

First Sensor   
is now part of



Mobility

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# Individual sensor solutions for the automotive industry

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Our applications and products



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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.

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# 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.

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“Sensor technology is the key to the mobility of the future.”

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Dr. Dirk Rothweiler, CEO of First Sensor AG

In the growth market of sensor systems, First Sensor develops and produces standard products as well as 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

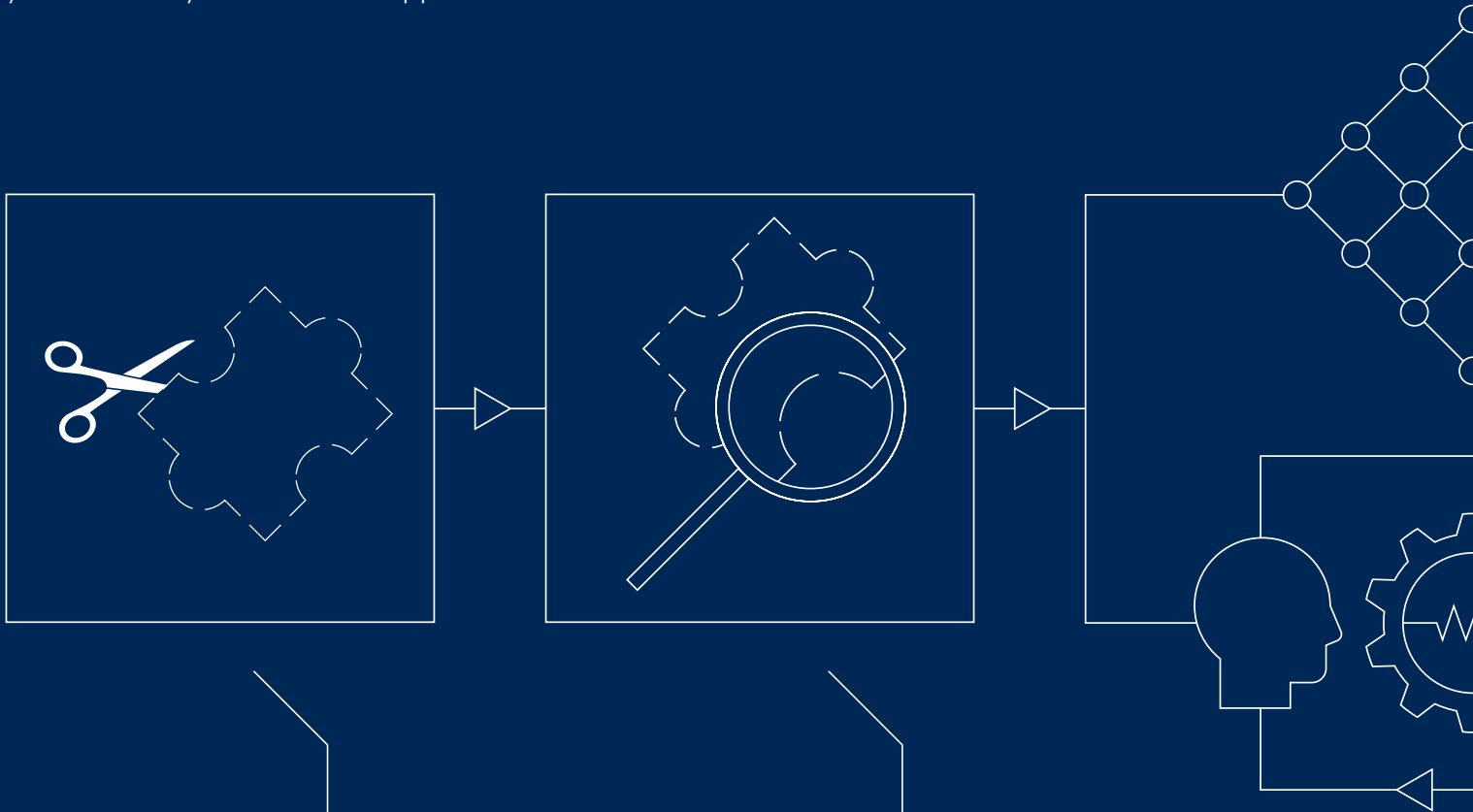


You will already find the right solution to many applications in our wide and field-tested range of high-performance product platforms: We detect light, radiation, pressure, flow, level and acceleration. Our sensors can also be adapted specifically to your application or even developed individually.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

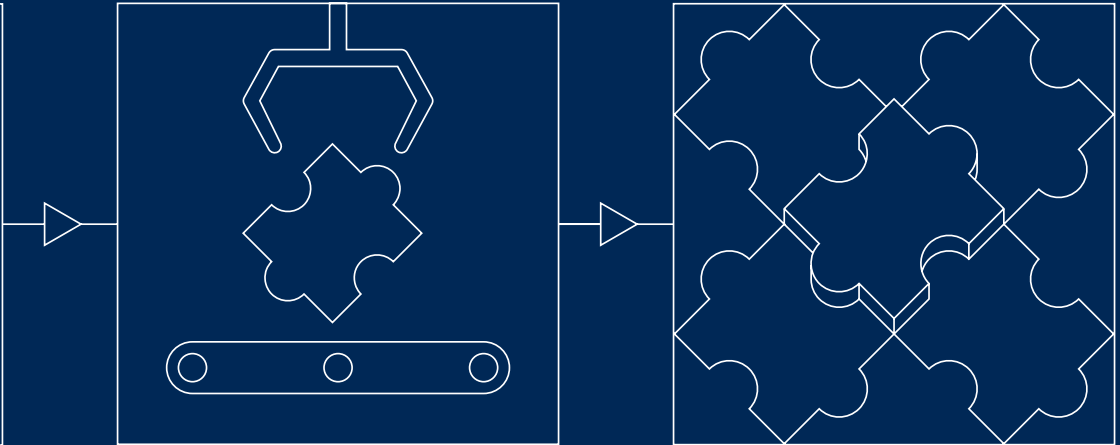
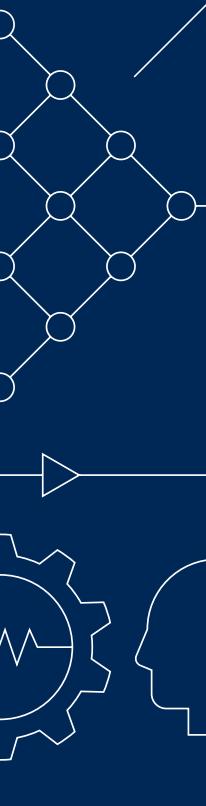
We support your specific application.



