PHOTONICS NEWS

LASER COMPONENTS USA, Inc. Magazine #42 ▪ 12|18 laser-components.com

Autonomous Driving

Automotive Manufacturing

Mobile Emissions Monitoring

New Products

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February 05–07, 2019

Race to the Future

Technology is moving fast and the development of LiDAR for autonomous vehicles is moving quickly with it. LASER COMPONENTS is taking the road ahead, keeping up with the demands for laser ranging and detection safety features and enhancing a healthier environment with the monitoring of emission. Vehicles of the near future will include a myriad of sensors to interact with the environment, other transportation vehicles, people, and infrastructure; and creating an awareness that reduces stress in regards to collisions.

As a company interacting with the technology and moving it along, we also look forward to interacting with you at our upcoming Photonics West, 2019 booth. We welcome you to stop by and learn more about these components that are transporting us in the industry. Or learn more at our full-day industry workshop where we will cover the specifics of lasers, optics, and detectors for the most advancing photonics applications. If you're looking to join the race, start with us at booth #1751.

Ready, set, go!

Gary Hayes
CEO/General Manager, LASER COMPONENTS USA, Inc.

LASER COMPONENTS
www.laser-components.com

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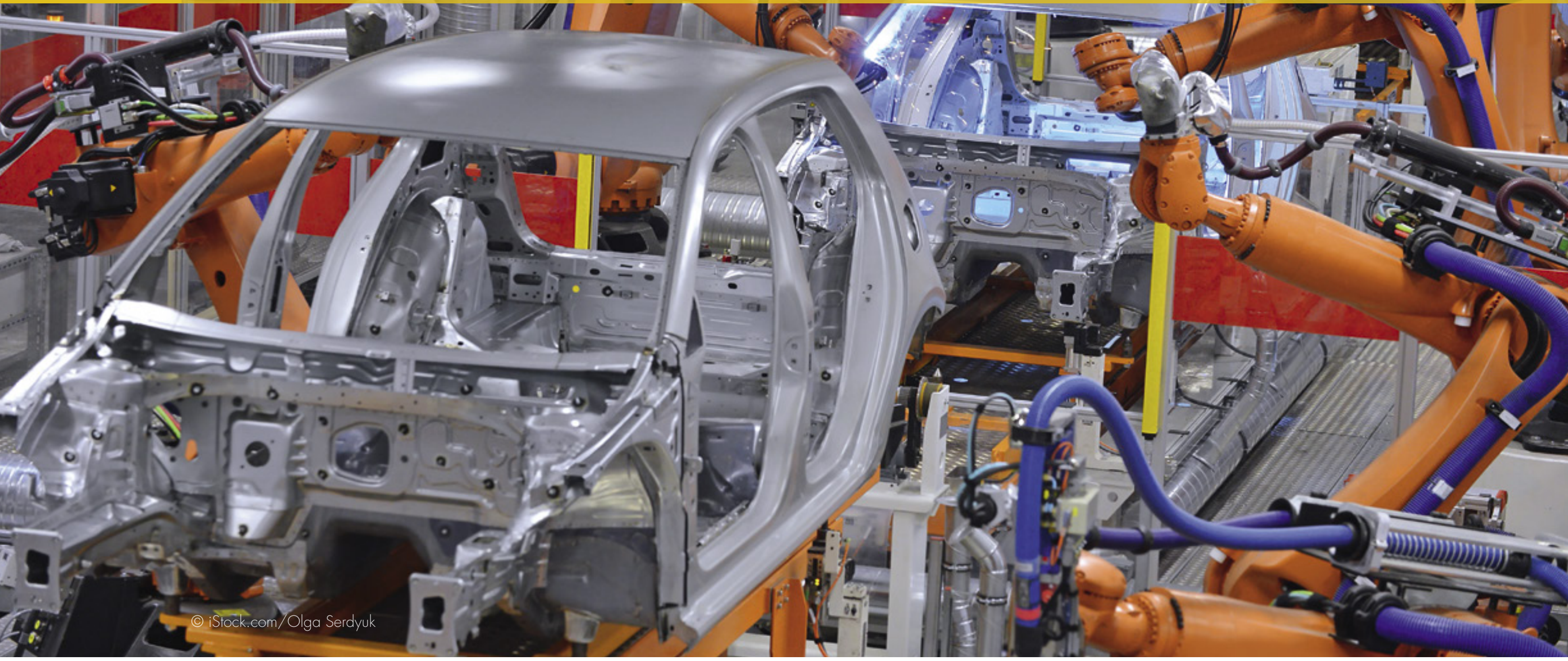
LASER COMPONENTS USA, Inc.
116 South River Road, Building C
Bedford, NH 03110, USA
Phone: (603) 821 7040
Fax: (603) 821 7041
www.laser-components.com
info@laser-components.com



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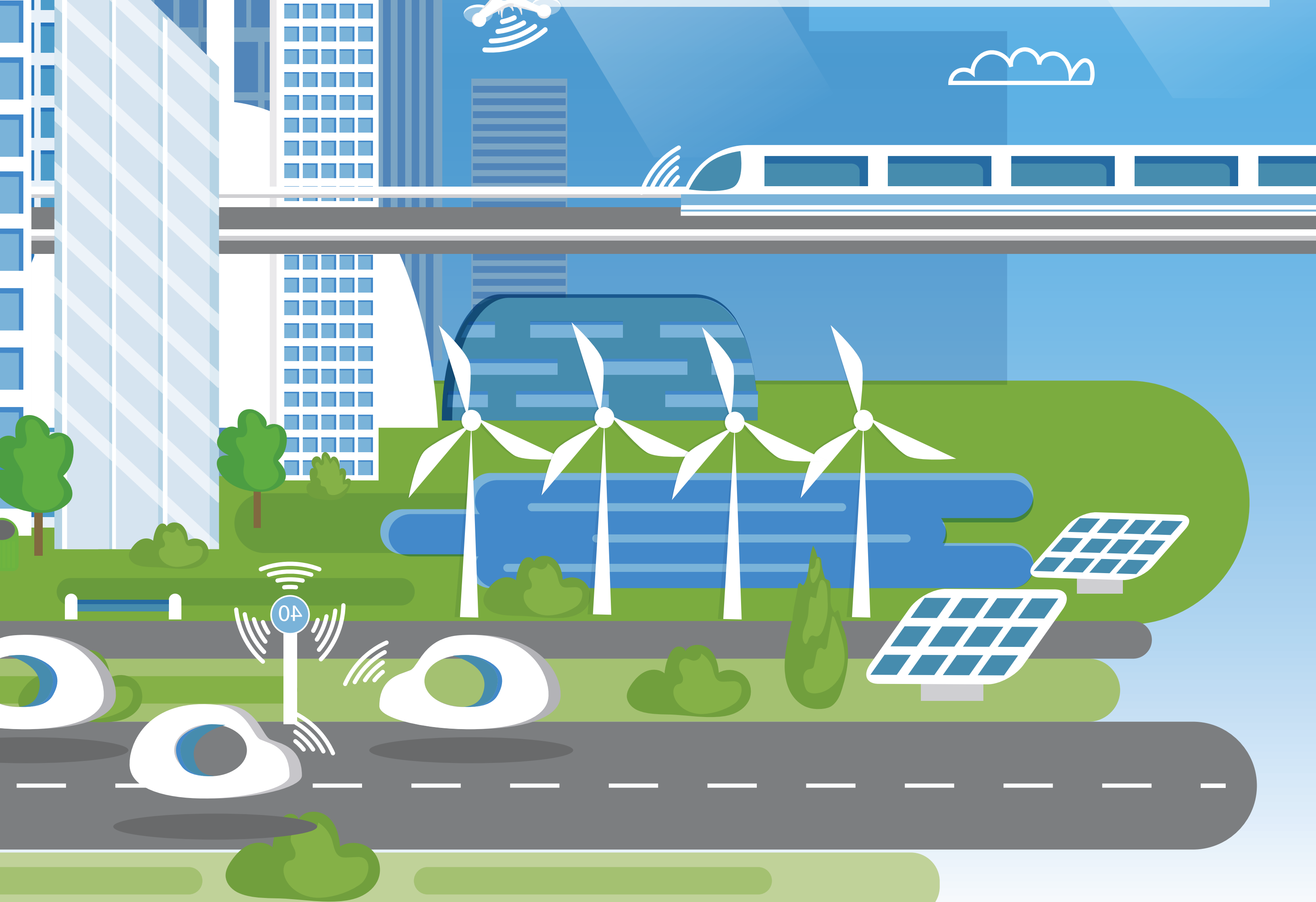
Drive My Car

