PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS Nordic AB
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Drones: Opportunities and Challenges

Safety with Laser Scanners

Alcohol Control in the Car

New Products

Editorial

LOOK INTO THE FUTURE

Dear Reader,

LASER COMPONENTS Nordic had a fantastic 2016 and the new year started very much in the same way. End of January/beginning of February we were part of LASER COMPONENTS exhibit at Photonics West. As always, it was a great week and we met many friends and customers. Next conference up, Elektronik 2017, was held in our home town of Gothenburg, Sweden. The event is arranged at the same time as Advanced Engineering and the mixed crowd visiting meant two very interesting days. We would like to thank the visitors of both events for coming to our booth and for making these exhibitions so enjoyable.

This new issue of Photonics News® Nordic features hot topics such as drones, LiDAR, and optoelectronic security technologies. LASER COMPONENTS' products fit right into these segments and we are proud to be able to contribute to advancing technology for industry and consumer applications alike. Specifically, we write about pulsed laser diode and avalanche photodiode combinations for distance measurements. Furthermore, we cover IR sensors for security solutions and breath alcohol measurements. Breathalyzers are well on their way to becoming integral parts of automotive technology and are already present in many vehicles used in the transport sector.

Speaking of IR technology, we also take some time to summarize our IR WORKshop, held in November 2016. In a concentrated working environment, the main players from the infrared world presented the latest developments from their specialized fields. Keep an eye open for the invitation to this year's workshop, which will be announced during the spring.

Also, make sure to check out the final pages, where we present a selection of new products. In particular, we are very happy to announce our new customizable APD arrays for LiDAR applications. The configuration and pixel size of this array can be selected freely!

Just before and after the summer, we have a couple of conferences and trade shows coming up. First, the Optics and Photonics Days in Oulu (Finland), which is held May 29–30 at the Radisson Blu hotel. The next exhibition for us is a EuroExpo trade show held in Kongsberg (Norway), September 6–7. More information about this trade show will be announced shortly on our web page, so please check our events list if you are interested.

Yours,

Mikael Winters

Content

Imprint

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Drones Will Change the World

Science Fiction Was Yesterday

German Air Traffic Control estimates the number of private drones in Germany at 500,000; the 2016 Christmas season alone witnessed the addition of 100,000 new systems. The rapid rise in the sale of drones increases the risk of collisions, crashes, and accidents. The obligation of drone owners to have proper insurance coverage has been in place since 2005. And now it is time for clear regulations to ensure air traffic safety beyond model airfields: in 2015, fourteen flying objects were sighted in close proximity to airplanes and helicopters, and in 2016 there were sixty reports. In January 2017, Minister Dobrindt ultimately introduced an interstate drone ordinance for Germany: the most important cornerstones relate to labelling requirements, drone licensing requirements, flight altitudes, and flight areas.

Drones are unmanned aerial vehicles (UAVs) that can be used privately or commercially. Private persons primarily use camera drones in the form of multicopters, which can be controversial: in addition to safety-relevant regulations, it is crucial to observe data privacy laws, especially because film and photography are not permitted everywhere. The laws change continually; therefore, regular updating of information is required.

Commercial use opens up entirely new application possibilities for drones; discussions in this direction presumably include parcel delivery via UAVs. Horror scenarios paint pictures of flying objects filling the sky. The application of UAVs in civil protection or disaster control is undisputed: fire-fighting and sea and mountain rescue missions can be coordinated more efficiently with UAVs. In the future, industrial facilities will also be able to be monitored by drones to detect gas leaks, for example. Feasibility studies are being carried out to test their use in production facilities.

Drones in Fire Department Operations

UAV systems are already used today in rescue missions. In the most straightforward fire department operations, they are used to localize the source of the fire; this is especially useful in forest fires when initiating targeted fire-fighting operations. The U.S.A. has already gained positive results in this respect.
These systems should also be used to save lives in accidents involving the transportation of hazardous materials. Drones aid in determining the condition of the injured or whether there are leaks, detecting hazardous materials, and measuring the concentration of the hazardous materials: With this data, dispersion forecasts of pollutant clouds can be deduced and appropriate preventive measures coordinated. The further development of these systems is the subject of the AirShield research project funded by the Federal Ministry of Education and Research.