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 cooperation 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.

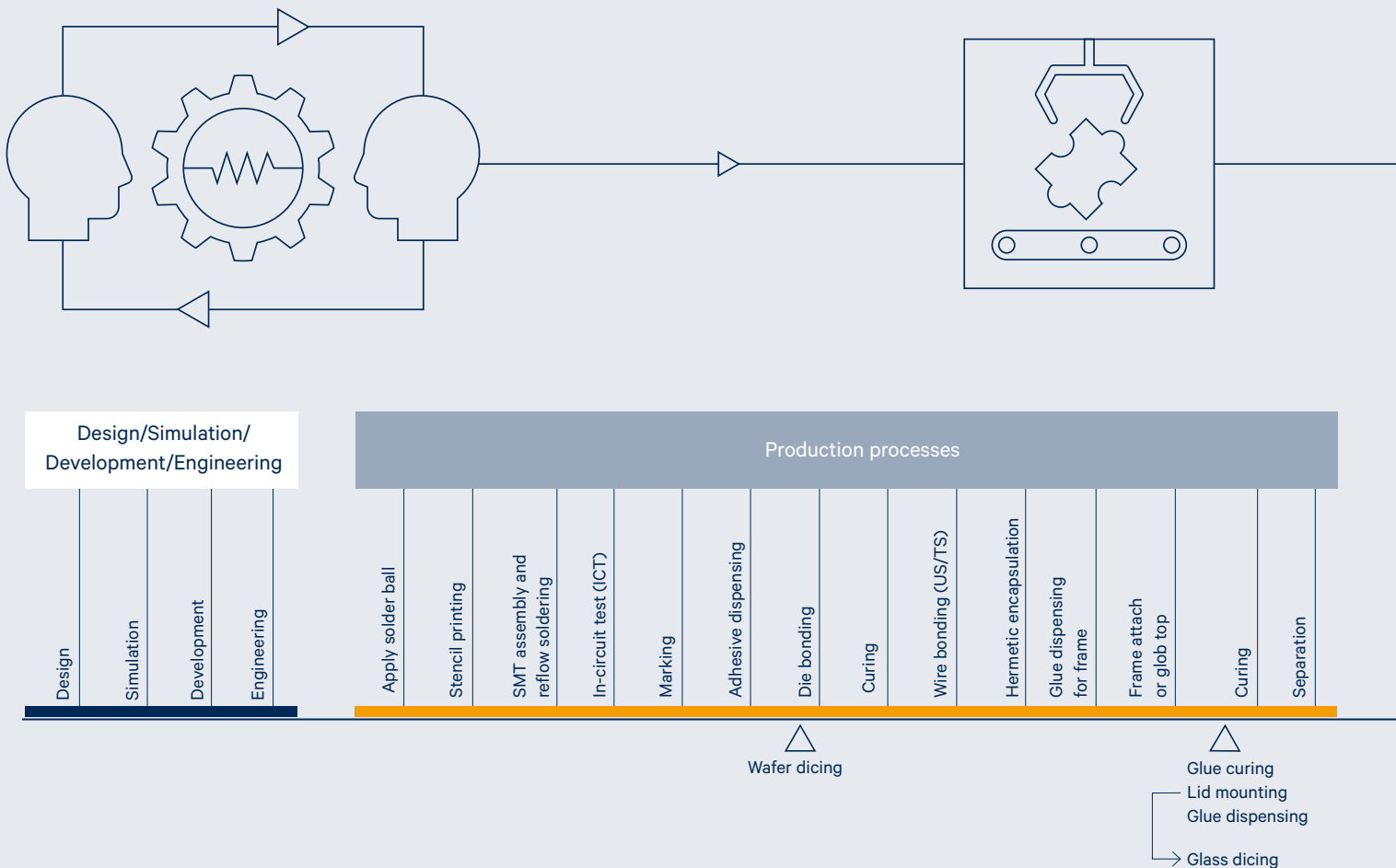
## Development and production services

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.