On the Road to Self-Driving Cars

My Car and How It Sees the World

In the world of science fiction, self-driving cars are practically standard vehicles. In "real life," we are catching up fast with authors' imaginations. Even today, it seems as if a new warning system is being added every year. Lane departure warning systems and distance and parking assistants are already available in mid-range cars. At least in stop-and-go mode, higher-priced models practically drive themselves. Does that mean commuters have time to take a little nap in the daily morning traffic jam? The technology is not quite there yet, but there is real competition among car manufacturers on the road to autonomous driving.

Whenever this automotive future begins, one thing is certain: so-called vehicle-environment sensor technology will play a major role in achieving this next step because in order to independently steer through traffic, the vehicle must be able to keep an eye on its surroundings at all times. Many of the solutions are already being used in assistance systems today. There is astonishing technological diversity because each of the measurement principles used has its advantages and disadvantages. The spectrum ranges from electromagnetic to acoustic to numerous different optical systems. As an outsider, you can lose track of these innovations: ➔



A Bat in the Car?

Locating objects and navigating by ultrasound has been seen before in nature. The most well-known example is bats. They emit ultrasonic waves and can recognize prey and obstacles by means of a reflected echo. Their maximum range is around twelve meters. The ultrasonic sensors used in cars function according to the same principle. The problem is that the artificially generated sound waves also have a comparatively short range; therefore, they can only be used at close range. The most well-known applications are distance meters for parking assistants.

The first models with this assistance system came onto the market in the early 1980s. Ultrasonic technology is now not only used at the rear of the car but with blind spot sensors or to measure the distance to the vehicle ahead at low speeds as well. In addition to the short range, engineers must also deal with external interference factors when developing ultrasonic-based assistance systems. The hydraulic brakes of trucks and buses, for example, also generate ultrasonic waves, which can cause acoustic confusion in sensors in the immediate vicinity.

A Car with Eyes

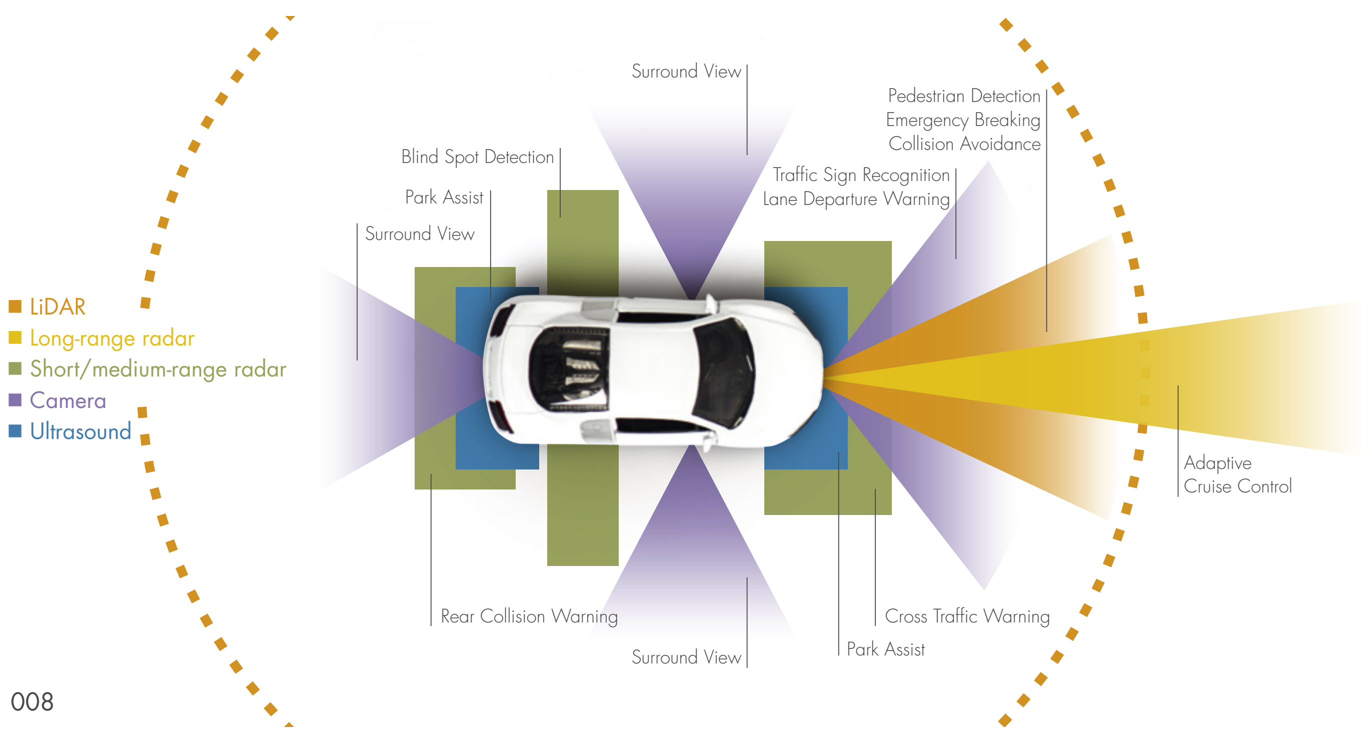
Camera systems probably come closest to imitating human perception. A camera installed in the car continuously records the vehicle's surroundings while in motion. Software interprets the data. It recognizes, for example, edges that might mean other vehicles or lane markings. As the resolution of cameras increases continually, more and more details can be evaluated. This enables the system to detect not only obstacles but traffic signs or traffic lights as well. This information helps to prevent accidents and contributes to orientation because the camera also recognizes details that are not recorded on the digital maps of common navigation systems.

There are two main problems with camera-based systems: the lack of three-dimensionality and the limited viewing angle. A single camera reduces the three-dimensional world to two dimensions. In an environment like street traffic, where there is a lot of movement, this can lead to a misinterpretation of data.

A person intuitively knows that objects appear larger as they come closer; however, a computer must first learn these correlations. It is also possible that an object becomes larger and larger at the same distance. In addition, the camera's field of vision is limited. While other systems with wide sensor beams scan the world, it can only ever look forward. A pedestrian who suddenly runs onto the road is often only recognized shortly before a collision. Both disadvantages can be overcome by using several cameras simultaneously, possibly with different focal lengths.

RaDAR or LiDAR?

