WLPI FIBER OPTIC MEASUREMENT SOLUTIONS

Fiber optic sensors

Pressure, Force, Strain, Displacement, Temperature, Signal Conditioning

Your expert partner in sensors & controls

INFORMATION ABOUT ALTHEN SENSORS & CONTROLS

Althen Sensors & Controls stands for pioneering measurement and sensor solutions. We accept every measurement challenge. We are constantly looking for innovation and are only satisfied when we have found the perfect solution four your measurement task. We develop customer-specific solutions in our in-house production facilities. Althen is partner to many recognized universities and leading organizations. We find ourselves in an intensive knowledge transfer, developing future technologies. Althen is one of the first companies in its branch with a certification by the German technical inspection association in Hessen (TÜV PROFICERT) in accordance with DIN EN ISO 9001:2015.

The right sensor and measurement technology solution for your requirements: We at Althen draw on decades of experience to develop products ranging from standard and customised sensors to complete measuring systems for our customers. Focus is always on benefitting the customer: so you get the best solution for your measurement requirements. Our product range covers all physical quantities and diverse technologies for measuring them. Thanks to our lengthy experience, our technical know-how, our strong team of engineers with various professional backgrounds and our wide range of products we can offer the most efficient solutions for nearly all applications in all branches of industry.

bar	Pressure	mm	Displacement	g	Acceleration		Signal conditioning
N	Force	α	Rotation	m/s^2	Vibration	1010	Data logger
Nm	Torque		Joystick	°/s	Angular rate		Automation
ε	Strain		Inclination	°C	Temperature	A	Measurement systems

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Broadporte Holding NV was founded in 2001 in the Netherlands. The holding is active in various business areas with a focus on technology. 'A very different approach, with very different results' Further information can be found at: **broadporte.com**

BROADPORTE
HOLDING NV

Althen Sensors & Controls is your specialised partner for sensors and control elements for OEM applications, testing and measurement technology, and automation solutions.

Now we can also support you as a partner for WLPI fiber optic measurement solutions.

CONTENTS

WHY WLPI FIBER OPTIC MEASUREMENT SOLUTIONS?

6 UNIQUE ADVANTAGES

1. Insensitive to high voltages and electromagnetic interference
2. Long-term stability
3. Intrinsically safe
4. Resistant and robust
5. No drift
6. Maintenance-free after installation "plug an forget"

ASK ABOUT
OUR SOLUTIONS FOR AEROSPACE

INFORMATION ABOUT THE FIBER OPTIC WLPI TECHNOLOGY

Fiber optic white light polarisation interferometry (WLPI) is a patented fiber optic technology which enables precise measurements to be made in the most challenging of applications. It offers maximum flexibility in sensor design such that reliable measurements can be generated even in extremely unfavourable environments.

Fiber optic measurement systems comprise two main components: The fiber optic sensor and the signal analysis unit. Added to these are a fiber optic cable (FOC) which can fulfil different purposes depending on the technology employed.

A fiber optic sensor is made up of a sealed housing in which the optical sensor element is situated. This sensor element is sensitive to the physical quantity to be recorded. Different fiber optic measurement methods based on one or more of the specific characteristics of light (intensity, phase, polarisation and spectrum) exist. In principle the measurement quantity to be recorded changes one or more of the special characteristics (according to the technique), causing a changed light signal to be reflected back.

Fiber optic sensors can be generally be divided into two classes: Extrinsic and intrinsic sensors. Their differences in terms of design and functioning yield special properties that can have a positive or negative effect depending on the application. For intrinsic sensors the fiber optic cable is an essential part of the measuring mechanism. The optical fiber is the sensor. Fiber optic sensors based on Fiber Bragg technology are popular sensors in this class.

In contrast, extrinsic sensors are characterised by the decoupling of the sensing part and the optical fiber. The optical fiber (FOC) serves solely to transmit the light signal from the sensor unit to the signal conditioning unit . Temperature sensors based on gallium arsenide (GaAs) crystals and the fiber optic sensors based on WLPI technology presented in the following are categorised as extrinsic sensors.

The signal conditioning unit is used to feed the light signal into the fiber, to receive the reflected modified light signal and to process the received signal and convert the results into physical units for the measured quantity. The light source used differs according to measurement technique and technology.

Optical interferometry involving measurement of the phase modulation of light is considered to be the most sensitive fiber optic measurement method. The interferometer is a very precise optical measuring instrument in which at least two light bundles are guided by semi-transparent mirrors along different optical paths, reflected at the ends of the paths by additional mirrors and then recombined. This results in an interference pattern determined by the difference in optical paths travelled by the individual beams before they are superimposed.

A physical quantity can be measured using interferometry provided that changes in the quantity result in changes in the path length in the interferometer.

The original use of a laser, a source of light with a narrow bandwidth, led to the problem of phase ambiguity because the coherent length of the light source was generally larger than the path length difference in the interferometer. This limited the application possibilities for the fiber optic sensors based on interferometry. The solution to this problem is to use a light source with a short coherence length and an accordingly wide spectrum.

This type of interferometry is called ‘white light interferometry’ or ‘coherence tomography’. The founders of Opsens are pioneers in the introduction of white light interferometry into fiber optic measurements. In the field of industrial sensors they have developed this technology to the market readiness stage and can now present their latest development in the form of an improved fiber optic measurement technology: white light polarisation interferometry.

COMPARISON BETWEEN WLPI AND OTHER FIBER OPTIC TECHNOLOGIES

Compared with electronic sensors, fiber optic sensors offer a number of significant advantages including insensitivity/immunity to electromagnetic interference and high voltages. They are intrinsically safe, impervious to lightning strikes and capable of being built with extremely small dimensions. White light polarisation interferometry (WLPI) also possesses other advantages over conventional fiber optic technologies such as Fiber Bragg grating sensors.

