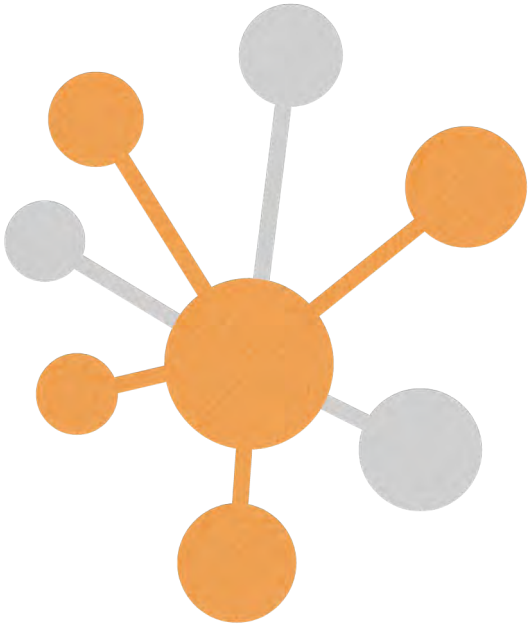
RUGGED MONITORING

Fibre Optic Temperature Monitors and Sensors

October 2019



Lsens-B Fiber Optic Temperature Sensor

- Small diameter for fast response
- Outstanding repeatability
- Complete immunity to RFI, EMI, NMR and microwave radiation
- Plug and Play operation, does not require setup or calibration
- Minimal thermal shunting

Solutions for scientists working in laboratories, research centers and universities who are looking for reliable instruments with fast response & dielectrically neutral in advanced research applications.

Product Summary

A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in demanding applications. The sensor offers complete immunity to RFI, EMI, NMR and microwave radiation. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of +/-0.2 °C it allows precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, and the fiber tip has 0.3 mm x 0.3 mm area with a Polyimide coating. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and is immune to external fields. Therefore, the probes are explicitly suitable for use in large temperature ranges as well as in aggressive operating environments. The sensor length can be from several meters to 1 kilometer in length without impacting the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Semi-conductor
- Electronic component
- Magnetic, RF and microwave environments
- Catheter design
- High voltage environments
- Medical applications
- Microwave assisted chemistry
- Sterilization applications
- RF and microwave drying applications

Benefits

- Sensors do not require any recalibration
- High Stability, no shift over time
- Direct and accurate readings
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Temperature range (Optional Range extensions)	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated, except for the sensor tip
Connector	Stainless Alloy / Optional - Dielectric
Response time	As fast as 35 ms
Probe sensitive area - Diameter	0.3 mm x 0.3 mm
Longevity	Probe accuracy & repeatability constant over time

ORDERING CODE

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, B = Bare tip, 0.4 mm diameter

Sensor tip length in centimeters,
Default = 05 cm for Probe Type B

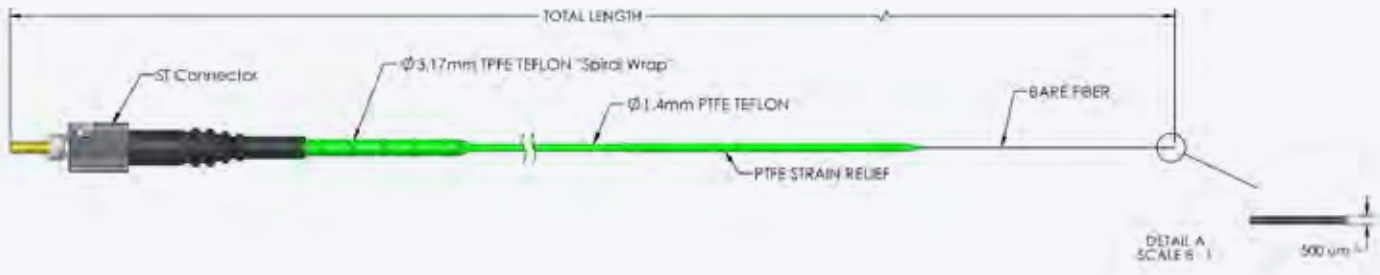
FOS = Fiber Optic Sensor

F O S – T G – [ ][ ] – B – [ ][ ] – X Y Y

G = Gallium Arsenide

T = Temperature

Options
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

RUGGED MONITORING

Lsens-C Fiber Optic Temperature Sensor

- Small tip Polyimide, protected
- Outstanding repeatability with high flexibility
- Complete immunity to RFI, EMI, NMR and microwave radiation
- Does not require recalibration or complex inputs to operate
- Cryogenic temperature range (as low as 4 °Kelvin)

