

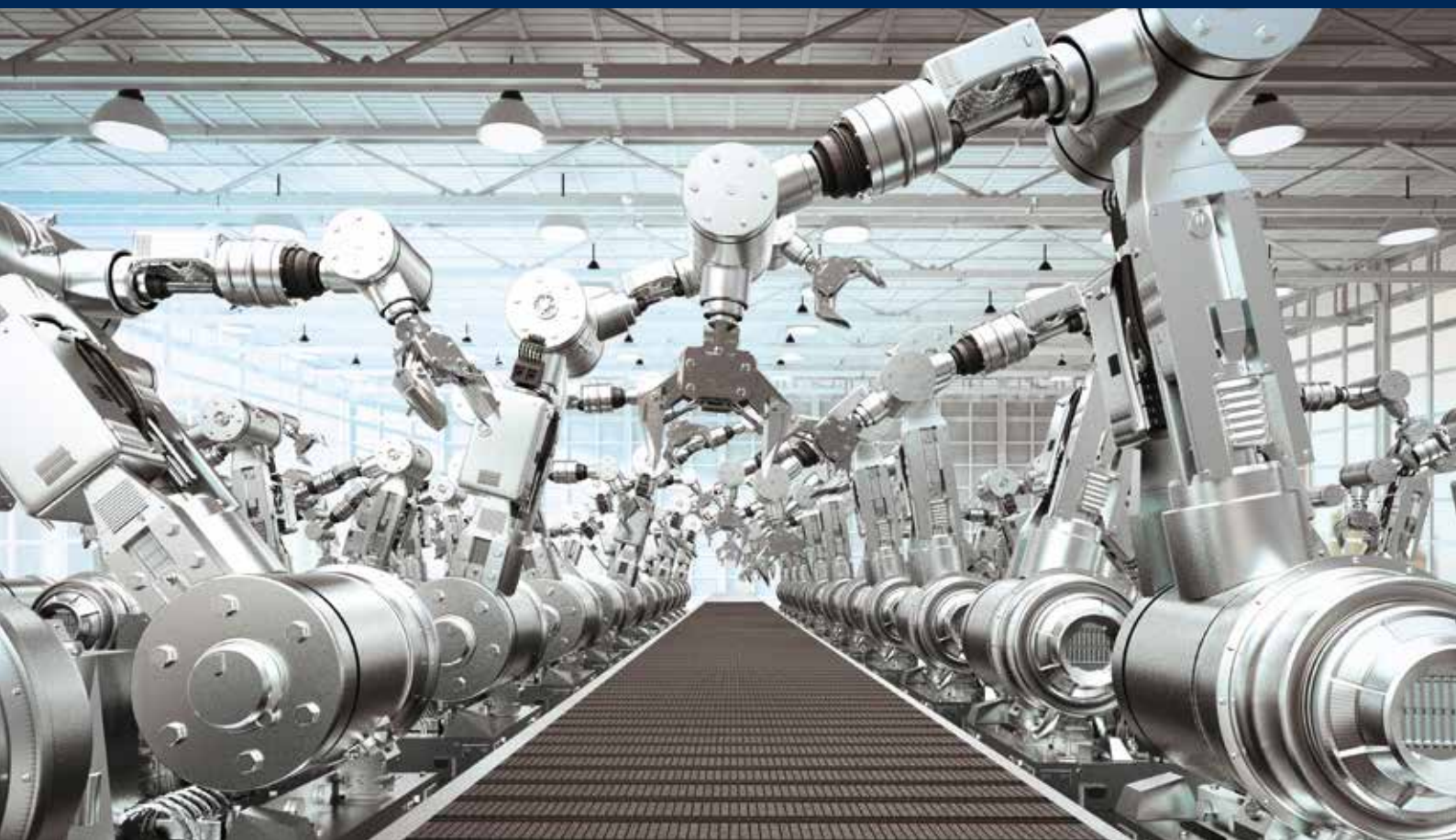
First Sensor 
is now part of



Industrial

Individual sensor solutions for the industrial sector

Our applications and products



First Sensor AG is one of the world's leading suppliers in the field of sensor systems. Our company develops and manufactures standardized and customized sensor solutions for applications in the industrial, medical and mobility growth markets.





Developing tomorrow's products together today

First Sensor is one of the world's leading suppliers in the field of sensor systems and part of TE Connectivity. In the growth market of sensor systems, First Sensor develops and produces customer-specific solutions for the ever-increasing number of applications in the industrial, medical, and mobility target markets. Our goal here is to identify, meet and solve the challenges of the future with our innovative sensor solutions early on.

„With our technical solutions, you can already realize the future visions of tomorrow today.“

Dr. Dirk Rothweiler, CEO of First Sensor AG

In the growth market of sensor systems, First Sensor develops and produces standardized and customer-specific solutions for the ever-increasing number of applications in the industrial, medical, and mobility target markets. Based on tried-and-tested technology platforms, we develop solutions such as chips, components, sensors, and entire smart sensor systems. These products give you a real competitive edge. Trends such as Industry 4.0, autonomous driving, and Smart Health will drive our growth extremely rapidly in the future.

Using our detailed understanding of your specific application, we develop solutions whose capabilities go far beyond those of standard components already on the market. By focusing on technology-driven target markets, we are already playing a role in their exceptionally rapid growth. In the future, too, we will benefit from the megatrends that drive these markets. Our goal here is to identify and meet the challenges of the future early on – a goal that is firmly anchored in our corporate culture.

Among the customers of First Sensor are well-known industrial groups and young technology companies that utilize our know-how and many years of expertise to develop their own innovative products. They appreciate the opportunity to make individual adjustments at every stage of the value chain in order to create exceptionally powerful sensors and sensor systems with tailored features. This joint development work frequently forms the basis for long-standing partnerships.

Our expertise – your success

What sensor suits your application best?

Is a suitable sensor available or might a customized solution even attain a better „total cost of ownership.“ We place great importance in understanding your application so that we can literally „talk the same language.“ No matter whether specific quality criteria have to be complied with or new developments are to be integrated promptly and seamlessly in the existing technological environments. Our project management expertise ensures that

all process steps are oriented to your needs – from development and production to quality testing and logistics.

Innovative products are frequently associated with high investments and quality standards. That makes long-term production and supply certainty all the more important. Our project team can therefore accompany you through the entire process while offering advice on all levels.

1 State-of-the-art production in our own clean rooms

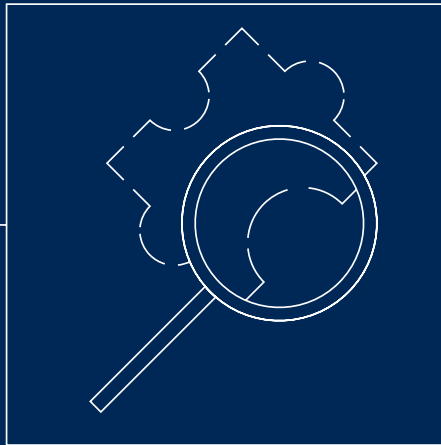
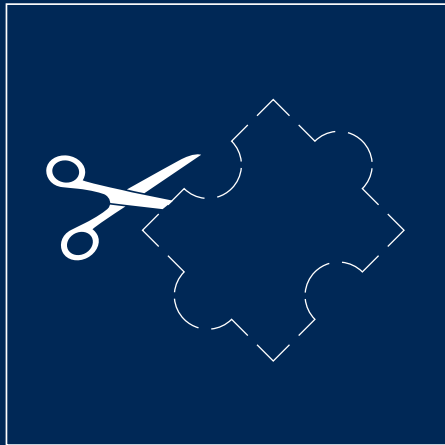


You will already find the right solution to many applications in our wide and field-tested range of high-performance product platforms: We detect light, radiation, pressure, flow, level and acceleration. Our sensors can also be adapted specifically to your application or even developed individually. This will help you to save time and resources!



Sensor Solutions

Together we can plan, develop and guide your entire sensor system project, tailored to your requirements. We offer a wide range of application-optimized standard products or customized solutions - products providing exactly what you need for your individual application.



Step_1 Idea

No matter whether you already have the full specifications for your sensor or merely a rough idea – our sales department will be pleased to advise you about the right solution in terms of implementation and cost. We know about the underlying conditions associated with production engineering and are familiar with the manufacturing time frames often spanning many years. We would like to utilize our expertise and experience to establish a long-standing and trusting partnership with you.

Let's talk about your ideas.

Step_2 Requirements-oriented analysis

We are specialized in the customized development and production of sensor solutions. Our highly qualified planning and manufacturing expertise enables us to help shape the entire value added chain at in-house production sites – from the chip up to final qualification. Together with you, we can realize optimum solutions for your successful applications with unique selling propositions.

We support your specific application.

Step_3.1
**Wide-ranging
product portfolio**

Our products are renowned for their efficiency and accuracy. Technical excellence, precision and reliability take top priority at First Sensor. Our product platforms have been specially optimized for the demands of your application and can also be adapted individually as required.

Find everything you need.

Step_3.2
**Individual product
development**

Our Research & Development and our production sites are specialized in finding and implementing individual solutions for your requirements. Components, modules and sensor systems are developed in close co-operation with you in a Stage-Gate-Process®.

We offer tailored individuality.

Step_4
**Production and
quality assurance**

Utilize our flexible production capacity – from rapid prototype manufacture via medium-sized quantities to order-based, cost-efficient series production involving millions of units. We carry out our development, validation, qualification and reliability approval work along with production and testing in accordance with the quality standards and certifications specific to your sector. At our different production sites we offer application-specific measurement technologies and master various calibration methods.

We customize our production.

Step_5
Implementation

Our products and processes are individually tailored to your needs, offering long-term availability and a high level of specialization. As a reliable partner oriented to continuity, we are there for you with proven project management. We are always pleased to inspire ideas for your further developments in all stages of the value chain. Come to us for your innovation process.

Together we realize your solution.

