°F) susceptible to creeping.

FOS-N Dimensions



SFO-W
Spot-Welded Strain Sensor

Applications

- Steel structures
- Dams
- Nuclear power plants
- Structural members of buildings and bridges
- Tunnel supports
- Corrosive environments
- High EMI/RFI environments

Key Features

- Immune to EMI/RFI/lightning
- Intrinsically safe
- Static/dynamic response
- High sensitivity and resolution: 0.01% full scale
- Signal transmitted over long distances
- No interference due to fi ber bending
- Absolute measurements in engineering units
- Data-acquisition compatible

The SFO-W is a fi ber optic, spot-welded strain sensor designed for civil engineering applications such as the monitoring of dams, bridges, tunnels, and other structures.

The SFO-W strain sensor offers small size, high accuracy, immunity to EMI/RFI, and resistance to corrosive environments with a high temperature range.

Manufacturers, civil structure designers, and research engineers may now improve structure technology by monitoring the performance of civil structures. Monitoring specifi c properties over time will help improve the safety and durability of these structures. The deployment of SFO-W strain sensors within a structure, provides accurate information on changes in strains in structural members of buildings, bridges, tunnel linings and supports during and after construction. The use of the SFO-W strain sensor allows a complete stress/strain analysis in the most challenging environments.

The SFO-W consists of a small diam eter stainless steel tube welded on a steel sheet, suitable for spot-welding on steel surfaces. The sensor is based on a unique fi ber optic strain sensor which constitutes a breakthrough in fi ber optic sensing. The extrinsic Fabry-Perot strain sensor is bonded inside the steel tube, thereby following the tensile or compressive movements of the spot-welded sensor.

FISO's patented fi ber optic technology allows installation of the SFO-W strain sensor at distances as far as 3 kilometers away from the signal conditioner, which makes this optical sensor the perfect candidate for civil structure monitoring.

The SFO-W sensor is designed to be installed easily, without the assistance of a skilled welder. The SFO-W sensor is intended for long-term, precise strain measurements on a variety of structures. It can be installed on fl at or cylindrical surfaces.

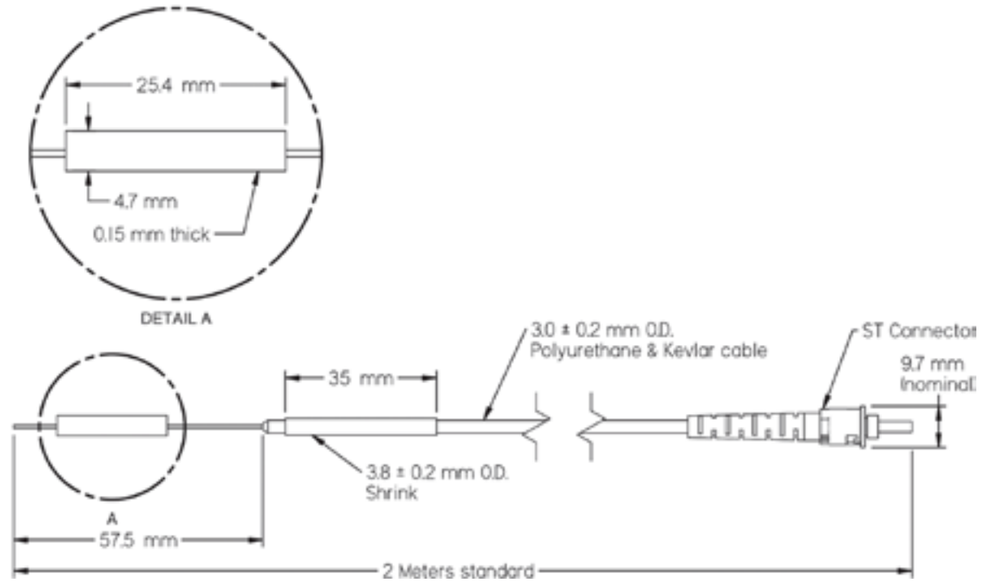
The SFO-W has a sensitivity and resolution of 0.01% on its full scale and is available with a range of up to 2000 micro-strains.

Specifications

Strain range	±1000 με, ±1500 με, ±2000 με
Resolution[1]	0.01% of full scale
Transverse sensitivity	<0.1% of full scale
Connector type	ST connector
Operating temperature	−40°C to 85°C (−40°F to 185°F)

1. Signal conditioner dependent.

SFO-W Dimensions



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FOD Linear Position and Displacement Sensor

Applications

- Microwave and RF environments
- In-situ process monitoring
- Harsh and hazardous environments
- High-temperature environments

Key Features

- Intrinsically safe
- Immune to EMI/RFI
- Up to 100°C (212°F)
- Resolution of up to 0.002 mm
- 20 mm linear stroke
- Aluminum or composite material housing

The FOD is a fi ber optic linear position and displacement sensor that provides high accuracy, absolute measurements of position and displacement. The FOD is well suited for diffi cult to reach locations and hazardous environments such as those containing explosive materials.

Features complete immunity to EMI and RFI, built-in safety for hazardous environments, high precision and high temperature operating range.

Research engineers in aerospace, defense, and different industrial areas may now improve process and product technology by monitoring the performance of specifi c properties over time that will provide accurate information on changes in displacement during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FOD linear position and displacement sensor allows a complete analysis in the most challenging environments.

The FOD is an absolute position sensor and it is the fi ber optic version of the wellknown Linear Variable Differential Transformer (LVDT). However, unlike its electrically activated counterpart, the FOD requires no energizing AC voltage or driving signal with the associated wiring. Thus, the FOD is completely immune to EMI and RFI and carries no risk of current leakage or ignition. The FOD can be packaged in a very compact form and can be located up to 5 km away from the signal conditioner.

Our unique design is based on a Thin Film Fizeau Interferometer device (TFFI) mounted on a movable shaft. The TFFI acts as a spatially distributed Fabry-Perot cavity where the cavity length varies along the lateral position. The tip of an optical fi ber faces the surface of the TFFI, which moves relative to the optical fi ber extremity.

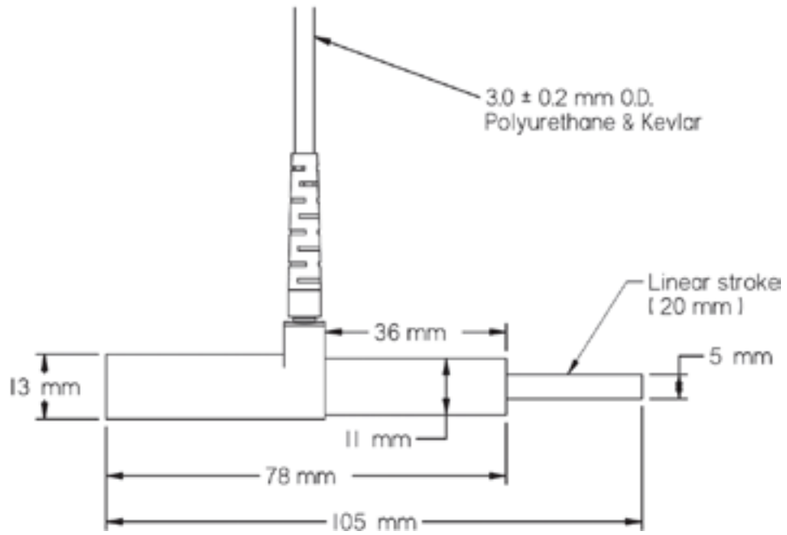
The FOD fi ber optic linear position and displacement sensor combines all the desired characteristics you would expect in the ideal sensor. Its compact size, immunity to EMI/RFI, resistance to corrosive environments, high accuracy, and reliability make it the best choice for linear position and displacement measurements.

Specifications

Linear stroke	20 mm (0.8 in)
Resolution [1]	0.002 mm (0.00008 in)
Accuracy [2]	±0.02 mm (0.0008 in)
Connector type	ST connector
Operating temperature	−20°C to 100°C (−4°F to 212°F)*

1. Signal conditioner dependent.
2. Calculated at calibration temperature using a fourth-order polynomial equation.
* Lower or higher temperature available upon request.

FOD Dimensions



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FRI Refractive Index Sensor

Applications

- Microwave and RF environments
- In-situ process monitoring
- Harsh and hazardous environments
- High-temperature environments

Key Features

- Intrinsically safe
- Immune to EMI/RFI
- Up to 100°C (212°F)
- Resolution of up to 0.002 mm
- 20 mm linear stroke
- Aluminum or composite material housing

The FRI is a fi ber optic refractive index sensor, ideal for refractive index mea surement of fl uids in industrial, chemical and food processing industryapplications. Frequently used for Oil Concentration Ratio measurement, this fi eld-proven solution is an invaluable asset for engineers working in instrumentation.

The FRI is a miniature sensor that provides in-situ refractive index measurements and allows continuous monitoring of any process, whether industrial, chemical of food-engineering, thus eliminating manual sampling and measurements repeatability problems. These sensors are also designed to withstand variable temperature, EMI and vibration conditions.

Research engineers working in cooling systems development, those involved in any area where fl uids chemistry and fl uids quality control are applied, may now improve process and product technology by monitoring the performance of specifi c properties over time. This will provide accurate information on changes in the refractive index during the operation, the manufacturing process or throughout the lifetime of a product. The use of the FRI refractive index sensor allows a complete refractive index analysis in the most challenging environments.

Our unique design is based on the variation of a liquid-fi lled Fabry-Perot optical cavity length to precisely determine the refractive index of the liquid. The liquidfi lled optical cavity length varies in direct proportion with the refractive index of the liquid sample. The refractive index measurement is achieved by measuring the Fabry-Perot cavity length using white light interferometer technology.

The fi ber optic signal conditioner has the capability to perform the refractive index measurement under challenging conditions of temperature, EMI, humidity and vibration with uncomplicated calibration tasks that the user can perform.

The FRI fi ber optic refractive index sensor provides the industry with better and more reliable refractive index measurements for existing applications, and with extended capabilities for new applications requiring continuous in-situ monitoring of fl uids refractive index under adverse conditions.

The FRI fi ber optic refractive index sensors are available in a miniature package (FRI-BA model) or in a rugged stainless steel package (FRI-NP model), suitable for industrial applications.

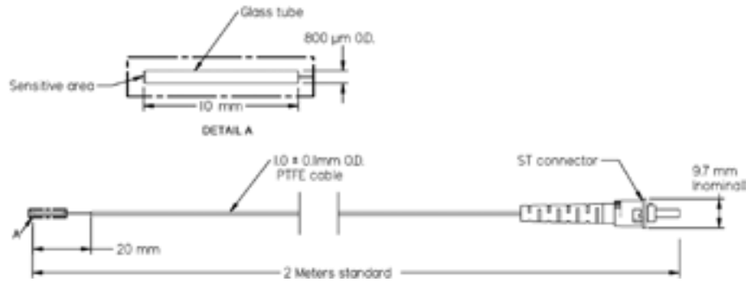
Specifications

Refractive index range From	1.0000 to 1.7000 RI
Resolution[1]	0.0001 RI or 0.036% of Oil Concentration Ratio in refrigerant
Accuracy	±0.0005 RI
Connector type	ST connector
Operating temperature	0°C to 100°C (32°F to 212°F)

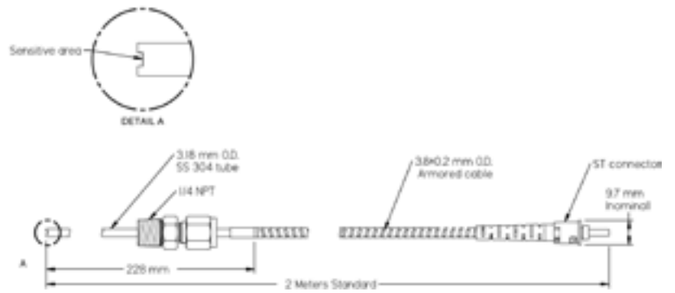
1. Signal conditioner dependent.