Easier installation / handling
In contrast to Fiber Bragg technology, the fiber optic cables in WLPI technology only have the task of transmitting the light signal between the sensor and the signal conditioning unit; hence the fiber optic cable length can easily be adjusted. Optical extension cords which can be interconnected with plug-in connections are available for this. Laborious splicing of the FOC is not necessary. Depending upon the application, assembly can be done e.g. via spot welding, bonding or complete integration into a component or a structure.

Easier adjustment to requirements / flexibility
There are several standard sensors available for measuring strain, pressure, displacement and temperature. These sensors are always adapted to the requirements of the given application for ensuring both optimal function and protection of the sensor. The sensor design for a pressure sensor for fuel level monitoring differs greatly from that for a sensor adapted to the harsh conditions and high temperatures encountered at the depth of an oil well, although the functionality and the technology used are identical.

Greater stability
Fluctuations in light intensity have no effect on the WLPI sensors as their function is based on the path length change in the interferometer, not on intensity changes. Thus optical losses, for example due to losses in the plug, cannot affect the movement or bend of the fibers or the performance of the system.

The extrinsic character of the WLPI technology is particularly relevant for fiber optic strain measurement due to the insensitivity of WLPI sensors, unlike Fiber Bragg sensors, to transverse strain. Moreover, the temperature compensation required with Fiber Bragg sensors is done away with.

Better reliability
When the system is used continuously with the maximum light intensity the MTBF value is 100.000 hours. In practice the light source is only very rarely operated above 50% of the maximum intensity.

Improved safety
In terms of the generated energy WLPI is safer than laser-based fiber optic measurement techniques. If the light source is working with maximum intensity and the FOC is limited to 1 cm the maximum measurable intensity at the end of the fiber is less than a few microwatts. In comparison, a laser can output a few hundred milliwatts in a fault situation.

Maintenance-free
A broadband light source as used for the WLPI technology does not have to be calibrated. Laser-based methods such as the Fiber Bragg technology require regular maintenance and calibration for compensating the drift and correcting the wavelength and intensity.

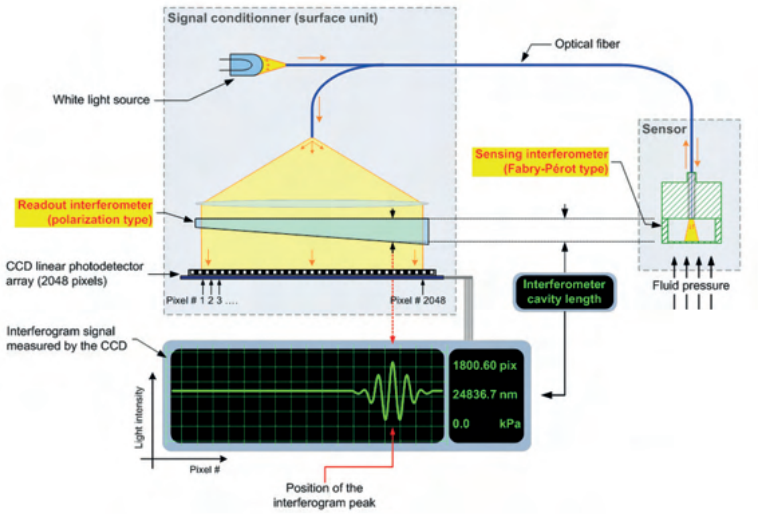
Lightweight, compact design
WLPI-based sensors can be built with very small dimensions. Moreover, all components needed for signal analysis can be accommodated on a module approximately the size of a credit card.

Versatile
All supported measurement quantities can be recorded with the same signal conditioning unit.

PRINCIPLE OF OPERATION

USEFUL INFORMATION

The working principle of the white light polarisation interferometry (WLPI) technology upon which the sensors are based on, is presented here.



Light radiation emitted by the light source reaches an interferometer with a defined cavity length in the sensor head. The cavity length is the distance between two mirrors which are partly reflecting and transparent; thus two light signals with different path lengths arise. The cavity length and hence the path length of the light signal are a function of the measured quantity. By means of a pressure sensor with a flexible diaphragm at the sensor tip it can be shown that pressure changes change the deflection of the diaphragm and thus the cavity length. The reflected light signals are guided back into the signal conditioning unit which houses another interferometer. The light signal shows local interference effects where the cavity lengths of the two interferometers are similar. The maximum interference signal can be found where the cavity lengths of the two interferometers are identical.

The cavity length of the analysis interferometer is precisely coordinated with the positions of a CCD sensor. This enables nanoscale cavity lengths to be assigned to a pixel on the CCD sensor. Digital signal processing according to a patented method enables sub-pixel resolution.

Real-time measurement of the position of the interferogram peak value supplies a clear and precise measurement of the cavity length of the interferometer in the sensor. According to the calibration values of the sensor the cavity length of the sensor is simply converted into a pressure measurement via the signal conditioning unit.

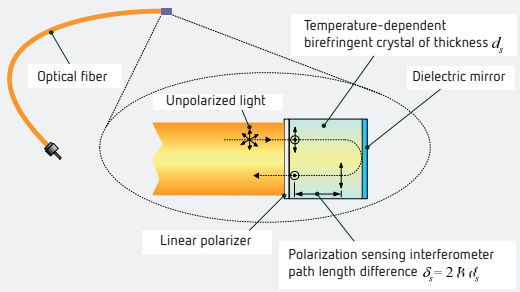
SUMMARY:

- The WLPI technology is based on the positioning of a signal peak value and, contrary to most fiber optic measuring methods, is not affected by changes in light intensity.
- This makes the WLPI technology robust to interfering effects such as optical losses from plug-in connections, bending of the fibers or darkening due to reactions with hydrogen.
- Possible losses e.g. due to OH absorption lines affecting specific wavelengths can be coped with due to the broad spectrum of white light.