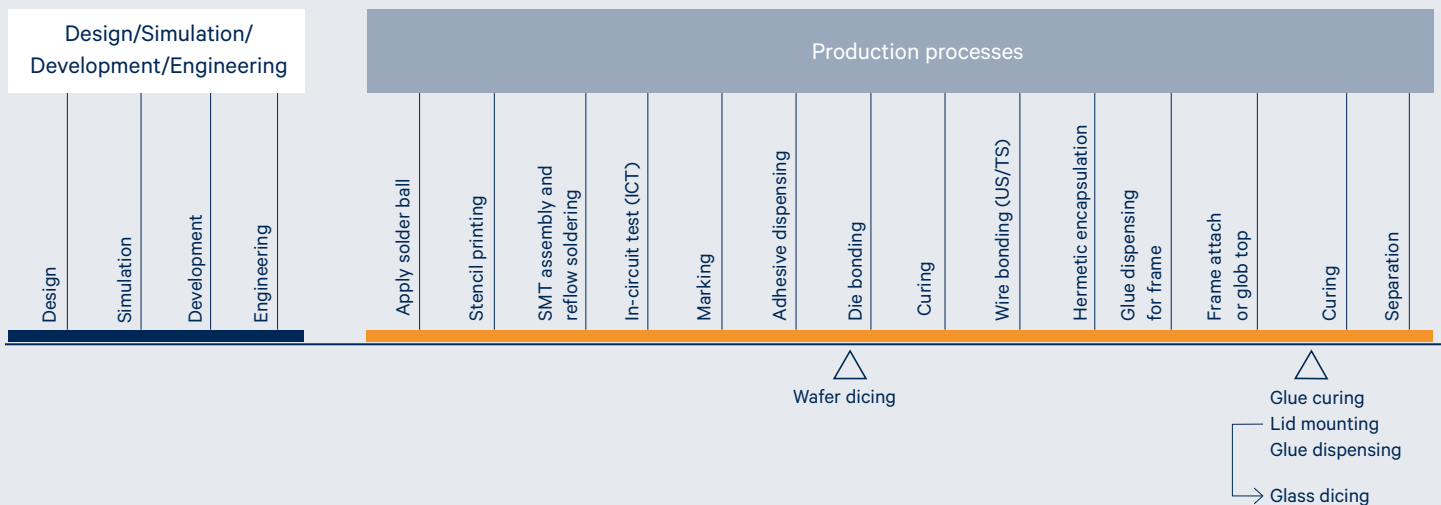
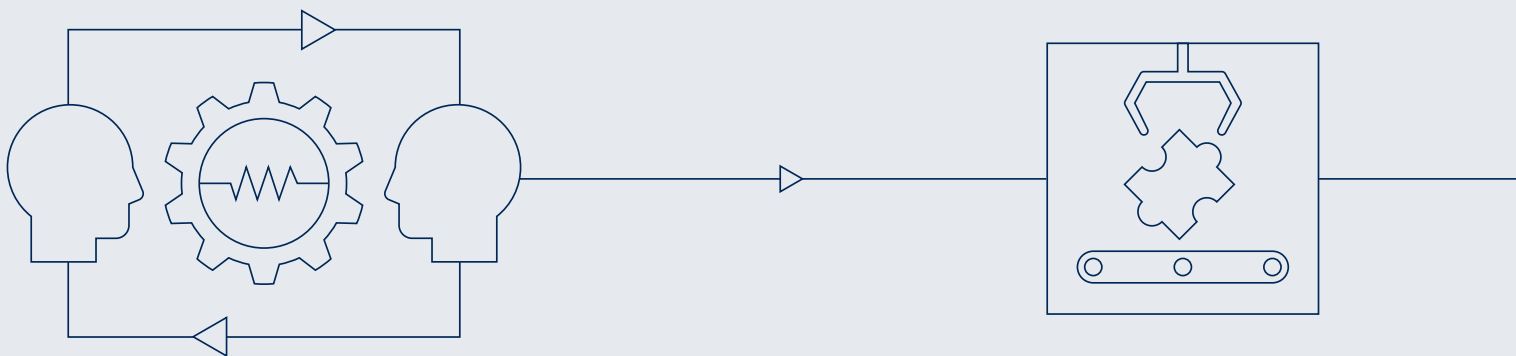
Development and production services

As a manufacturer of sophisticated systems, are you always facing new challenges because of global competition, increasing process requirements and new customer requests? Are you looking for ways to distinguish yourself and your products? You can do this with even more precise and faster measurements, more efficient and cost-reducing integration, application-specific combinations of measure-

ment procedures, special form factors of sensor systems and/or greater reliability.

Standard sensors are often no longer enough to distinguish yourself from the competition. Sustainable application, quality and cost advantages can only be achieved and guaranteed with customized sensor systems. The development of application-specific sensor systems

therefore presents you with a make-or-buy decision. Even if the sensor technology is an extremely important system component of your targeted solution, you are often unwilling or unable to allocate the development resources and expertise required for such developments.

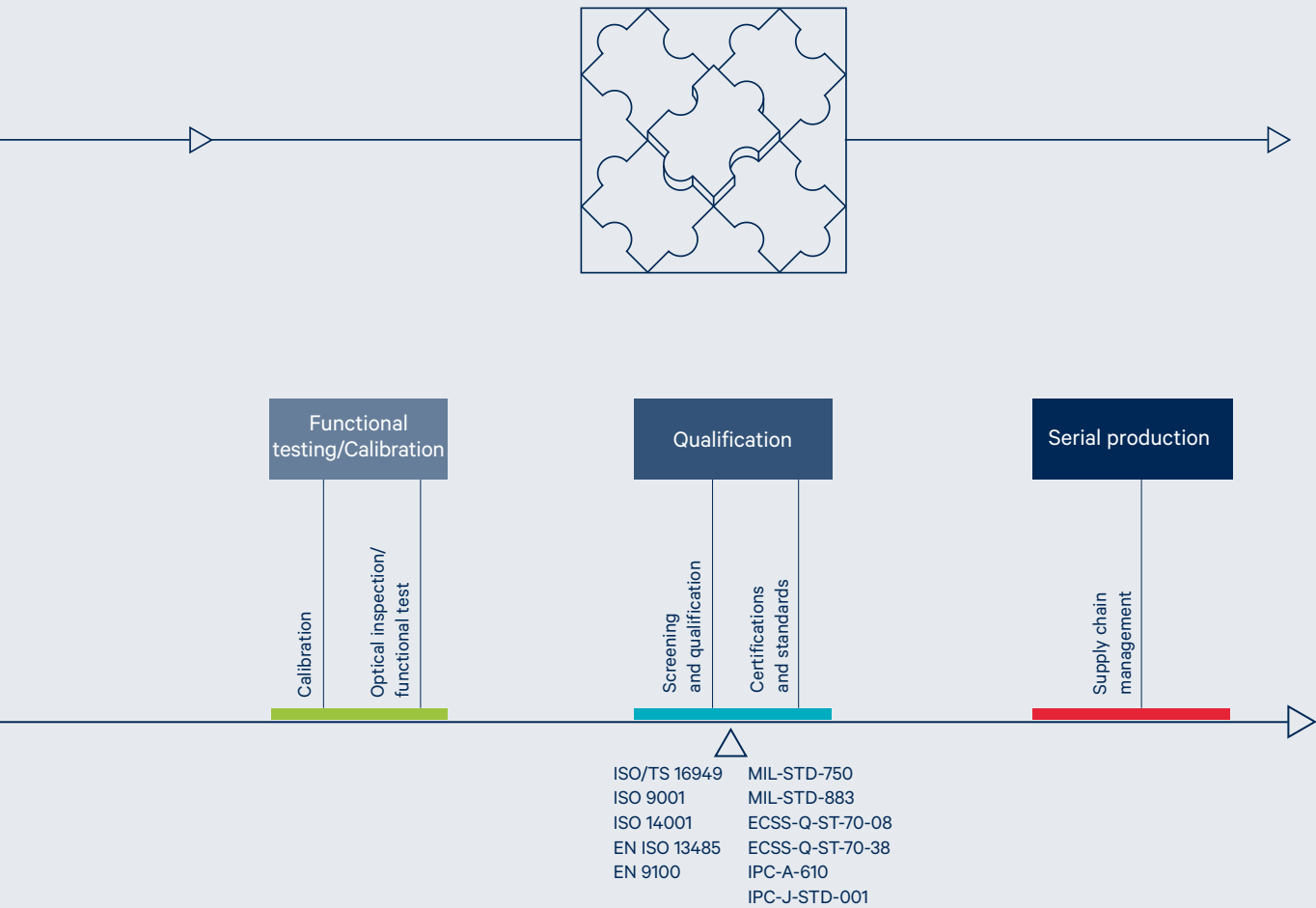


The reasons for this are manifold:

- Capacity bottlenecks: internal development teams are tied up in other projects.
- Specific expertise: you do not have the metrological know-how to develop and produce specific sensor systems reliably and efficiently or to integrate new sensor technology.

- Outsourcing strategy: sensor technology is part of your own applications but is not considered a core competence.
- Risk and cost management: you want to speed up development projects significantly, limit cost and technology risks or achieve a predictable ROI via external development projects at fixed prices.

First Sensor is your first port of call if you are looking for a competent, reliable partner with many years' experience for the development and production of high-performance, customer-specific sensor systems.



Strategic partner for development and production of customized products

As a specialist in the development and production of sensor systems, we have been enabling long-term differentiation from the competition for many years. We provide all the expertise, technology and capacity this requires:

- Complete development services ranging from the solution concept and initial proof-of-concept to prototypes and serial production maturity; from hardware to software and integration; microsystems technology from the ASIC and the module to the end product.
- Design and implementation of technologies that enable many sensor functions and applications in the first place. State-of-the-art production capacity for a broad range of volumes – from rapid prototype production to order-based, cost-efficient serial production of millions of units.
- Support for development by metrology specialists from various disciplines and the use of application-specific metrological test stations and calibration services.
- Development, validation, qualification and reliability certification, production and testing according to industry-specific quality standards and certifications (e.g. EN ISO 13485 for medical devices and ISO/TS 16949 for the automotive industry)

1 State-of-the-art production in our own clean rooms



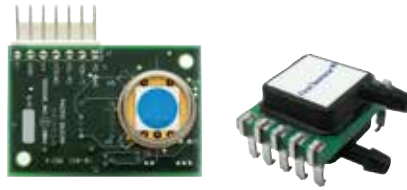
Tried-and-tested approach for maximum efficiency and minimum risks

The entire value added chain

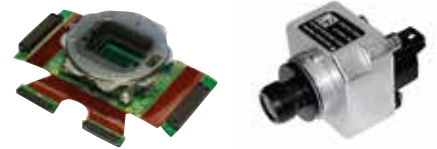
WAFER + COMPONENT



SENSOR



SYSTEM



ELECTRONIC ENGINEERING & MANUFACTURING SERVICES

We offer you not only metrological know-how, but also seasoned project management that allows highly efficient as well as low-risk developments.



Triple the experience and innovation

First Sensor is focused on three core markets: Industrial, Medical and Mobility. We support these markets with our international sales as well as uniformly controlled production processes. The development of tailor-made sensor solutions as well as the manufacturing of the products is specifically guided by your performance requirements.