FRI Dimensions

FRI-BA Model



FRI-NP Model



Medical Pressure Solution

Key Features

- High accuracy
- EM/RF/MW interference complete immunity
- Miniature and rugged sensor for in situ pressure measurements

Application Products

- FOP-MIV sensor
- FPI-HR module
- EVOLUTION chassis

Specifications

PRESSURE RANGE OPTION	R1	R2
Pressure range[1]	−300 mmHg to 300 mmHg	−300 mmHg to 7500 mmHg
Sensitivity thermal effect	−0.05% / °C	0.15% / °C
Zero thermal effect	−0.4 mmHg / °C	3 mmHg / °C
Proof pressure	>4000 mmHg (0.53 MPa)	22 500 mmHg (3 MPa)
Accuracy	1.5% Full scale[2]	0.1%[3]
Resolution	<0.3 mmHg (40 Pa)	2.6 mmHg (0.34 kPa)
Sampling rate	Up to 250 Hz per module	Up to 250 Hz per module
Power consumption	5 Watts	5 Watts
Analog output (Optional)	0 to 5V or 4–20 mA / 16 bits resolution	0 to 5V or 4–20 mA / 16 bits resolution
Operating temperature	10ºC to 50ºC	10ºC to 50ºC
Storage temperature	−30ºC to 80ºC	−30ºC to 80ºC
Connector	SCAI[4], SCA (ST optional)	SCAI[4], SCA (ST optional)
Fiber core size	62.5/125µm (50/125µm optional)	62.5/125µm (50/125µm optional)
Number of channel(s)	1 or 2	1 or 2
Communication / Evolution chassis	USB via EVO chassis / TS 35 DIN RAIL	USB via EVO chassis / TS 35 DIN RAIL
Communication/OEM	RS-232 / RS-485	RS-232 / RS-485
LED sensor signal and communication diagnostic	Yes	Yes

1. Relative to atmospheric pressure
2. Or ±1 mmHg, whichever is greater
3. Or ±8 mmHg, whichever is greater
4. SCAI is an SCA connector with smart chip communicating calibration data to signal conditioner module

Applications

Medical

- Cardiology
- Neurology
- Anaesthesiology
- Pneumonology
- Gastroenterology
- Urology
- Genycology
- Ophthalmology
- Electrosurgery
- Thermal therapy
- Preclinical studies
- MRI and other RFI environments

Laboratory

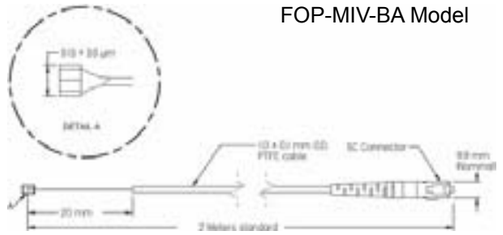
- Preclinical studies
- Animal testing
- Pharmacology

OEM products

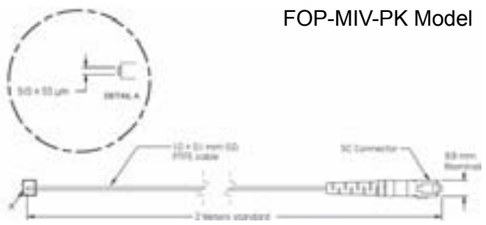
- Custom design for embedment in diagnostics or therapeutic medical devices
- High volume / low cost available sensors
- Proven high volume automated production facilities and practices complying with recognized medical authorities
- Computerized product testing in assembly line

FOP-M Dimensions

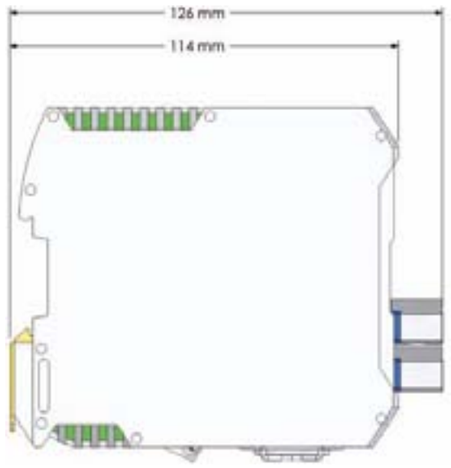
FOP-MIV-BA Model

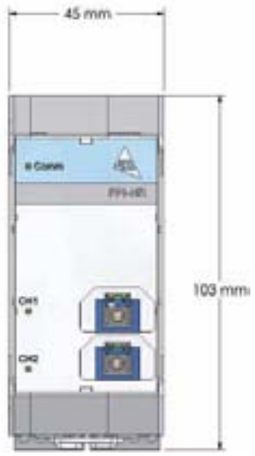


FOP-MIV-PK Model



FPI-HR Module Dimensions



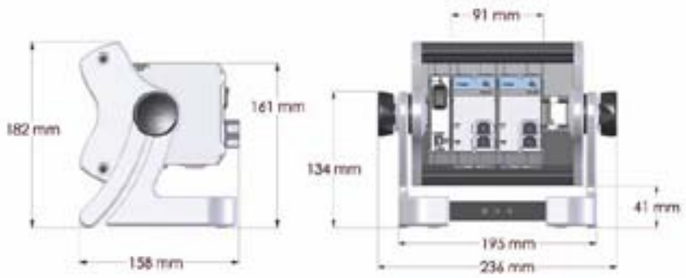


Specifications

	EVOLUTION EVO-SD-2	EVOLUTION EVO-SD-5	EVOLUTION EVO-HMI-3 (Coming Soon)	EVOLUTION EVO-RM-8 Rackmount
Display	—	—	LCD WVGA (800 × 480) Touchscreen	—
Communication	USB Expansion RS-485	USB Expansion RS-485	USB Ethernet Gbits Expansion RS-485	USB Expansion RS-485
Data logging memory	Via computer	Via computer	Internal, SD, USB slave	Via computer
Number of modules	Up to 2	Up to 5	Up to 3	Up to 8
Expansion chassis	EVO-SD-5	EVO-SD-5	EVO-SD-5	EVO-RM-8
Power supply	24VDC 70W	24VDC 70W	24VDC 70W	24VDC 70W

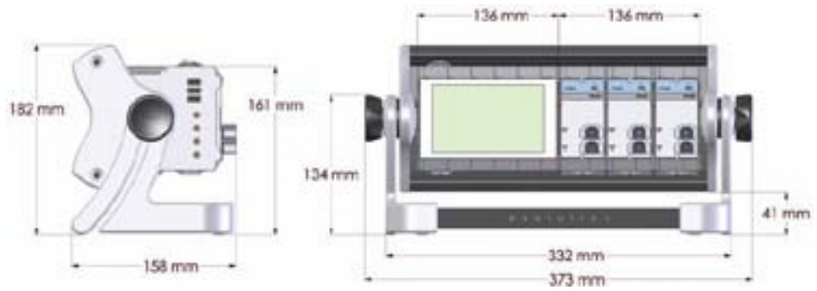
Evolution Chassis Dimensions

EVO-SD-2 Model



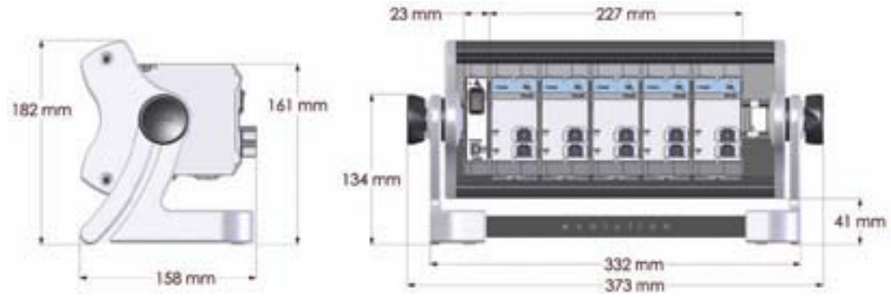
EVO-HMI-3 Model

COMING SOON



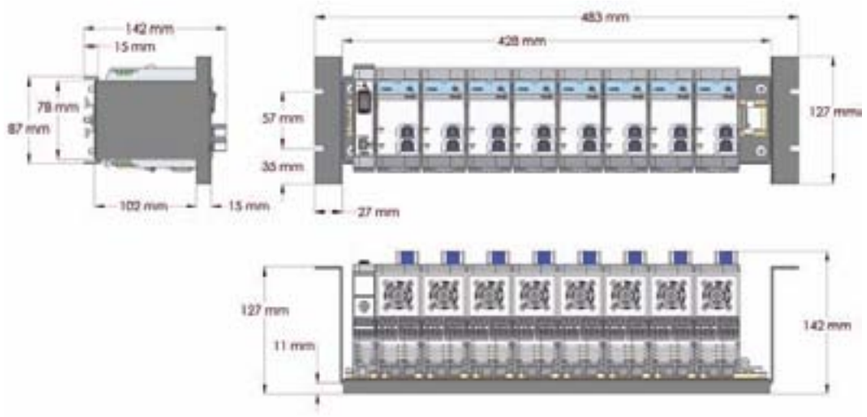
Evolution Chassis Dimensions

EVO-SD-5 Model



EVO-SD-5-EXP-Cable Model

EVO-RM-8 Model



General Temperature and Pressure Applications

Application Products

- FOT-L Temperature sensor
- FOP-M Pressure sensor
- FPI-HR module
- EVOLUTION chassis

Key Features

- High accuracy
- Up to 250 Hz sampling rate
- Temperature-compensated modules

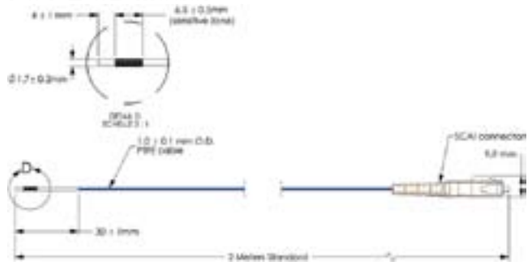
Specifications

FPI-HR Module	TEMPERATURE – FOT-L	PRESSURE – FOP-M
Measuring range	−10°C to 120°C	R1: 0 to 5 psi / R2: 0 to 50 psi R3: 0 to 150 psi / R4: 0 to 1000 psi
Temperature operating range	SD: −40°C to 300°C BA: −40°C to 250°C	−20°C to 150°C
Response time[1]	<1.5s	—
Accuracy[2]	R4: ±0.25°C / R5: ±0.40°C	±0.5% of full scale
Resolution	0.01°C	0.05% of full scale
Sampling rate	Up to 250 Hz per module	Up to 250 Hz per module
Power consumption	5 Watts	5 Watts
Analog output (Optional)	0 to 5V or 4–20 mA / 16 bits resolution	0 to 5V or 4–20 mA / 16 bits resolution
Operating temperature	10ºC to 50ºC	10ºC to 50ºC
Storage temperature	−30ºC to 80ºC	−30ºC to 80ºC
Connector	SCAI[3], SCA (ST optional)	SCAI[3], SCA (ST optional)
Fiber core size	62.5/125µm (50/125µm optional)	62.5/125µm (50/125µm optional)
Number of channel(s)	1 or 2	1 or 2
Communication / Evolution chassis	USB via EVO chassis / TS 35 DIN RAIL	USB via EVO chassis / TS 35 DIN RAIL
Communication/OEM	RS-232 / RS-485	RS-232 / RS-485
LED sensor signal and communication diagnostic	Yes	Yes

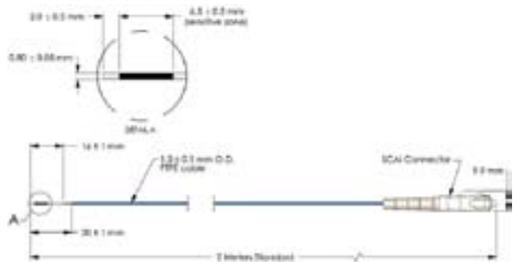
1. Time required to reach 63% of a temperature step.
2. Includes reproducibility (sensor/module exchange), repeatability and hysteresis, non-linearity, scale error, offset error, conditioner temperature compensation error.
Temperature: Accuracy of ±0.25°C can be achieved using the 25°C to 45°C calibration.
Accuracy of ±0.40°C can be achieved using the −10°C to 120°C calibration.
Pressure: Accuracy at room temperature.
3. SCAI is an SCA connector with smart chip communicating calibration data to signal conditioner module.