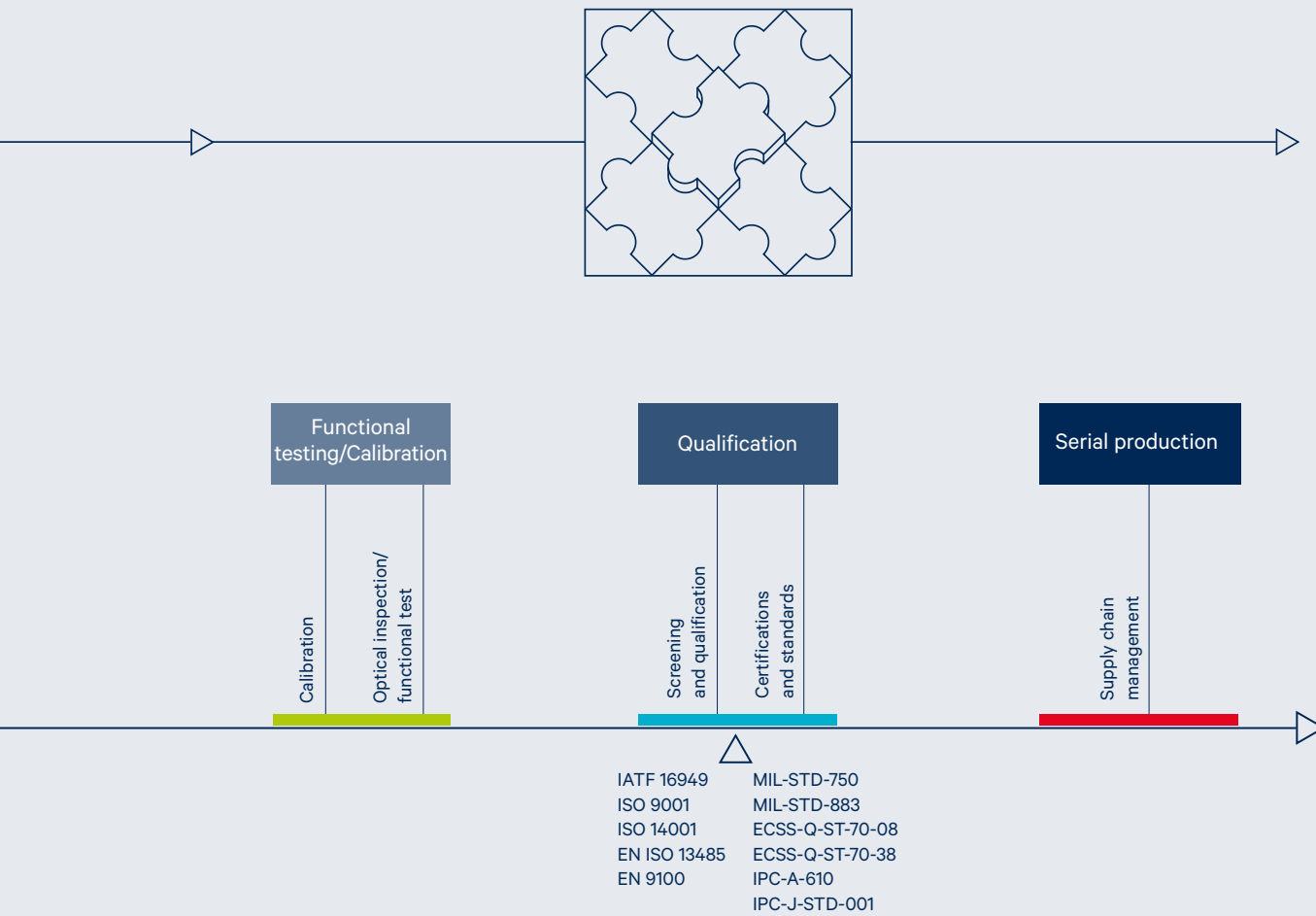


The reasons for this are manifold:

- 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

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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 IATF 16949 for the automotive industry)



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1 State-of-the-art production processes according to IATF 16949 (Photo: GiS pix)

2 Packaging technologies according to certified processes

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

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### The entire value added chain

WAFER + COMPONENT



SENSOR



SYSTEM



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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.

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# 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

# Intelligent mobility redefined

The joint, reliable partnership with you is the foundation for our high performance products and system solutions. We have many years of application and project experience and know the special requirements in the automotive and vehicle industry.

To ensure that in the future we also transport people and goods fast, safely and comfortably, smart sensors are needed. It is more and more important that this happens efficiently, with low-emission and resource-conserving too. This is why we are developing and manufacturing pressure sensors and cameras designed to withstand the toughest conditions: cold, heat or continuous vibrations for cars, trucks, busses, special vehicles as well as agricultural, construction and mining machines. We have the technology, capacity and experience to adapt and optimize our sensors to your individual requirements and markets. At First Sensor, the entire production process is implemented

as a coherent whole – from processing the sensor chips through to the prefabricated sensor or camera system. All customized pressure sensors and cameras are developed and manufactured in accordance with the quality management system for the automobile industry IATF 16949.

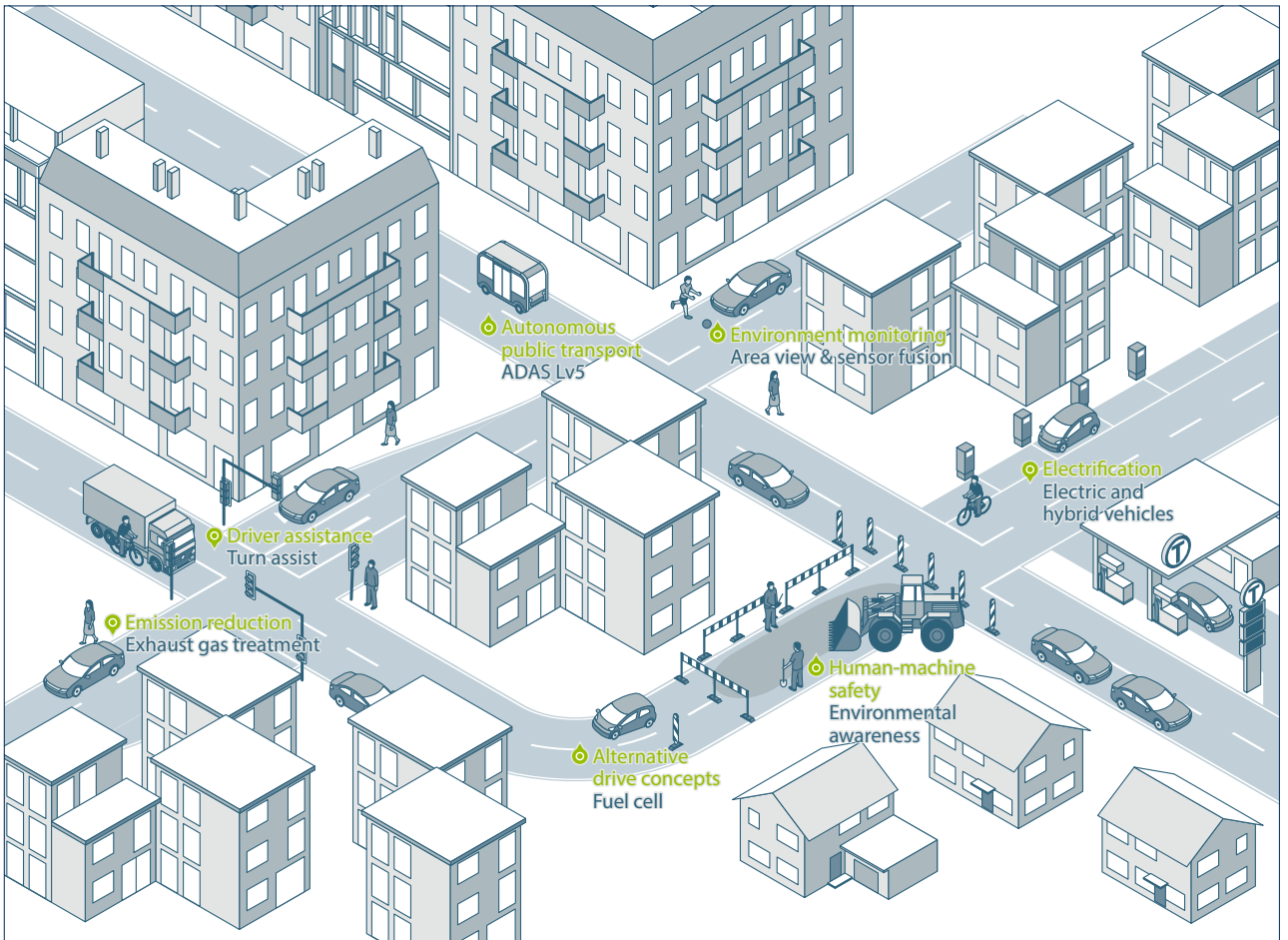
Our effective CMOS cameras are used in advanced driver assistance systems or agricultural and construction machinery, where they warn against obstructions, help to prevent lane departures and detect speed restrictions. That means our modular camera concept with various physical interfaces and data formats