Proximity to markets and customers is for us the key to economic success. The development and production of sensor solutions with you and for you is therefore the central focus of our business model. We see you and your markets from a future-oriented perspective and ask questions like: In what direction are the markets developing? What will be needed in the years ahead? Where can we offer you added value and a competitive advantage? The answer to these and similar questions is custom sensors and sensor system solutions from our company – smart, miniaturized and reliable.

This market- and customer-oriented strategy is clearly aligned to the core markets of industrial applications, medical technology as well as automotive and transport. These core markets all share common ground: They combine above-average growth and a technological challenge that can only be mastered by an innovative and professional company like First Sensor.

In the Industrial market First Sensor has many years of experience and expertise in development and production engineering, allowing it to offer a wide variety of high-quality sensor solutions that can be adapted to your specific requirements. The focus of the applications includes length measurement, radiation and security, smart building as well as industrial process control. Another complex field of application is aerospace. Here some of the requirements are very high, which in turn calls for our custom solutions.

First Sensor has been manufacturing and supplying sensor solutions for medical technology for over 30 years and has extensive experience in this field. Our specialists are dedicated to not simply providing sensor solutions but also finding and implementing the solution for the relevant measuring task that is the best possible in terms of technology and also affordable. Medical technology is there to save lives, enable patient healing, improve medical treatments and help those affected gain a better quality of life. That means we have to take a

special degree of responsibility as a company – a challenge we gladly rise to.

We are about to enter a new era in mobility. Smart mobility has already become an everyday feature in new automobile models: With driver assistance systems from automatic start-stop systems and parking aids to options for semi-autonomous driving. The foreseeable future is set to witness fully autonomous vehicles that can transport their occupants safely and comfortably from A to B. First Sensor will accompany the automotive industry into this new era with its sensor solutions.

We work closely with you in the development of new sensor solutions right from the start. You describe your application, and we contribute the technical standards and our expertise. This means we can jointly configure a perfectly tailored solution. The spectrum ranges from wafers and individual sensor components to conventional sensors and smart sensor systems.

Industrial

Optical and radiation sensors for

- laser rangefinders
- laser scanners/LiDAR
- laser alignment systems
- encoders
- spectrometers
- baggage and container scanners
- passenger counters

Pressure, flow and level sensors for

- volumetric flow controllers
- filter monitoring
- leak detection
- level sensing
- industrial printers
- cabin air pressure

Inertial sensors for

- condition monitoring
- control and navigation systems



Highly sensitive optical sensors for precise alignment in industrial process control

Medical

Optical and radiation sensors for

- computer tomographs
- videoscopes
- pulse oximeters
- blood sugar measuring devices
- gamma probes

Pressure, flow and level sensors for

- respiratory devices
- sleep diagnostic devices
- sleep apnea therapy devices (CPAP)
- spirometers
- anesthetic devices
- dialysis machines
- infusion pumps
- oxygen concentrators
- insufflators



Customized detector arrays for computer tomography

Mobility

Cameras and optical sensors for

- advanced driver assistance systems
 - LiDAR
 - ACC (Adaptive Cruise Control)
 - collision avoidance systems
 - traffic sign recognition
 - blind spot detection
 - lane departure warning

OEM pressure sensors for

- tank pressure measurement
- fuel delivery
- tank leakage diagnostics
- tank air intake and extraction
- brake booster systems
- start-stop systems
- power-assisted steering
- engine suspension
- air-conditioning systems
- exhaust gas recirculation systems
- filter monitoring



Camera systems and optical sensors for advanced driver assistance systems

Sensor solutions for industry

First Sensor offers innovative sensor solutions backed up by many years of technical manufacturing expertise. We define quality based on our superlative products, which make a reliable and lasting contribution to the continued success of our customers.

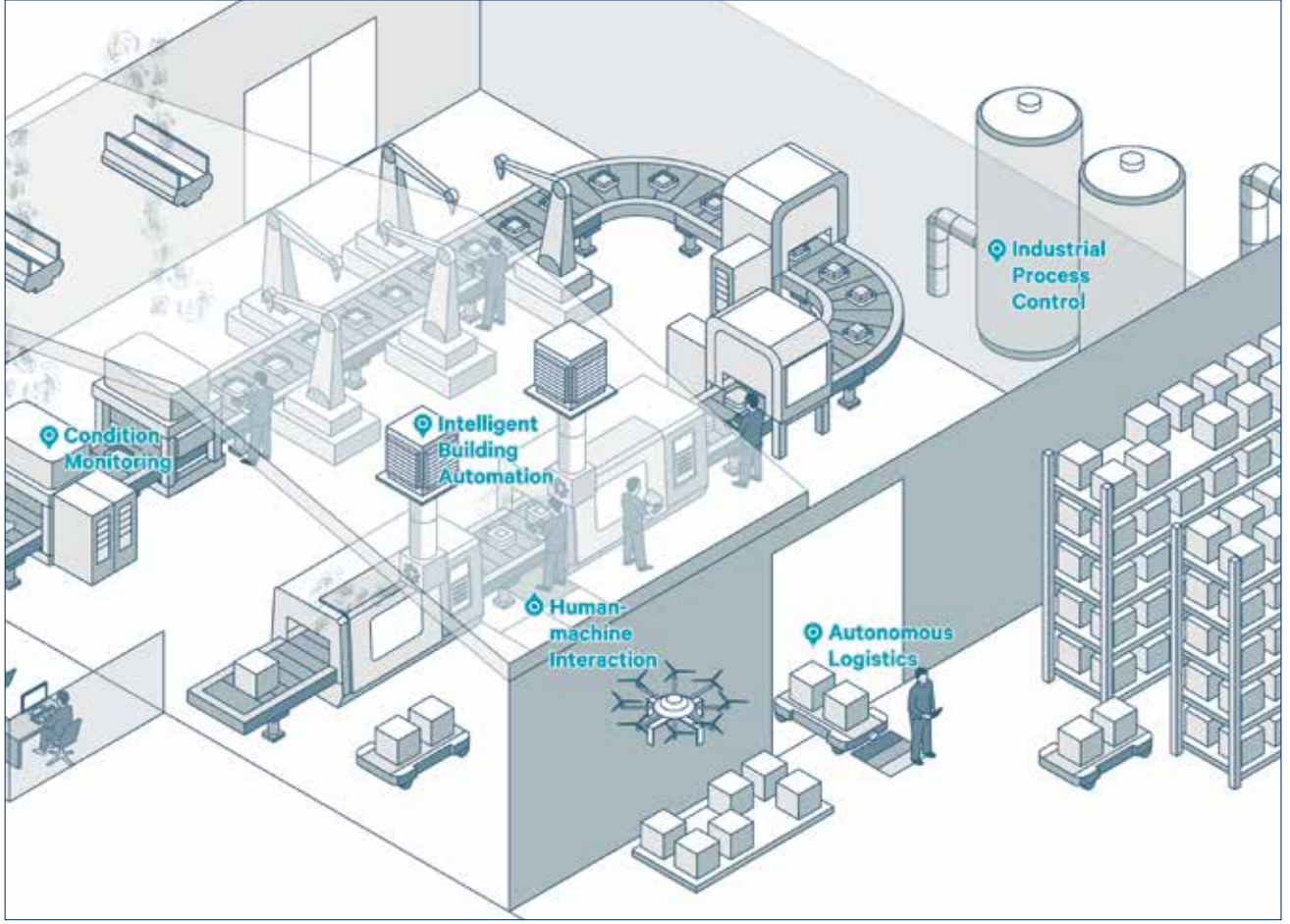
Sensors in industrial applications reveal the entire spectrum of parameters covered - light, radiation, pressure, flow, level, or acceleration. In this respect, sensors often form the core element in their products and solutions and have a decisive influence on the quality, economic efficiency, and safety of the application by controlling key process parameters. For this reason, we take great care in our development, production and service activities – working in accordance with certified processes and procedures. From bare sensor elements and media-isolated industrial transmitters to complex systems, we offer innovative sensor solutions and a broad spectrum of technologies across the entire value chain.

First Sensor has the technology, capacity, and experience to adapt and optimize its sensors to your specific applications and markets. We offer specialized technical expertise, comprehensive consultancy services and customized quality products for the core areas of length measurement, radiation and security, smart building, industrial process control and aerospace. We are the right partners for customized sensor technology if you do not have sufficient in-house development and production resources, if you want to limit cost and technology risks, or if you simply want to focus on your core activities. Save on time-consuming research - ask our experts about the optimum sensor solution for your industrial application. Our ultra-modern semiconductor production facility with its dedicated clean

rooms allows you to plan flexible batch sizes to suit your needs.

We can give you the edge in terms of technology so that you can manufacture long-lasting measuring devices and machines of very high precision – for use in production and quality assurance, research and development or maintenance and monitoring. The application areas for our high-quality sensors in industry are extremely diverse: They can detect the smallest amounts of light in optical distance measurement. They help screen items of baggage and freight. They monitor air flows in HVAC systems. They recognize levels and pressures in tanks and can detect positions and acceleration when monitoring the condition of buildings.





Supply chain flexibility will become increasingly important for you. As a reliable partner, we offer a range of services from tailored solutions to integration in your value and supply chain. As a global provider of sensors, we maintain an extensive international presence -

with our corporate headquarters in Germany as well as sales and production locations in Europe, America, and Asia. Talk to us - and reap the benefits of the perfect sensor solution from First Sensor for your specific industrial application.

1 State-of-the-art production in our own clean rooms

Length measurement / LiDAR

Industrial optical length measurement delivers swift and reliable measurement results with ultra-high precision over short and long distances. First Sensor develops and manufactures detector solutions for optical distance measuring devices such as laser rangefinders, laser scanners, LiDAR systems, and encoders. We optimize our photodiodes for your special requirements, for example, with reference to sensitivity, amplification, rise time, or capacitance.

Laser rangefinders

Laser rangefinders have numerous applications and are used, for example, to measure rooms and buildings in the construction sector and for distance measurement in industry. In most cases, the devices use a continuous laser beam with a modulated intensity and measure the phase shift of the laser beam reflected by the object in comparison to the output beam (phase measurement process). Laser rangefinders use sensitive avalanche photodiodes that enable them to cover ranges of up to 200 meters.

Our sensor solutions for laser rangefinders

Avalanche photodiodes (APDs) from First Sensor are optimized for various wavelengths from blue (400 nm) to infrared (1064 nm). Series 8 and 9 have their highest sensitivity at 650 to 850 nm or 905 nm and are used in many laser rangefinders. Series 10 is particularly suitable for all applications using Nd:YAG laser beam sources at 1064 nm.