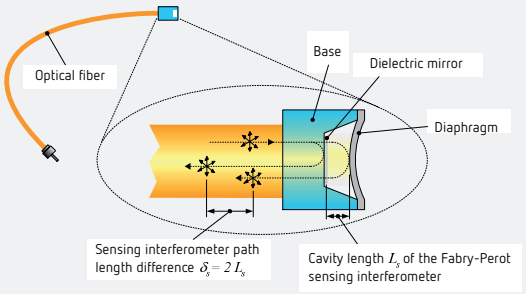
USEFUL INFORMATION

The following illustrations show schematic representations of the sensor design for the appropriate measurement quantity (temperature, pressure, strain / force and displacement). The described working principle applies to all variants.

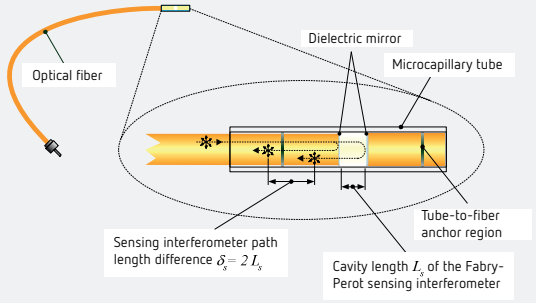
Temperature transducer based on the polarization interferometer



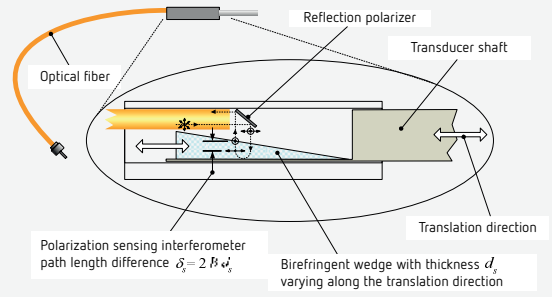
Pressure transducer based on the Fabry-Perot interferometer



Strain and force transducer based on the Fabry-Perot interferometer



Linear position transducer based on the polarization interferometer



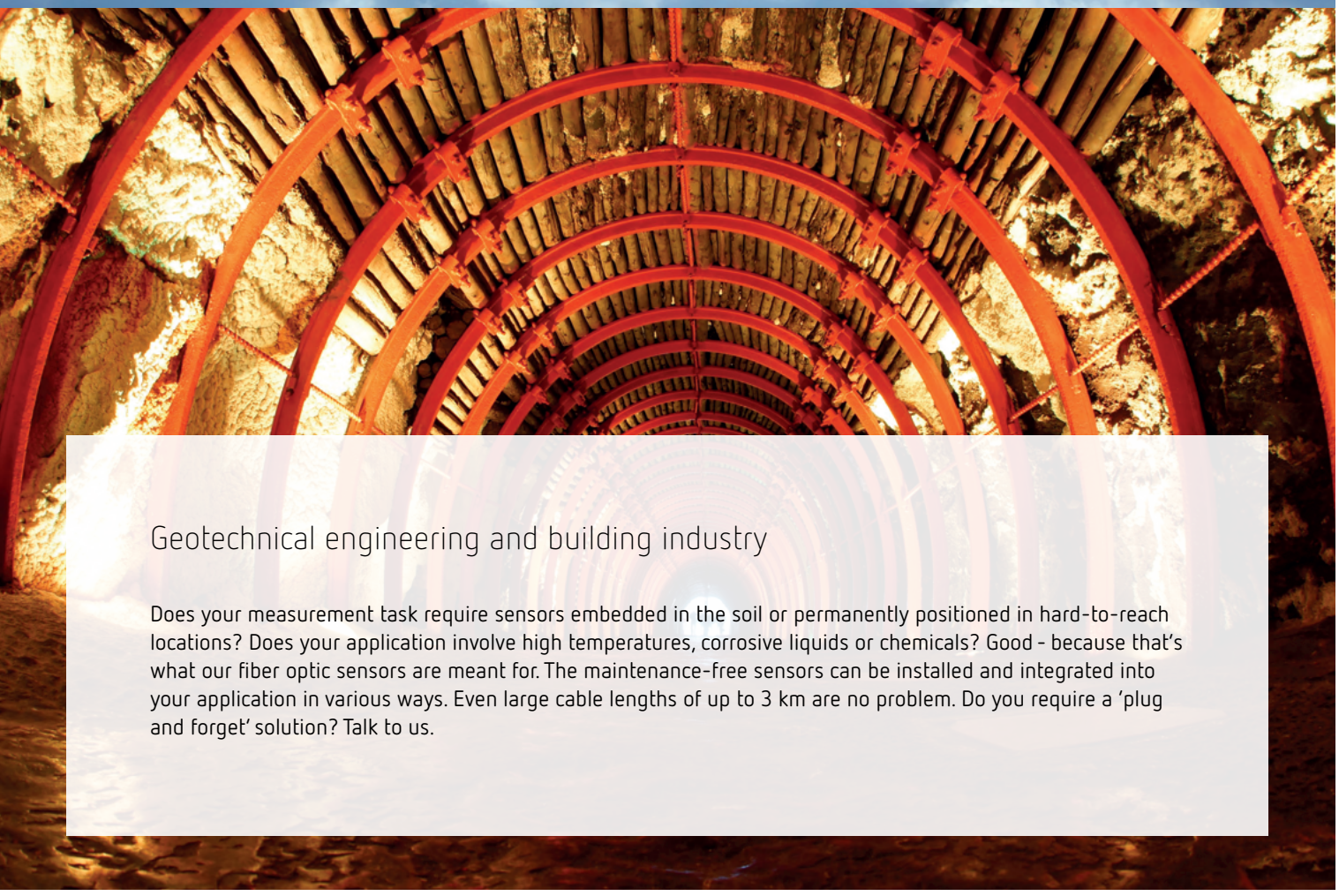
AREAS OF APPLICATION

Industry

Measuring equipment is needed for monitoring process and environment parameters in diverse industrial applications. Conventional electronic sensors frequently come up against the limits of the technology because interfering effects such as high voltages or EMI limit the operability of the systems. Particularly in these environments the fiber optic products from Opsens can create new possibilities for reliable measurements.