RaDAR and LiDAR do not just happen to have similar "names." They are both used in detection and ranging; like ultrasonic detection, they are based on the analysis of reflected waves – except that in one case the waves are RAdio waves and in the other case LIght waves. This results in some differences, which are significant with respect to automotive sensors:



Radar: Frequency-Modulated Continuous-Wave (FMCW) radars, in which the frequency of the electromagnetic wave is constantly modulated in the form of a ramp, are commonly used in environment recognition. Using the doppler effect, the distance and speed of an object can be determined from the propagation time of the wave and the frequency difference of the reflected wave. To determine the position of an object, several antennas are arranged in crescent shapes. However, the lobes of the individual antennas are comparatively wide, which results in overlap. This gives the impression that the object jumps back and forth between the individual sensors. Radar does not provide any information about the size or shape of an object.

LiDAR: LiDAR measurements emit several thousand laser pulses per second. Each pulse lasts only a few nanoseconds. The distance to the obstacle can be determined by the difference in transit time between the outgoing signal and the incoming reflection, the so-called time of flight (ToF). Since pulsed laser diodes emit their beams at an interval of a few nanoseconds and – as we all know – nothing is faster than light, LiDAR provides reliable information in the shortest possible amount of time. Compared to other systems, however, the scanning field of a single transmitter-receiver unit is limited.

Looking for optimal field of view, different scanning systems are being evaluated, either mechanical or solid-state. The mechanical scanning systems use a rotating mechanism, galvo-mirrors or MEMs while solid-state systems use waveguides, phased arrays or meta-surfaces. There are a few new systems using the same FMCW method as in radar to obtain velocity and distance information in a return optical signal.

The LiDAR method works considerably faster than the radar method and provides a greater amount of precise data. Yet, the design of the LiDAR instrument has to consider atmospheric limitations like fog, smog and solar radiation. To solve the scanning and atmospheric conditions, each LiDAR method can optimize laser output power, change laser wavelength and radar frequency, or use multiple laser and detector arrays. The end result is to obtain object detection at greater than 300 meters in every conceivable driving condition.

Strength in Numbers

With automated – now referred to as autonomous – driving, nothing may be left to chance. While a human being can intuitively draw on his wealth of experience and intuitively react to situations, a computer must constantly make new decisions. To do this, it needs as much data as possible. Each sensor system can contribute to this decision with its specific advantages and disadvantages. There are prototypes that are only equipped either with cameras or exclusively with LiDAR. Most automobile manufacturers, however, rely on solutions in which several of the above-mentioned technologies are used simultaneously. This fusion enables them to make optimum use of the strengths of each process and benefit from synergistic effects. ■

Transmitter and Receiver from a Single Resource

WEB US42-950

LiDAR systems should be reliable, small, and cost effective at the same time. For manufacturers of laser-based measuring devices and optoelectronic components, this is a great challenge.

LASER COMPONENTS manufactures all components for powerful and future-oriented LiDAR solutions in its ISO-certified production facilities: pulsed laser diodes with ultra-short pulses provide better resolution for distance measurement. In combination with highly-sensitive avalanche photodiodes (APDs), even the smallest signals can be detected.

In addition, there is a cooperation with the Fraunhofer Institute for Microelectronic Circuits and Systems (IMS) for 1-dimensional and 2-dimensional CMOS-SPAD arrays. The researchers from Duisburg can contribute new sensor technologies that promise particularly precise measurements. ■

Matt Robinson: lasers@laser-components.com

Lasers Easily Make Tough Measurements in Automobile and Aircraft Manufacturing

Misalignment: A Matter of the Past

As creative innovators in the automobile and transport industries continue to drive for new solutions to old manufacturing problems, dot, line and patterned laser modules continue to move technology into the future. Where rotational wobble threatens with wear, tear and lowered performance efficiency, the exactness of the dot or line laser can quickly ensure optimal alignment in the manufacturing process. Where gaps and seams threaten mechanical integrity, the line laser can raise the flag before the problem leaves the factory. In an era where superior engineering is signified by alluring body design, the ideal 3D form analysis can be generated by the right diffractive optical element and laser module.

Let's take a closer look at these scenarios. ➔

Dot Lasers for Alignment Tasks

How many different ways can a part on an automobile or aircraft wobble, vibrate, deflect, compress, disconnect and so on? Mechanical tools necessarily take mechanical operation and that may add variability, uncertainty or take extra production steps. The linearity of the dot laser beam can turn a minute into a micro-second. When used with a low-cost photodiode as an on/off detector, the dot or line laser can instantly red flag or even quantify vibration, wobble or mechanical tolerancing of tooling and parts. Alignment feedback loops can automate alignment adjustments or let you know when your tooling is correctly set up and ready to go! This can change your process from money spent into money saved.

Gap Measurement Using Line Lasers

Now let's take a closer look at using a line laser for gap measurement. Gap measurement is an important part of manufacturing control. The presence and size of gaps can have a big impact on the performance of products, especially in the automotive and aircraft industry. Out of control gap tolerances can cause safety risks or engine efficiency loss that rank your automobile too far down the list. Cosmetic problems on the outside tell the customer what's probably happening on the inside. There isn't a big market for luxury cars which have lots of wind or vibrational noise along with leaky door seals.

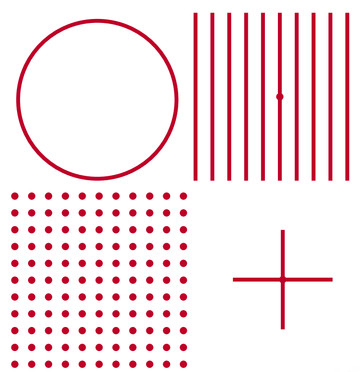
Traditional methods of gap measurement involve mechanical tools such as taper gages, slip gauges and Vernier calipers. These have numerous shortcomings such as low repeatability, a requirement for skilled labor, the need to record measurements and the risk of damage to the measured parts. Using a line laser module as a non-contact measurement solution eliminates these troubles. When used with a camera, this tool measures a gap quickly, providing instant feedback and data that can be logged immediately into process run and control charts.

Line laser technology for gap measurement has been used by manufacturers of aero engines to measure and record the gap between the end of the turbine blades and the casing. This parameter was identified as the leading cause of inefficiency, unreliability and noise production. Monitoring this gap with laser precision enabled an otherwise complex measurement to be made simply so that design improvements could be controlled and quantified.

Automotive manufacturers have also utilized line lasers to improve their output by taking multiple gap measurements of panel fit while vehicles are moving through the production line. This has allowed significantly more measurements to be made without the need to slow down the manufacturing process. Customers experience less vibration and wind noise in a vehicle that looks as good as it performs.

Pattern Generators

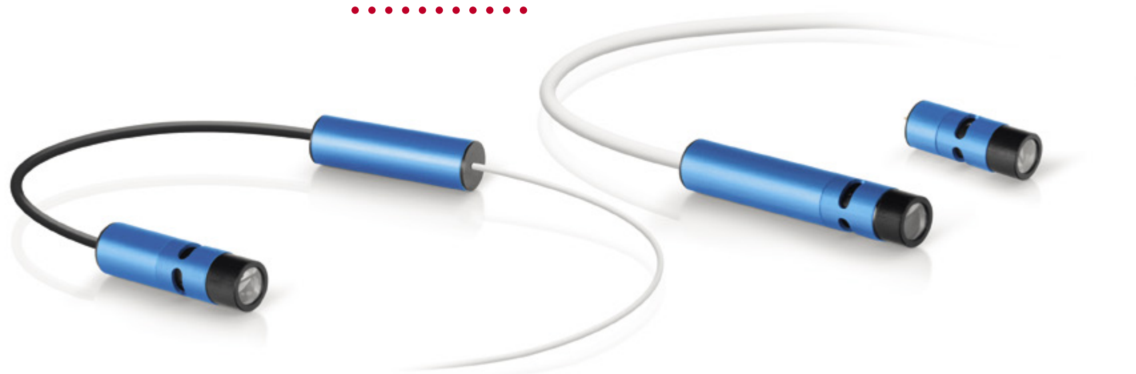
Let's finally take a look at the use of a diffractive optical element with a laser module. Body shapes on cars, aircrafts and their components have become more advanced than ever with appealing contours and mathematically complex forms. The ability to computer model and design shapes that cut wind resistance and look fantastic mark a new era in intelligent design and manufacturing. It would make sense to use a metrology technique that ensures that a design is brought to its fullest realization. Diffractive optical elements are designed to generate a unique pattern that can help you measure the geometry of your art.