Laser scanners and LiDAR systems

In laser scanners and LiDAR systems, the environment is usually scanned with a pulsed laser beam and the reflection time of the signal from the object back to the detector is measured. The Time-of-Flight (TOF) reflection time measurement can be used over distances ranging from one meter up to several kilometers. To increase the range of the systems, very short laser pulses in the invisible NIR range are used. These enable a higher laser power compared to continuous wave lasers while still complying with eye safety requirements. During the scanning process, the systems gather individual distance points within an aggregate of points, from which three-dimensional images of the environment can be computed. The laser scanners deflect the laser beam using deflecting mirrors, which enables them to achieve very wide fields of vision. Some LiDAR systems also rotate around their own axis and offer 360° all-round visibility. Modern devices achieve very high data rates with over one million distance points per second.

PRODUCTS

Series 8: APDs optimized for high cut-off frequencies – 650-850 nm

Series 9: APDs with enhanced NIR sensitivity – 900 nm

Series 10: APDs with enhanced NIR sensitivity – 1064 nm

Customized sensors, modules and arrays

Our sensor solutions for laser scanners and LiDAR systems

For measuring systems based on the reflection time process using light pulses of varying intensity in the nanosecond range, First Sensor offers highly sensitive avalanche photodiodes (APDs) with internal amplification across a wide dynamic range as well as wide bandwidths. To achieve the high spatial resolutions required in optical LiDAR systems, First Sensor develops APD arrays that consist of multiple sensor elements. For the matrix arrays, development modules that simplify the process of testing the detector are also available.

1 Sensitive avalanche photodiodes for laser rangefinders

Radiation and security

Sea ports and airports use inspection and security systems such as container scanners, cargo scanners, and baggage scanners to screen and inspect vehicles, freight, and baggage. First Sensor offers a range of photodiodes and sensor systems for measuring ionizing radiation directly via the absorption in the crystal lattice or indirectly via the measurement of the luminescence radiation of a scintillation crystal.



1



Freight inspection systems and baggage scanners

Freight inspection systems such as container scanners and cargo scanners screen and check vehicles and cargo in sea ports, in container terminals and at border crossings. Mobile freight inspection systems can be flexibly deployed at the area of application. Stationary drive-through systems are suitable for higher throughputs at a fixed location. With an output of up to 6 MeV, freight inspection systems can penetrate steel up to 30 cm thick. Airports use freight inspection systems and baggage scanners to carry out X-ray inspection of baggage and freight. In addition, X-ray scanners are used in forwarding agents, warehouses, and logistics companies.

Our sensor solutions for freight inspection systems and baggage scanners

For high-quality X-ray images with highly detailed resolution, precision detectors are essential. Photodiodes from First Sensor with very low dark current and low capacitance enable low-noise X-ray images with very high contrast.

The X7 PIN photodiodes are optimized for scintillator luminescence radiation in the visible wavelength range and feature an ultra-flat design (chip-scale package). Using the latest flip-chip technology, the chip is mounted on the carrier with its active area and the contacts facing down. The chip is illuminated from the back. This enables a flat chip surface without

fragile bond wires, which is ideal for the precision mounting of a scintillation crystal. By means of solder bumps and surface mount technology (SMT), multiple X7 photodiode elements can be assembled to create larger linear or matrix arrays with very high fitting accuracy. First Sensor develops and manufactures custom specific arrays, sensors, and complete systems for OEM manufacturers of freight inspection systems and baggage scanners worldwide.

PRODUCTS

Series X: detectors for ionizing radiation

SiPM: silicon photomultipliers for ultra-low light levels

Customized sensors, modules and arrays

- 1 Photodiodes and sensor systems for container and cargo scanners
- 2 Large detector arrays for X-ray inspection of baggage and freight

Smart building

Today, modern building automation and HVAC systems intelligently match energy generation, energy distribution, air conditioning, and heat recovery to ensure that energy is used in a manner that saves resources and costs. First Sensor offers high-quality sensor solutions that range from individual sensors to complex customer-specific sensor systems that help to boost the energy efficiency of heating, ventilation, and air-conditioning systems.

HVAC systems

In HVAC systems, the ability to monitor volumetric flow rates and pressures in lines and rooms is decisive when it comes to operating heating, ventilation, and air-conditioning systems efficiently and economically. Pressure sensors are a central element for controlling the systems. To ensure compliance with strict legal requirements and to minimize energy costs, ever-decreasing measuring ranges as well as greater measuring sensitivities, accuracies, and long-term stabilities of the sensors are required. In addition, the pressure sensors must cope with particular requirements in HVAC systems, such as dust-laden air, and must be small and easy to integrate in OEM systems.

Our sensor solutions for HVAC systems

First Sensor offers a range of sensor technologies for measuring lowest differential pressures in volumetric flow controllers, ventilation ducts, rooms and filter monitoring.

Our flow-based LDE/LME/LMI differential pressure sensors operate according to the principle of thermal mass flow measurement of air which is conducted through a very small flow channel integrated in the sensor chip. This innovative sensor technology enables highly sensitive measurement of ultra-low pressures from 25 Pa (0.25 mbar) full scale with ultra-high resolution and offset stability. Due to the minimal gas flow, the sensors are highly

resistant to dust, humidity, and long connection tubes First Sensor's membrane-based piezoresistive pressure sensors from the HCL and HCLA series combine very high offset stability with low position sensitivity thanks to a special internal compensation technique. The silicon MEMS sensors achieve especially linear signal/pressure characteristic curves for pressure measuring ranges from 2.5 mbar full scale and offer analog and digital interfaces.

The very small and flat piezoresistive low differential pressure sensors of the HTD series with measuring ranges from 1 mbar are ideal for space-saving manifold assemblies.

1 Sensors for measuring differential pressures in HVAC systems

2 MEMS inertial sensors for condition monitoring

PRODUCTS

LDE/LME/LMI Series: ultra-low pressure sensors based on flow measurement

HTD/HCL/HCLA Series: piezoresistive low pressure sensors

WBI/WBA/WTA Series: thermal mass flow sensors

SI/SA Series: capacitive MEMS inertial sensors

Customized sensors, modules and systems

1





2

Condition monitoring of buildings

A new generation of miniaturized sensor-based monitoring systems uses precision MEMS inertial sensors to monitor structural changes, damage, and critical stress conditions of buildings and structures. In this way, the load exerted on bridges, for example, by usage, aging, and environmental influences such as wind and temperature is recorded and checked by a dense network of sensors at various locations. Micromachining inertial sensors are also suitable for condition monitoring of wind power systems, high-current cables, and pipelines.

Our sensor solutions for condition monitoring of buildings

First Sensor operates an innovative technology platform for manufacturing precision inertial sensors that can be flexibly adapted to your customer-specific requirements. The capacitive inclination and acceleration sensors are based on single crystal silicon sensor elements and the latest micromachining technology. The MEMS sensors achieve a very high signal-to-noise ratio as well as exceptional temperature stability and can detect the smallest changes in position or acceleration. The high aspect ratio microstructures (HARMS) guarantee ultra-low cross axis sensitivities. Furthermore, patented AIM (Air gap Insulated Microstructures) technology minimizes parasitic capacitances by insulating the active areas with an air gap.



Industrial process control

Industrial process control involves monitoring and controlling machinery, systems, and processes across a large number of industries: chemicals, pharmaceuticals, biotechnology, energy, water/wastewater, oil, gas, plastic, paper, food, and beverages. Nowadays, industrial preparation, processing, and manufacturing systems are highly automated in order to ensure that raw materials and energy are consumed in a conservative and efficient manner. In this context, the ability to measure pressures, levels, and flow rates reliably and precisely in harsh, humid, and dusty environments and to measure aggressive, corrosive, explosive, and other liquids and gases is essential.



Level sensing

Level sensing is one of the most common applications in industrial process control. Key factors influencing the choice of a suitable level sensor include the size, geometry, and material of the vessel, the presence of equipment in the tank such as agitators, and the type of process medium. Level sensors from First Sensor for industrial process control include hydrostatic level sensing as well as optoelectronic level switches and ranges from simple limit value detection to precision continuous level sensing.

Our sensor solutions for hydrostatic level sensing

For level sensing in industrial process control systems, First Sensor supplies hydrostatic OEM submersible sensors and OEM pressure transmitters for the development and construction of plants, measuring systems, and devices. In addition, we can offer you customer-specific solutions and our comprehensive technical development support.

Pressure transmitters and submersible sensors for hydrostatic measurements are sophisticated and largely resistant to corrosive and aggressive substances because the pressure gage and housing for the sensors – depending on the surrounding medium – can be made of ceramic, stainless steel, or plastic.

Our range of pressure transmitters and submersible sensors comprises the compact CTE family with slim housings, the extremely rugged BTE pressure transmitters made of stainless steel, and the KTE family with housings and pressure connections made of plastic for high compatibility with many corrosive and aggressive liquid media. Furthermore, we offer sensors with a flush-mount membrane that prevent the build-up of deposits and are easy to clean. We can adapt all pressure transmitters and submersible sensors quickly and flexibly to your specific requirements, for example, in terms of calibration, mechanical structure, process connection, electrical connection, or output signal.

1 Submersible sensors and pressure transmitters for industrial process control

2 Sensors, electronic circuits, modules, and customized systems for aerospace applications

PRODUCTS

CTE Series: compact pressure transmitters and submersible sensors with small diameters

KTE Series: pressure transmitters and submersible sensors with very high media compatibility

BTE Series: rugged pressure transmitters and submersible sensors

Sensor adaptations and new developments

Aerospace

Sensors, electronic circuits, modules, and customized systems have a decisive influence on the quality, economic efficiency and safety of aerospace applications. Extreme environmental conditions such as temperature changes, acceleration, and vibrations place very high demands on the reliability and resilience of the products.

First Sensor Lewicki GmbH, which is owned by First Sensor AG, has over 45 years of application expertise and experience in aerospace technology and operates development, production, and service activities according to processes and procedures certified to EN 9100. To check the reliability of our products, we conduct stress tests (design margin tests) as well as screening and qualification, for example, according to ESA standards. The use of the latest thick-film hybrid technology enables the construction of very small, robust, and ultra-reliable electronic modules and circuits.

Our sensor solutions for aerospace

The NuSTAR X-ray satellite launched in 2012 uses two-dimensional position-sensitive diodes (PSDs) from First Sensor to manage the continuous alignment of the telescope lens relative to the sensor unit.