FOT-L Dimensions

FOT-L-SD Model

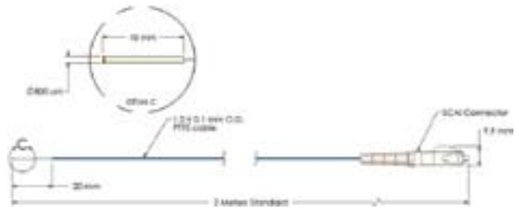


FOT-L-BA Model

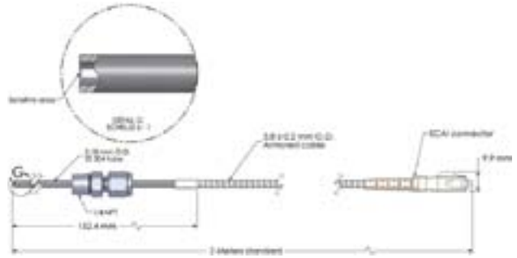


FOP-M Dimensions

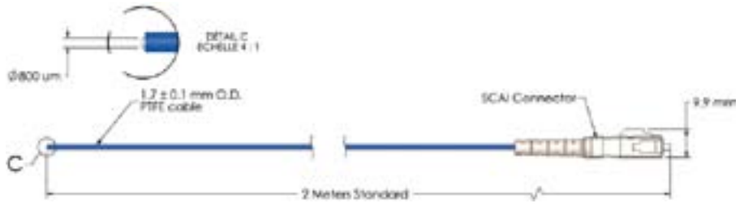
FOP-M-BA Model



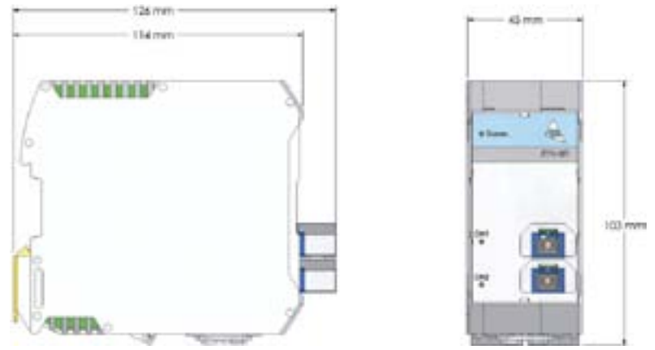
FOP-M-NP Model



FOP-M-PK Model



FPI-HR Module Dimensions



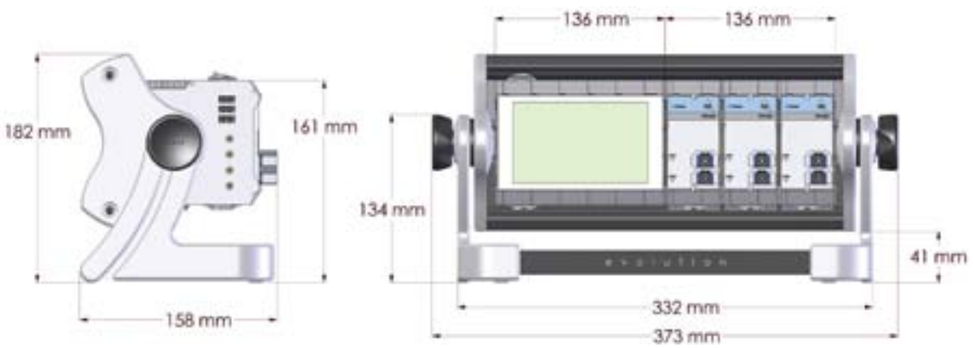
Specifications

	EVOLUTION EVO-SD-2	EVOLUTION EVO-SD-5	EVOLUTION EVO-HMI-3 (Coming Soon)	EVOLUTION EVO-RM-8 Rackmount
Display	—	—	LCD WVGA (800 × 480) Touchscreen	—
Communication	USB	USB	USB	USB
Data logging memory	Via computer	Via computer	Internal, SD, USB slave	Via computer
Number of modules	Up to 2	Up to 5	Up to 3	Up to 8
Expansion chassis	EVO-SD-5	EVO-SD-5	EVO-SD-5	EVO-RM-8
Power supply	24VDC 70W	24VDC 70W	24VDC 70W	24VDC 70W

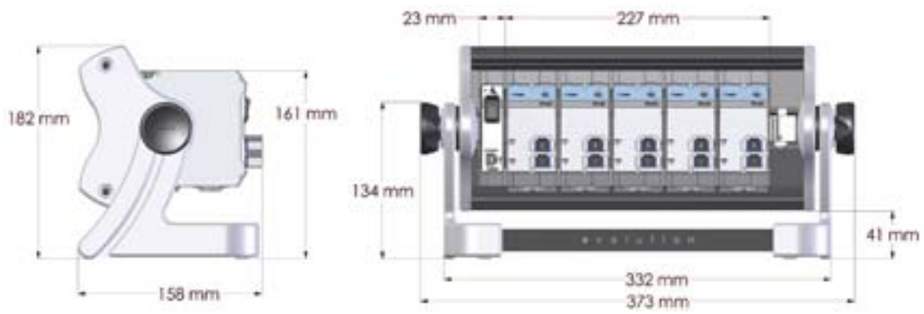
Evolution Chassis Dimensions
EVO-SD-2 Model

EVO-HMI-3 Model

COMING SOON

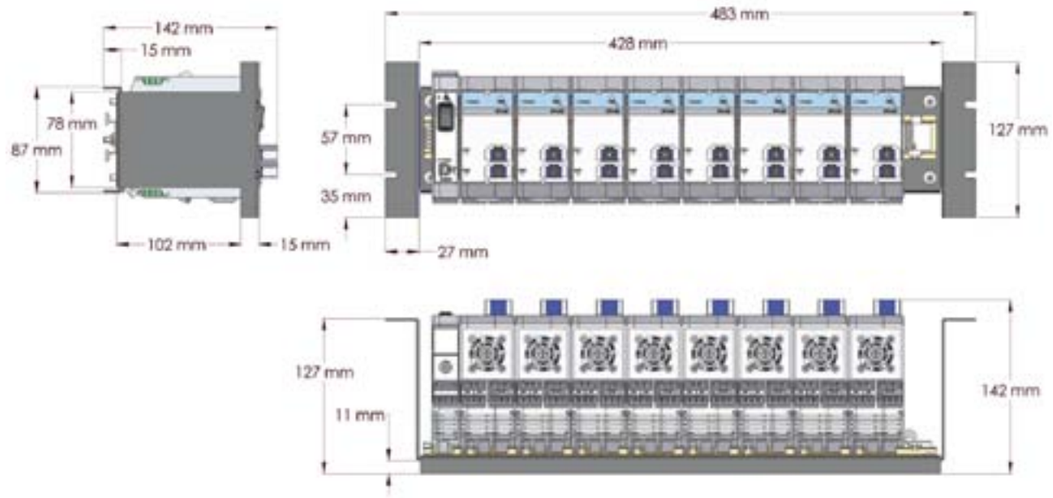


Evolution Chassis Dimensions
EVO-SD-5 Model



EVO-SD-5-EXP-Cable Model

EVO-RM-8 Model



Pressure High-Speed Measurement Applications

Application Products

- FOP pressure sensor
- FPI-HS module sensor
- EVOLUTION chassis

Key Features

- High accuracy
- Up to 15 kHz sampling rate
- Temperature-compensated modules
- Atmospheric pressure compensation (option)

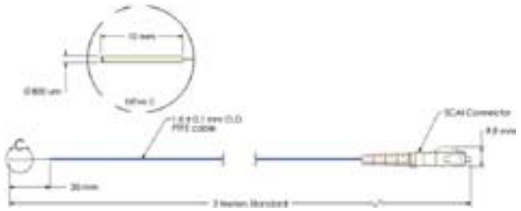
Specifications

FPI-HS Module	PRESSURE – FOP-M
Measuring range	R1: 0 to 5 psi / R2: 0 to 50 psi R3: 0 to 150 psi / R4: 0 to 1000 psi
Operating temperature	−20°C to 150°C
Accuracy[1]	±0.5% of full scale
Resolution	0.05% of full scale
Sampling rate	Up to 15 kHz
Number of channel	1
Analog output (Optional)	0 to 5V or 4–20 mA / 16 bits resolution
Operating temperature	10ºC to 50ºC
Storage temperature	−20ºC to 70ºC
Power consumption	<12 Watts
Lamp lifetime[2]	3000 hours
Connector	SCAI[3], SCA
Fiber core size	62.5/125µm
Communication / Evolution chassis	USB via EVO chassis / TS 35 DIN RAIL
Communication / OEM	RS-232 / RS-485
LED sensor signal and communication diagnostic	Yes

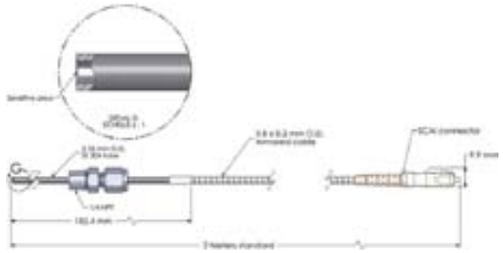
1. Includes reproducibility (sensor/module exchange), repeatability and hysteresis, non-linearity, scale error, offset error, conditioner temperature compensation error. Pressure: Accuracy at room temperature.
2. Lamp is replaceable on fi eld.
3. SCAI is an SCA connector with smart chip communicating calibration data to signal conditioner module.