A multiple use fiber optic temperature sensor for measurement in a wide range of demanding applications, where immunity to electromagnetic fields is mandatory.

Product Summary

A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in demanding applications. The sensor offers complete immunity to RFI, EMI, NMR and microwave radiation. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of +/-0.2 °C it allows precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, and the fiber tip has 0.3 mm x 0.3 mm area with a Polyimide coating. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and is immune to external fields. Therefore, the probes are explicitly suitable for use in large temperature ranges as well as in aggressive operating environments. The sensor length can be from several meters to 1 kilometer in length without impacting the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Electric Vehicle and Battery Testing
- High voltage environments
- Nuclear and hazardous environments
- Medical applications
- Chemical and Process Industries
- RF and Microwave drying applications
- Cryogenic and vacuum environment available (Optional)

Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Optional spiral wrap
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Temperature range (Optional Range extensions)	Down to 4 °K / Up to +85 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated, with Polyimide protection for sensor tip
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	0.7 mm
Protective Tube - Diameter	Teflon / 1.4 mm
Longevity	Probe accuracy & repeatability constant over time

ORDERING CODE

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, C = Bare tip, 0.7 mm diameter

Sensor tip length in centimeters,
Default = 10 cm for Probe Type C

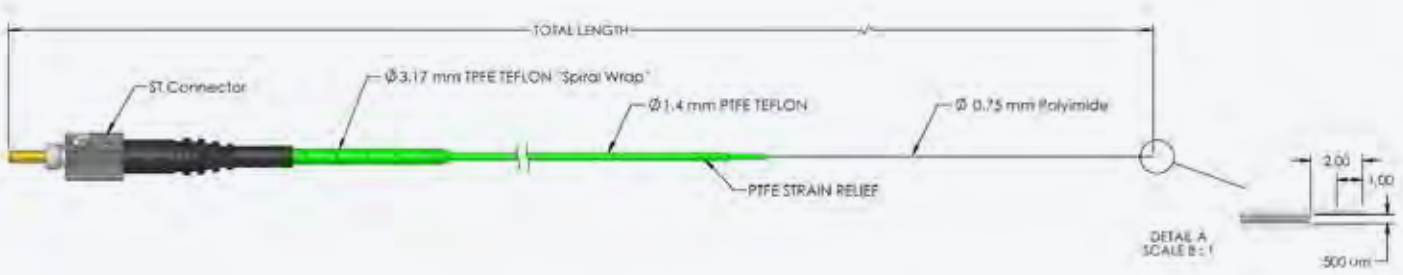
FOS = Fiber Optic Sensor

F O S – T G – _ _ – C – _ _ – X Y Y

G = Gallium Arsenide

T = Temperature

Options
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

RUGGED MONITORING

Lsens-P Fiber Optic Temperature Sensor

- Small tip Polyimide, protected
- Outstanding repeatability with high flexibility
- Complete immunity to RFI, EMI, NMR and microwave radiation
- Does not require recalibration or complex inputs to operate
- Cryogenic temperature range available (as low as 4 °Kelvin)

A multiple use fiber optic temperature sensor for measurement in a wide range of demanding applications, where immunity to electromagnetic fields is mandatory.