Defence and aerospace

Do you give top priority to the safety and reliability of your measuring equipment even in harsh environments with abrupt changes in weather and temperature such as occur during take-off and landing? Are your product development activities focussed on the core topics of lightweight construction and electromagnetic interference? WLPI technology-based fiber optic sensors offer the advantages you are looking for. Insensitivity to temperature fluctuations and lightning strike immunity to EMI, extremely small dimensions for weight reduction, high reliability and maintenance-free operation are only some of the advantages of our fiber optic sensors. The possible applications are diverse and the solutions numerous and adapted to your requirements. Talk to us.



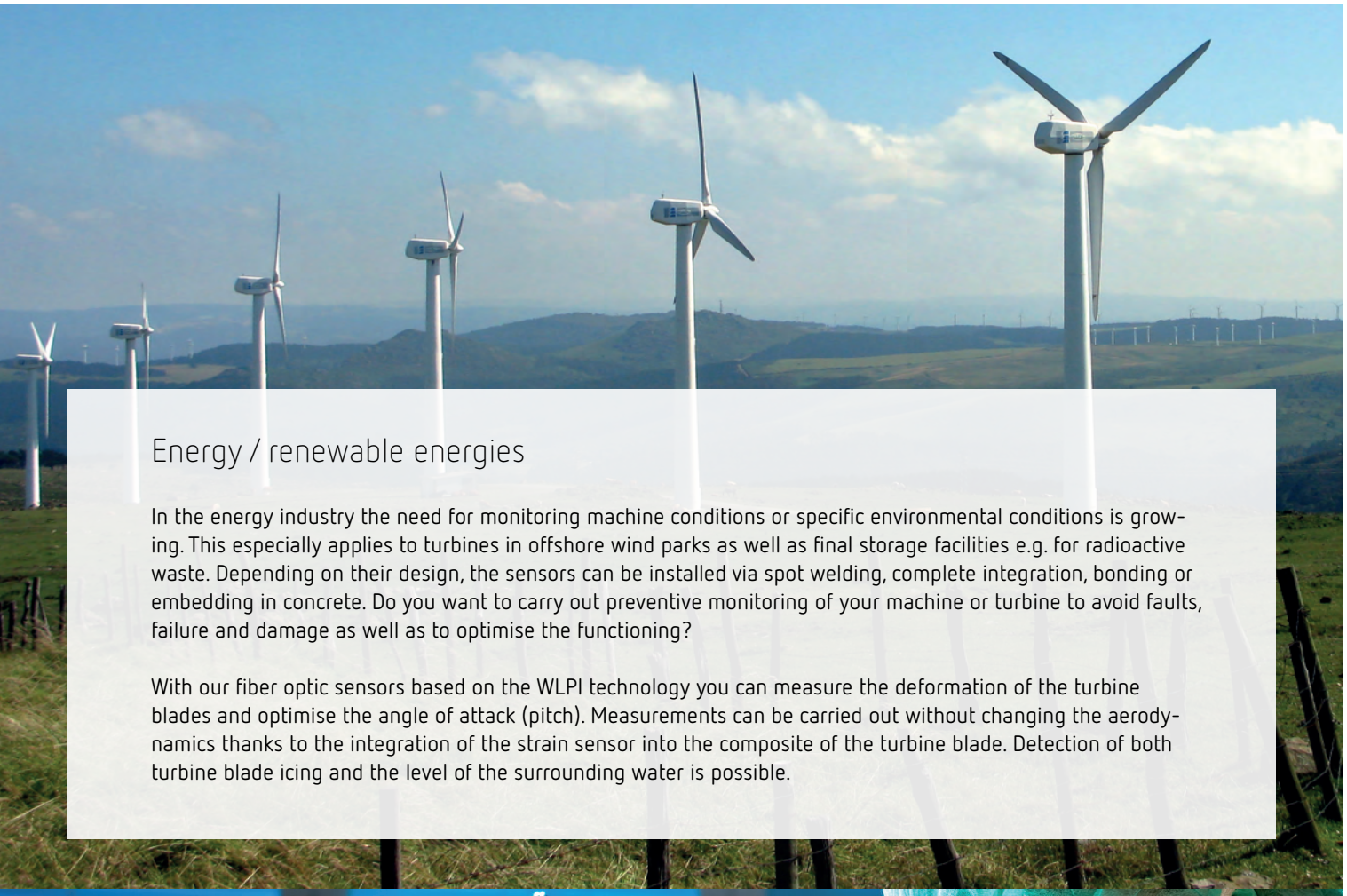
Geotechnical engineering and building industry

Does your measurement task require sensors embedded in the soil or permanently positioned in hard-to-reach locations? Does your application involve high temperatures, corrosive liquids or chemicals? Good - because that's what our fiber optic sensors are meant for. The maintenance-free sensors can be installed and integrated into your application in various ways. Even large cable lengths of up to 3 km are no problem. Do you require a 'plug and forget' solution? Talk to us.