Sensor Technology Challenges

UAVs used privately are only allowed to fly within direct sight of the operator and must be kept away from other flying objects. Professional drones, however, fly autonomously; therefore, high demands are placed on their safety systems. The UAVs must be able to determine their exact position at any time and react automatically to external influences. Sophisticated sensor technology is necessary for aircraft operations.

Safe Flying

Take-off and landing are particularly challenging at high-speed winds. It is necessary to quickly offset so-called gust effects and, thus, be able to determine the exact position to within a centimeter. Satellite navigation and reference measurements aid this procedure. The interaction between the flight calculator and the navigation and air-data sensors makes it possible to take effective countermeasures. RWTH Aachen proved this impressively.

Paketkopter in Reit im Winkel; Source: Deutsche Post AG; © Andreas Heddergott

DHL Paketkopter 3.0

In collaboration with the Institute of Flight System Dynamics (of RWTH Aachen), which is directed by Prof. Dieter Moormann, DHL Paket tested autonomous cross-country flights in the Bavarian village of Reit im Winkl at the beginning of 2016. Packages were successfully delivered from the valley to Winklmoosalm across 8 km and ascending 500 meters in altitude at quickly-changing weather conditions and high temperature fluctuations. Medicine was able to be expedited to the DHL Skyport in the mountains in just eight minutes; a car would have taken thirty minutes under winter conditions.

Teammembers of RWTH Aachen with the Paketkopter at the DHL Skyport in Reit im Winkl © RWTH Aachen

This flight was carried out without visual contact; therefore, redundant safety systems were applied and a data link set up with a long range: Radio communication and a mobile phone network made operation possible. Delivery was also carried out intelligently: Loading and unloading of the package was carried out automatically and the batteries were even changed to facilitate an immediate return flight. This flight proved the technical feasibility of such delivery methods. DHL was the first parcel service worldwide to test the extensive integration of package delivery via UAVs into the delivery chain (dpdhl.de/paketkopter).

In December 2016 other logistics companies followed suit: DPD and Amazon conducted flights in France and Cambridge, respectively. For daily application of UAVs, it will be necessary to establish the legal parameters of UAV flight and also continue to refine the drones.

Future Project: Autonomy and Swarming

In large-area disasters in the future, drones should be able to fly without active control in order to autonomously analyze a given area and forward the recorded data. Possible application scenarios include nuclear accidents or major earthquakes, in which streets are damaged or the telephone network fails, for example. This autonomous areal analysis is only possible in drone swarms in which the individual UAVs communicate with each other and forward their information and data to ground stations. The fact that drones in a swarm must not be allowed to cause collisions goes without saying.

Prevention of Collision via Distance Measurement

UAVs present a large risk to the cockpits and engines of rescue helicopters and low-flying passenger airplanes. To allow drones to avoid other aircrafts, distance sensors are integrated into autonomous UAVs; depending on the distance to be measured, radar systems or LiDAR systems could be used. LIDAR systems will probably also play a role in so-called near-field navigation near buildings (e.g., for inspection tasks) or even inside buildings. ■

Autonomous Flight - Products for Distance Measurements

WEB N06-041

It may soon be a requirement that drones be able to measure their distance to obstacles. LASER COMPONENTS offers the components necessary to build inexpensive sensors for this purpose.

Avalanche Photodiodes

Small and inexpensive: the SAH series avalanche photodiodes are packaged in an SMD housing that has an edge length of just 3.1 mm x 1.8 mm. These components are optimized for the wavelengths 850 nm and 905 nm, have a high quantum efficiency, and operate quickly.

Inexpensive Pulsed Laser Diodes

The UA series pulsed laser diodes are a good counterpart to the inexpensive APDs, featuring power levels of up to 75 W. They are as inexpensive as comparable PLDs in a plastic housing; however, they are of a higher quality with their ultra-precise mechanical tolerances. The hermetically-sealed metal housing has a diameter of 5.6 mm, providing excellent temperature stability of the component.

Pulsed Laser Diodes with Short Pulses

We are ready to introduce pulsed laser diodes that are called QuickSwitch®. This year we will celebrate the introduction of these new components into the market. They are characterized by particularly short pulse widths of just 2.5 ns. A preliminary datasheet is available online under the web code provided. More information will follow over the course of the year. ■

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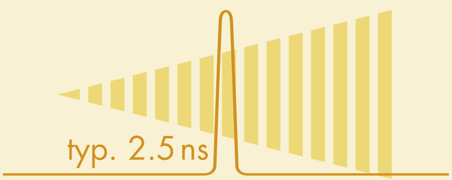


Distance Measurements Prevent Collisions

LiDAR Systems for the Recognition of Obstacles

For vehicles to drive autonomously or unmanned aerial vehicles to fly alone, they must be able to recognize obstacles in order to avoid them. Monitoring surroundings using LiDAR systems has many advantages: These systems are not only inexpensive, but they can also measure distances of up to 100 meters. LiDAR is short for **li**ght **d**etection **a**nd **r**anging.