Product Summary

A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in demanding applications. The sensor offers complete immunity to RFI, EMI, NMR and microwave radiation. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of +/-0.2 °C it allows precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, and the fiber tip has 0.3 mm x 0.3 mm area with a Polyimide coating. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and is immune to external fields. Therefore, the probes are explicitly suitable for use in large temperature ranges as well as in aggressive operating environments. The sensor length can be from several meters to 1 kilometer in length without impacting the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Electric Vehicle and Battery Testing
- High voltage environments
- Nuclear and hazardous environments
- Medical applications
- Chemical and Process Industries
- RF and Microwave drying applications
- Cryogenic and vacuum environment available (Optional)

Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Optional spiral wrap
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Temperature range *(Optional Range extensions)*	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated, with Polyimide protection for sensor tip
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	0.7 mm
Protective Tube - Diameter	Teflon / 1.4 mm
Longevity	Probe accuracy & repeatability constant over time

ORDERING CODE

FOS = Fiber Optic Sensor

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, P = Thin Polyimide , 0.7 mm Diameter

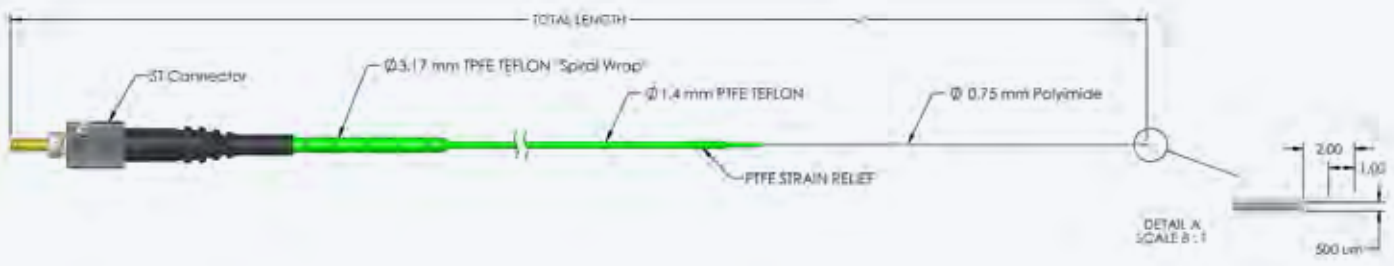
Sensor tip length in centimeters,
Default = 10 cm for Probe Type P

F O S – T G – [ ][ ] – P – [ ][ ] – X Y Y

Options
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP

G = Gallium Arsenide

T = Temperature



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

Lsens-R Fiber Optic Temperature Sensor

- Industrial use with rigid polyimide tip, 1.7 mm diameter
- Rugged tip ideal for industrial application
- Complete immunity to EMI/RFI/lightning
- High vibration environments

Recommended for hostile environment where it is exposed to high vibration and immunity to electric fields is mandatory

Product Summary

A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in demanding applications. The sensor offers complete immunity to RFI, EMI, NMR and microwave radiation. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of +/-0.2 °C it allows for precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, and the fiber tip has a diameter of 1.7 mm with Rugged Polyimide coating and has a stainless steel ST-connector. For mechanical stability and applications e.g. in oil special protective coatings and hoses are available. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and immune to external fields, therefore probes are explicitly suitable for the use in high temperature ranges as well as in aggressive operating environments. The sensor cable can be from several meters to kilometers long without influencing the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Industrial process control and monitoring applications
- High voltage environments
- Harsh and Hazardous environments
- Temperature measurements conducted in confined spaces,bhazardous or strong EMI/RFI/MRI environments
- Wood drying industry

Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Robust packaging
- Each sensor comes with a complete test certification
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications.