Sometimes a grid of dense lines, a circle, parallel lines or a simple dot matrix will give you the best spatial measurement gage to inspect the form of your manufactured vehicle or aircraft against your computer model. The measured results can put your customer in an automobile or aircraft that looks great and has known superior structural integrity and safety.

Advanced Manufacturing

The future of mechanical design is at hand and laser modules are the measurement tools that provide the linearity, spatial dimensions and metrological surety that will establish your design as the standard of excellence and the customer's choice. ■



FLEXPOINT MVnano – Compact and Flexible

WEB US42-074

The FLEXPOINT MVnano range of line laser modules is an ideal component when designing a non-contact, quick acquisition and data logging sensing instrument. When viewed by a linear detector array or camera the projected laser line is absent across the gap. Once calibrated the absent image can be assigned to the physical width of the gap.

Monitoring such gaps utilizing the FLEXPOINT MVnano aids for such improvements in a much quicker and less skill intensive way than would have been possible using other means.

With three different product variations and numerous options, the FLEXPOINT MVnano module is particularly versatile. ■

Kelly Child: lasers@laser-components.com

E-Mobility Requires Lasers and Digitization

Electromobility is more than just a trend; it is on its way directly to the mass market. Companies such as the laser specialist TRUMPF see it as a great opportunity for both themselves and the industry because automobile manufacturers need innovative technologies for mass production. They require robust processes that can be quickly scaled from today's low production volumes to mass production. This calls for expertise in two areas: laser technology and digitization. Laser technology can efficiently and affordably manufacture the key components of electromobility, such as electric drives, power electronics, and batteries. Digitization is necessary to meet the production requirements of the automotive industry – maximum utilization of capacity and maximum flexibility.

Electric mobility is on the rise worldwide. In 2017, more than one million electric cars were registered for the first time over the course of one year. This amounts to 57 percent more than in the previous year. China is the front runner with around 60 percent of all new registrations, followed by Europe and the U.S. Delivery services and logistics service providers all over the world are also converting their fleets to emission-free electric vehicles. Stringent emission standards and the demand for better fuel mileage suggest that the number of e-cars will continue to increase.

The growing demand for electric mobility is also becoming apparent at TRUMPF: every tenth euro of the Germany-based high-tech company's sales in the automotive sector can be attributed to battery production – and the trend is rising. "We have the right manufacturing processes in place to economically manufacture the central components required for mobility in the future: Only lasers can produce electric drives, high-performance electronics, and batteries in series so flexibly and at such a top level of performance," says Christian Schmitz, chief executive officer of laser technology at TRUMPF. ➔

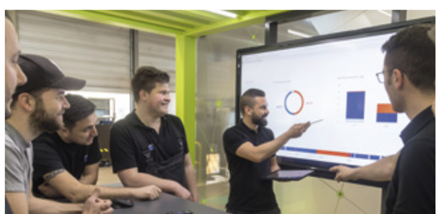
e-mobility

New Hairpin Technology Reduces Cost of E-Motor

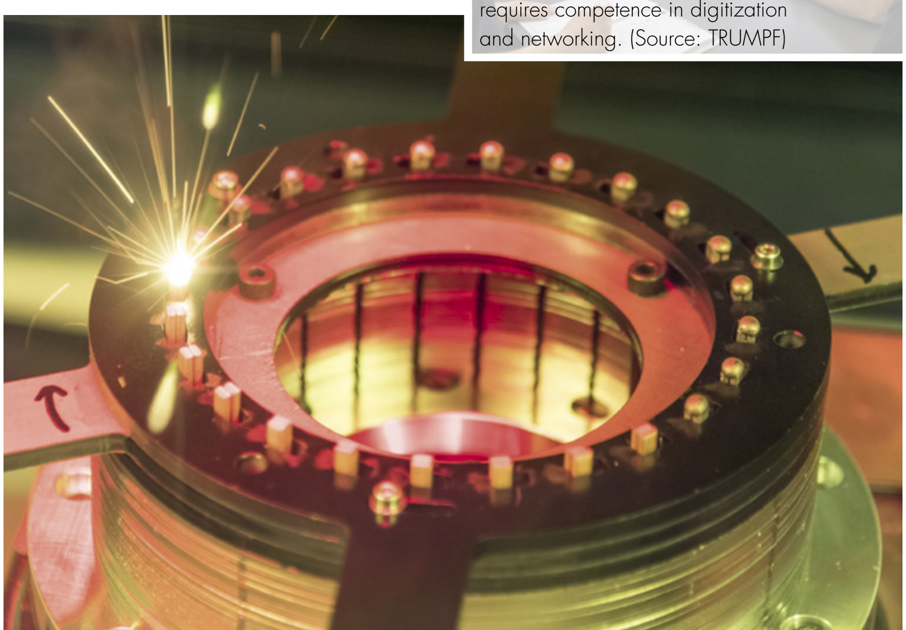
Automotive manufacturers are increasingly relying on so-called hairpin technology for electric motors. To generate a stable magnetic field, the stators (i.e., the immovable parts of an electric motor) are typically wound with copper wire. Each individual groove of the carrier unit is wrapped – the way a knitting needle is used. Due to the thick copper wires, this is too complex and time-consuming for strong electric motors designed to drive a car. In the hairpin process, a compressed-air pistol shoots preformed "hairpins" made of rectangular copper wire into grooves at the edge of the motor. The wires are then wound together and welded. The highest precision is required to maintain the electrical conductivity of the copper. Such clean and precise welds can only be achieved with lasers. "With our welding process for the hairpins, we ensure that electric motors can be manufactured quickly, safely, and cost effectively. The costly and time-consuming winding of coils with thick copper wires for strong electric motors is no longer necessary. This makes mass production considerably easier," says Schmitz.

"Green Technology" for High-Performance Electronics

The designers relied on copper not only for the engine. While a 24-volt battery sufficiently powers the complete electronics of a combustion engine, voltages of around 800 volts are quickly generated in an electric car. To withstand this load, the designers use the excellent heat and power conduction properties of copper. However, the same capabilities of this metal also pose challenges: laser welding normally uses infrared radiation. But it is precisely in the wavelength range of around 1000 nm that copper exhibits highly-reflective properties. Depending on the surface condition, uniform weld seams can therefore only be guaranteed to a certain extent – and is oftentimes not high enough for industrial purposes. Deep penetration welding can also produce spatter that damages the component and, in a worst-case scenario, leads to short circuits on the boards.