AREAS OF APPLICATION

Structure health monitoring

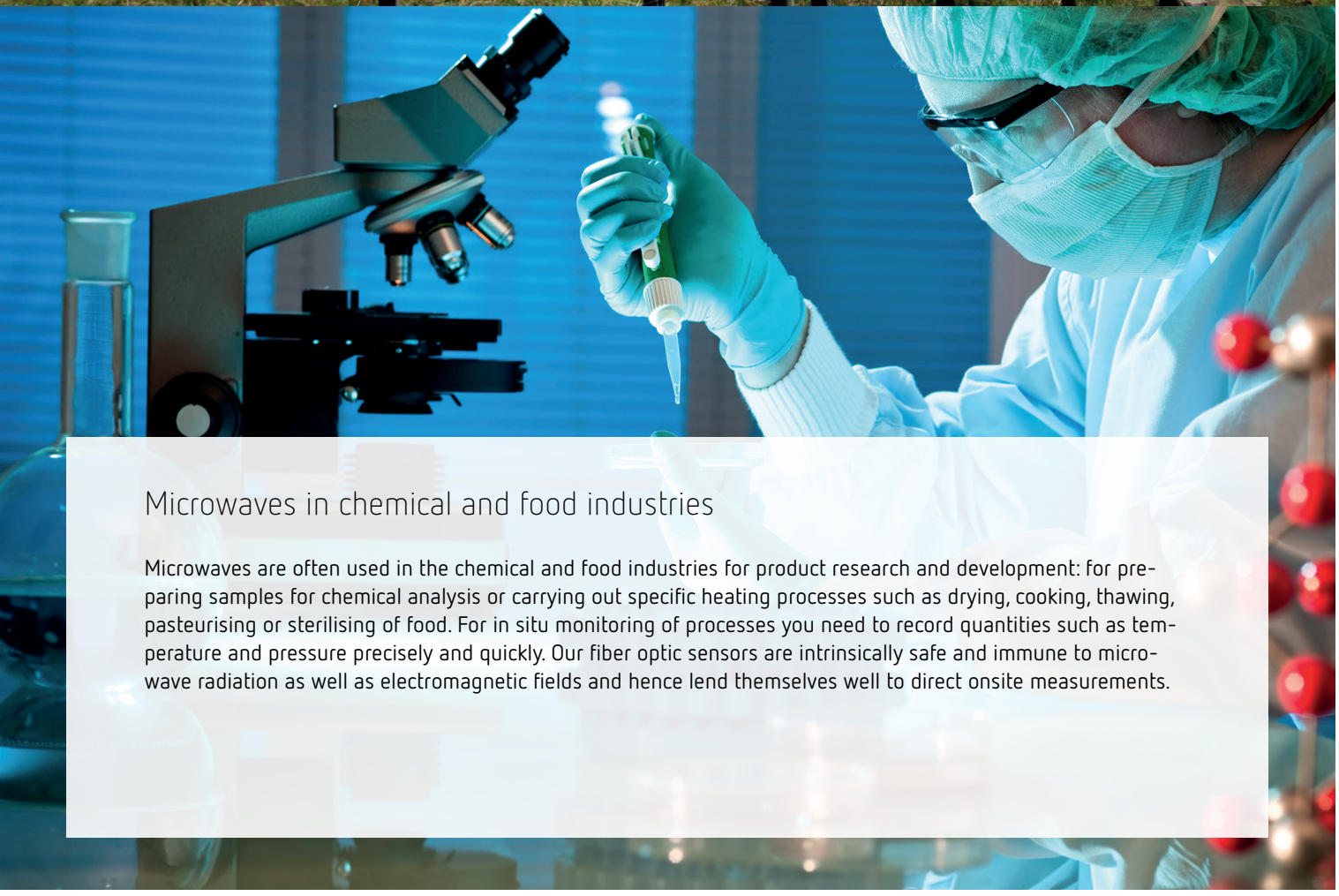
Ageing infrastructure, dilapidated structures such as bridges and long-term monitoring of critical components are becoming critical due to the danger to humans and materials posed by strain and deformation of structural elements. That's where fiber optic WLPI technology comes in, enabling robust, reliable sensors to be built with no drift over time and no sensitivity to transverse strain. Because they are insensitive to temperature fluctuations the sensors can be welded at the measurement location. For retrofitting, monitoring of initial damage (crack formation) or integration into a new building – we have the right solution for your measurement task. Talk to us.



Energy / renewable energies

In the energy industry the need for monitoring machine conditions or specific environmental conditions is growing. This especially applies to turbines in offshore wind parks as well as final storage facilities e.g. for radioactive waste. Depending on their design, the sensors can be installed via spot welding, complete integration, bonding or embedding in concrete. Do you want to carry out preventive monitoring of your machine or turbine to avoid faults, failure and damage as well as to optimise the functioning?

With our fiber optic sensors based on the WLPI technology you can measure the deformation of the turbine blades and optimise the angle of attack (pitch). Measurements can be carried out without changing the aerodynamics thanks to the integration of the strain sensor into the composite of the turbine blade. Detection of both turbine blade icing and the level of the surrounding water is possible.



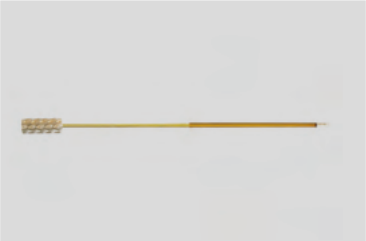
Microwaves in chemical and food industries

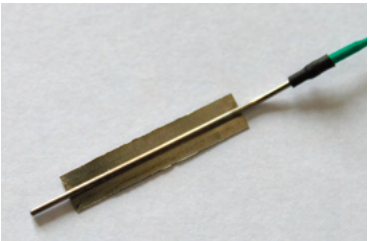
Microwaves are often used in the chemical and food industries for product research and development: for preparing samples for chemical analysis or carrying out specific heating processes such as drying, cooking, thawing, pasteurising or sterilising of food. For in situ monitoring of processes you need to record quantities such as temperature and pressure precisely and quickly. Our fiber optic sensors are intrinsically safe and immune to microwave radiation as well as electromagnetic fields and hence lend themselves well to direct onsite measurements.