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Temperature range *(Optional Range extensions)*	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated, Rugged Polyimide protection for sensor tip
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	1.7 mm Diameter
Longevity	Probe accuracy & repeatability constant over time

ORDERING CODE

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, R = Rugged, Thick Polyimide, 1.7 mm Diameter

FOS = Fiber Optic Sensor

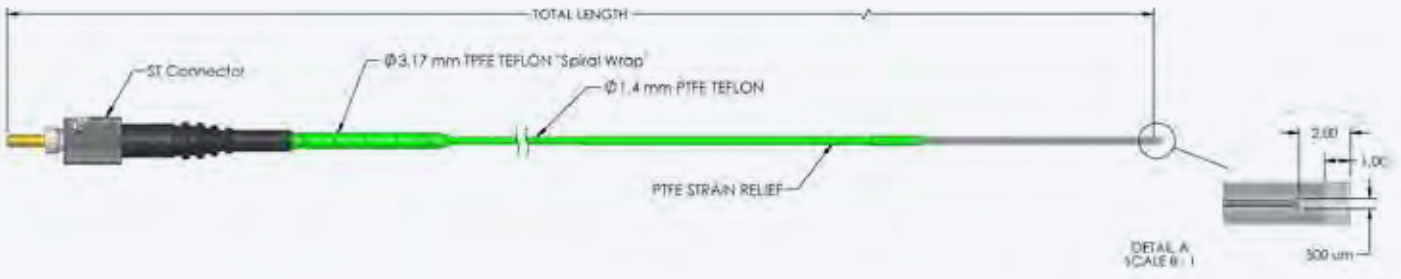
Sensor tip length in centimeters, 2 Digits,
Default = 05 cm for Probe Type R

F O S – T G – [ ][ ] – R – [ ][ ] – X Y Y

G = Gallium Arsenide

T = Temperature

Options
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP



Rugged Monitoring Services

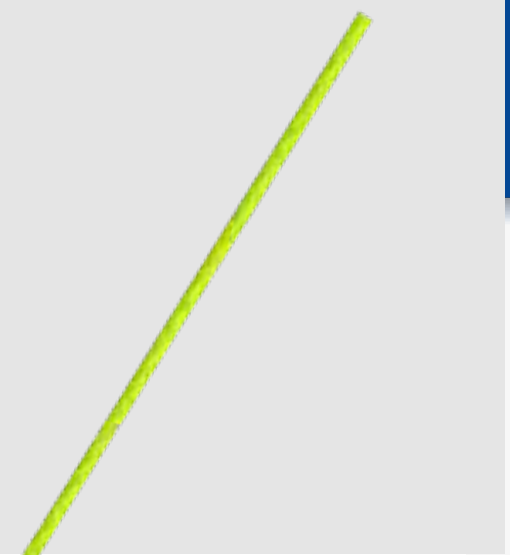
Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

Lsens-T Fiber Optic Temperature Sensor



- PTFE protected
- Outstanding repeatability with high flexibility
- Complete immunity to RFI, EMI, NMR and microwave radiation
- Does not require recalibration or complex input to operate
- Liquid proof and withstands aggressive chemical solutions

A multiuse fiber optic temperature sensor for measurement in a wide range of demanding applications where immunity to electromagnetic fields and explosion proof requirements are mandatory.

Product Summary

A multiuse fiber optic temperature sensor designed for a wide range of applications, especially for the use in R&D and industrial applications. The sensor offers complete immunity to RFI, EMI, NMR, Corrosive and microwave radiation making it the best choice for all demanding applications. The standard temperature sensor has a response time of 0.2 s. With a standard deviation of +/-0.2 °C it allows precise and repeatable measurements. The coating of the temperature sensor is made of PTFE, while the fiber tip has a diameter of 1.1mm and has a stainless steel ST-connector. For mechanical stability and applications e.g. in oil special protective coatings and hoses are available. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and immune to external fields, therefore probes are explicitly suitable for use in high temperature ranges as well as in aggressive operating environments. The sensor cable can be from several meters to kilometers long without influencing the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- Magnetic, RF and Microwave environments
- High voltage environments
- Nuclear and hazardous environments
- Medical applications
- Aggressive Chemical environments
- Sterilization applications
- RF and microwave drying applications

Benefits

- Sensors do not require any recalibration
- No shift over time, high stability
- Optional spiral wrap
- Robust fiber optic temperature sensor
- Available in different cables and sheath options
- Customizable according to customer specific applications
- Suitable for OEM-type applications.