saves you unnecessary development expenses when it comes to integration into your systems.

In addition to air and oil pressure, our compact pressure sensors for large series production also measure pressures in particularly demanding media such as hydrogen, urea solution and various fuels. The sensors are available in different pressure ranges from vacuum to high pressure and with customized electrical connections and pressure connections. In addition, we offer a variety of analog and digital interfaces.







Flexibility in the supply chain is set to 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 a perfect sensor solution from First Sensor for your specific application in automobile and vehicle technology.

1 State-of-the-art production processes in packaging technology (Photo: GIS pix)

# Advanced driver assistance systems – ADAS

Driver assistance systems both increase the safety and efficiency of motor vehicles, commercial vehicles and special vehicles and shape the mobility of tomorrow. Thereby highly resilient and reliable cameras, optical sensors and LIDAR systems are essential for applications such as reversing aid, adaptive cruise control (ACC), traffic sign recognition, blind spot detection, blind spot assist, lane departure or warning 360° all-round view. First Sensor supplies OEMs, integrators and retrofitters at various levels of the value chain from components to modules and complete systems.

## Advanced driver assistance systems

Advanced driver assistance systems support the driver with additional information, warn against potential dangers and spare you the effort of dealing with certain tasks. Statutory regulations are increasingly stipulating advanced driver assistance systems as a mandatory component in cars, trucks as well

as commercial and special vehicles. Automobile manufacturers throughout the world are currently developing the next generation of advanced driver assistance systems – self-driving cars that can steer, accelerate and brake fully autonomously.

Vehicle applications place high demands on the reliability and resilience of the sensors used. Vibrations, dirt, moisture or extreme

heat or cold must not influence the specifications of the systems used. In addition, it must be possible to integrate the cameras and sensor systems easily and flexibly in advanced driver assistance systems and vehicle electrical systems. If different sensor technologies are combined and for example camera and LIDAR data is fused, this considerably increases the range, accuracy and reliability of the driver assistance system.



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**1+2** Resilient cameras, optical sensors and LIDAR systems for advanced driver assistance systems – ADAS



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### **First Sensor camera solutions for ADAS**

First Sensor develops and manufactures robust digital HDR CMOS cameras for advanced driver assistance systems in cars, trucks as well as agricultural, construction and mining machines. With their large dynamic range, the cameras are ideally suited to poor light conditions and major differences in brightness. The automobile cameras provide a wide range of digital interfaces. Our Embedded Control Unit is also the perfect platform for combining not only cameras but also other sensor signals such as RADAR and LIDAR (sensor fusion). With its ECU, First Sensor also offers a flexible platform for implementing custom software. All systems are subject to the IATF 16949 quality management system.

### **First Sensor OPTO solutions for LIDAR systems**

For distance measurement and generation of three-dimensional images of the environment, LIDAR systems are integrated ever more frequently into vehicles and mobile machines. A pulsed laser beam measures the signal's transit time from the object back to the detector. To measure the light pulses in the nanosecond range, First Sensor offers highly sensitive avalanche photodiodes (APD) 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. Standard products are available with linear 8 or 16 pixels and matrix configuration using 5 × 5 or 8 × 8 pixels. Custom specific arrays can be designed and optimized to your specific application.

The development module from First Sensor can be used to address, demonstrate and validate your own specific LIDAR application. All processes such as APD manufacturing, APD packaging, circuit development, final assembly, final testing and automotive qualification are covered in-house. This enables maximum design flexibility for your LIDAR system with respect to environmental conditions, bandwidth, sensitivity, data processing, integration of optics and filters as well as field of view.

Already today, First Sensor is setting the course for the next development step – its own LIDAR systems, which integrate the laser, detector and the optics in a single automotive qualified component in a confined space and manage without mechanically moving parts.

# OEM pressure sensors

First Sensor develops and manufactures innovative and reliable OEM pressure sensors for integration in motor vehicles, commercial vehicles as well as construction and agricultural machines, which can be adapted to your individual customer requirements with a high level of application expertise. By manufacturing all central components ourselves, we ensure the long availability of all products for series production and the aftermarket.

## OEM pressure sensors

The number of sensors in modern vehicles and mobile machines is continually increasing. Sensors supply the measuring values for the electronic control units and are therefore an essential component for the safe, comfortable and economic operation. The extreme conditions in automobile applications such as heat,

cold, continuous vibrations and aggressive media place high demands on the reliability and resilience of sensors. At the same time, the sensors need to be small, energy saving and cost effective.