First Sensor supplies precision inertial sensors for use in control and navigation applications for aircraft and unmanned spacecraft. The capacitive inclination and acceleration sensors are based on single crystal silicon sensor elements and the latest micromachining technology (HARMS). The innovative technology platform makes it possible to flexibly adjust the inertial sensors to your specific requirements. Our precision piezoresistive silicon pressure sensors monitor and control the cabin air

pressure in aircraft. In addition, First Sensor develops and manufactures multi-sensor modules that integrate a large number of

components such as sensors, valves, pumps, switches, and micro-controllers to create compact plug-and-play solutions.



2

PRODUCTS

PSD Series 7: fully depletable position-sensitive IR diodes

SI/SA Series: capacitive MEMS inertial sensors

HDI Series: piezoresistive pressure sensors with digital signal conditioning

Customized sensors, modules and systems

Detect more, achieve more – our products

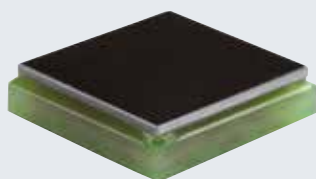
What would you like to find out today? Or what would your product, your customer or a user like to find out? Whether it involves light, radiation, pressure, flow, level, or acceleration – we know which sensor is right for you and will provide you with the precise value.

Our sensor modules and systems immediately convert this value into results and signals that can be used digitally, thereby giving your product eyes, ears, or a sense of touch. Needless to say, we can adapt all our products or develop them specially to fit your application. You will already find the right solution for many applications in our broad and field-tested range of high-performance product platforms. This will help you to save time and resources!

Light

Radiation

Pressure



Optical sensors

- PIN photodiodes
- avalanche photodiodes (APDs)
- photodiode arrays
- position-sensitive diodes (PSDs)
- silicon photomultipliers (SiPMs)

Optoelectronic modules

Laser diodes

HDR CMOS cameras

Detectors for ionizing radiation

- with and without scintillator
- photodiode arrays
- modules

MEMS pressure sensor elements and components

Pressure sensors

- from 0.25 mbar to 10 bar
- uncompensated and temperature compensated
- flow-based and membrane-based
- with integrated signal conditioning
- also for corrosive media

Pressure transmitters

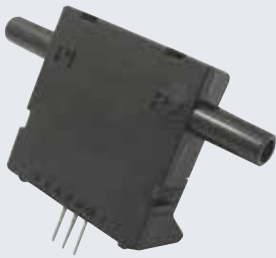
- from 1 mbar to 400 bar
- for corrosive liquids and gases

OEM pressure sensors

Flow

Level

Acceleration



Thermal mass flow sensors

Sensors for volumetric flow measurement



Hydrostatic liquid level sensors

Level switches



MEMS inertial sensors

- inclination sensors
- acceleration sensors

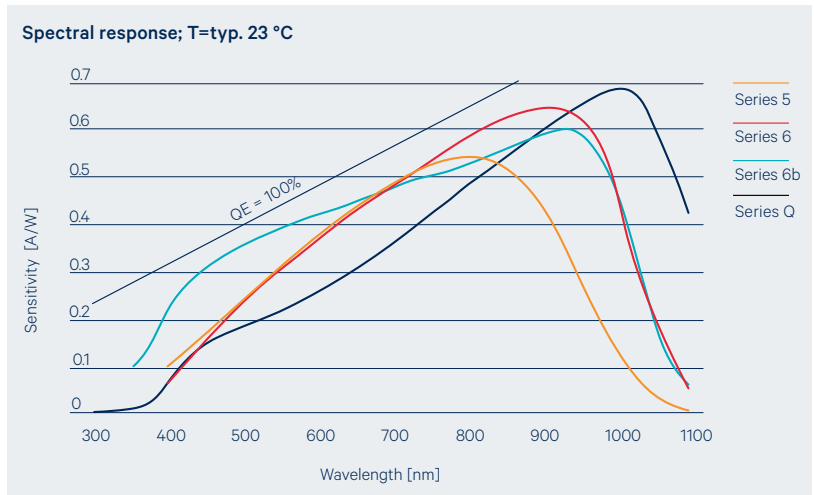
Optical sensors

First Sensor develops and manufactures a large selection of photodetectors with high sensitivity, high speed, and low dark current which can be adapted to your specific requirements. Our sensors are optimized for ultraviolet, visible, or infrared light as well as ionizing radiation. Package solutions include surface-mount (SMD) and through-hole (THD) devices. Further, we provide silicon photomultipliers for the detection of lowest light levels.



PIN photodiodes

Silicon features unique properties for light detection. Silicon PIN photodiodes are used to convert photonic energy into electrical current and achieve very fast rise times. First Sensor develops and manufactures PIN photodiodes in standard product lines optimized for specific wavelength ranges as well as customized detectors adapted to your specific requirements. Additionally, we offer quadrant PIN photodiodes with four optically active areas.



Applications:

- Photometry
- Pulsed light detection
- Analytical instruments
- Fluorescence detection
- Spectroscopy
- High speed optical communication
- Laser power monitoring
- Fiber optic light monitoring
- Bar code readers
- YAG laser detection

PIN series	Optimized for	Special features
Series 6b	350...650 nm	Blue/green enhanced
Series 5	500...900 nm	High speed NIR-enhanced Epitaxy PIN-diode
Series 6	700...1000 nm	General purpose, low dark current, fast response
Series Q	900...1100 nm	Enhanced NIR sensitivity, low voltage, fully depletable, low capacitance
Series i	900...1700 nm	InGaAs photodiode, high IR sensitivity, low dark current

Series 6b: blue/green-sensitive photodiodes

PIN photodiodes with enhanced sensitivity in blue and green spectral range.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) 5 V	Rise time (ns) 410 nm, 5 V, 50 Ω
3001225	PS13-6b	TO5	3.5×3.5 / 13	0.25	50

Series 5: high speed NIR-sensitive photodiodes

These high-speed epitaxial photodiodes are ideal for VIS and NIR applications with low operating voltages.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) 3.5 V	Rise time (ns) 405 nm, 3.5 V, 50 Ω
3001393	PS0.25-5	LCC6.1	0.5×0.5 / 0.25	0.1	0.4
3001048	PS0.25-5	SMD1206	0.5×0.5 / 0.25	0.1	0.4
3004648	PS1.0-5	TO52	1×1 / 1	0.2	1

Series 6: IR photodiodes with minimal dark current

High-performance PIN photodiodes for low-capacitance light detection as well as for alpha, beta, gamma and X-ray radiation detection.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) 3.5 V	Rise time (ns) 850 nm, 10 V, 50 Ω
3001208	PC10-6	TO5	∅ 3.57 / 10	0.2	20
3001047	PC20-6	TO8	∅ 5.05 / 20	0.3	25
3001054	PS100-6	CERpinG	10×10 / 100	1	40

Series 6 / quadrant PIN photodiodes (QP)

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Gap (μm) 150 V	Dark current (nA) 10 V	Capacitance (pf) 10 V	Rise time (ns) 850 nm, 10 V, 50 Ω
5000029	QP1-6	TO52	∅ 1.13 / 4×0.25	16	0.1*	1	20
3004334	QP50-6	TO8S	∅ 7.8 / 4×12.5	42	2.0*	25	40

* per segment

Optical sensors

Series Q / quadrant PIN photodiodes (QP)

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) 150 V	Rise time (ns) 1064 nm, 180 V, 50 Ω
3001177	QP22-Q	TO8S	Ø 5.3 / 4×5.7	1.5*	12
3001275	QP45-Q	TO8Si with heater	6.7×6.7 / 4×10.96	8*	12
3001386	QP154-Q	TO1032i	Ø 14.0 / 4×38.5	10*	12
3001433	QP154-Q	TO1081i with heater	Ø 14.0 / 4×38.5	10*	12

* per segment

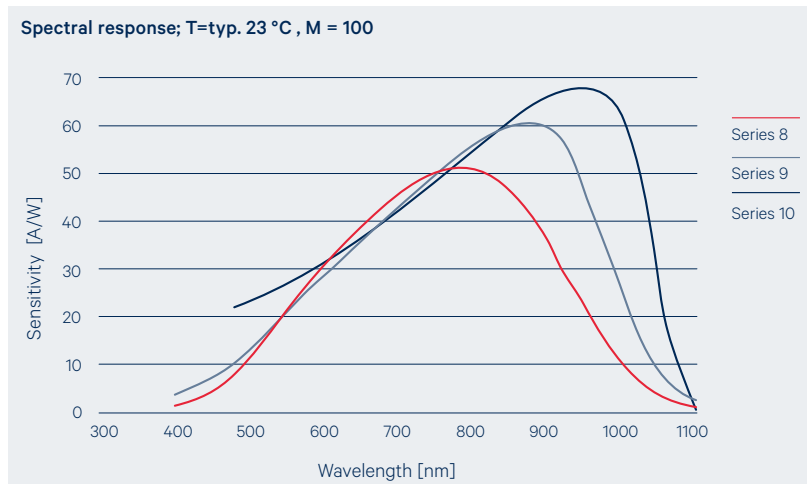
Series i / InGaAs photodiodes: low dark current, high sensitivity

First Sensor offers large-area InGaAs PIN photodiodes with active sensor surfaces up to 3 mm in diameter. The diodes feature low dark currents and high sensitivity up to 1700 nm wavelength. A model enhanced for the visible wavelength range is also available. Housing options include both hermetic TO solutions as well as SMD versions. Ask us about your specific sensor solution.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Spectral response (A/W) at 650 nm / 1550 nm	Dark current (nA) at 5V	Capacitance (pF) at 5 V	Wavelength (nm)
3001210	PC0.7-i	LCC6.1	1.0 / 0.7	0.05 / 0.95	2	70	900...1700
3001211	PC0.7-ix	LCC6.1	1.0 / 0.7	0.3 / 0.95	2	70	900...1700
3001213	PC0.7-ix	TO52S1	1.0 / 0.7	0.3 / 0.95	2	70	900...1700
3001228	PC7.1-i	TO5i	3.0 / 7.1	0.05 / 0.95	25	700	900...1700
3005751	PC0.7-i	TO52S1	0.95 / 0.77	- / 1.0	2	60	850...1550

Avalanche photodiodes

Silicon avalanche photodiodes (APDs) are optical detectors with an internal gain mechanism capable of a high gain bandwidth product. Due to their very high sensitivity avalanche photodiodes are ideally suited for measurements of very low light levels. First Sensor provides single element APDs as well as linear and matrix APD arrays with multiple active areas.