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Temperature range *(Optional Range extensions)*	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	1.6 mm

ORDERING CODE

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, T = PTFE Teflon, 1.6 mm diameter

Sensor tip length in centimeters,
Default = 00 cm for Probe Type T

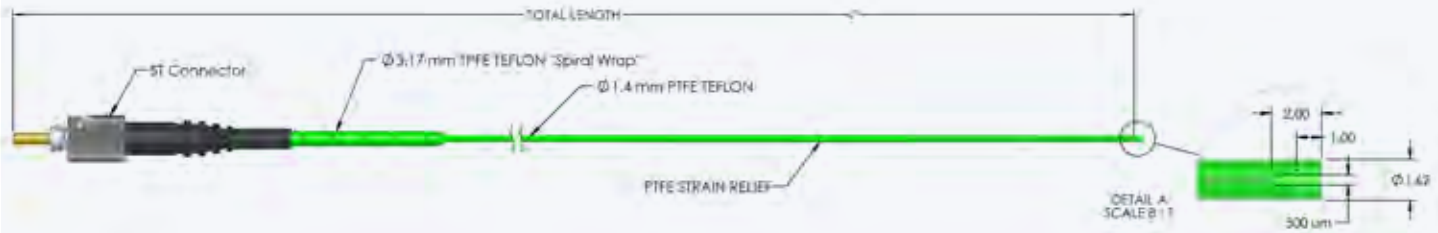
FOS = Fiber Optic Sensor

F O S – T G – [ ][ ] – T – [ ][ ] – X Y Y

G = Gallium Arsenide

T = Temperature

Options
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

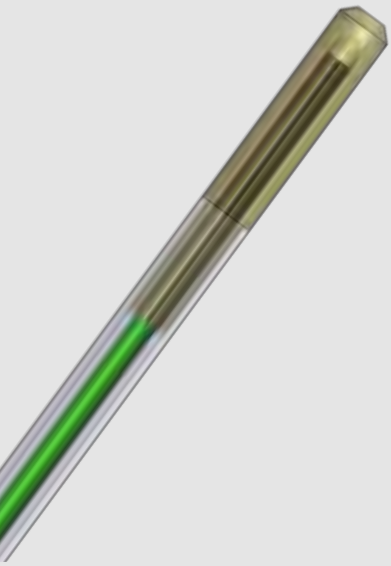
About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

RUGGED MONITORING

LSENS-U FIBER OPTIC TEMPERATURE SENSOR



- Heavy duty protection gives longevity to sensors under harsh and dynamic operating conditions
- Complete immunity to RFI, EMI, NMR and microwave radiation
- Outstanding repeatability improves accuracy of testing instruments
- Plug and Play operation, does not require recalibration or complex input to operate
- Liquid proof and withstands aggressive chemical solutions

A Heavy duty fiber optic temperature sensor for measurement in a wide range of demanding applications where robustness of sensors, immunity to electromagnetic fields and explosion proof requirements are mandatory

Product Summary

A heavy duty fiber optic temperature sensor specially designed for harsh and dynamic operating conditions where stress on the Fiber Optic Cable is more than normal. The sensor offers complete immunity to RFI, EMI, NMR, Corrosive and microwave radiation making it the best choice for all demanding applications. The standard temperature sensor has a response time of 0.2 s. with a standard deviation of +/-0.2 °C. Each sensor allows precise and repeatable measurements. The coating of the temperature sensor is made of heavy duty material, while the fiber tip has a diameter of 1.1mm and has a stainless steel ST-connector. For mechanical stability and applications e.g. in oil special protective coatings and hoses are available. The fiber optic probe consists of a PTFE protected glass fiber and a GaAs-crystal (Gallium Arsenide) at the sensor tip. It is totally free of metal and immune to external fields, therefore probes are explicitly suitable for use in high temperature ranges as well as in aggressive operating environments. The sensor cable can be from several meters to kilometers long without influencing the accuracy of the measurement result. Other sensor lengths and connector types are available upon request.