SENSORS

ε

STRAIN

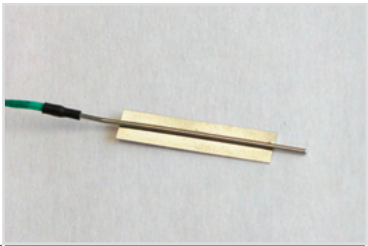




TECHNICAL DATA	OSP-A	OSP-SW0
Measuring range	±1000 με; ±2500 με; ±5000 με	±500 με; ±1000 με; ±2000 με; ±2500 με; ±5000 με; 0 – 10000 με
Resolution	0.15 με; 0.3 με; 0.5 με	0.15 με
Precision	±3 %; ±5 %; ±10 %	±0.5 με to 0.3με
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	9 mm x 0.23 mm Outer diameter	25 mm x 5 mm x 1 mm Outer diameter
Cable	Dense acrylate buffer, fiberglass braid	Acrylate with fiberglass braid shielding (other shielding upon request)
Compatible signal analysis unit	WLPI	WLPI
Features / application	High precision High temperature Miniature design General, industry	High precision and resolution Simple integration due to Compact design High temperatures Suitable for all application areas
Operating temperatures	-40° – 250 °C	-40° – 250 °C
Operating pressure	-	-

ε

STRAIN



TECHNICAL DATA	OSP-SW20	OSP-SW 300
Measuring range	±500 με; ±1000 με; ±2000 με; ±2500 με; ±5000 με	±500 με; ±1000 με; ±2000 με; ±2500 με; ±5000 με
Resolution	0.15 με	0.15 με
Precision	±0.5 με to 0.3με	±0.5 με to 0.3με
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	25 mm x 5 mm x 1 mm Outer diameter	25 mm x 5 mm x 1 mm Outer diameter
Cable	PM4 cable (other cables upon request)	Inox tube, 1/8" (other tubes upon request)
Compatible signal analysis unit	WLPI	WLPI
Features / application	High precision and resolution Simple integration due to Compact design High temperatures Suitable for all application areas	High precision and resolution Simple integration due to Compact design High temperatures Suitable for all application areas
Operating temperatures	-40° – 250 °C	-40° – 250 °C
Operating pressure	Up to 20 bar	Up to 300 bar

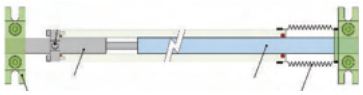
ε

EXTENSOMETER

TECHNICAL DATA	OEP-A	OEP-B
Measuring range	±500 με; ±1000 με; ±2000 με; ±2500 με;	±500 με; ±1000 με; ±2000 με; ±2500 με;
Resolution	0.15 με	0.15 με
Precision	±0.5 με to 3 με	±0.5 με to 3 με
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	50 x 20 x 2 mm diameter	50 x 20 x 2 mm diameter
Cable	PM4 (others upon request)	PM4 (others upon request)
Compatible signal analysis unit	WLPI	WLPI
Features / application	High precision and resolution Suitable for high temperatures All application areas	High precision and resolution Suitable for high temperatures All application areas
Operating temperatures	-40° – 250 °C	-40° – 250 °C

ε

EXTENSOMETER



TECHNICAL DATA	OEP-C	OEP-AC
Measuring range	±500 με; ±1000 με; ±2000 με; ±2500 με;	±500 με; ±1000 με; ±2000 με; ±2500 με; ±5000 με; 0 – 10000 με
Resolution	0.15 με	0.15 με
Precision	±0.5 με to 3 με	N/a
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	50 x 20 x 2 mm diameter	50 mm / 100 mm /500 mm/ 1 m /1.5 m/2 m
Cable	PM4 (others upon request)	PM4 (others upon request)
Compatible signal analysis unit	WLPI	WLPI
Features / application	High precision and resolution Suitable for high temperatures All application areas	High precision and resolution Suitable for high temperatures All application areas
Operating temperatures	-40° – 250 °C	-40° – 250 °C

SENSORS

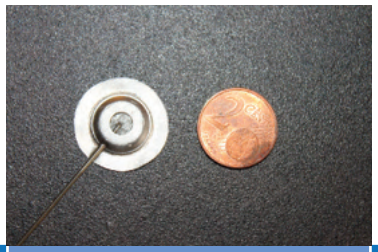
bar

PRESSURE

TECHNICAL DATA	OPP-B	OPP-C
Measuring range	0 – 50 psi to 0 – 1000 psi	0 – 50 psi to 0 – 1000 psi
Resolution	< 0.01 % FS typical	< 0.02 % FS typical
Precision	±0.1 % FS	±0.1 % FS
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	12.7 x 2.5 mm diameter	9.5 mm x 58 mm
Cable	Teflon	4 mm outer diameter polyurethane
Compatible signal analysis unit	WLPI	WLPI
Features / application	Robust design, Aerospace, defence	Robust design, General, industry
Operating temperatures	To 100 °C	-20°...85 °C

bar

PRESSURE



TECHNICAL DATA	OPP-GF	OPP-M
Measuring range	0 – 2 bar and 0 – 7 bar	-50 mmHg – 300 mmHg (relative pressure)
Resolution	< 0.01 % FS	0.5 mmHg
Precision	±0.1 % FS	±1 mm Hg or ±1.5% FS, the larger value in each case applies
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	10 – 20 mm diameter	0.25 mm x 0.4 mm
Cable	Teflon (others upon request)	Customer-specific
Compatible signal analysis unit	WLPI	LifeSens CoreSens
Features / application	Very robust Very high precision Geotechnical engineering Energy	Miniature design Medicine
Operating temperatures	-40°...65 °C	10°...50 °C

mm

DISPLACEMENT

TECHNICAL DATA	ODP-A
Measuring range	0 – 25 mm (others upon request)
Resolution	1 µm
Precision	0.2 % FS
Response time	Dependent on signal analysis unit
Dimensions	104 mm x 19 mm
Cable	PM4 cable (other cables upon request)
Compatible signal analysis unit	WLPI
Features / application	Suitable for all application areas
Operating temperatures	-40°...85 °C

°C

TEMPERATURE WLPI

TECHNICAL DATA	OTP-A	OTP-M	OTP-P
Measuring range	-40 °C to +250 °C	0 °C to +85 °C	-40 °C to +250 °C
Resolution	0.1 °C	0.01 °C	0.1 °C
Precision	±1.0 °C	±0.15 °C	±1.5 °C
Response time	1.5 s	< 1 s (typical)	n/a
Dimensions	1.8 mm outer diameter	1.2 mm outer diameter	4.8 mm diameter, stainless steel or ceramic, length as per customer specification
Cable	Teflon	Teflon or dense PVC buffer	Teflon (others upon request)
Compatible signal analysis unit	WLPI	WLPI	WLPI
Features / application	High precision Multi-purpose use, industry	Maximum precision Robust Medical technology	Very robust Industry