For mass production of electromobility it requires competence in digitization and networking. (Source: TRUMPF)

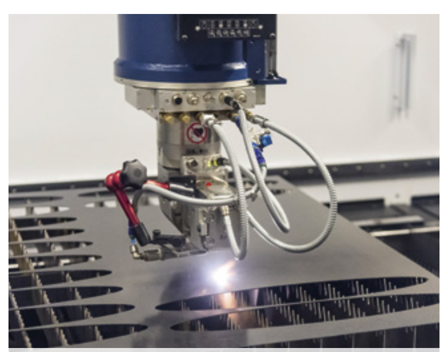


Welding hairpins using TRUMPF laser technology (Source: TRUMPF)

TRUMPF has therefore developed a solution using a green laser. The green wavelength is absorbed much better by copper. Because the material reaches its melting temperature faster, the welding process starts more quickly and requires less laser power. While the infrared laser operates at 2.6 kilowatts of peak pulse power, the green laser uses 1.4 kilowatts for the same weld seam. This process is more energy efficient and produces significantly less spatter. This means that copper welds are always produced with consistent quality on every type of surface.

"In addition to factors such as the correct wavelength, laser optics also make a critical contribution to the precision of laser welding processes," explains Mike Tuohy, sales engineer at LASER COMPONENTS USA. "They bundle the laser beam with all its energy onto a small spot. Due to the high energy of industrial lasers, a high laser damage threshold is a crucial factor. For special requirements, DOEs can be used to implement a wide variety of beam shapes."

With these and other laser processes for electronic components, all 200 or so welds of an electric motor can be performed in just over a minute. The charger plug, current transformer, and rectifier are examples of the range of new power electronics being introduced into the car.



Laser technology processing of key electromobility components. (Source: TRUMPF)

Digitization for Secure Battery Production

In addition to the production of motors and electronics, laser technology also plays a crucial role in the production of batteries. In this area alone, TRUMPF has already sold more than 500 lasers. The batteries consist of several layers of wafer-thin copper and aluminum foils, which are cut with the laser. The battery is then filled with liquid electrolyte and welded shut with a lid. These welds must be tightly sealed: if the battery breaks down during operation, there is a risk of fire and injury. From the battery cell via the battery module to the battery pack, the laser takes over all welding processes. The laser systems have sensor systems and are connected to a cloud solution via software. The sensors provide values for quality assurance and documentation but also control the welding process.

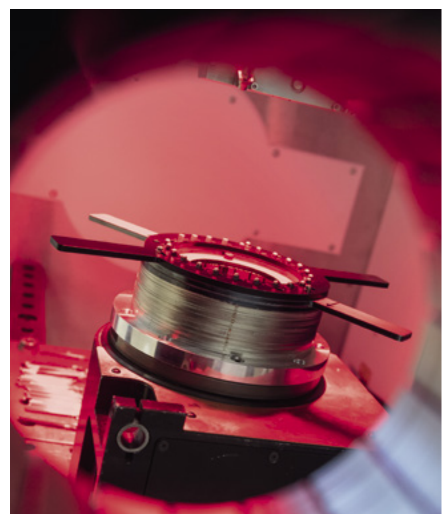
Laser welding a battery housing for a single cell in a battery block for electric cars (Source: TRUMPF)

Battery production requires not only know-how in laser technology but also in digitization. This is because process monitoring is an important basis for stable production, especially in battery production for electric cars. "Battery manufacturers are faced with the problem that they can only test the functionality of the battery at the end of the production process. They need continuous monitoring of this process to ensure that the battery functions properly at the end of the process," says Schmitz. In addition, digitization can generate data that is of interest to the end customer, including performance data, speed data, and sensor data that lists both the welding result and the seam width.

With this data, the manufacturer can document the quality of production, detect deviations from the standard, and intervene at an early stage. In addition, manufacturers are increasingly relying on maximum flexibility in their systems. They produce different types of engines – both internal combustion engines and electric cars – on one and the same production line. This flexibility can only be achieved if systems are digitized and intelligently networked.

Not Only Cars Drive Electric

The market potential of electric mobility is only just beginning to fully unfold because mobility via electric traction drive means more than just electric cars. Fully electric trucks with overhead lines are currently undergoing practical testing in Sweden and Germany; in Norway, the first strictly battery-powered passenger and car ferries are already in operation; in many parts of the world, municipalities are relying on electric street cleaning and gritting vehicles; the first fully electric tractors are already quietly plowing furrows through fields; bicycles supported by an electric motor have enjoyed growing popularity for years; and electric scooters are a market with millions sold per year, especially in East and Southeast Asia. All these e-vehicles require batteries, power electronics, and electric motors. ■



TRUMPF laser technology for efficient mass production of electric motors. (Source: TRUMPF)

Roadside Monitoring

Tuning Down Pollution

It took less than a century for cars to become an indispensable part of our modern lifestyle. They keep us mobile and take us to faraway places. For many of us, even routine affairs such as the daily commute would be unthinkable without cars. But the flip side of the coin has become as obvious as the advantages: vehicular air pollution affects air quality in both metropolitan and small-town areas all around the world. Stratospheric ozone depletion and toxic air pollution are among the most pressing issues of our time.

To combat air pollution in the U.S., Congress enacted the Clean Air Act (CAA) in 1963 pertaining to air quality and ozone protec-tion. The '65 amendment added the Motor Vehicle Pollution Control Act to set the first automotive emissions standards with restrictions on fuel and engine production and plans to measure and report respectively. Its counterpart in Canada, the On-road Vehicle and Engine Emission Regulations under the Canadian Environmental Protection Act (CEPA), was introduced in 1999 to be more stringent than previously set regulations and aligned with those of the U.S. Throughout Europe, politicians have also implemented a diverse range of measures to limit exhaustion of CO_2, greenhouse gases, and particulate matter. In some cities, only cars with even numbers may drive on even-numbered days, while elsewhere people must pay considerable fees to get admittance to city centers. ➔

Dr. T.K. Subramaniam has been working as a professor of physics at Sri Sairam Engineering College, Chennai, India for more than twelve years. As a renowned specialist in the field of laser spectroscopy, he has twenty-nine years of experience in research and industry. In 2004, he earned his PhD from the famous Banaras Hindu University (BHU) in Varanasi, India, where he also helped to establish a laser spectroscopy laboratory. His work includes twenty-three research publications in international journals of repute and a textbook on Engineering Physics recently published by the Oxford University Press (OUP). He also serves as a peer reviewer for the Optical Society of America (OSA) group of journals, i.e., the Journal of the Optical Society of America and Applied Optics, USA. ■

Real-life Implementation

In 2015 experts from the European Union, Japan, and India agreed on the Worldwide harmonized Light vehicles Test Procedure (WLTP) following the guidelines of the UNECE World Forum for Harmonization of Vehicle Regulations. Any new model produced after September 2017 must comply with these regulations. In addition to the usual lab tests, cars must also undergo a so-called Real Driving Emissions (RDE) test following clearly-defined statistical guidelines. Some pollutants, such as nitrogen oxides (NOx), cannot be determined under lab conditions but need to be tested in a driven car. Therefore, the RDE test will certainly deliver more accurate and extensive results. Some scientists, however, state that the bulky equipment commonly used for RDE testing leads to unreliable results because it changes the aerodynamics and weight of the car. Instead, they propose TDLAS systems that would easily fit into the trunk of the car. Their detection units could be attached to the exhaust pipe without any convoluted constructions.

Controls for used cars have also been streamlined. After a maximum period of four years before the first check-up, every car must periodically undergo a vehicle inspection, which includes an emissions test. In most European countries, these checks are conducted every two years. Following these regulations, there is a certain need for every car on the road to meet governmental standards. Outside the EU, the picture is a little bit more confusing.

In the U.S. and Canada regular vehicle and emissions tests are part of state or provincial legislation. The aforementioned CAA merely requires the implementation of vehicle emissions inspection programs in metropolitan areas where air quality does not meet federal standards. Therefore, there are virtually fifty different regulations within the U.S.; sparsely populated states like Wyoming and Alaska do not feel the need for any inspection whatsoever.