All custom OEM pressure sensors are developed and manufactured in accordance with the quality management system for the automobile industry IATF 16949. Requirements for the classification of the ASIL according to ISO 26262 as well as the technical cleanliness ISO 16232 can also be implemented.



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- 1 OEM pressure sensors for the safe, comfortable and economic operation of cars
- 2 High pressure sensors for hydraulic applications

## First Sensor solutions for fuel applications

Our OEM pressure sensors for fuel applications are used for tank pressure measurement, tank leakage diagnostics and fuel delivery and optionally come with an integrated temperature sensor. The sensors are installed on the tank wall or directly in the tank, where they are completely enclosed by fuel or fuel vapors. For measurement in the tank, we offer patented technologies and processes that enable space-saving, maintenance-friendly and cost-effective sensor solutions. The sensor can also be mounted on components of the fuel supply system such as the tank flange or fuel line or can be directly integrated into the fuel delivery module. Our highly accurate low pressure sensors are used for leakage measurement, as they are able to detect minimal pressure changes in the fuel tank. To regulate the tank air intake and extraction, pressure sensors from First Sensor monitor negative pressures and overpressures in the fuel tank.

## First Sensor solutions for reducing exhaust gas emissions

A raft of new legislation has been enacted to promote the worldwide, continued reduction of the exhaust gas components  $\text{CO}_2$  and  $\text{NO}_x$ . For diesel vehicles, systems designed to reduce  $\text{NO}_x$  are already being mass-produced for commercial vehicles and cars. But the pressure is on to reduce  $\text{CO}_2$  emissions from gasoline vehicles, too. This is being accomplished through the use of water injection, a technology already deployed in motorsports, where it is undergoing intensive trials. For both applications, we offer the sensor technology required for monitoring system pressures. In frosty, dirty or corrosive environments, our sensors offer a range of benefits over rival products. Whether fully integrated or directly line-mounted, our sensors reliably measure and transmit analog or digital signals over the entire service life of the vehicle.

## First Sensor solutions for the technology of the future

The future of the automobile will affect millions. Will we be driving all-electric vehicles in the future? Will our vehicles be equipped with fuel cells? First Sensor develops sensor solutions for the applications of tomorrow. Fuel-cell vehicles need high storage system pressures in order to achieve the required energy density. Our products featuring patented senseEdge® technology offer not only outstanding burst pressure behavior and hydrogen compatibility but also a high degree of accuracy and long-term stability. For battery-driven vehicles, we develop sensors designed to monitor coolant pressures. For electrohydraulic power-assisted steering, we offer high-pressure sensors with multiple pressure connections for measuring different pressures and temperatures.

# Smart assistants – the revolution in mobility applications

Demand for safety and comfort in the area of mobility is increasing. State-of-the-art, high performance assistance systems and safety functions are nowadays important selling points, as well as distinguishing features of different manufacturers in their competition for customers.

Whether default or personalized, we develop and manufacture reliable cameras, LIDAR, RADAR and pressure sensors for a diverse range of mobility applications on the basis of the applicable sector standards

and norms. We also do this for small batches and special vehicles, with great variety in terms of resolution, connections and size.

With our flexible embedded control units (ECUs), we can also offer you an intelligent platform that integrates various sensors – proprietary sensors as well as third-party ones. This takes the strain off your development team, reduces development times, creates flexibility and ensures redundant interaction of sensor modules in the vehicle.

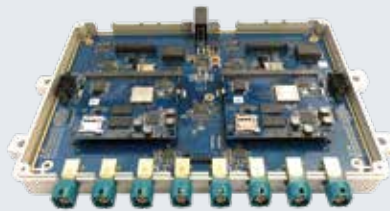
## Optical sensors for advanced driver assistance systems (ADAS)

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### CMOS cameras

- Rugged digital HDR CMOS cameras
- Programmable VGA CMOS cameras
- Standard cameras
- Custom development and production



### Embedded Control Unit

- Multiple sensor input
- Sensor fusion
- SW platform



### Optical sensors for LIDAR

- Avalanche photodiodes (APDs)
- APD hybrids
- Development modules

## Pressure sensors for eco-friendly vehicles

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Tank pressure and leakage detection sensors (OBD)



Frost-resistant sensors for exhaust gas treatment with AdBlue and water injection