APD series	Optimized for	Special features
Series 8	750...820 nm	High speed, low temperature coefficient, high gain bandwidth product
Series 9	750...930 nm	Fast rise time at higher NIR sensitivity, high gain
Series 10	900...1100 nm	Sensitivity at 1064 nm close to physical limits

Applications:

- Laser range finder
- Laser distance meter
- Laser scanners/LiDAR
- Shape recognition
- Collision warning
- High speed optical communication
- Laser alignment
- Scintillator luminescence detection
- Photometry
- YAG laser detection
- Fluorescence detection

Optical sensors

Series 8: optimized for high cut-off frequencies – 650-850 nm

Due to their high gain and speed, these APDs are suitable for many industrial applications such as distance measurement, laser scanning and optical communication.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) M = 100	Breakdown voltage (V)	Rise time (ns) M = 100, 905 nm, 50 Ω
3001401	AD230-8	LCC6.1	Ø 0.23 / 0.04	0.3	80–120	0.18
3001341	AD230-8	TO5251	Ø 0.23 / 0.04	0.3	80–120	0.18
3001399	AD500-8	LCC6.1	Ø 0.5 / 0.2	0.5	80–120	0.35
3001349	AD500-8	TO52S1	Ø 0.5 / 0.2	0.5	80–120	0.35

Selected chips are also available with bandpass (BP) filter

Order #	Chip	Package	Active area (mm)	BP (nm)	BP Transmission (%)	BP FWHM (nm)
3001405	AD230-8	LCC6.1f	Ø 0.23	635	>90	55
3001396	AD500-8	LCC6.1f	Ø 0.5	635	>90	55

Series 9: with enhanced NIR sensitivity – 900 nm

These avalanche photodiodes were developed specifically for the laser radar system LiDAR and laser rangefinders. The series provides fundamental technology for the development of arrays with multiple individual sensors.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) M = 100	Breakdown voltage (V)	Rise time (ns) M = 100, 905 nm, 50 Ω
3001345	AD230-9	TO52S1	Ø 0.23 / 0.04	0.5	160–240	0.5
3001415	AD230-9	LCC6.1	Ø 0.23 / 0.04	0.5	160–240	0.5
3001351	AD500-9	TO5251	Ø 0.5 / 0.2	0.8	160–240	0.55
3001413	AD500-9	LCC6.1	Ø 0.5 / 0.2	0.8	160–240	0.55

Selected chips are also available with bandpass (BP) filter

Order #	Chip	Package	Active area (mm)	BP Center (nm)	BP Transmission (%)	BP FWHM (nm)
3001429	AD230-9	TO52S1F2	Ø 0.23	905	>90	45
3001493	AD230-9	LCC6.1f	Ø 0.23	905	>90	45
3001380	AD500-9	TO52S1F2	Ø 0.5	905	>90	45
3001495	AD500-9	LCC6.1f	Ø 0.5	905	>90	45

Series 9 / multi-element arrays

Order #	Chip	Package	
3001188	8AA0.4-9	SOJ22GL	8 elements, QE > 80 % at 760-910 nm with NTC
3001411	16AA0.4-9	SOJ22GL	16 elements, QE > 80 % at 760-910 nm
3005259	16AA0.13-9	SMD	16 elements, QE > 80 % bei 760 - 910 nm

Series 10: with enhanced NIR sensitivity – 1064 nm

These avalanche photodiodes are suitable for laser rangefinders or any applications using YAG lasers or similar NIR radiation sources.

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA) M = Vop	Breakdown voltage (V)
3001157	AD500-10	TO5i	Ø 0.5 / 0.2	1.5	220-600
3001426	AD4000-10	TO8Si	Ø 4 / 12.56	50	220-600
3001064	AD4000-10	TO8S	Ø 4 / 12,56	50	280 - 500

Series 10 / quadrant APDs (QA)

Order #	Chip	Package	
3001421	QA4000-10	TO8Si	Quadrant avalanche photodiode, high QE at 850-1070 nm
3001284	QA4000-10	TO8S	Quadrant avalanche photodiode, high QE at 850-1070 nm

Optical sensors



Silicon photomultipliers (SiPMs)

Silicon photomultipliers from First Sensor enable the detection of ultra-low light levels down to single photons. The detectors are optimized for near ultraviolet (NUV) or red, green and blue light with peak sensitivities at 420 nm or 550 nm. Compared to conventional photomultiplier tubes, our SiPMs offer significant advantages such as low operating voltage, excellent temperature stability, immunity to magnetic fields and a much smaller size for easy system integration.

SiPM-NUV: near ultraviolet (NUV) SiPMs

Order #	Package	Active area (mm)	Pixel size (μm)	Pixel	Fill factor	Dark count rate (kHz/mm ²)	Photon detection efficiency (%)	Gain
5000076	SMD	1x1	40x40	625	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x10 ⁶
5000077	SMD	Ø 1.2	40x40	673	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x10 ⁶
5000078	SMD	3x3	40x40	5520	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x10 ⁶
5000079	SMD	4x4	40x40	9340	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x10 ⁶

SiPM-RGB: red, green, blue (RGB) SiPMs

Order #	Package	Active area (mm)	Pixel size (μm)	Pixel	Fill factor	Dark count rate (kHz/mm ²)	Photon detection efficiency (%)	Gain
5000080	SMD	1x1	40x40	625	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x10 ⁶
5000081	SMD	Ø 1.2	40x40	673	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x10 ⁶
5000082	SMD	3x3	40x40	5520	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x10 ⁶
5000083	SMD	4x4	40x40	9340	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x10 ⁶

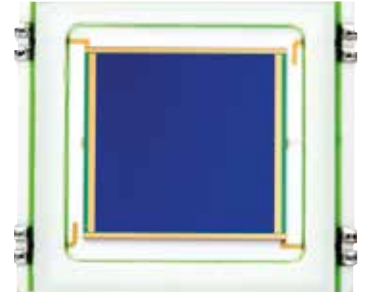
Applications:

High energy physics
Analytical instruments
Fluorescence detection
Flow cytometry
Radiation detectors

Position-sensitive diodes (PSDs)

Position-sensitive diodes monitor relative changes in the position of a light spot on the detector. These silicon PIN photodiodes utilize the effect of the lateral division of the generated photocurrent between the electrical contacts. First Sensor offers one- and two-dimensional PSDs with high sensitivity in the red and infrared spectral range and very high linearity and spatial resolution.

PSD: Position-sensitive diodes with high resolution



Order #	Chip	Package	Dimension	Active area Size (mm) / Area (mm ²)	Rise time (ns) M = 100,20 V, 50 Ω	Inter-electrode resistance
3001032	DL100-7	CERpin	Dual axis	10×10 / 100	4000	12
3001156	DL100-7	LCC10	Dual axis	10×10 / 100	4000	12
3001034	DL100-7	CERsmd	Dual axis	10×10 / 100	4000	12

Applications:

- Distance measurement
- Optoelectronic displacement transducer
- Proximity sensor
- Laser alignment
- Photometry
- Pulsed light detection

Optical sensors

Our development modules connect the optical sensor with the amplification and electronics required for signal processing and optional with an ultra-stable voltage supply. This allows the sensor to be tested under laboratory conditions and simplifies the integration into your application.



Hybrids

First Sensor offers compact integration of photodiodes and amplifiers. The amplifier is matched to the specific features of the detector. Contact us to find your specific sensor solution.

Series 8: optimized for high cut-off frequencies – 650-850 nm

Order #	Chip	Package	Transimpedance [Ohm]	Bandwidth [MHz]
5000001	AD230-8	TO5	2750	2000
5001315	AD230-8	TO52	2750	2000
5000002	AD500-8	TO5	2750	1000
5000074	AD500-8	TO52	2750	2000

Series 9: with enhanced NIR sensitivity – 900 nm

Order #	Chip	Package	Transimpedance [Ohm]	Bandwidth [MHz]
5000041	AD500-9-8015	TO52	2750	500
5001322	AD230-9	TO5	2750	600
5000073	AD500-9	TO5	2750	500

Series 10: with enhanced NIR sensitivity – 1064 nm

Artikel #	Chip	Gehäuse	Transimpedanz [Ohm]	Bandbreite [MHz]
5000044	QA4000-10	TO8Si	8k	68

Optoelectronic modules

Development modules

First Sensor manufactures APD modules and development boards as well as modules for quadrant photodiodes, position- and wavelength-sensitive photodiodes. They enable test runs in the research lab and easy integration into your system.



Evaluation modules: fast test runs, easy integration

Order #	Chip	Type	Package
3001464	16AA0.4-9	APD array	PCBA
5000021	QP45-Q	Quadrant PIN photodiodes	HVSD
5000010	QP50-6	Quadrant PIN photodiodes	SD2
5000023	QP154-Q	Quadrant PIN photodiodes	HVSD
5000011	DL100-7	Position-sensitive diode	PCBA3
3001265	X100-7 with scintillator	Gamma pulse counter	Shielded module

Complete evaluation kits: including power supplies

Order #	Chip	Type
3001287	AD1100-8 (other chips available)	USB module APD-eval-kit
3001473 to 83	SiPM	Module SiPM

High voltage sources

High voltage sources from First Sensor are optimized for use with PIN photodiodes and APDs and feature minimal voltage noise and compact designs.

High voltage sources: up to 500 V

Order #	Max. Voltage [V]	Ripple [mVpp]	Description	Features	Footprint [mm]
3001442	-500	7.5	High performance HV source	Ultra-low ripple	45x29
3001439	+500	7.5	High performance HV source	Ultra-low ripple	45x29
3001440	+200	7.5	High performance HV source	Ultra-low ripple	51x32
3001441	+200	<10	Compact HV source	Small footprint	35x20
3001246	+600	<10	PIN photodiode HV source	Very small footprint	23x23

HDR CMOS cameras

Our rugged and compact cameras withstand the toughest conditions: cold, heat or permanent vibrations to name only a few. At First Sensor the complete assembly process is under one roof – from the processing of the sensor chip to the finishing of the camera system. At the same time we save you unnecessary development effort during the integration into your systems due to our modular camera design with different interfaces and data formats. All cameras can be adapted quickly and flexibly to your specific requirements.

Blue Next: Rugged digital HDR CMOS cameras



The Blue Next camera family offers a basis for industrialized automotive cameras. The robust megapixel cameras can be easily and flexibly integrated. There is a range of interfaces available for connecting them. With their large dynamic range (>120 dB), they are ideally suited to poor light conditions and significant differences in brightness. First Sensor also develops specially customized cameras.