Fixed Monitoring Stations

In many cities around the world, pollution measurements are also conducted by fixed metering stations. The concentrations of pollutants such as SO_2, H_2S, CO, NO, NO_2 or ozone are monitored on a 24-hour basis, often using a different method for each substance. Sulfur compounds may be measured using UV fluorescence, NOx values are determined by chemiluminescence, and CO is determined by IR absorption. This is a useful strategy to obtain an overview of the overall pollution. These stations do not differentiate between vehicular, industrial, and domestic pollution but provide an overview of the overall air quality at a spe-cific point and time. Many of them are placed in heavy traffic areas; it can, therefore, be concluded that variations of certain pol-lutants are mainly caused by vehicle emissions. These stations are the main source for pollution values as commonly men-tioned by the media. According to the U.S. EPA (Environmental Protection Agency), the emissions of air toxics declined by 68% from 1990 to 2014[1].

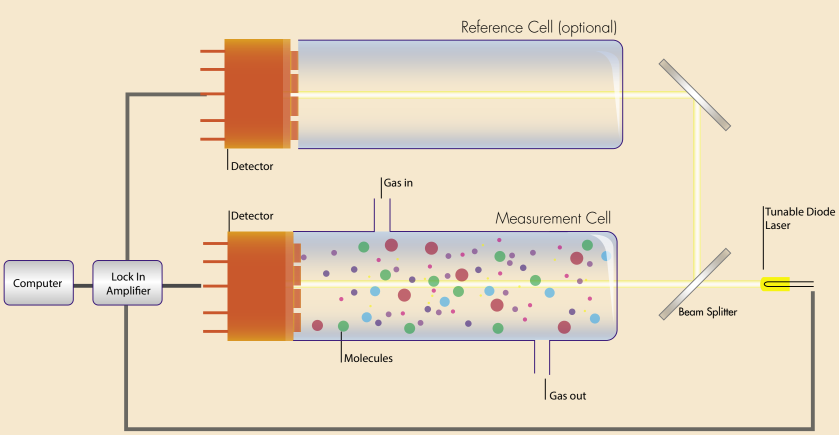
1 https://gispub.epa.gov/air/trendsreport/2018/#air_pollution

TDLAS

Tunable Diode Laser Absorption Spectroscopy (TDLAS) is a sensitive detection method that uses a tunable diode laser to determine not only the existence, but also the concentration of a substance in a medium. According to the Beer-Lambert extinction law, the amount of attenuation in a light pulse depends on the concentration of the absorbing molecules and the path length over which absorption occurs.

As light traverses a medium containing an absorbing analyte, decreases in intensity occur as the analyte becomes excited. This means that for a given path length attenuation increases with the concentration of absorbers. Semiconductor lasers can be tuned in wavelength to match distinctive absorption lines. By transmitting a beam of light through a gas mixture containing a (usually trace) quantity of the target gas, tuning the beam's wavelength to one of the target gas's absorption lines, and accurately measuring the absorption of that beam, one can deduce the concentration of target gas molecules integrated over the beam's path length. This measurement is usually expressed in units of ppm-m.

LASER COMPONENTS supplies detectors, optics, and lasers to manufacturers of specialist TDLS equipment. ■



Roadside Measuring

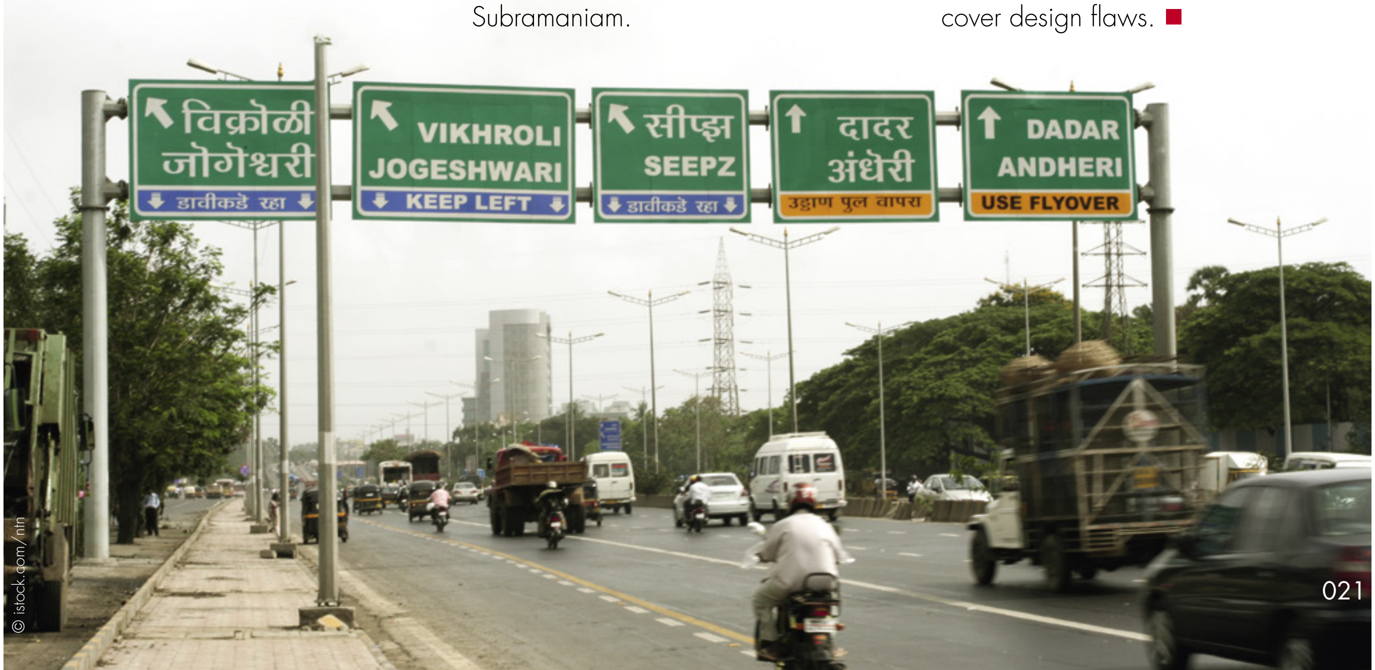
It appears that North America and Europe have found a way to keep track of their pollution and started taking measurements. But there is great potential for developing countries to reduce their production of CO_2 emissions. In 2014, the World Health Or-ganization (WHO) declared New Delhi the dirtiest city in the world regarding particulate matter. To cope with these problems, Indian scientists have come up with a reliable, cost-effective, and easy-to-use method for roadside measurement of vehicular emissions:

At the LASER COMPONENTS **IR WORKshop** in 2016, Dr. T.K. Subramaniam of the Department of Science & Humanities (Physics) at Sri Sairam Engineering College in Chennai, India proposed a laser-based method that would allow the in-situ roadside measurement of all pollutants in a single scan. He applied Tunable Diode Laser Absorption Spectroscopy (TDLAS), which builds on well-known spectroscopic principles and uses sensitive detection techniques, coupled with tunable diode lasers and optical fibers developed by the telecommunications industry.