Hydrogen (H<sub>2</sub>) pressure sensors for fuel cell cars

## Applications of our CMOS cameras and optical sensors

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### Turn assist

with blind spot recognition

### Multiple front cameras

Object recognition, far and near  
ASIL conform



### Night vision / sensor fusion

360° area view camera systems  
ASIL conform

### Active brake assist / ACC

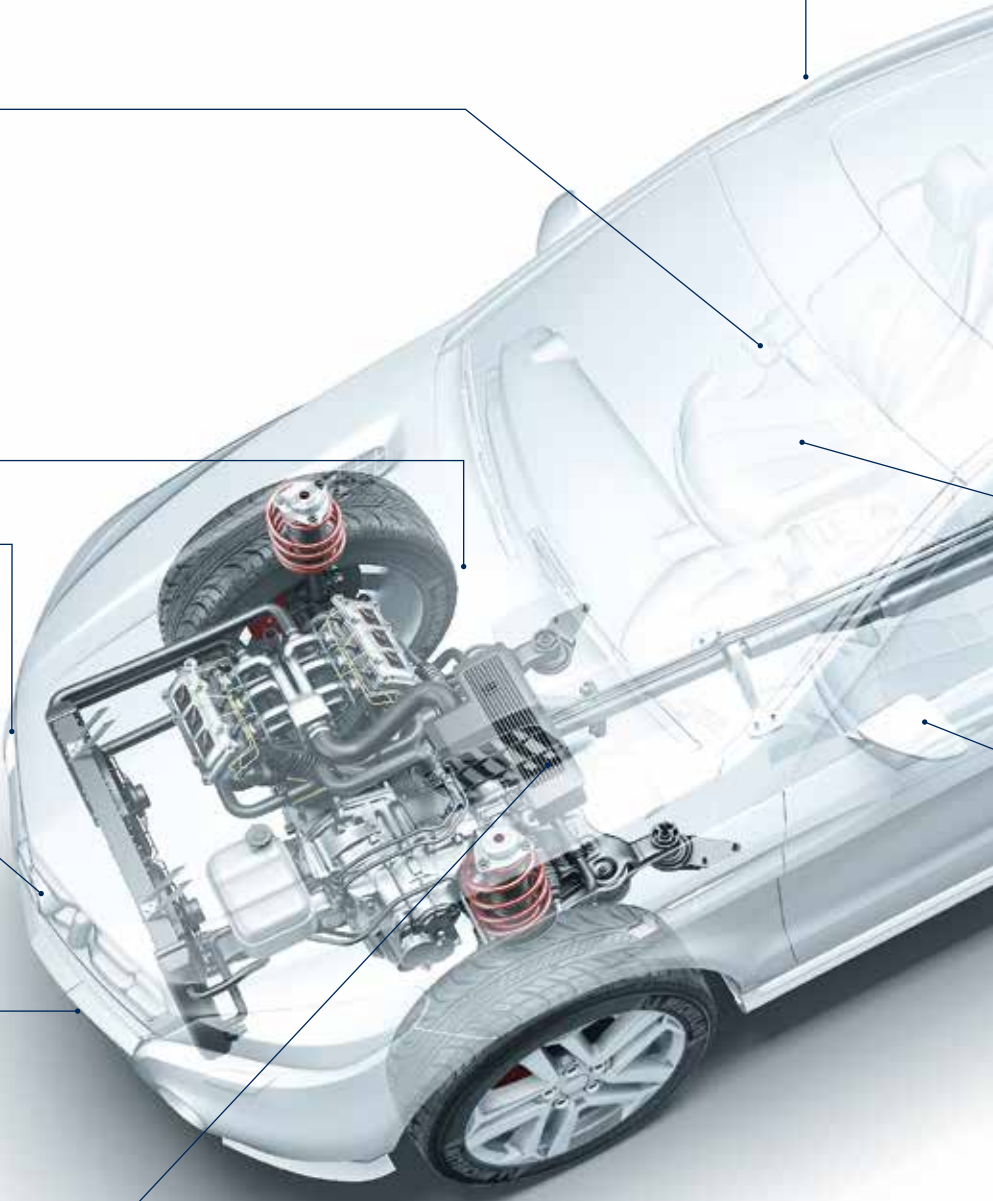
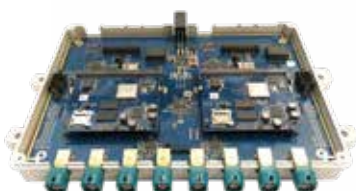
Adaptive cruise control  
Emergency break control  
Accident reduction  
Night vision