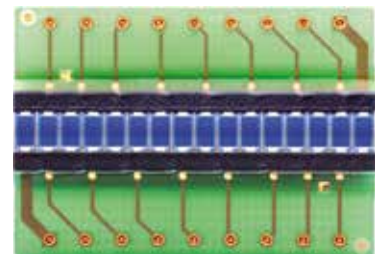
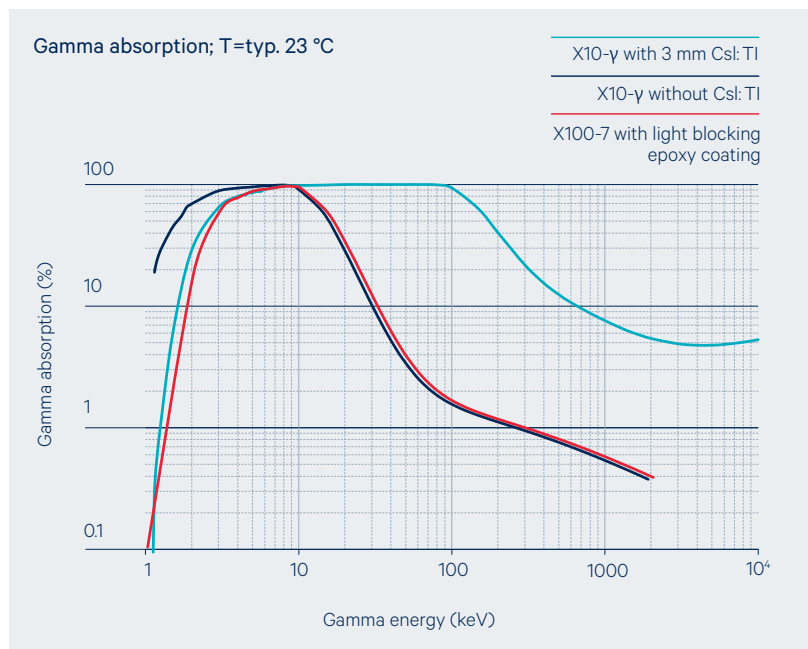
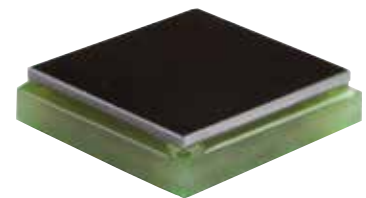
Parameter	Features
High dynamic range (HDR)	>120 dB
Resolution	1,2 / 1,3 / 2 megapixel
Input voltage	12 V / 24 V / PoE
Current consumption	<150 mA
Data interface	LVDS, APIX, ethernet
Diagnostic function	ASIL support
Temperature range	-40...85 °C

Detectors for ionizing radiation

Alpha, beta, gamma, and X-ray radiation can be detected with silicon PIN photodiodes either directly via the absorption in the crystal lattice or indirectly via the measurement of the luminescence radiation of a scintillation crystal. First Sensor develops and manufactures customized photodiodes, detector arrays, and complete systems adapted to your specific requirements.

Radiation sensors with or without scintillator

The Series X from First Sensor features optimized silicon PIN photodiodes, which form wide, fully depleted space-charge regions even at low reverse voltages in order to guarantee the maximum absorption of radiation. For high-energy radiation we offer detectors with a CsI:TI scintillation crystal. Scintillators convert the ionizing radiation into visible light, which is then measured by highly sensitive photodiodes. Our flat surface mount devices can be assembled to create larger custom detector arrays with very high fitting accuracy.



Applications:

- Radiation detectors
- Container scanners
- Baggage scanners
- Scintillator luminescence detection
- Photometry
- Dosimeter
- X-ray fluorescence spectrometers

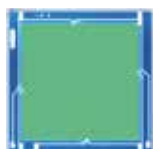
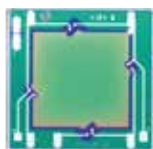
Series X: modular, sensitive / detectors for ionizing radiation

Order #	Chip	Package	Active area Size (mm) / Area (mm ²)	Dark current (nA)	Capacitance (pF)	Gamma energy (KeV)	Scintillator CsI (TI)	Window
5000040	X100-7	CerPin	10 x 10 / 100	3	80	>5	No	Black epoxy
3001448	X100-7	CerPin	10 x 10 / 100	5	80	5...>1000	4 mm	White coating
3001447	X100-7	CerPin	10 x 10 / 100	5	80	5...>1000	8 mm	White coating

MEMS pressure sensor elements and components

Pressure sensor elements from First Sensor utilize the „Sensor Technology for Advanced Resistors“ (STARe). This technology is based on the development of suitable materials, layouts and electrical shielding and enables pressure measurement with highest accuracy and stability.

Pressure sensor elements: highest accuracy and stability



Our piezoresistive silicon pressure sensors include product lines for highest precision (High Stability Line) as well as for aggressive media and fluids (Harsh Environmental Line) for absolute, gage and differential pressure from 3 kPa (30 mbar) up to 60 MPa (600 bar).

	Standard Line STARe	Industrial Line STARe
Pressure ranges	1 bar to 30 bar	100 mbar to 600 bar
Pressure type	Absolute, gage, differential	Absolute, gage, differential
Output signal (span)	typ. 70...100 mV	typ. 60...290 mV
Thermal effects		
- Offset	typ. +0.02 %FSS/K	typ. ±0.02 %FSS/K
- Span	typ. -0.19 %FSS/K	typ. -0.19 %FSS/K
- Bridge resistance	typ. +0.31 % /K	typ. +0.26 % /K
Operating temperature range	-40...150 °C	-40...150 °C

	High Stability Line STARe
Pressure ranges	30 mbar to 400 bar
Pressure type	Absolute, gage, differential
Output signal (span)	typ. 80...250 mV
Thermal effects	
- Offset	typ. ±0.01 %FSS/K
- Span	typ. -0.20 %FSS/K
- Bridge resistance	typ. +0.09 % /K
Operating temperature range	-40...125 (150) °C

Pressure sensor components: highest accuracy and stability

K-Series STARe pressure sensor components from First Sensor are pressure sensor elements of the High Stability Line STARe mounted on a TO-8 header whose coefficient of thermal expansion is adapted to the sensor element. Further, the devices include a high-precision PTC temperature sensor and ceramic components to reduce the dead volume. This construction enables precision measurements within the 0.04 % accuracy class. The K-Series STARe is supplied with a plastic housing for transport protection and pressure measurements up to 10 bar.

	K-Series STARe A/G	K-Series STARe D
Pressure ranges	60 mbar to 400 bar	30 mbar to 10 bar
Pressure type	Absolute, gage	Differential
Output signal (span)	typ. 100...250 mV	typ. 80...100 mV
Thermal effects		
- Offset	typ. ± 0.01 %FSS/K	typ. ± 0.01 %FSS/K
- Span	typ. -0.20 %FSS/K	typ. -0.20 %FSS/K
- Bridge resistance	typ. $+0.09$ % /K	typ. $+0.09$ % /K
Operating temperature range	-40...125 °C	-40...125 °C



Pressure sensors and pressure transmitters

First Sensor develops and manufactures a large selection of highly accurate and reliable pressure sensors and pressure transmitters for air, gas and liquids. The sensors either provide basic mV signals or fully signal conditioned analog or digital outputs. Our rugged industrial pressure transmitters use ceramic or stainless steel pressure sensor elements to achieve high media compatibility for corrosive liquids and gases.

Uncompensated pressure sensors: piezoresistive basic pressure sensors



Our cost-effective piezoresistive pressure sensors for air and gases offer pressure ranges up to 10 bar. The uncalibrated and uncompensated basic sensors feature analog mV output signals and almost unlimited resolution. They offer very small housings with pressure ports for tubing or manifold connection and custom pressure ranges.

	HDU	HMU
Pressure range	100 mbar to 5 bar	100 mbar to 10 bar
Pressure type	Absolute, gage, differential	Absolute, gage, differential
Output signal (span)	typ. 60...100 mV	typ. 50...100 mV
Thermal effects		
- Offset	typ. ± 0.02 %FSS/ $^{\circ}$ C	typ. ± 0.02 %FSS/ $^{\circ}$ C
- Span	typ. -0.2 %FSS/ $^{\circ}$ C	typ. -0.19 %FSS/ $^{\circ}$ C
- Bridge resistance	typ. 0.26 %/ $^{\circ}$ C	typ. 0.26 %/ $^{\circ}$ C
Operating temperature range	-40...85 $^{\circ}$ C	-40...85 $^{\circ}$ C

Applications:

- Instrumentation
- HVAC
- Pneumatic and environmental controls
- Industrial measurement and control
- Industrial machines
- Analytical instruments

Temperature compensated pressure sensors: calibrated and temperature compensated

High-precision miniature piezoresistive pressure sensors for air and gases from First Sensor feature full scale pressure ranges from 5 mbar. The sensors provide calibrated and temperature compensated analog mV output signals and almost unlimited resolution. They are available in many different housing options and with custom pressure ranges.

	HCL	HDO	HRO
Pressure range	5 to 75 mbar	10 mbar to 5 bar	10 mbar to 10 bar
Pressure type	Gage, differential	Absolute, gage, differential	Gage, differential
Output signal (span)	typ. 10...20 mV	typ. 20...90 mV	typ. 13...100 mV
Accuracy (non-linearity, hysteresis)	typ. ± 0.05 %FSO	typ. ± 0.1 %FSO (P-Grade) typ. ± 0.2 %FSO (H-Grade)	typ. ± 0.25 %FSS
Temperature range			
- compensated	0...50/70 °C	0...50 °C	0...50/70 °C
- operating	-25...85 °C	-40...85 °C	-25...85 °C



Pressure sensors with integrated signal conditioning: amplified output signal

Digital piezoresistive miniature pressure sensors with amplified output signals for air and gases from First Sensor feature full scale pressure ranges from 1 mbar, a broad range of housing options and custom pressure ranges. High-resolution digital signal conditioning provides for a very high level of overall accuracy within large operating temperature ranges.

	HTD	HCLA	HCE/HDI
Pressure range	1 mbar to 10 bar	2.5 to 75 mbar	10 mbar to 5 bar, barometric pressure ranges
Pressure type	Gage, differential	Gage, differential	Absolute, gage, differential
Output signal	Analog and SPI bus or I ² C bus	Analog and I ² C bus	Analog and SPI or I ² C bus
Accuracy			
- Non-linearity, hysteresis	typ. ± 0.1 %FSO	typ. ± 0.05 %FSS	
- Total accuracy (0...85 °C)	max. ± 0.5 %FSO		max. ± 0.5 %FSS
Operating temperature range	-25...85 °C	-25...85 °C	-20...85 °C



Pressure sensors and pressure transmitters

Pressure sensors based on flow measurement: ultra-low pressure



Our ultra-low differential pressure sensors from 0.25 mbar (25 Pa) are based on thermal mass flow measurement. The extremely low air flow through a micro-flow channel integrated within the sensor chip ensures high immunity to dust contamination and condensation. The sensors feature high sensitivity and offset stability.