Dr. Subramaniam proposes the use of TDLAS measuring systems (see box) for the roadside monitoring of exhaust gas emissions. To get results that reflect the average pollution rate of a car, measurements must be made at a time when the engine has been running for several minutes. The catalytic converters usually need three to five minutes to reach their operating temperature, during which time carbon monoxide and unburned hydrocarbons are released into the air. The emission of nitrogen oxides also increases with the motor load. Measurements, therefore, will have to be conducted on road sections on which cars are indeed driven. According to Dr. Subramaniam, highway intersection ramps and toll plazas would be the best spots for roadside exhaust controls. "At intersections, the motor has been running for a considerable amount of time; driving uphill puts additional strain on the combustion system. The ramps could, therefore, be used to check the emissions and environmental effects of each vehicle. At toll plazas, a number of instruments could be used simultaneously when the vehicles are at "idling condition" after running through long distances. In these places, it may be possible to add supplementary sensors to capture vehicle payload and other values that affect emissions", says Dr. Subramaniam.

"If the vehicle being tested is found to have emissions which violate the rules of the day as prescribed by a government of the day, a high-speed camera is activated within a microsecond or a picosecond to take a photograph of the license plate of the vehicle and the driver of the vehicle, as well as to note other details like the time and place of booking, etc. The driver will then be notified that his car needs maintenance. In grave cases, tough consequences could be implemented. If the car complies with regulations, the driver receives a badge showing proof of suc-cessful control." He is convinced that "TDLAS is a fool-proof method to detect and control vehicular emission. Remote sensing instruments can measure the emissions of thousands of vehicles per day."

Some U.S. states follow a similar strategy by conducting mobile roadside emission tests – not unlike speed traps or alcohol tests. Experts state that compared to station-based tests, roadside controls can check thousands of in-use vehicles under real-life conditions. The data collected "on the road" could be used to improve government or manufacturer programs. For example, they could be used to find out builds or models with particularly high pollution rates and thus help discover design flaws. ■



Customer Visits, Workshops, Trade Shows

Personal Contact is More Important than Ever Before

"LASER COMPONENTS manufactures according to the specifications of its customers!" This is one of our company's most important messages and at the same time shows that few products come off the shelf. The adapted products are created in direct consultation with customers; intensive contact is therefore a prerequisite for our course of action.

During the project phase, our sales engineers are on site at the customer's facilities – often accompanied by our product development engineers. However, coordination also takes place at trade shows and workshops. These events have the advantage to interact with each other and bring together research and industry in a short period of time.

In 2019, we will be present at six trade shows in the U.S. And with the SPIE Industry Workshop at Photonics West and our very own IR WORKshop, we will be hosting two major events, at which we expect over hundred guests each.

We look forward to welcoming you at one event or another. ■

UPCOMING EVENTS 2019

SPIE DCS
Baltimore, MD
April 16–18
Booth 524

ATX West Automation
Anaheim, CA
February 05–07
Booth 4166

Sensors Expo
San Jose, CA
June 25–27
Booth 419

SPIE Photonics West
San Francisco, CA
February 05–07
Booth 1751

SPIE Optics + Photonics
San Diego, CA
August 13–15

Automate
Chicago, IL
April 08–11
Booth 8536

6th IR WORKshop
Princeton, NJ
October 28–30

SPIE. Industry Workshop

How to Get the Most Out of Optics, Lasers, and Detectors

February 06, 2019
Moscone Center (North Exhibit Level)
San Francisco, CA

Part of Photonics West, the industry's most important photonics technologies event, LASER COMPONENTS will be hosting a one-day workshop on the essential properties and working principles of a wide variety of optics and optoelectronic components.

The program is designed for those who would like to be more familiar with the advantages and challenges of these technologies, as well as the trade-offs. The primary goal is to develop a better understanding of how to specify the right device and set the optimal device performance in a given application.

The workshop is free of charge; however, registration is required. You can already do so on:
https://bit.ly/2yKoPZ2

Participants can select one or more 30-minute sessions throughout the day, depending on the interest. LASER COMPONENTS product development engineers and guest speakers will be talking about specific topics centered around three major subject matters: Optics, Lasers and Detectors.

For a detailed program, please consult the events page: https://bit.ly/2JAZogN

IR WORKshop

Connecting Infrared Research to Industry

October 28–30, 2019
Princeton, NJ

We are pleased to announce the 6th International WORKshop on Infrared Technologies, a continuation of the alternating event in Germany and the US. Thanks to the support of MIRTHE+ Photonics Sensing Center, a leading organization focused on connecting research and industry, the event will take place at Princeton University.

This unique and successful IR WORKshop format is designed to create a community conversation about industry breakthroughs and challenges, to present the latest research, and to generate professional connections and common interests. Active participation is encouraged in an interactive environment organized to have half of the attendees present a paper or poster while the other attendees are invited to participate during breakout session discussions.

New developments covered will include infrared detectors and new material development, sources and lasers, filters, optics, MEMS, spectroscopy, and sensing systems.

A detailed program, list of topics and speakers, along with the online registration form is coming soon:
www.ir-workshop.info

LASER COMPONENTS Announcing MIRTHE$^+$ Membership

Supporting Research and Knowledge in Mid-infrared Technology

LASER COMPONENTS USA is proud to have become an active member of the MIRTHE$^+$ Photonics Sensing Center.

MIRTHE$^+$ Photonics Sensing Center at Princeton University supports the efforts in advancing mid-infrared photonics sensing technologies for environmental, medical and homeland security applications.

Their collaborative program with academic partner institutions, industry and government laboratories accelerates technological innovation and offers unique access to innovative research and technology transfer opportunities. Ultimately moving photonics sensing technologies into commercial markets. ■

Roxanne Zellin, Education outreach director, with Prof. Gerard Wysocki, Director MIRTHE$^+$ Photonics Sensing Center and Associate Professor of Electrical Engineering, Princeton University, at the 4th International IR WORKshop in 2017.

Important Milestones Realized at Polarizer-Supplier CODIXX

Awarded ISO 9001:2015 Certification and Celebrating 20 Year Anniversary

WEB US42-085

20 years have passed since CODIXX AG was founded in 1998. A small company with a big idea to change the polarizer market by introducing a new production technique.

CODIXX´s business is based on a unique technology to make polarizers with exceptional properties. The idea of using silver in glass has been around for some years, and has been used since the 14th century when yellow glass was made for church windows. Some hundred years later, the dichroism and therefore polarization abilities of silver-nanoparticles in glass have been discovered. This produced the idea for the CODIXX founders for a revolutionary production of high-quality polarizers, known as colorPol® polarizers. Thanks to this technology, customers can request nearly unlimited customizations at a competitive price.

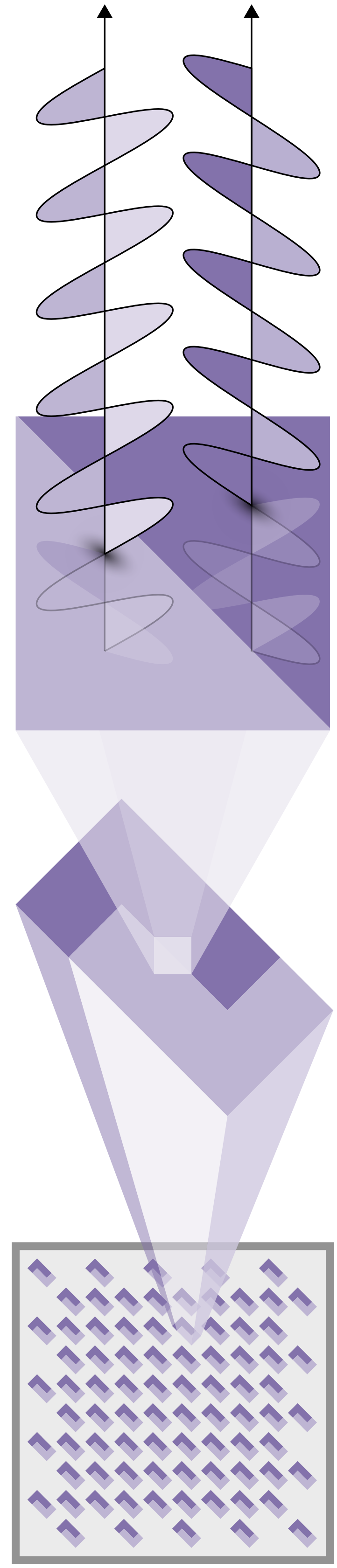
CODIXX

Since then a lot has happened. The portfolio expanded continuously from standard colorPol® polarizers to the high transmittance series colorPol® HT, the colorPol® Laserline and the patterned colorPol® S. In 2018, the latest in narrowband polarizers, the so-called colorPol® N, was added to the product offering.