Applications

- RF and microwave drying applications
- Food Processing and sterilization applications
- Electric Vehicle and Battery Testing
- Medical Applications
- Industrial process control and monitoring applications
- Nuclear, Magnetic and hazardous environments
- High voltage environments
- Aggressive Chemical environments

Benefits

- Longer life of sensors under harsh and dynamic operating conditions
- Cost saving on recalibration; sensor does not require any recalibration
- Customizable to meet different requirements of customer applications
- Optional spiral wrap reinforces robustness of sensor cable
- Suitable for OEM-type applications and during operation of machines
- Higher accuracy and repeatability increase confidence of validation and measurement
- Faster support from industry known fiber optic experts
- Available in different cables and sheath options

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Measurement range (Optional Range extensions)	Down to 4 °K / Up to +300 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon Coated
Connector	Stainless Alloy / Optional - Dielectric
Response time	Up to 0.2 Sec
Probe sensitive area - Diameter	1.6 mm

ORDERING CODE

Sensor length in meters, Ex: 02 = 2 Meters

Probe Type, T = PTFE Teflon, 1.6 mm diameter

FOS = Fiber Optic Sensor

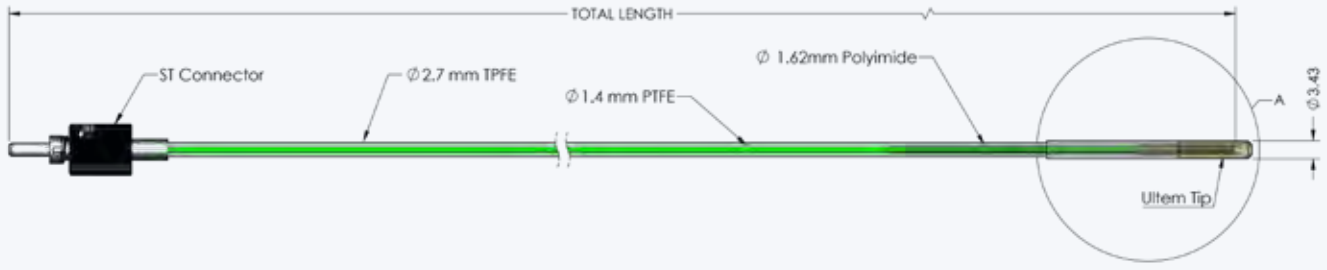
Sensor tip length in centimeters
Default = 00 cm for Probe Type T

F	O	S	–	T	G	–			–	U	–			–	X	Y	Y

Option
X = 0, No Spiral Wrap (Default)
X = W, With Spiral Wrap
YY = 00, Regular ST Connector (Default)
YY = DU, Dielectric Connector ULTEMP

G = Gallium Arsenide

T = Temperature



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com

RUGGED MONITORING

Tsens Fiber Optic Temperature Sensor

- Optimized for easy installation in oil-filled and dry-type transformers and reactors
- Rugged and robust construction built to outlast your transformer life
- Outstanding repeatability, zero-drift GaAs technology
- 9 mm disc design, suitable for all locations in a transformer (windings, cores, busbars, tap changers, etc.)
- Solvent and chemical resistant

An innovative patented probe design gives transformer manufactuers probe robustness and ease of installation. Transformer operators then get reliable and longterm temperature data, essential for precise transformer aging evaluation.

Product Summary

The Rugged Monitoring Tsens probes have been designed and built so they can be incorporated in your transformers to give precise results (direct measurements of temperature). The sensing technology is based on the proven zero-drift GaAs technology. They are completely built using first quality materials, all with very high dielectric strength, so your transformers can benefit from accurate temperature readings, which is essential to a good knowledge of transformer aging rate. During a factory heatrun tests these probes will give both transformer manufacturer and operator invaluable information regarding the transformer expected MVA performance. The patented tip construction makes them extremely robust, while being very easy to install in radial spacers or in other pressboard material (such as for temperature measurements in cores or other transformer components). This tip along with a 200 µ Ø fiber offers the highest probe pulling force in the industry. The spiral-wrap cable is especially constructed to allow complete oil penetration so you can be assured that no air can be present. All materials used in the probe construction are compatible with high temperature kerosene desorption processes.