FOP-M Dimensions

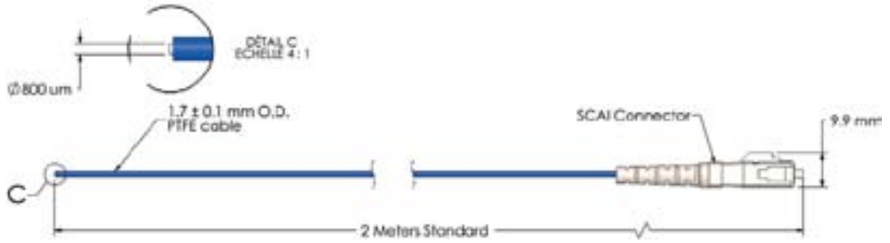
FOP-M-BA Model



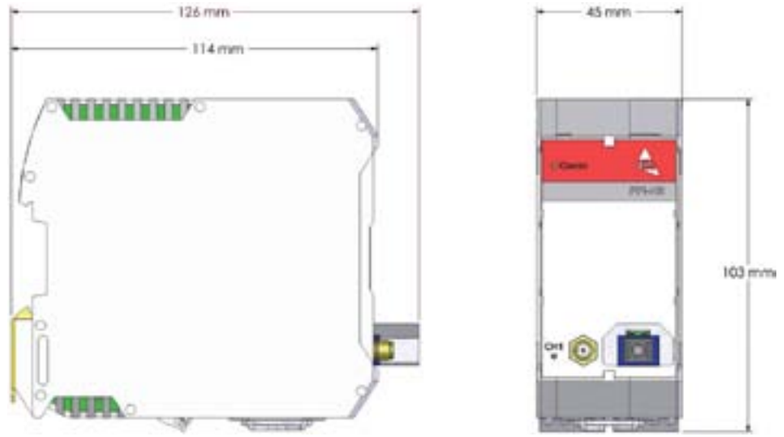
FOP-M-NP Model



FOP-M-PK Model



FPI-HS Module Dimensions



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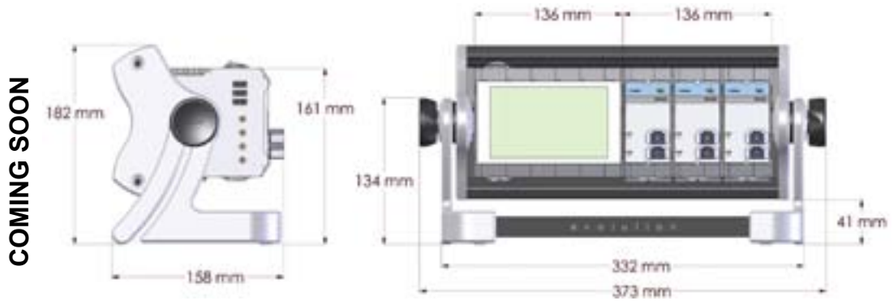
Specifications

	EVOLUTION EVO-SD-2	EVOLUTION EVO-SD-5	EVOLUTION EVO-HMI-3 (Coming Soon)	EVOLUTION EVO-RM-8 Rackmount
Display	—	—	LCD WVGA (800 × 480) Touchscreen	—
Communication	USB	USB	USB	USB
Data logging memory	Via computer	Via computer	Internal, SD, USB slave	Via computer
Number of modules	Up to 2	Up to 5	Up to 3	Up to 8
Expansion chassis	EVO-SD-5	EVO-SD-5	EVO-SD-5	EVO-RM-8
Power supply	24VDC 70W	24VDC 70W	24VDC 70W	24VDC 70W

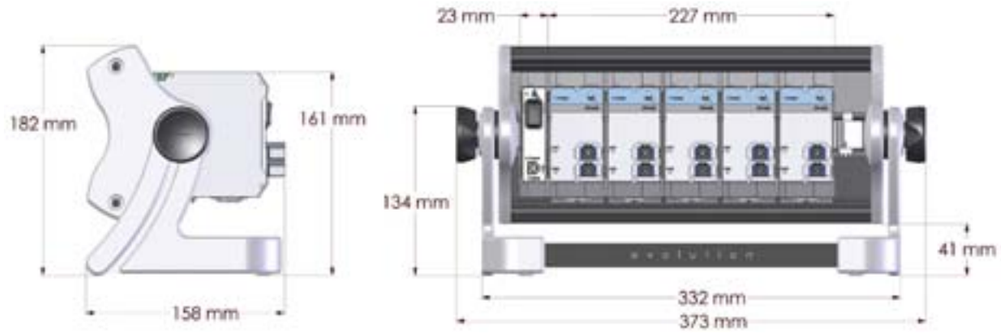
Evolution Chassis Dimensions
EVO-SD-2 Model

EVO-HMI-3 Model

COMING SOON

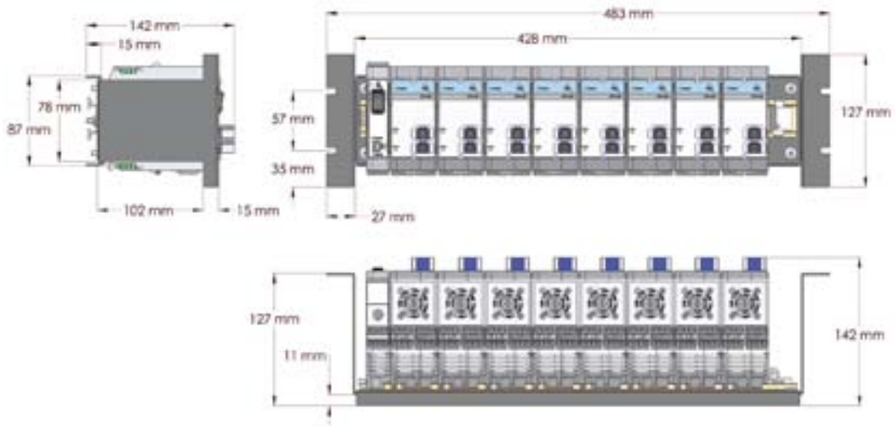


Evolution Chassis Dimensions
EVO-SD-5 Model



EVO-SD-5-EXP-Cable Model

EVO-RM-8 Model



HERO Application (HS/HE)

Application Products

- FOT-HERO Sensor
- FPI-HS/HE module
- EVOLUTION chassis

Key Features

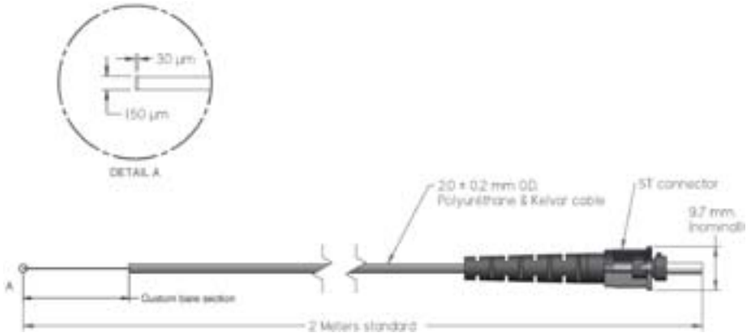
- Absolute measurement
- Sensor signal diagnostic
- Compatible with FOT-HERO
- Sustain multiple connections, strong bending and vibration of the fi bers and extensions
- Sensor maintains calibration with any extension length
- Temperature-compensated modules

Specifications

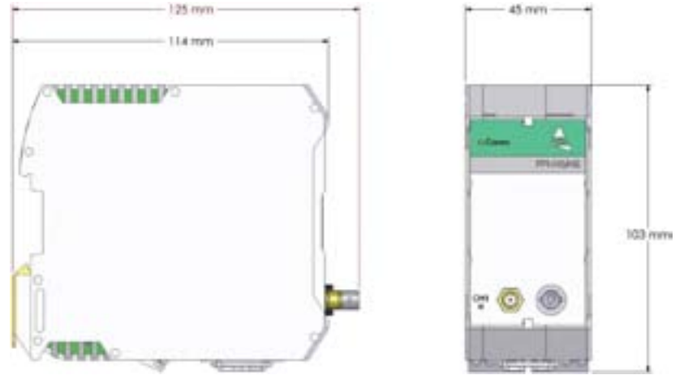
FPI-HS/HE Module	FOT-HERO
Temperature measuring range	0°C to 120°C
Minimum current detected on MK1 squib	<5 mA
Resolution[1,2]	<1 mA
Response time of bare sensor[3,4]	<1 millisecond
Sampling rate	Up to 15 kHz per module5
Power consumption	5 Watts
Analog output	0 to 5V (16 bits resolution)
Operating temperature	10ºC to 50ºC
Storage temperature	−30ºC to 80ºC
Connector	ST
Fiber core size	100/125µm
Number of channel	1
Communication / Evolution chassis	USB
Communication/OEM	RS-232 / RS-485
LED sensor signal and communication diagnostic	Yes

1. Corresponding accuracy in milliamps is relative to the EED under test and has to be determined by an experimental test.
2. Based on MK1 squib, performance is related to system averaging.
3. Based on MK1 squib, 60 milliseconds, defi ned as the ratio of energy and power which produces the same peak output.
4. Based on MK1 squib, 275 milliseconds, defi ned as the rise time (10% to 90%) of the output.
5. Bandwidth up to 1.6kHz

FOT-HERO Sensor Dimensions



FPI-HS/HE Module Dimensions



Specifications

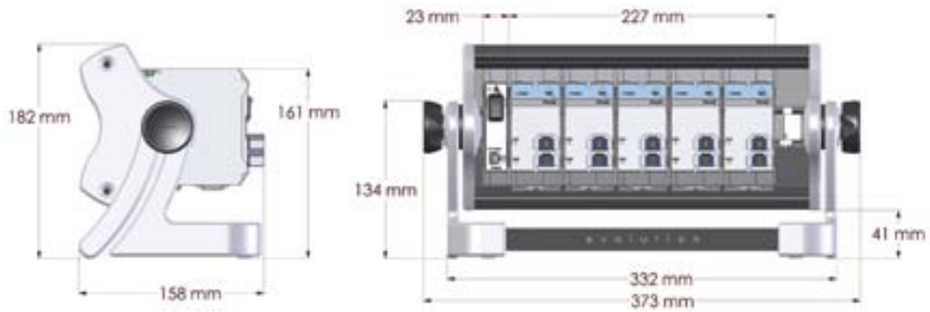
Chassis	EVOLUTION EVO-SD-2	EVOLUTION EVO-SD-5	EVOLUTION EVO-HMI-3 (Coming Soon)	EVOLUTION EVO-RM-8 Rackmount
Display	—	—	LCD WVGA (800 × 480) Touchscreen	—
Communication	USB Expansion RS-485	USB Expansion RS-485	USB Ethernet Gbits Expansion RS-485	USB Expansion RS-485
Data logging memory	Via computer	Via computer	Internal, SD, USB slave	Via computer
Number of modules	Up to 2	Up to 5	Up to 3	Up to 8
Expansion chassis	EVO-SD-5	EVO-SD-5	EVO-SD-5	EVO-RM-8
Power supply	24VDC 70W	24VDC 70W	24VDC 70W	24VDC 70W