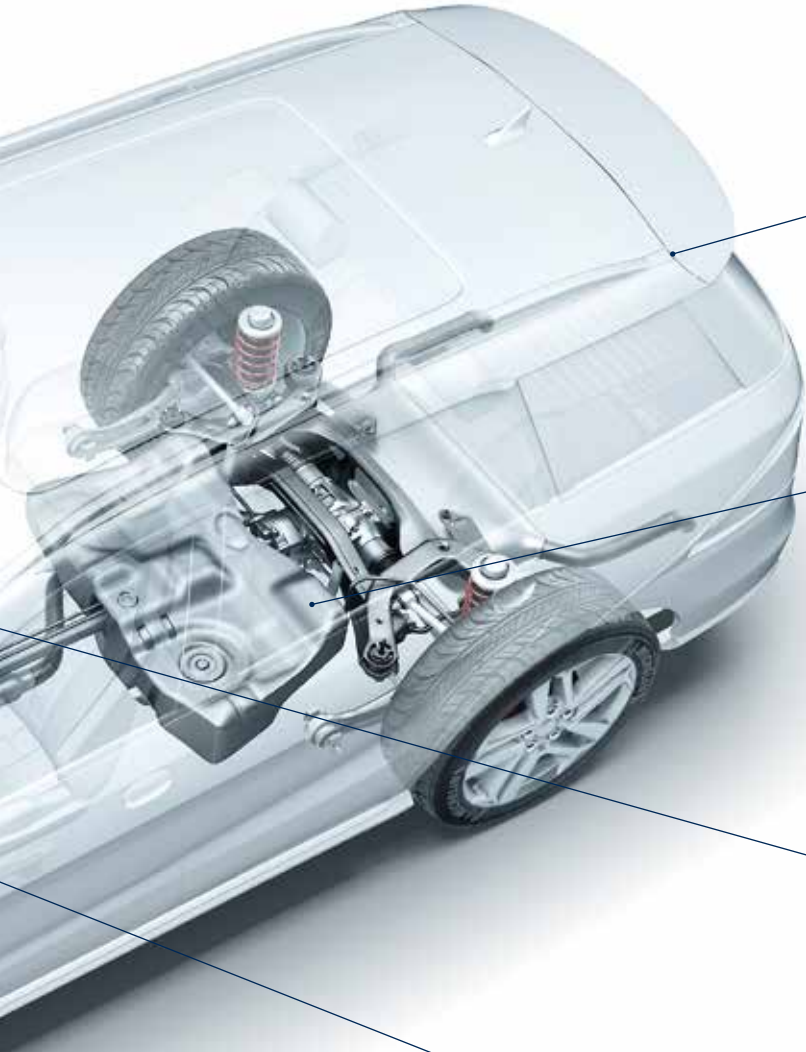
### Cross traffic assist

### Embedded Control Unit

Area view  
Sensor fusion  
HW & SW platform







**Smart rear camera**

Park assist, trailer assist,  
self-parking, night vision



**Pre-crash-side assistant**



**Interior camera**

Driver monitoring,  
gesture recognition

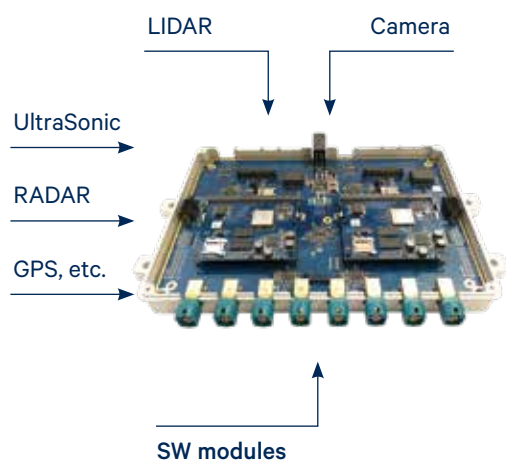


**Mirror replacement rear**

High resolution and HDR,  
blind spot detection

## CMOS cameras and Embedded Control Unit

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 customer-specific requirements.



### Embedded Control Unit (ECU)

The Embedded Control Unit from First Sensor is the latest technology for advanced driver assistance systems and is based on our many years of experience in the development of CMOS cameras for the automotive industry. The ECU is a flexible platform not only for connecting multiple cameras but also for fusion with additional sensors such as ultrasonic, RADAR and LIDAR sensors. Software modules featuring basic functions such as object detection algorithms or overlays are provided and can be expanded according to customer needs. With First Sensor Area View application, the ECU provides real-time images both from a bird's-eye view and from any angle in a 360° all-round view. The hardware and software application architecture meets requirements for embedded systems, e.g. with regard to real-time capability and security. The system was developed in accordance with Automotive SPICE (ISO/IEC 15504-2) process rules and fulfills the Automotive Safety Integrity Level (ASIL) risk classification scheme.

Parameter	Special features
Interfaces	LVDS FPD-Link III, ETH, USB, CAN, CAN FD, LIN Video: HDMI, SDI > up to four independent video outputs
SW modules	Modular software in accordance with Automotive SPICE
Diagnostic functions	ASIL support

## Rugged digital HDR CMOS cameras

The BlueNext 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	Special 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

## Programmable VGA CMOS cameras

These analog cameras with a screw thread are especially designed for mobile video surveillance applications. A programmable interface allows individual settings of brightness adaptation and mirror functions. In addition, the rugged housings protect the cameras against the ingress of water and dust.



Parameter	Special features
Memory	8 KB flash
Input voltage	12/24 V <sub>DC</sub>
Current consumption at 12 VDC /30 fps	55 mA
Data interface	Analog (PAL/NTSC)
Operating temperature	-40 ... 105 °C

## Optical sensors

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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, and infrared light. Package solutions include surface mount (SMD) and through hole (THD) devices.



### 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 e.g. with 8, 16, 5 x 5 or 8 x 8 pixels.



### APD 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.



### Development modules

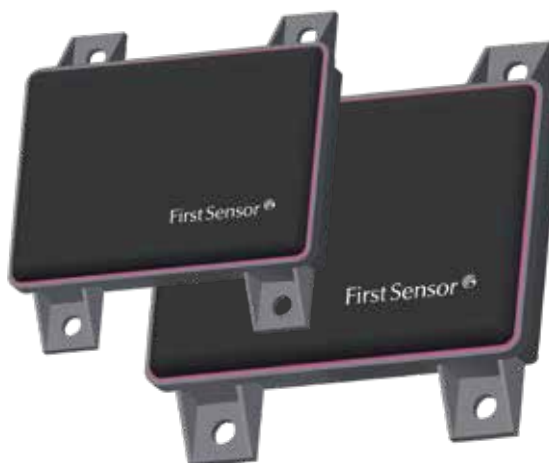
Development modules for APD arrays from First Sensor provide fast test runs in research and development as well as easy integration into OEM LIDAR devices. They feature a temperature compensated high voltage supply and highly accurate amplification in order to achieve excellent APD signal quality. Our development modules can be adapted to your specific application, for example as development boards with digital output signal and LVDS interface.

## RADAR sensor technology

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First Sensor offers a range of platform solutions for high-frequency RADARs that can be used for surroundings detection and collision avoidance. The sensors are designed for short-, medium- and long-range measurements in the 77 GHz frequency band. The sensor platform covers applications in both the mobile and stationary sectors. In combination with our Embedded Control Unit, the signals from the RADAR sensors can be fused with image information from the CMOS cameras and other sensors and further processed. That means that in addition to simple distance measurement systems, complex multisensor systems (ADAS) with object detection and redundancy can be implemented in anticipatory and safety-relevant applications.

Parameter	Features: short and medium range	long range
Dimensions	90 × 70 × 30 mm	125 × 100 × 50 mm
Distance	75 m / 150 m	250 m / 300 m
Angle (FoV)	±45° bei 75 m ±30° bei 150 m	±10° bei 300 m
Angular resolution	<0,5°	<0,15°
Power consumption	5 W	9 W / 13 W
Operating temperatures	-40 ... 85 °C	
Operating frequency	76 ... 81 GHz	
Safety (optional)	ASIL B (D)	



## Applications of our OEM pressure sensors

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### Tank pressure

(pressure and temperature)



### Adaptive shock absorbing system



### Common rail injection

(pressure on fuel high pressure storage)

### HVAC

(combination pressure/temperature)