Applications

- Power transformers, oil-filled and dry-type
- Ideal for direct measurements of temperature
- High voltage environments (1 MV, or more)
- Suitable for HVDC windings
- Mounts in standard radial spacers
- Withstands kerosene desorption
- Compatible with all types of transformer oil, including ester type
- Compatible with all Rugged Monitoring instruments

Benefits

- Sensors do not require any calibration, ever
- No shift over time, high stability
- PTFE Teflon spiral-wrap reinforcement
- Robust fiber optic temperature sensor tip
- Available wth disc and without disc
- Surpass ASTM D2413 and D149 standards
- Very low PD performance
- Designed to exceed transformer life

TECHNICAL SPECIFICATIONS

Temperature range	-200 °C to +250 °C
Repeatability	0.2 °C
Accuracy absolute temperature	+/- 0.8 °C
Accuracy relative temperature	+/- 0.2 °C
Probe sheathing material	Teflon spiral-wrap
Tip material	Torlon (with disc) or Polyimide (no disc)
Connector	Stainless alloy ST with zirconia ferrule (Optional: Dielectric Torlon ST with zirconia ferrule)
Probe length	Up to 25 meters
Response time	Up to 0.2 sec without disc. About 2 sec with disc
Longevity	Probe accuracy and repeatability constant over time

ORDERING CODE

Length In Meters, Two digits, ex: 02 = 2 Meters

Transformer Probe Type
X = 3 for 3 mm Diameter

Tip Options
Z = 0, for no Retaining Disc
Z = 1, for 9 mm Disc (default)
Z = 2, for 9 mm Disc (width cut at 7 mm)

TFS = Transformer Fiber Sensor

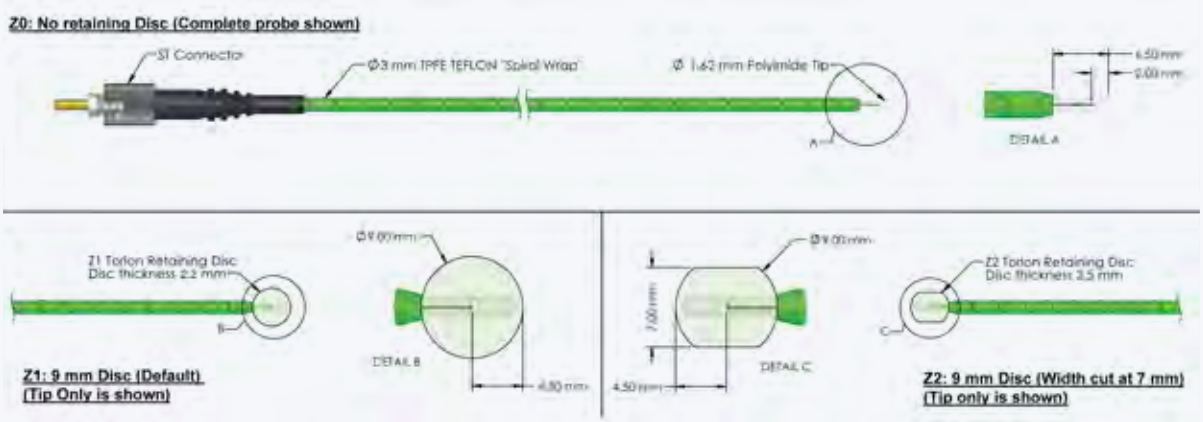
T F S – T G – [ ][ ] – X – Z – Y Y – T L

TL = Tip length in mm (optional); only valid with Z = 0 (if not specified dafault = 09 (9mm))

T = Temperature

G = Gallium Arsenide

Options
YY = 00, Regular ST Connector (Default)
YY = DT, Dielectric Connector TORLON



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry leading team of fiber optic experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

+1-418-767-0111 info@ruggedmonitoring.com www.ruggedmonitoring.com