Evolution Chassis Dimensions
EVO-SD-2 Model

EVO-HMI-3 Model

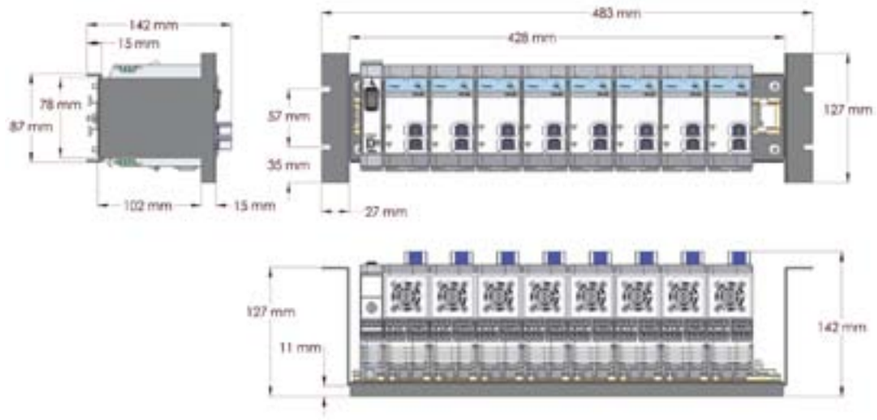
COMING SOON

Evolution Chassis Dimensions
EVO-SD-5 Model



EVO-SD-5-EXP-Cable Model

EVO-RM-8 Model



HERO Application

Application Products

- FOT-HERO Sensor
- FPI-HERO module
- EVOLUTION chassis

Key Features

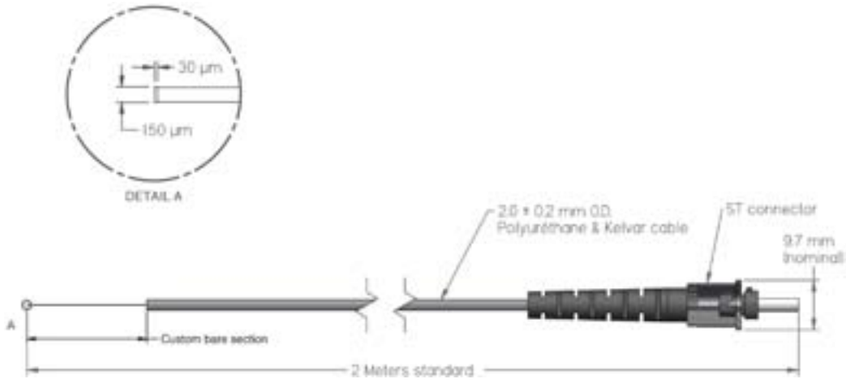
- Absolute measurement
- Sensor signal diagnostic
- Compatible with FOT-HERO
- Limited effect due to vibration
- Sensor maintains calibration with any extension length and connections
- Temperature-compensated modules

Specifications

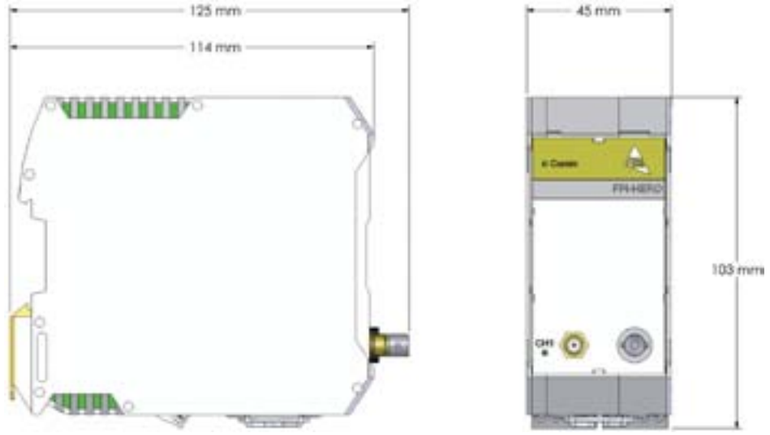
FPI-HERO Module	FOT-HERO
Temperature measuring range	0°C to 120°C
Minimum current detected on MK1 squib	6 mA
Resolution[1,2]	1 mA
Response time[3,4]	<1 millisecond
Sampling rate	Up to 250 Hz per module
Power consumption	5 Watts
Analog output (Optional)	0 to 5V or 4–20 mA / 16 bits resolution
Operating temperature	10ºC to 50ºC
Storage temperature	−30ºC to 80ºC
Connector	SCA (ST optional)
Fiber core size	100/125µm (62.5/125µm optional)
Number of channel	1
Communication / Evolution chassis	USB
Communication/OEM	RS-232 / RS-485
LED sensor signal and communication diagnostic	Yes

1. Corresponding accuracy in milliamps is relative to the EED under test and has to be determined by an experimental test.
2. Based on MK1 squib, performance is related to system averaging.
3. Based on MK1 squib, 60 milliseconds, defi ned as the ratio of energy and power which produces the same peak output.
4. Based on MK1 squib, 275 milliseconds, defi ned as the rise time (10% to 90%) of the output.

FOT-HERO Sensor Dimensions



FPI-HERO Module Dimensions



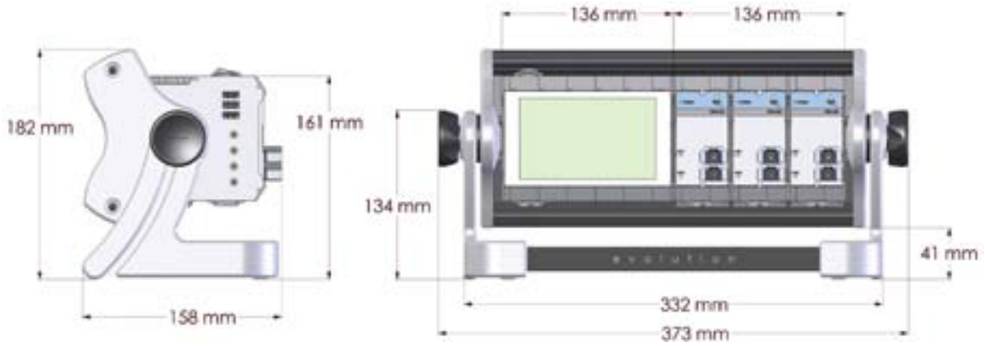
Specifications

Chassis	EVOLUTION EVO-SD-2	EVOLUTION EVO-SD-5	EVOLUTION EVO-HMI-3 (Coming Soon)	EVOLUTION EVO-RM-8 Rackmount
Display	—	—	LCD WVGA (800 × 480) Touchscreen	—
Communication	USB Expansion RS-485	USB Expansion RS-485	USB Ethernet Gbits Expansion RS-485	USB Expansion RS-485
Data logging memory	Via computer	Via computer	Internal, SD, USB slave	Via computer
Number of modules	Up to 2	Up to 5	Up to 3	Up to 8
Expansion chassis	EVO-SD-5	EVO-SD-5	EVO-SD-5	EVO-RM-8
Power supply	24VDC 70W	24VDC 70W	24VDC 70W	24VDC 70W

Evolution Chassis Dimensions
EVO-SD-2 Model

EVO-HMI-3 Model

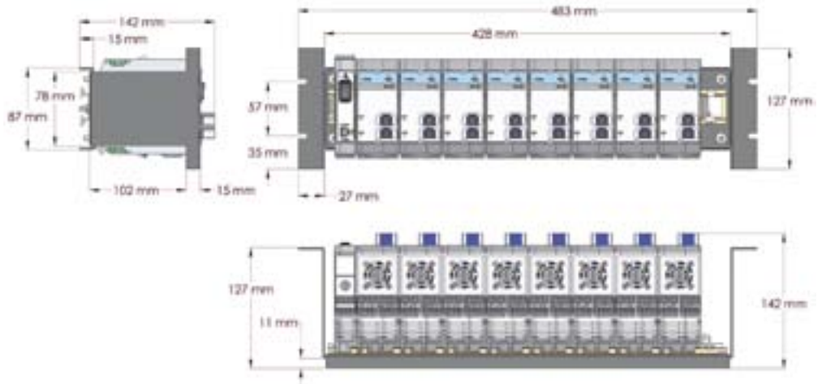
COMING SOON



Evolution Chassis Dimensions
EVO-SD-5 Model

EVO-SD-5-EXP-Cable Model

EVO-RM-8 Model



FTI-10 Single-Channel Signal Conditioner

Application Products

- Microwave food processing
- Thermotherapy
- NMR applications
- Microwave and RF
- High temperature pressure measurements
- Multi-purpose laboratory applications
- Advanced composite materials
- Hazardous environments
- Aerospace applications

Key Features

- Compatible with most of FISO's fi ber optic sensors
- Voltage output and RS-232 communication port
- Backlighted LCD screen
- Small footprint
- Rugged and easy to use
- Battery powered
- 1/8 DIN enclosure

The FTI-10 is a single-channel, battery-powered fi ber optic signal conditioner especially designed to work with all of FISO's fi ber optic sensors. It is a general-purpose instrument ideally suited to perform single-point measurements in a myriad of industrial and R&D applications.

The FTI-10 conditioner is designed to perform accurate single-channel measurements. Thanks to its unique, patented technology, the FTI-10 conditioner is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, providing highly accurate and reliable measurements. The FTI-10 has a 0.01% full-scale resolution and a 0.025% full-scale precision.

The FTI-10 optical input channel is easily accessible through the unit's front panel. It comes standard with an RS-232 communication port and a ±10 V adjus table analog output. Moreover, the unit's internal Flash ROM can be accessed to allow fi rm ware upgrades and updates.

Data is stored in the internal memory buffer for later retrieval or sent directly to any analog input signal reading device through the ±10 V adjustable analog output available on the back panel of the FTI-10 unit.

FISO's fi ber optic temperature, pressure, strain, refractive index, and displacement sensors offer complete immunity to RF and microwave radiation with high temperature opera ting capability, intrinsic safety, and non-invasive use. A seven-digit gauge factor assigned to each sensor allows the FTI-10 conditioner to recognize automatically the sensor type and calibration, reducing test setup time.

The FTI-10 conditioner has a non-volatile memory buffer that can store up to 50 000 data points. Data logging sequences, duration, and other acquisition and data-management parameters are easily programmable using the front-panel interface, through RS-232 remote control commands or, even more easily, thanks to its accompanying software, FISOCommander.

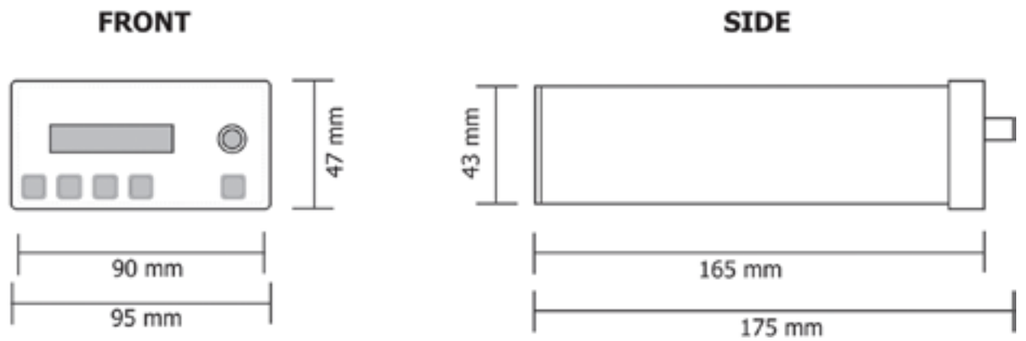
The FTI-10 comes in a rugged 1/8 DIN casing designed to withstand heavy use and operation in industrial environments and has up to 8 hours of battery autonomy.

Specifications

Number of channels	1
Sampling rate	10 Hz
Averaging	1 to 500 samples
Precision	0.025% of full scale
Resolution	0.01% of full scale
Dynamic range	15 000 : 1
Display	1 line 16 characters liquid crystal display with back-light
Data logging	50 000 data points
Analog output	±10 V with screw connectors1
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Lamp life[2]	40 000 hours of continuous use
Weight	0.9 kg (2 lb)
Dimensions (W × D × H)	90 × 165 × 48 mm (1/8 DIN) (3.5 × 6.5 × 1.9 in)
Autonomy	8 hours with fully-charged battery (0.5 Watt power consumption)
Power requirements	12 Volts DC (wallmount adapter included)
Operating temperature	−20°C to 40°C (−4°F to 104°F)

1. 4–20 mA optional.
2. Lamp is replaceable.