°C

TEMPERATURE GaAs

TECHNICAL DATA	OTG-A	OTG-F
Measuring range	-40 – +250 °C (others upon request)	-40 – +250 °C (others upon request)
Resolution	0.1 °C	0.05 °C
Precision	±0.3 °C for 20 – 45 °C, ±0.8 °C FS	±0.3 °C for 20 – 45 °C, ±0.8 °C FS
Response time	0.5 s (for shorter response time see OTG-F)	5 ms
Dimensions	1.1 mm diameter	0.15 mm diameter
Cable	Teflon PTFE	Teflon PTFE
Compatible signal analysis unit	SCBG (GaAs)	SCBG (GaAs)
Features / application	General Industry Cryogenic	Ultra-small High precision Very fast response time Laboratory
Operating temperatures	SCGB (GaAs)	SCGB (GaAs)

°C

TEMPERATURE GaAs

TECHNICAL DATA	OTG-M	OTG-R
Measuring range	0 °C to +85 °C	0 – 120 °C (others upon request)
Resolution	0.01 °C	<35 dB below the NFT
Precision	±0.3 °C	±1.5 °C
Response time	Dependent upon packaging	< 10 ms
Dimensions	0.17 mm diameter	0.15 mm diameter
Cable	Teflon	Dense acrylate or PVC buffer
Compatible signal analysis unit	SCBG (GaAs)	RadSens
Features / application	Excellent precision Medical technology Industry	High resolution HERO / RADHAZ applications EED Military equipment
Operating temperatures	SCGB (GaAs)	SCGB (GaAs)

ε | bar | mm | °C

SPECIAL

TECHNICAL DATA	OSP-PM	OSP-SM	ODP-PM
Special	STRAIN	STRAIN	DISPLACEMENT
Measuring range	±1000 µe; ±2500 µe; ±5000 µe	±1000 µe; ±2500 µe; ±5000 µe	25 mm (others upon request)
Resolution	0.15 µe; 0.3 µe; 0.5 µe	0.15 µe; 0.3 µe; 0.5 µe	1 µm
Precision	± 3 % ; ±5 %; ±10 %	± 3 % ; ±5 %; ±10 %	0.2 % FS
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	54.6 mm diameter	500 x 100 x 5 mm	n/a
Compatible signal analysis unit	WLPI, CoreSens	WLPI, CoreSens	WLPI, CoreSens
Features / application	Monitoring of deformations / Changes in road surfacing	Monitoring of deformations / Changes in road surfacing	Monitoring of deformations / Changes in road surfacing
Operating temperatures	-40°... 250 °C	-40° – 250 °C	-40°– 85 °C

ε | bar | mm | °C

SPECIAL

TECHNICAL DATA	OPP-W	BOLT
Special	PRESSURE / TEMPERATURE	STRAIN
Measuring range	0 – 1200 psi (others upon request)	±500 µe; ±1000 µe; ±2000 µe; ±2500 µe; ±5000 µe
Resolution	0.0002 % FS	0.15 µe
Precision	±0.2 % FS	±1 % FS
Response time	Dependent on signal analysis unit	Dependent on signal analysis unit
Dimensions	19 mm diameter, 120 mm long	50 mm x 20 mm x 2 mm
Cable	SST-316L, Incoloy 825	PM4 (others upon request)
Compatible signal analysis unit.	Wellsens	WLPI
Features / application	Oil and gas boreholes pressure and temperature monitoring for: Oil extraction by steam flooding (SAGD) for remote-controlled and unconventional oil and gas production	High precision and resolution Simple integration due to compact design High temperature Suitable for all application areas
Operating temperatures	-40°– 300 °C	-40°– 250 °C

A

CUSTOMER-SPECIFIC LOAD MEASURING CELL

Upon request we can develop load measuring cells with a customised shape for your specific application case.

All load measuring cells are based on the fiber optic WLPI technology which offers many unique advantages.

For further information about development possibilities please visit your nearest Althen subsidiary. Contact information can be found on the last page of this brochure.

SIGNAL CONDITIONING

SIGNAL CONDITIONING UNIT

TECHNICAL DATA	PICOSENS	CORESENS	MULTISENS
Number of channels	1	2 per module 26 channels maximum	4 to 8
Scanning rate	20 Hz	500 Hz 1000 Hz	20 Hz
Output signal / interface	LCD display Memory RS-232 ±5 V	LCD display 0-5 V, ±5 V, 0-10 V, 0-20 mA, 4-20 mA Ethernet 10/100 Base-T EtherCAT	LCD display Memory RS-232 ±5 V
Features / application	Hand-held unit Battery-operated Microwaves and food industry Civil engineering Geotechnical engineering	Industry Laboratory Dynamic measurements	Laboratory application Microwaves and food industry
Sensors	WLPI	WLPI	WLPI

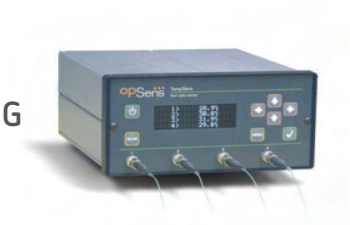
SIGNAL CONDITIONING UNIT

TECHNICAL DATA	FIELDSENS	LIFESENS
Number of channels	4 to 16	1
Scanning rate	20 Hz	250 Hz
Output signal / interface	LCD display Memory RS-232, RS-485 ±5 V	LCD display RS-232 ±5 V
Features / application	Industry Civil engineering	Hand-held unit Battery-operated Microwaves and food industry
Sensors	WLPI	WLPI (OPP-M)

SIGNAL CONDITIONING UNIT

TECHNICAL DATA	PICO M	RADSENS
Number of channels	1	1 to 8
Scanning rate	50 Hz	1000 Hz per module
Output signal / interface	LCD display Memory RS-232 ±5 V	LCD display Memory ±5 V Ethernet
Features / application	Hand-held unit Battery-operated	Industry Laboratory EED / HERO application
Sensors	SCBG (GaAs)	OTG-R