In addition to the growth of the polarizer family and the number of employees, the need for a bigger production facility grew as well. The decision was made quickly to invest in increased production capacity, that started back in 2017 and is still ongoing. Furthermore, the ISO 9001 certification renewal to the improved 9001:2015 standard guarantees consistent product quality and enhanced customer satisfaction.

New products under development and increased production capacity will continue to improve polarizers long into the future. LASER COMPONENTS USA is looking forward to supporting the product line for all spectral ranges, contrasts conditions, and designs for its customers in North America. ■

Huyen Vu:
optics@laser-components.com



New Products

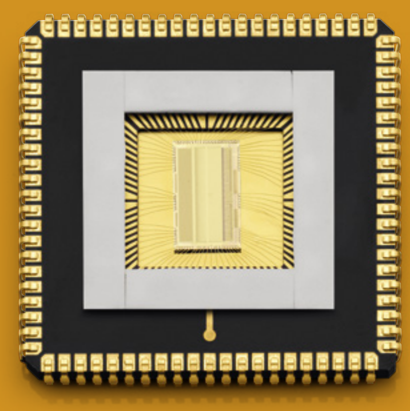
SPAD Arrays expand Product Portfolio

Detector for Flash LiDAR Systems

WEB US42-0925

Conventional LiDAR scanners use a failure-prone mechanism with rotating mirrors. Flash LiDAR technology, however, uses highly-sensitive 2D single-photon avalanche diode (SPAD) arrays. With a resolution of 2 x 192 pixels and noise < 50 cps, these components are around 10^6 (one million) times more sensitive than the photodiodes integrated in smartphones, for example.

Unlike classic LiDAR, the arrays do not detect just one point; each individual pixel provides information on the position. In addition, the sensor and evaluation electronics have been mounted on the same chip for the first time. This makes this new development particularly space saving. For example, car manufacturers could install it behind windshields or headlights. ■



Matt Robinson:
photodiodes@laser-components.com

Automotive Qualified Pulsed Laser Diodes

AEC-Q101 Qualified

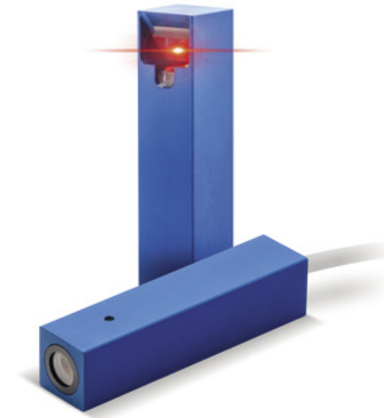
Low-Cost Meets High-End

WEB US42-950

The pulsed laser diode model 905D1S3J09UA is qualified to the AEC-Q101 standard, meeting the highest quality standards for use in the automotive industry. The highly reliable pulsed laser diodes are available at 905 nm as a single element design with a peak power up to 110 W.

They combine excellent overdrive capabilities with very precise chip alignment inside the hermetic housing. Already successful in ranging and laser scanning applications, these devices are becoming ever more popular for the automotive industry and a key component for LiDAR technology in autonomous driving. ■

Paul Buettner:
lasers@laser-components.com



FLEXPOINT MVsquare Line Laser Module

Don't Care! Be Square!

WEB US42-075

One major challenge in the series production of 3D sensor systems for industrial image processing is the fine adjustment of the line laser. Focus and beam position must be set correctly for each individual module. The MVsquare offers a remedy for this: its rectangular housing serves as a clear reference surface for the alignment of the line during installation.

All parameters are set at the factory according to customer specifications and the module can be integrated without further adjustments.

Since mechanical elements such as the focusing mechanism are not required, the customer can be sure that all parameters remain unchanged even after installation.

For applications in which every millimeter counts, the MVsquare is also available in a version in which the laser beam is deflected by 90°. ■

Carol Howard:
lasers@laser-components.com

Robust Line Laser with a M18 Thread

The FLEXPOINT MV18 is Perfectly Suited for Permanent Installation in Industrial Facilities

WEB US42-076

FLEXPOINT modules with an integrated external thread can be easily integrated in standardized systems. The MV18 is the latest in the range of line lasers for industrial image processing: it not only guarantees a homogeneous power distribution along the projected line but can also be easily screwed into existing internal threads with its M18 thread.

This robust line laser is available in many wavelengths between 405 nm and 850 nm. With an output power of up to 200 mW, the 450 nm version is the most powerful of the current MV series.

In addition to the standard version with adjustable focus, the FLEXPOINT MV18 is also available in a low-cost version with a factory-fixed focus. ■

Kelly Child:
lasers@laser-components.com

Laser Module ILM12IP is Dustproof and Waterproof

Protection Class IP67

WEB US42-077

The FLEXPOINT ILM12F laser module has always been robust; and now the ILM12IP version is virtually indestructible. This new housing complies with protection class IP67 making it dust-tight and water-resistant.

The module is available with a green (520 nm) and a red (635 nm) laser. The focus of the IP version can be set at a fixed distance or collimated. ■

Carol Howard:
lasers@laser-components.com

LASER COMPONENTS USA, Inc.
116 South River Road, Building C
Bedford, NH 03110, USA

RETURN SERVICE REQUESTED

SPIE. PHOTONICS WEST

Free Workshops at the Industry Events

Sponsored by LASER COMPONENTS

Wednesday, February 06, 2019 ■ Moscone Center (North Exhibit Level)

How to Specify Spatial Light Modulators, Laser Optics, and Polarizers

Specifying the correct optical component may determine the success of an application. This session focuses on spatial light modulators utilized as adaptive optical elements, laser damage thresholds in laser optics, custom laser optics coatings, and polarizers, their functional principles, essential properties, and corresponding effects depending on the application. ■

Instructors from:
HOLOEYE, CODIXX and
LASER COMPONENTS

Part I
8:30–11:30 am

From Distance Measurement in LiDAR to Next-Gen Laser White Light: How to set the Optimal Device Performance

The workshop explains the different working principles of (Flash) LiDAR-optimized Pulsed Laser Diodes, Single-Photon Avalanche Diodes, and optical Transimpedance Amplifiers for use with photodiodes. To close this session, we will illustrate optical design considerations when building high intensity, long throw spot lighting or fiber optic illumination. ■

Instructors from:
Fraunhofer IMS, Analog Devices,
SLD Laser and LASER COMPONENTS

Part II
11:30 am–2:30 pm

Important Factors to Consider When Selecting and Operating the Appropriate Infrared Detector

Infrared detectors are used in a wide variety of applications including spectroscopy, gas analysis, flame detection, moisture sensing, range finding, remote temperature measurement, and even gravitational wave measurements. Whatever your instrument design or research requirements, there are a few key parameters to understand when selecting and operating the optimum IR detector. ■

Instructors from:
LASER COMPONENTS

Part III
3:00–4:00 pm

Secure your seat:
https://bit.ly/2yKoPZ2

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