FTI-10 Dimensions



TMI Temperature Signal Conditioner

Application Products

- Microwave food processing
- Microwave packaging design
- Thermotherapy applications
- NMR
- Automotive
- Aerospace
- Multi-purpose laboratory applications
- In-situ process monitoring
- New material research
- Hazardous environments

Key Features

- 4 or 8 channels
- ±5 V analog outputs
- RS-232 and USB communication ports
- High resolution
- 20 Hz sampling rate
- Large VFD display
- Upgradeable to multiparameter UMI

The TMI is a fi ber optic signal conditioner especially designed to work with FISO's temperature sensors. It is a general-purpose instrument ideally suited to perform multi-point temperature measurements in a myriad of industrial and R&D applications.

The TMI conditioner is designed to perform accurate multi-channel temperature measurements and is compatible with FOT-L/H and FOT-M temperature sensors. Thanks to its unique, patented technology, the TMI conditioner is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, providing highly accurate and reliable measure ments. The TMI has a 0.01% full-scale resolution and a 0.025% full-scale precision.

FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, intrinsic safety, and non-invasive use.

The TMI comes in a 4-channel or in an 8-channel version. All optical input channels are easily accessible through the unit's front panel. The system scans all the channels in use sequentially with a switching time of 0.15 seconds. It can also read on a discrete channel at a 20 Hz sampling rate. Data is stored in the internal memory buffer for later retrieval or sent directly to any analog input signal reading device through the ±5 V adjustable analog output available for each channel on the back panel of the TMI unit.

The TMI conditioner has a non-volatile memory buffer that can store up to 50 000 data points. Data logging sequences, duration, and other acquisition and datamanagement parameters are easily programmable using the front-panel interface, through remote control commands or, even more easily, thanks to its accompanying software, FISOCommander. Moreover, a Flash ROM allows fi rmware upgrades.

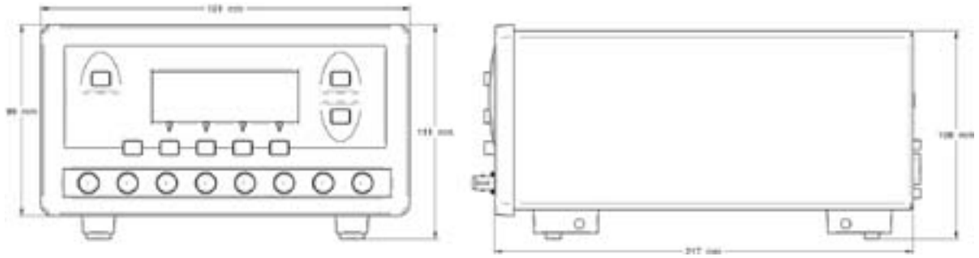
The TMI is the only test unit that can be upgraded to a multi-parameter conditioner to measure temperature, pressure, strain, refractive index, and displacement.

Specifications

Number of channels	4 or 8
Sampling rate	20 Hz
Switching time	150 ms
Averaging	1 to 500 samples
Precision	0.025% of full scale
Resolution	0.01% of full scale
Dynamic range	15 000 : 1
Display	4 lines by 20 characters Vacuum Fluorescent Display
Data logging	50 000 data points
Analog outputs	±5 V software adjustable in scale and offset
Communication	RS-232; USB
Upgradeability[1]	Flash ROM fi rmware
Lamp life[2]	40 000 hours of continuous use
Weight	2.2 kg (4.9 lb)
Dimensions (W × D × H)	191 × 217 × 99 mm (7.2 × 8.5 × 3.9 in)
Power requirements	10 to 20 Volts (5 Watts)
Operating temperature	−20°C to 40°C (−4°F to 104°F)

1. Through an upgrade, can be converted into a UMI signal conditioner.
2. Lamp is replaceable.

TMI Dimensions



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UMI Universal Multichannel Instrument

Application Products

- Microwave food processing
- Microwave packaging design
- Thermotherapy applications
- NMR
- Automotive
- Aerospace
- High temperature displacement measurement
- Multi-purpose laboratory applications
- In-situ process monitoring
- Civil engineering
- New material research
- Hazardous environments

Key Features

- 4 or 8 channels
- ±5 V Analog output
- RS-232 and USB communication ports
- Up to 20 Hz sampling rate
- Large VFD Display
- Compatible with all of FISO's fi ber optic sensors

The UMI is a tabletop, fi ber optic signal conditioner especially designed to work with all of FISO's fi ber optic sensors. It is a general-purpose instrument ideally suited to perform multi-point temperature, pressure, strain, refractive index and displacement measurements in a myriad of industrial and R&D applications in hostile environments.

The UMI conditioner is designed to perform accurate multi-channel temperature, pressure, strain, refractive index, and displacement measurements. Thanks to its unique, patented technology, the UMI conditioner is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, provi ding highly accurate and reliable measurements. The UMI has a 0.01% full-scale resolution and a 0.025% full-scale precision.

FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, intrinsic safety, and non-invasive use.

The UMI comes in a 4-channel or in an 8-channel version. All optical input channels are easily accessible through the unit's front panel. The system scans all the channels in use sequentially with a switching time of 0.15 seconds. It can also read on a discrete channel at a 20 Hz sampling rate. Data is stored in the internal memory buffer for later retrieval or sent directly to any analog input signal reading device through the ±5 V adjustable analog output available for each channel on the back panel of the UMI unit.

A seven-digit gauge factor assigned to each sensor allows the UMI conditioner to reco gnize automatically the sensor type and calibration, reducing test setup time.

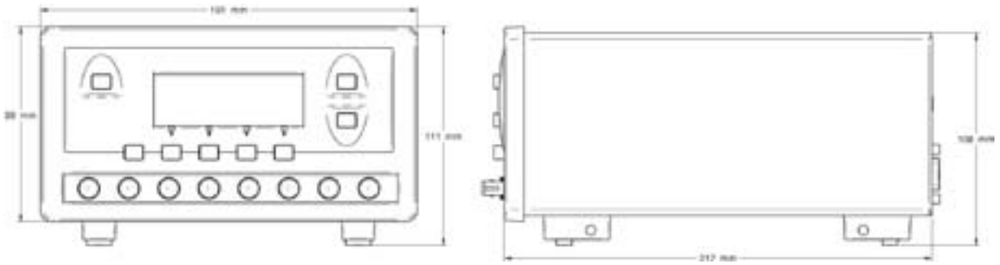
The UMI conditioner has a non-volatile memory buffer that can store up to 50 000 data points. Data logging sequences, duration, and other acquisition and datamanagement parameters are easily programmable using the front-panel interface, through remote control commands or, even more easily, thanks to its accompanying software, FISOCommander. Moreover, its Flash ROM allows fi rmware upgrades.

Specifications

Number of channels	4 or 8
Sampling rate	20 Hz
Switching time	150 ms
Averaging	1 to 500 samples
Precision	0.025% of full scale
Resolution	0.01% of full scale
Dynamic range	15 000 : 1
Display	4 lines by 20 characters Vacuum Fluorescent Display
Data logging	50 000 data points
Analog outputs	±5 V software adjustable in scale and offset
Communication	RS-232; USB
Upgradeability	Flash ROM fi rmware
Lamp life[1]	40 000 hours of continuous use
Weight	2.2 kg (4.9 lb)
Dimensions (W × D × H)	191 × 217 × 99 mm (7.2 × 8.5 × 3.9 in)
Power requirements	10 to 20 Volts (5 Watts)
Operating temperature	−20°C to 40°C (−4°F to 104°F)

1. Lamp is replaceable.

UMI Dimensions



TSC
www.toptical.com.tw 02-2346-1510 toptical@ms17.hinet.net

DMI Signal Conditioner

Application Products

- Multi-points continuous monitoring
- Civil engineering
- High voltage and RF fi elds
- In-situ process monitoring
- Hazardous environments

Key Features

- 16 to 32 channels
- 50 000 samples datalogger
- Programmable datalogger
- NEMA-4 enclosure
- Compatible with most of FISO's fi ber optic sensors

The DMI is a multi-channel, universal fi ber optic signal conditioner especially designed for applications that require continuous monitoring of a large number of measuring points. Designed to work with all of FISO's fi ber optic sensors, it is a general-purpose instrument ideally suited to perform multi-point temperature, pressure, strain, displacement, and force and load measurements in a myriad of industrial and R&D applications in hostile environments.

The DMI conditioner is designed to perform accurate multi-channel temperature, pressure, strain, and displacement measurements. Thanks to its unique, patented technology, the DMI conditioner is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, providing highly accurate and reliable measurements. The DMI has a 0.01% full-scale resolution and a 0.025% full-scale precision.

FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, intrinsic safety, and non-invasive use. The sensors are also designed to withstand harsh and corrosive environments. The DMI comes in a 16-channel or in a 32-channel version. All optical input channels are easily accessible through the unit's front panel. The system scans all the chan nels in use sequentially with a switching time of 0.15 seconds. It can also read on a discrete channel at a 20 Hz sampling rate. Data is stored in the internal memory buffer for later retrieval.

The DMI conditioner has a non-volatile memory buffer that can store up to 50 000 data points. Data logging sequences, duration, and other acquisition and datamanagement parameters are easily programmable using remote control commands or, even more easily, thanks to its accompanying software, FISOCommander. Moreover, a Flash ROM allows fi rmware upgrades.

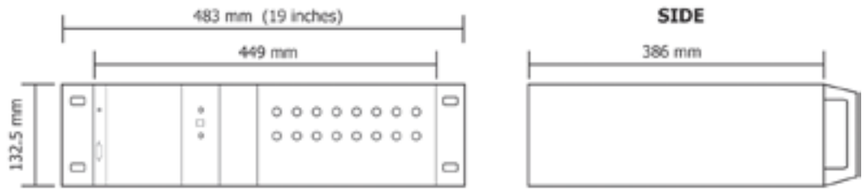
The DMI signal conditioner comes standard in a 19-inch rackmount that accommodates from 16 or 32 channels. A NEMA-4 DMI version is optionally available.

Specifications

Number of channels	16 or 32
Sampling rate	20 Hz
Switching time	150 ms
Averaging	1 to 500 samples
Precision	0.025% of full scale
Resolution	0.01% of full scale
Dynamic range	15 000 : 1
Data logging	50 000 data points
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Lamp life[1]	40 000 hours of continuous use
Weight	4.8 kg (10.6 lb)
Dimensions (W × D × H)	448.8 × 326 × 132.5 mm (17.7 × 12.8 × 5.2 in)
Power requirements	10 to 20 Volts (5 Watts)
Operating temperature	−20°C to 40°C (−4°F to 104°F)

1. Lamp is replaceable.

UMI Dimensions



BUS System

Application Products

- Multi-points dynamic strain measurements
- Laboratory uses
- Civil engineering
- New material research
- Hazardous environments
- High temperature environments
- Aerospace applications

Key Features

- 1 to 8 simultaneous channels
- Voltage output
- RS-232 communication port
- Up to 1000 Hz Sampling Rate
- 19-inch Rack Mount chassis
- Upgradeable number of channels
- Compatible with most of FISO's fi ber optic sensors

The BUS System is a multi-channel, universal fi ber optic signal conditioner especially designed for applications that require simultaneous-reading of a large number of measuring points with fast sampling rates. It is designed to offer the speed and versatility required for the most demanding applications.

Designed to work with all of FISO's fi ber optic sensors, the BUS System is a general- purpose instrument ideally suited to perform multi-point temperature, pressure, strain, displacement, refractive index, and force and load measurements in a variety of industrial and R&D applications. The BUS System allows simultaneous multi-channel measurements at sampling rates of up to 1000 Hz. This is the ideal ins trument when multi-channel, simultaneous and fast data recording is required.