	LDE	LME	LMI
Pressure range	±25 to ±500 Pa	±25 to ±2500 Pa	±25 to ± 2500 Pa
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog and SPI bus	Analog and SPI bus	I ² C bus
Offset stability	max. 0.1 % p.a.	max. 0.1 % p.a. (25 to 500 Pa)	typ. 0.02 % p.a. (25 to 500 Pa)
Total accuracy	typ. ±0.5 %FS	typ. ±0.5 %FS	typ. ±0.5 %FS
Temperature range			
– compensated	0...70 °C	0...70 °C	-20...85 °C
– Operating	-20...80 °C	-20...80 °C	-40...85 °C

Pressure sensors with increased media compatibility: amplified output and digital interface



Our miniature piezoresistive pressure sensors with digital signal conditioning provide measurement ranges up to 10 bar and increased media compatibility for gases and liquids. We offer various housing options with a selection of pressure ports and custom pressure ranges.

	HMA	HMI	HME
Pressure range	100 mbar to 10 bar	100 mbar to 10 bar	100 mbar to 10 bar
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog	I ² C bus	SPI bus
Accuracy			
– Non-linearity, hysteresis	max. ±0.25 %FSS	max. ±0.25 %FSS	max. ±0.25 %FSS
– Total accuracy (-20...85 °C)	max. ±1.5 %FSS	max. ±1.5 %FSS	max. ±1.5 %FSS
Operating temperature range	-20...85 °C	-20...85 °C	-20...85 °C

Pressure sensors for corrosive liquids and gases: fully welded, stainless steel



Our fully welded, media isolated stainless steel pressure sensors allow for high media compatibility with corrosive liquids and gases. These sensors stand out through their excellent price/performance ratio as well as very good stability and repeatability.

	SSO	SSI
Pressure range	200 mbar to 35 bar	200 mbar to 35 bar
Pressure type	Absolute, gage	Absolute, gage
Output signal	typ. 45...130 mV (span)	Analog and I ² C bus
Accuracy		
– Non-linearity	typ. ±0.1 %FSO	
– Total accuracy (-20...85 °C)		max. ±1.5 %FSS
Temperature range		
– compensated	0...50 °C	-20...85 °C
– operating	-40...125 °C	-40...120 °C

Low pressure transmitters: for air and gases

Low pressure transmitters for air and gases from First Sensor offer full scale pressure ranges from 1 mbar. Options include a broad range of pressure and electrical connections as well as fast and flexible customization to specific requirements.

	CTE7000	BTE5000
Pressure range	10 mbar to 1 bar	1 mbar to 10 bar
Pressure type	Absolute, gage	Gage, differential
Output signal	0...5 V, 0...10 V, 4...20 mA	1...6 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ± 0.2 %FSO	typ. $\pm 0.1/0.2$ %FSO
Temperature range		
- compensated	0...50 °C	0...50/70 °C
- operating	-25...85 °C	-25...85 °C



Pressure transmitters for corrosive liquids and gases: high media compatibility

Our pressure transmitters for corrosive liquids and gases use ceramic or stainless steel pressure sensor elements to ensure high media compatibility. The transmitters are available with a choice of different pressure and electrical connections and as custom versions.

	CTE8000	CTE9000	KTE6000
Pressure range	250 mbar to 100 bar	100 mbar to 35 bar	250 mbar to 400 bar
Pressure type	Absolute, gage	Absolute, gage	Absolute, gage
Output signal	0...5 V, 0...10 V, 4...20 mA	0...5 V, 0...10 V, 4...20 mA	0...5 V, 0...10 V, 0.5...4.5 V, 1...6 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ± 0.1 %FSO (incl. repeatability)	typ. ± 0.1 %FSO	typ. ± 0.1 %FSO (incl. repeatability)
Temperature range			
- compensated	0...70 °C	0...50 °C	0...70 °C
- operating	-25...85 °C	-40...85 °C	-25...85 °C



OEM pressure sensors

First Sensor develops and manufactures innovative and reliable pressure sensors for OEM applications that are adapted to your specific requirements with the help of our vast application experience. Due to our in-house production of all main sensor components we are able to ensure long product availability for your serial production.



Custom OEM pressure sensors

We design, develop and manufacture compact pressure sensors for integration into high-volume OEM applications. Our sensors are available in different pressure ranges from vacuum to high pressure and with customer-specific electrical connectors and pressure ports. Further, we offer a range of analog and digital interfaces such as ratiometric voltage output, SENT, LIN, PWM and I²C.

Parameter	Special features
Pressure range	up to 3000 bar
Pressure type	Absolute, gage
Output signal	Ratiometric, SENT, LIN, PWM, I ² C
Temperature range	-40...150 °C
Protection class	IP6K9K

Flow sensors

Our thermal mass flow sensors record even smallest flows fast and with high precision. Within a modular technology platform First Sensor provides complete packaging technologies so as to realize complex custom specific solutions from individual chip elements. Further, our differential pressure sensors detect ultra-low pressure drops in volumetric flow measurement applications.

Thermal mass flow sensors: fast, low power consumption

Our mass flow sensors for air and gases utilize a highly sensitive thermal measuring principle to detect even smallest flows. The sensors are based on highly stable MEMS silicon chip technology and feature fast response times, low power consumption and bidirectional sensing capabilities.

	WBI	WBA	WTA
Flow ranges	0-200 sccm/min 0-1 sl/min	0-200 sccm/min 0-1 sl/min	2 to 50 sl/min
Output signal	I ² C bus	1...5 V	0.5...4.5 V
Accuracy (hysteresis, repeatability)	max. ±0.25 % of reading	max. ±0.25 % of reading	typ. ±0.25 % of reading
Temperature range			
- compensated	0...50 °C	-25...85 °C	0...50 °C
- operating	-25...80 °C	-25...85 °C	-25...85 °C



Differential pressure sensors: for volumetric flow measurement

Differential pressure sensors and rugged differential pressure transmitters for volumetric flow measurement from First Sensor detect the pressure drop across a flow element. Our flow-based ultra-low differential pressure sensors from 0.25 mbar (25 Pa) feature high sensitivity and offset stability as well as high immunity to dust contamination and condensation.

	LDE/LME/LMI	HTD	BTE5000
Pressure range	25 to 2500 Pa	1 mbar to 10 bar	1 mbar to 10 bar
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog and SPI bus, I ² C bus	Analog and SPI-Bus or I ² C-Bus	1...6 V, 4...20 mA
Housing	SMT, DIP	SMT	Transmitter (aluminum)



- Applications:**
- HVAC
 - Leak detection
 - Analytical instruments
 - Laboratory devices
 - Fuel cells
 - Gas meters

Level sensors

Fluid level control sounds quite easy but can turn into a demanding sensor application problem if movement, foaming, or media and container issues come into play. To reliably monitor the liquid level in tanks or containers, First Sensor offers different sensor technologies. Depending on the application, they can register the level continuously or using limit values.

Hydrostatic liquid level sensors: high media compatibility



Submersible hydrostatic liquid level sensors with amplified output signals from First Sensor use ceramic or stainless steel pressure sensor elements to achieve high media compatibilities. For these sensors we offer fast and flexible modifications based on your specific requirements.

	CTE8000...CS	CTE9000...CS	KTE8000...CS
Pressure/level ranges	from 250 mbar/from 2.5 mH ₂ O	from 100 mbar/from 1 mH ₂ O	from 250 mbar/from 2.5 mH ₂ O
Pressure type	Gage	Gage	Gage
Output signal	0...10 V, 4...20 mA	0...10 V, 4...20 mA	0...10 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ±0.1 %FSO (incl. repeatability)	typ. ±0.1 %FSO	typ. ±0.1 %FSO (incl. repeatability)
Temperature range			
- compensated	0...70 °C	0...50 °C	0...70 °C
- operating	-10...70 °C	-10...70 °C	-10...70 °C

Optical liquid level switches: small and cost-effective



Optical liquid level switches from First Sensor use solid state technology with no moving parts and reliably distinguish between liquid and gas. The sensors are suitable for simple, space-saving installation in tanks, containers and pipes.

	OLP	OLT	OLM
Output	100 mA, 1 A	100 mA, 1 A	10 mA, 800 mA
Supply voltage	4,5...15,4 V or 8...30 V	4,5...15,4 V or 8...30 V	5...12 V or 10...45 V
Wetted materials (tip/housing)	Polysulphone (tip/housing)	Trogamid (tip/housing)	Polysulphone (tip) Stainless steel (housing)
Sensor connection	M10 or M12 thread	M10 or M12 thread	G 1/2, 1/2 NPT

MEMS inertial sensors

First Sensor features a highly innovative technology platform for manufacturing high-precision inertial sensors for geoengineering, condition monitoring or navigation applications. The MEMS sensors allow for flexible customization to fit your individual application requirements.

Inclinometers and accelerometers

Our capacitive inclinometers and accelerometers are based on single crystal silicon sensor elements and utilize state-of-the-art micromachining technology to achieve large signal-to-noise ratios and excellent stability over temperature. Therefore, they are able to detect extremely small changes in inclination or acceleration. Due to high aspect ratio microstructures (HARMS) the sensors feature ultra-low cross axis sensitivities. Further, the patented highly flexible AIM (Air gap Insulated Microstructures) technology minimizes parasitic capacitances.



Parameter	Inclinometer	
	SI-11.S1C-30	Unit
Measurement range	±30	°
Resolution at 10 Hz	< 0.0015	°
Scale factor (repeatability)	±35	ppm
Scale factor (temperature coefficient)	±50	ppm/K
Bias (repeatability)	±0.0030	°
Bias (temperature coefficient)	±0.0025	°/K
Noise density	< 0.0004	°/√Hz
Measuring frequency	400	Hz
Digital interface	SPI	
Operating temperature	-40 ... 85	°C

Parameter	Accelerometer			Unit
	SA-12.S1C-3	SA-13.S1C-8	SA-14.S1C-15	
Measurement range	±3	±8	±15	g
Resolution at 10 Hz	< 40	< 65	< 95	µg
Scale factor (repeatability)	±35	±50	±50	ppm
Scale factor (temperature coefficient)	±50	±50	±50	ppm/K
Bias (repeatability)	±60	±150	±200	µg
Bias (temperature coefficient)	±130	±420	±700	µg/K
Noise density	< 12	< 20	< 30	µg/√Hz
Measuring frequency	400	400	400	Hz
Digital interface	SPI	SPI	SPI	
Operating temperature	-40...85	-40...85	-40...85	°C

Applications:
 Geoengineering,
 Condition monitoring
 Navigation
 Robotics
 Alignment and leveling
 Security systems

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