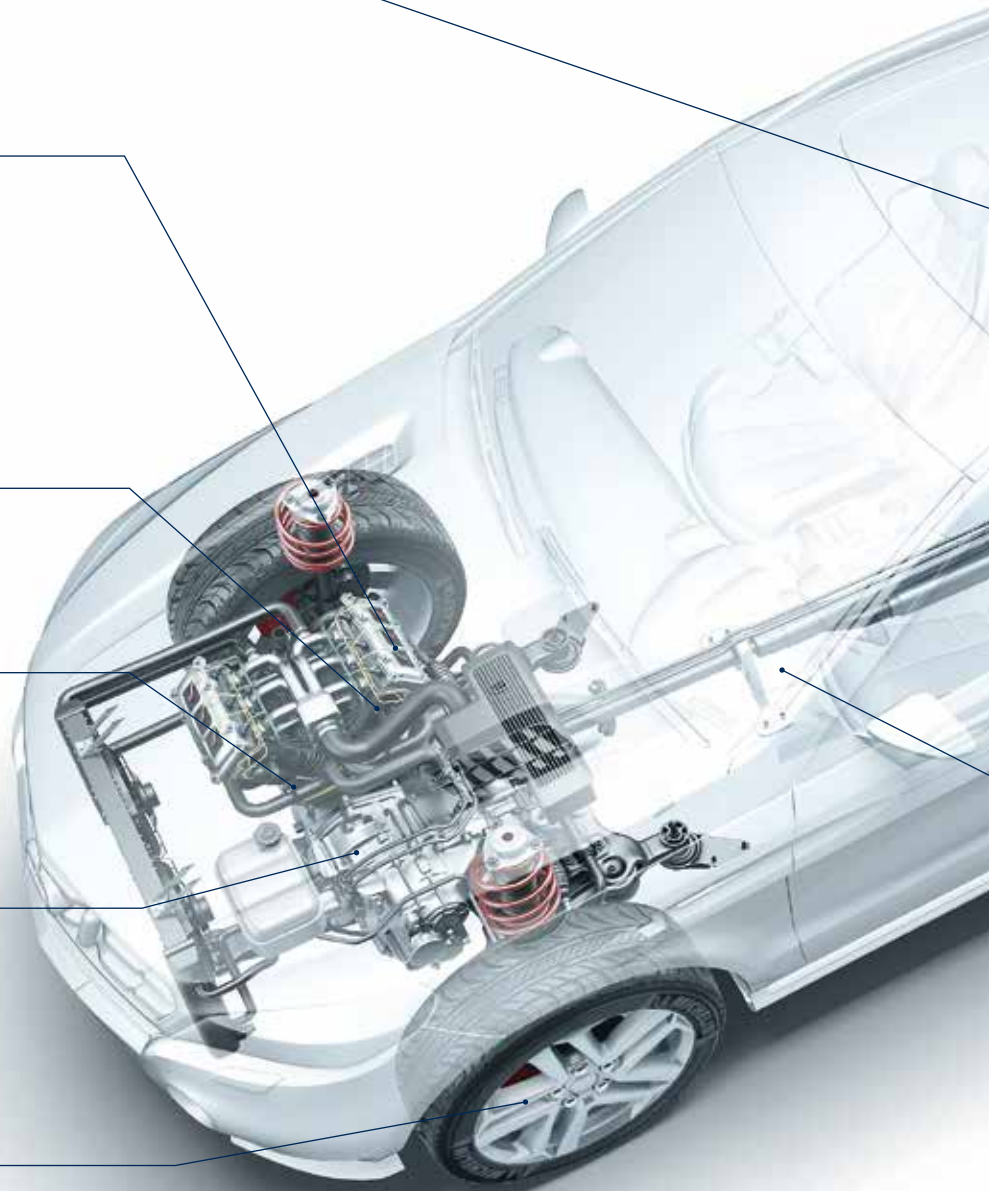
### OPS/DSG gearing

(oil pressure measurement)



### Brake application

(vacuum pressure, force/pressure for electrical brake, ABS/ ESP)





**Pump pressure**

(on-board diagnostics,  
leakage measurement)



**Fuel cell**

(hydrogen storage  
pressure)



**SCR**

(selective catalytic reduction)

**DEF/AdBlue**

(diesel exhaust fluid)



**Electro-hydraulic steering**

(multiple-pressure  
measurement)



## 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 as well as the aftermarket.



### Pressure sensors for fuel tank and pump pressure

First Sensor offers sensor solutions for all fuel tank related measurement tasks. Known for their media resistant design our sensors help you to decrease emissions as well as fulfill OBD regulations. Whether mounted inside the tank or outside of the tank - with their wide temperature and pressure range this sensor portfolio can offer the tailored solution for your application.

Parameter	Specification
Pressure range	-0.2 to 11 bar
Pressure mode:	Absolute, gage
Output signal	Analog voltage, LIN, SENT
Temperature range	-40 to 90 °C
Accuracy	< 0.5 %FS to 2 %FS



### Frost-resistant pressure sensors for SCR applications and water injection systems

With First Sensor's brand-new range of pressure sensors for SCR and WI, we offer our customers frost-resistant, high-accuracy sensors with outstanding burst pressure and defrost behavior, helping our customers to fulfill current and future requirements regarding vehicle emissions.



Parameter	Specification
Pressure range	0 ... 11 bar
Pressure mode:	Gage
Output signal	Analog voltage, LIN, SENT
Temperature range	-40 ... 125 °C
Accuracy pressure	±1,5 %FS



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## Hydrogen (H<sub>2</sub>) pressure sensors for fuel cell cars

Alternative drive systems are the business of the future. First Sensor is on board with high and medium pressure sensor solutions for fuel cell cars. With senseEdge® First Sensor offers a technology that is resistant to hydrogen embrittlement which supports you to achieve the strong safety requirements. The required pressure and burst resistance is widely exceeded by our hermetic metal design.

Parameter	Specification
Pressure range	16 to 900 bar
Pressure mode:	Gage
Output signal	Analog voltage, LIN, SENT
Temperature range	-40 to 130 °C
Accuracy	0.5 %FS



## Pressure sensors with multiple ports for electrohydraulic steering

For safety relevant applications such as electrohydraulic steering First Sensor produces and develops pressure sensors with multiple ports to achieve the necessary ASIL requirements. The versatile design options of our senseEdge® technology enable the decoupling of the pressure ports from the ground plate to achieve higher sensor accuracy.

Parameter	Specification
Pressure range	<10 to 120 bar (3000 bar)
Pressure mode:	Gage
Output signal	Analog voltage, SENT
Temperature range	-40 to 150 °C
Accuracy	1 %FS



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