The BUS conditioner performs accurate multi-channel temperature, pressure, strain, displacement, refractive index, and force and load measurements. Thanks to its unique pa tented technology, the BUS conditioner is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, providing highly accurate and reliable measurements.

FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high tempe rature operating capability, and intrinsic safety. The sensors are also designed to withstand harsh and corrosive environments.

The BUS System comes in a 19-inch industrial rack chassis that can incorporate from 1 to 8 channels. BUS Systems can be cascaded to obtain a higher number of channels. All optical input channels are easily accessible through the unit's front panel. The system scans all the channels simultaneously at variable sampling rates that can be set individually to 100, 500 or 1000 Hz. Data is stored in the internal memory buffer for later retrieval. Each channel has its own 10-volt analog output and is independently controlled through the RS-232 communication port.

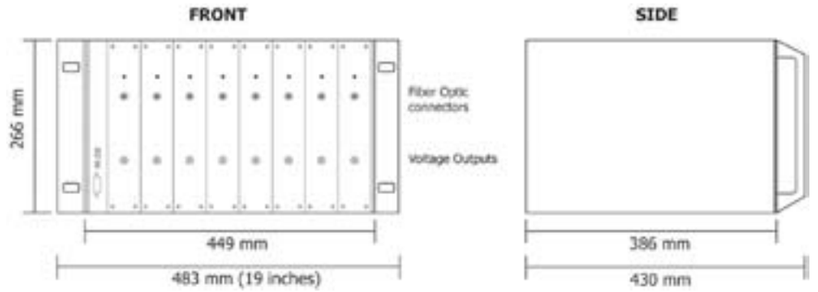
The BUS System conditioner has a non-volatile memory buffer that can store up to 4096 data points per channel. Data logging sequences, duration, and other acquisition and data-management parameters are easily programmable using RS-232 remote control commands or, even more easily, thanks to its accompanying software, FISOCommander BUS/VELOCE Edition.

Specifications

Number of channels	1 to 8
Sampling rate	100 Hz, 500 Hz, 1000 Hz
Averaging	1 to 500 samples
Precision[1]	0.05% of full scale
Resolution[1]	0.01% of full scale
Dynamic range	15 000 : 1
Data logging	4096 data points
Analog outputs	±10 V with BNC connector
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Lamp life[2]	3000 hours of continuous use
Weight	
Chassis	6.3 kg (13.9 lb)
Module	1.2 kg (2.6 lb)
Dimensions	19-inch rackmount
Power requirements	
Chassis	28 W
Module	15 W
Operating temperature	−20°C to 40°C (−4°F to 104°F)

1. Sensor specifi cation not included.
2. Lamp is replaceable.

BUS Dimensions



VELOCE 50 Signal Conditioner

Application Products

- Multi-points dynamic measurements
- Laboratory uses
- In-situ process monitoring
- Reciprocating engine cylinder pressure
- New material research
- High voltage and RF fi elds
- Civil engineering
- Hazardous environments

Key Features

- 1 to 8 simultaneous channels
- Voltage output
- 200 kHz sampling rate
- 19-inch rack chassis
- Upgradeable number of channels
- Compatible with most of FISO's fi ber optic sensors

The VELOCE 50 signal conditioner is an upgradeable, multi-channel, fiber optic signal conditioner, especially designed for applications that require simultaneous reading of a large number of measuring points with fast sampling rates. It is designed to offer the speed and versatility required for the most deman ding applications.

With a 200 kHz sampling rate, the VELOCE 50 signal conditioner is the fastest fiber optic signal conditioner available on the market. It is best suited for applications that require dynamic readings and fast response time. This is the ideal instrument when multi-channel, simultaneous measurements and fast data recording is required.

Designed to work with all of FISO's fi ber optic sensors, the VELOCE 50 signal conditioner is a general-purpose instrument ideally suited to perform multi-point temperature, pressure, strain, displacement, refractive index, and force and load measurements in a variety of industrial and R&D applications.

Thanks to its unique patented technology, the VELOCE 50 conditioner is a relative measurement instrument that provides highly accurate and reliable measurements.

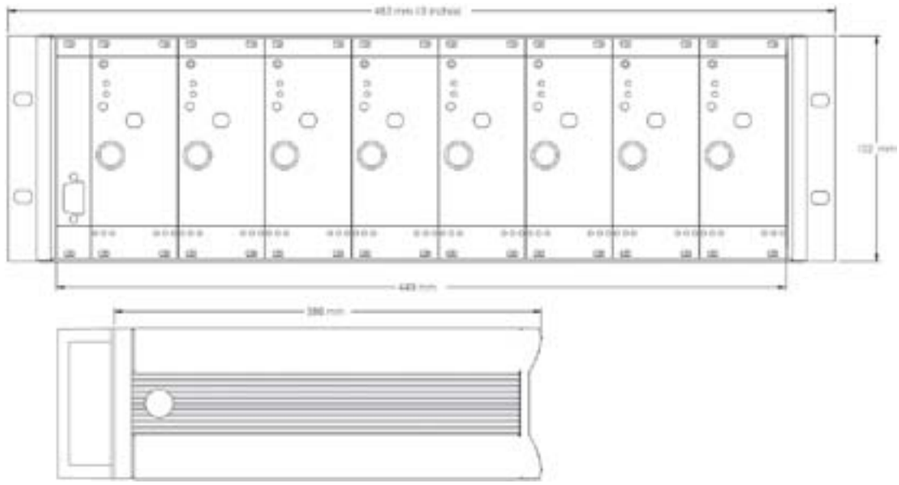
The VELOCE 50 signal conditioner is compatible with all of FISO's fi ber optic sensors, including strain, pressure, temperature, displacement, refractive index, and force and load. FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, and intrinsic safety. The sensors are also designed to withstand harsh and cor rosive environments.

The VELOCE 50 signal conditioner comes in a 19-inch industrial rack chassis that can incorporate from one to eight channels. All optical input channels are easily accessible through the modules' front panels. The system scans all the channels simul taneously at a 200 kHz sampling rate. Each channel has its own BNC ±5 volts analog out put and the unit is independently controlled through the RS-232 communi cation port or, even more easily, thanks to its accompanying software, FISOCom mander BUS/VELOCE Edition.

Specifications

Number of channels	1 to 8
Sampling rate	200 KHz
Averaging	0.005 to 100 ms
Precision	0.3% of full scale
Resolution	0.1% of full scale
Dynamic range	7000 : 1
Analog outputs	±5 V with BNC connector
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Weight	
Chassis	4.8 kg (10.6 lb)
Module	0.5 kg (1.1 lb)
Dimensions (W × D × H)	448.8 × 326 × 132.5 mm (17.7 × 12.8 × 5.2 in)
Power requirements	
Chassis	29 W
Module	4 W
Operating temperature	15°C to 35°C (59°F to 95°F)

VELOCE 50 Dimensions



TSC
www.toptical.com.tw 02-2346-1510 toptical@ms17.hinet.net

VELOCE 100
Fiber Optic Temperature Monitor

Application Products

- EED applications
- HERO Testing
- Point measurement applications
- Airbag igniters
- EMI compatibility of sensitive parts

Key Features

- Temperature resolution down to 0.025°C
- 1 to 8 simultaneous channels
- Voltage output
- 200 KHz sampling rate
- Upgradeable number of channels

The VELOCE 100 Fiber Optic Temperature Monitor is an upgradeable, multichannel, fi ber optic signal conditioner especially designed for electromagnetic interference (EMI) characterization on electronic explosive devices (EEDs). It provides simultaneous reading of a large number of measuring points with fast sampling rates.

The VELOCE 100 is specifi cally designed to meet the requirements needed for characterizing the EMI susceptibility of most bridge wire type EEDs.

The VELOCE 100 Fiber Optic Temperature Monitor is designed to be used in conjunction with the FOT-HERO fi ber optic temperature sensor. The miniature probe size facilitates the positioning of the probe over the center position of the bridge wire while its low thermal mass minimizes the heat sink effect, allowing a temperature resolution down to 0.025°C at a sampling rate of 200 KHz.

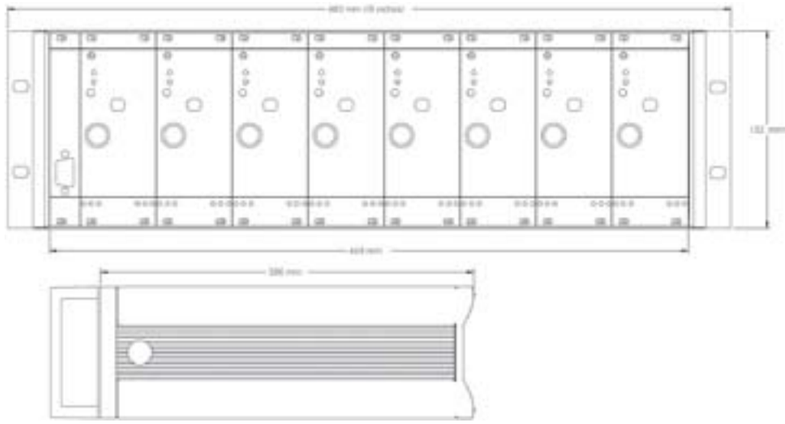
Thanks to its unique patented technology, the VELOCE 100 Fiber Optic Temperature Monitor is a relative measurement instrument that provides highly accurate and reliable measurements. The system's linear response is so reliable that it allows sensor calibration with only one or two known current reference points.

The VELOCE 100 Fiber Optic Temperature Monitor comes in a 19-inch industrial rack chassis that incorporates guide rails, connectors and a power supply. The chassis can accommodate from one to eight sliding independent optical modules. All optical input channels are easily accessible on the modules' front panels. The system scans all the channels simultaneously at a 200 KHz sampling rate. Each module has its own BNC ±5 volts analog output. Temperature changes, expressed in volts accordingly to user's own scale factor entry, are then collected by optional external analog acquisition systems. Each module can be independently controlled, upgraded, and optimized through its own RS-232 communication port or, even more easily, thanks to its accompanying software, FISOCommander BUS/ VELOCE Edition.

Specifications

Number of channels	1 to 8
Sampling rate	200 KHz
Averaging	0.005 to 100 ms
Precision	0.3°C
Resolution	0.03°C
Dynamic range	150°C (302°F)
Analog outputs	±5 V with BNC connector
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Weight	
Chassis	4.8 kg (10.6 lb)
Module	0.5 kg (1.1 lb)
Dimensions (W × D × H)	448.8 × 326 × 132.5 mm (17.7 × 12.8 × 5.2 in)
Power requirements	
Chassis	29 W
Module	4 W
Operating temperature	15°C to 35°C (59°F to 95°F)

VELOCE 100 Dimensions



NORTECH SENTINEL

Fiber Optic Direct Winding Temperature Monitoring System with Datalogging and Relays

Application Products

- Power transformer temperature monitoring
- Core
- Windings
- Bushings
- Load Tap Changer temperature monitoring
- Contacts
- Oil
- High voltage testing
- Generators
- Transmission lines
- High voltage cables
- Switchgears

Key Features

- 1 to 6 channels
- Up to 225ºC
- Accuracy ±1°C
- User selectable analog outputs (0–10 V, 4–20 mA)
- Six form-C relays for one system fault relay
- RS-232 & RS-485 ports
- Built in non volatile memory
- Nortech Commander Software
- Modem capabilities
- Network capabilities
- PLC and SCADA compatible
- Large, easy to read LED display
- Internal real time clock
- Compact, robust signal conditioner with optional 19-inch rack mount or NEMA 4 enclosure
- EMC compliant
- 4 year warranty

With more than 200 systems installed and used worldwide, FISO's Nortech Sentinel optical signal conditioner is a fl exible, multi-channel fi ber optic signal conditioner designed specifi cally for direct, accurate and real-time tem perature monitoring of transformer windings. FISO's Nortech product line offers accurate and repeatable measurements, reliability and long term performance. The Nortech solution provides its worldwide users with tangible benefi ts and distinct features.