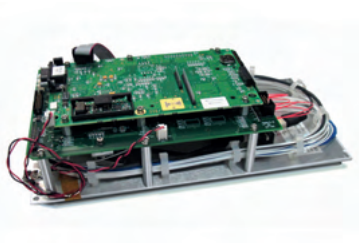
SIGNAL CONDITIONING UNIT



TECHNICAL DATA	TEMPSENS	TEMPMONITOR
Number of channels	4 to 8	4 to 16
Scanning rate	50 Hz	20 Hz
Output signal / interface	LCD display Memory RS-232 ±5 V	LCD display Memory RS-232, RS-485 ±5 V
Features / application	Laboratory application	Industry Civil engineering
Sensors	SCBG (GaAs)	SCBG (GaAs)

SIGNAL ANALYSIS

OEM BOARDS



TECHNICAL DATA	OEM-MNT	OEM-DUO	OEM-FLS
Number of channels	1	2	2, 4, 8, 12 or 16
Scanning rate	50 Hz	50 Hz	20 Hz
Output signal / interface	RS-232 0-5 V SCPI	RS-232	RS-232 RS-485 ±5V
Features / application	OEM integration	OEM applications in industry	Instrumentation in geotechnical engineering, high voltage, environments with electromagnetic and high-frequency interfering radiation as well as microwave radiation
Sensors	SCBG (GaAs)	SCBG (OTG-M)	WLPI
Dimensions	65 mm x 85 mm	65 mm x 85 mm x 46 mm	130 mm x 250 mm x 75 mm

OEM BOARDS

TECHNICAL DATA	OEM-ACS	OEM-MNP
Number of channels	1 to 8	1
Scanning rate	20 Hz	250 Hz
Output signal / interface	Display Memory RS-232 ±5V	RS-232 ±5V SCPI
Features / application	Applications in research with high field strengths	OEM integration
Sensors	WLPI (OPT-M)	WLPI (OPP-M)
Dimensions	30 mm x 90 mm x 155 mm	65 mm x 85 mm

A

Singular benefit for the customer:

Credit card size, also fits into a small housing.

INFORMATION ABOUT FIBER OPTIC GAAS TECHNOLOGY FOR TEMPERATURE MEASUREMENT

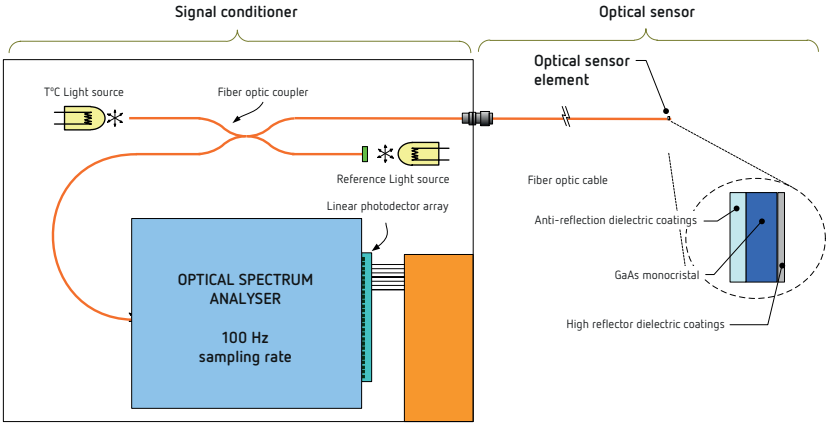


Figure 1

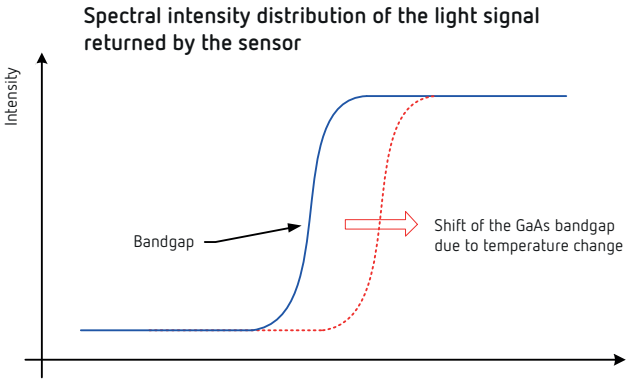


Figure 2

USEFUL INFORMATION

The gallium arsenide (GaAs) technology for fiber optic temperature measurement is based on a simple but reliable spectrophotometric technique.

The GaAs temperature sensors are based on a different fiber optic technology than the WLPI technology already presented. The gallium arsenide (GaAs) technology for fiber optic temperature measurement is based on a simple but reliable spectrophotometric technique. This technique uses the temperature dependence of the distance between the energy bands (gap) in a GaAs semiconductor crystal. The GaAs crystal is opaque at wavelengths below its band gap and transparent at wavelengths above it. The transition region, i.e. the spectral position of the band gap, is a function of temperature. Figure 1 shows a schematic representation of the GaAs technology The fiber optic temperature sensor consists of a miniature GaAs crystal attached to the tip of a fiber optic cable. Light fed into the fiber optic cable from the signal analysis unit reaches the GaAs crystal. The crystal absorbs the light with a wavelength below the spectral position of the band gap and reflects the light with wavelengths above the band gap back to the signal analysis unit. The light reflected back to the signal analysis unit enters a miniature optical spectrometer which spatially splits the light into its spectral components. A linear CCD detector measures the intensities of the individual wavelengths. Each pixel in the CCD array corresponds to a particular calibrated wavelength. Therefore the overall detector array delivers the spectral intensity distribution of the light reflected by the GaAs crystal. Figure 2 shows a typical spectral intensity distribution curve. Particularly small temperature sensors (150 x 150 µm) with particularly fast response times (a few microseconds) can be achieved with GaAs technology.

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