Benefi ts

- Accurate, direct and real-time knowledge of hot spot temperature.
- Provides assistance in transformer design and rating verifi cation.
- Safely maximizes loading and overloading.
- Prevents premature failure.
- Avoids equipment outage and undesirable failures.

With up to six channels per unit, an analog output for each channel, and user programmable event relays, the Nortech Sentinel provides the transformer industry with a powerful diagnostic tool. The Nortech Sentinel and its accompanying software, Nortech Commander, perform automated data collection and seamless data exchange with standard spreadsheet programs such as Microsoft Excel™. Through data analysis and graphing, users can maximize loading and transformer lifetime, while optimizing scheduled maintenance. This valuable information can be easily classifi ed and retrieved anytime allowing comprehensive data analysis and comparisons throughout the lifetime of the transformer.

Multiple data logging, event recording, and trend-tracking features provide the critical information that you need. The Megalogger tracks transformer temperature over extended periods of time, while the triggered logger supplies detailed short-term data from a pre-programmed event such as a temperature alarm and/or relays. Our event logger will provide you with a history for your Nortech Sentinel, recording alarms, data downloads, and all other events. The Nortech Sentinel can be used on-site and send collected data directly through the unit's analog outputs. Remote communication is also possible with its modem or RS-232 interface and the Nortech Commander software. Moreover, up to 32 units can be networked with the RS-485 interface, providing integrated access to 192 points of temperature data from transformers, LTCs, and bushings.

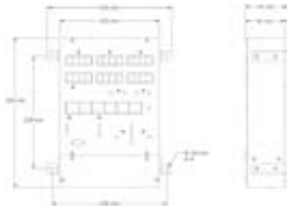
A 19-inch rack mount chassis (optional) or NEMA-4 enclosure (optional) allow you to place the Nortech Sentinel where you need it most. The Nortech Sentinel signal conditioner offers full compatibility with our TPT-32 sensors without any re-calibration. This product joins our cost effective Nortech TT solution for small, medium and distribution transformers. FISO offers a 4 year warranty on all Nortech signal conditioners.

Specifications

Number of channels	1 to 6
Reading temperature range	−40°C to 225°C
Resolution	0.1°C Analog, 1°C Digital
Conditionner accuracy	±1°C
Sampling rate	0.1 Hz
Display Large	1.56 cm (0.614 in) LED display
Relays	6 form C (SPDT) 3A, 24 VAC with user-confi gurable set points 1 form C (SPDT) 3A, 24 VAC. Fail-Safe system fault relay
Serial ports	1 × RS-232, 1 × RS-485
Communication protocol	Proprietary protocol, Modem capabilities
Analog outputs	1 to 6 user fi eld-selectable 4–20 mA or 0–10 V
Power supply	15 V DC, 85-264 VAC, frequency 45–65 Hz
Power requirement	15 V DC, 2 A
Light source	Life expectancy >25 years
Installation	Wall-mount (L brackets) Optional rack-mount chassis or NEMA-4 enclosure
Physical	
Weight	2.5 kg
Dimensions (H × W × D)	305 × 203 × 81 mm
Environmental	
Operating temperature	−20°C to 60°C
Storage temperature	−30°C to 85°C
Immunity	EMC compliant
Part number	NOR
Warranty	4 years

Complete Nortech Solution Includes

- Nortech Sentinel
- TPT-32 temperature sensors
- NOR-EST EasyThroughs
- Fiber optic external extensions
- Other optional available accessories



Nortech Sentinel Dimensions

NORTECH TT

Cost-effective Fiber Optic Temperature Monitoring System

Key Features

- 1,2,4,6 Channels
- Up to 225ºC
- Accuracy ±1°C
- Analog outputs
- RS-232 and RS-485 ports
- MODBUS communication
- Modem capabilities
- Networking capabilities
- Compatible with PLC, SCADA and other substation automation platform
- Aluminum powder coated die cast
- Large, easy to read led display
- Detachable connector blocks
- Wall or din rail mounting
- Protective Conductor Terminal
- Integrated Surge Protection
- EMC compliant
- Nortech Commander Software
- 4 year warranty

Application Products

- Distribution & Power transformers
  - Core
  - Windings
  - Bushings
- Load Tap Changer
  - Contacts
  - Oil
- High voltage testing
- Generators
- Transmission Lines
- High Voltage Cables
- Switchgears

FISO's Nortech TT has been thoroughly thought and designed to meet the temperature monitoring requirements of small and medium size transformers. The Nortech TT offers power utilities a simplifi ed, dependable but most importantly a cost-effective solution for direct, accurate and real time hot spot temperature measurement of transformer windings.

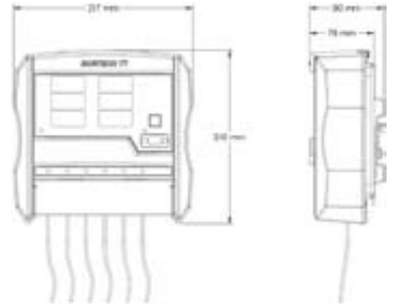
FISO's on-line temperature monitoring enhances safety and reliability issues while increasing economic benefi ts on capital investment and ongoing operating expenses of high voltage equipment. The use of the Nortech TT multi-channel fiber optic monitoring solution provides engineers and operators, an increased knowledge of operational condition assessment; load planning, asset management and end of life determination.

The Nortech solution provides its worldwide users with tangible benefi ts and distinct features.

Benefits

- Accurate, direct and real-time knowledge of hot spot temperature.
- Provides assistance in transformer design and rating verifi cation.
- Safely maximizes loading and overloading.
- Prevents premature failure.
- Avoids equipment outage and undesirable failures.

Distinct Features



The Nortech TT is available with or without display. Offered with standard RS-232 and RS-485 ports, it offers native MODBUS (ASCII, RTU) communication designed for easy integration to existing substation platforms. The use of this communication protocol allows simple and customizable data acquisition integration according to your specifi c needs. The signal conditioner also offers various confi gurations for the analog output, 4-20 mA, 0-1 mA or 0-10 V. All operational parameters are easily programmable using the RS-232 port and the Nortech Commander Windows™ based software. The Nortech TT offers two separate self diagnostic features; a System Status feature which continuously analyzes the internal electronics, the peripheral components along with software diagnostics and a Channel Status which gives you a clear indication on the fi ber optic sensors. The Nortech TT signal conditioner offers full compatibility with our TPT-32 sensors without any re-calibration. FISO offers a 4 year warranty on all Nortech signal conditioners.

Specifications

Number of channels	1, 2, 4 or 6		
Reading temperature range	−40ºC to 225ºC		
Resolution	0.1ºC Analog, 1ºC Digital output		
Conditionner accuracy	±1ºC		
Sampling rate	1 Hz		
Display (optional)	Large 1.56 cm (0.614 in) LED display		
Serial ports	1 × RS-232, 2 × RS-485		
Communication protocols	MODBUS (ASCII, RTU), Proprietary protocol, Modem capabilities		
Analog outputs	1, 2, 4 and 6 factory confi gurable 4–20 mA, Optional 0–1 mA and 0–10 V		
Power supply	24 V DC, 85–264 V AC, frequency 45–65 Hz		
Power requirement	12–30 VDC, 2A		
Light source	Life expectancy >25 years		
Installation	Standard Wall-mount, Optional-DIN rail or NEMA-4 enclosure		
Physical Weight Dimensions (H × W × D) Relative Humidity Standards met	 1.8 Kg 210 × 217 × 78 mm 95% RH at 25°C and 55°C IEC 60068-1 Environmental testing: general IEC 60068-2-1 Tests A :Cold IEC 60068-2-2 Tests B: Dry heat IEC 60068-2-14 Test N: change of temperature IEC 60068-2-30 Test Db and guidance: Damp IEC 60068-2-78 Test Cab: damp heat, steady MIL-STD-810F Vibration and shock		
Environmental Operating temperature Storage temperature	 −20ºC to 60ºC −30ºC to 85ºC		
Immunity	EMC EN61326 EN 61000-4-3 EN 61000-4-6	EN 55022* EN 61000-4-4 EN 61000-4-11	EN 61000-4-2 EN 61000-4-5
Part number	NOR-TT		
Warranty	4 years		

* Class B- Radiated, Class A- Conducted

MWS Microwave Work Station

Application Products

- Food product development
- Food packaging development
- Microwave food product testing
- Microwave food processing
- Cookware design
- Microwave oven design and testing
- New materials research
- Microwave and RF related applications

Key Features

- 8 fi ber optic channels
- Sequential measurement
- Turntable microwave oven
- Collect and save data in spreadsheet-compatible format
- Rugged, easy to use fi ber optic sensors
- Complete immunity to microwave energy

The MWS Microwave Work Station is designed to perform temperature measurements in a microwave oven equipped with a turntable. The use of fi ber optic sensing technology allows complete immunity to microwave energy as well as accurate and reliable measurements inside the microwave oven cavity.

The Microwave Work Station comes with the FISOCommander Workstation software for complete sensors and results management.

The Microwave Work Station fi ts most food developer and tester needs.

Thanks to its unique patented technology, the Microwave Work Station is capable of measuring the absolute cavity length of FISO's Fabry-Perot fi ber optic sensors with astonishing accuracy, providing highly accurate and reliable measurements.

The Microwave Work Station is compatible with all of FISO's fi ber optic sensors, including strain, pressure, temperature, displacement, refractive index, force and load. FISO's fi ber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability as well as intrinsic safety. The sensors are also designed to withstand harsh and corrosive environments.

The Microwave Work Station allows automated data collection and seamless data exchange with standard spreadsheet programs such as Microsoft Excel™ or Lotus 1-2-3™. Data includes temperature and pressure readings collected during the test session. Pictures of the sample under test and the positioning of the sensors can also be saved in the test fi le. This valuable information can be easily classified and retrieved anytime allowing comprehensive data analysis and comparisons.

The Microwave Work Station includes a microwave oven equipped with a turntable, a fi ber optic rotating unit for temperature measurements, the FISOCommander Workstation Edition software, all required wiring, and a comprehensive instruction manual.

Specifications

Number of channels	8
Sampling rate	20 Hz
Switching time	150 ms between each channel
Averaging	1 to 500 samples
Dynamic range	
Temperature	−40°C to 300°C (−40°F to 572°F)
Communication	RS-232
Upgradeability	Flash ROM fi rmware
Weight Rotating unit Microwave oven	 2.8 kg (6.2 lb) 13.5 kg (30 lb)*
Dimensions Rotating unit (Ø × H) Microwave oven (H × W × D)	 220 × 180 mm (8.7 × 7.1 in) 304 × 555 × 480 mm (12 × 21.9 × 19.4 in)*
Microwave oven capacity	0.05 m^3 (1.6 cu.ft.)*
Microwave oven cavity dimensions (H × W × D)	228 × 418 × 470 mm (9 × 16.5 × 18.5 in)*
Microwave oven maximum output power	1200 Watts*
Power requirements Rotating unit Microwave oven	 12 Volts DC 120 VAC 60 Hz; 12 A; 1460 Watts*
Operating temperature	15°C to 35°C (59°F to 95°F)

*As per microwave oven manufacturer specifi cations.

MWS Screenshot