During measurement, pulsed laser diodes (PLDs) are used as emitters and avalanche photodiodes (APDs) as receivers; this measurement principle is based on optical time-of-flight (ToF) measurements.

Optical ToF Measurements

The principle of optical ToF measurement can be easily explained: A PLD sends a single short light pulse; ideally, this light propagates undisturbed along the shortest path through the air until it detects an obstacle. At the obstacle, light is reflected and the pulse returned to be detected by an APD. The electronics that connect APDs and PLDs measure the time Δt between sending and receiving the returned light pulse. Because the propagation speed of light is already known, the distance l of an obstacle can be easily calculated from measured time.

Autonomous Driving

The study published by Frost & Sullivan on the "Automotive LiDAR Market for ADAS and Automated Driving, Global 2016" expects the advance of LiDAR technologies in autonomous driving. Application fields range from lane departure warning systems to autopilot functions. Their widespread introduction is expected by the year 2025.

Source: frost.com/mb5c

Basic Physical Principles

Light propagates in a vacuum at light speed c. Measurements in a vacuum yield the following value for c:

c = 299,792,458 meters/second

In the physical sense, a vacuum is space without matter; therefore, it has an optical density of n = 1.

The smallest dust particles found in the air change this optical density, which is known as the refractive index n.
The wavelength and phase speed are smaller than in a vacuum; therefore, the speed of light propagation also changes: $c_{air} = c/n_{air}$

Calculation Example

Imagine for a minute that a light pulse is detected at **Δt = 500 ns**. The obstacle has a distance of l, the measured time refers to the two-way (back and forth) path of light (i.e., 2*d).

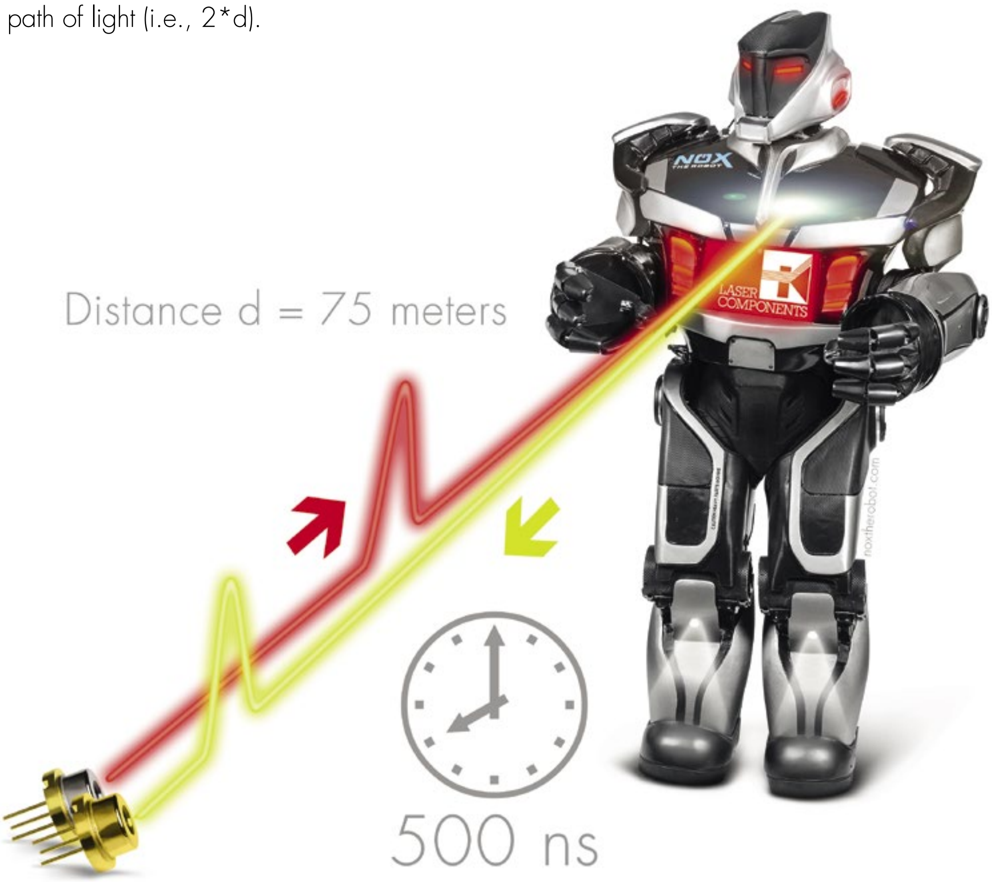
The distance can be measured in your head if you allow for the following approximate values:

*c = 300,000,000 m/s = 3*108 m/s*
n = 1

The following equation applies:
$\Delta t = 2*d*n/c = 500\ ns = 5*10^{-7}\ s$
$d = 0.5 * (c * \Delta t) / n$

The distance can be calculated as:
d = 0.5* (3*108 m/s * $5*10^{-7}$ s)/1
d = 0.5*3*5*10^{1} m = 75 m

It is impressive to realize just how small the intervals are that are required for measurements at short distances; these intervals extend into the picosecond range, which is the trillionth part of a second. ■



Open Sesame!

High-Tech Equipment is Responsible when Doors Open Automatically

Have you ever walked up to or even into a closed glass door? Or have you ever been caught in a sliding door? Often these types of collisions have a mild outcome and you can look back on such situations and laugh, but sometimes these types of collisions can cause considerable damage: that is why many doors in public institutions are now controlled automatically; sensors are responsible for the safety of these doors and their "intelligence" is increasing.

Automatic Sliding Doors

Almost all supermarkets today are equipped with sliding doors that open automatically, and even the commuter rail (S-Bahn) doors close almost by themselves. We will enter sensor-controlled door systems almost every day, but have you ever thought about how they actually work?

One-way Light Barriers

A simple safety system is the one-way light barrier, which recognizes barriers at the installed height: A light source emits a permanent beam that is received by a detector on the opposite side. This is controlled via electronics. The receiver sends an alarm if it does not detect the light sent by the light source with the feedback: barrier.

In sliding door systems, the light sources are used with infrared radiation that is invisible to the human eye. Usually, the sensors are installed at the height of a person's ankles. If the connection between the emitter and the receiver is interrupted, then the door's closing mechanism is suspended for a set time interval. In ground-level doors this safety mechanism is sufficient.

Light barriers are still commonly combined with additional safety mechanisms, for example if it is necessary to step up or down a step when entering a door, making it necessary to protect an arm on a railing from getting caught: the technology ranges from pressure sensors to the installation of further light barriers at different heights.

Light Curtains

Simple light barriers are being replaced more and more often by so-called light curtains. In this technology, many emitter and receiver units form a fine line grid to prevent people or objects from getting caught in a sliding door. Light curtains are also very widespread in industrial applications in which access points must be monitored.

Complex Sensor Technology for Revolving Doors

Revolving doors prevent a draft and save – compared to sliding doors – energy costs. They are, therefore, preferably used in large buildings. The safety requirements are physically trivial for sliding doors and extremely complex for revolving doors. Most safety equipment has to be tested to meet DIN18650 requirements.

We will introduce two standard optoelectronic methods that provide protection via distance measurements: inexpensive triangulation methods and complex laser scanners that use time-of-flight measurements. ■

Optoelectronic Personal Protection via Distance Measurements

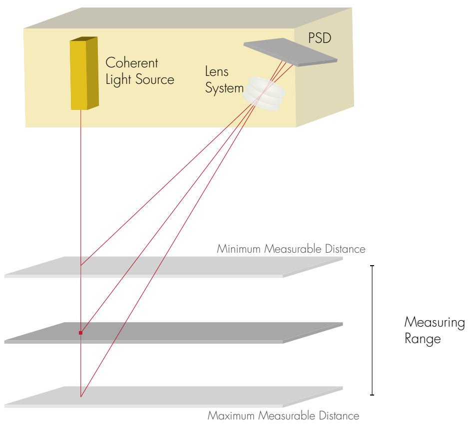
Triangulation and Time-of-Flight Measurements

Distance Measurements using Triangulation

Triangulation is used in automatic revolving doors: If a person stops moving in the door wing, the automatic rotation mechanism has to be stopped automatically to prevent the door from colliding with the person. The optoelectronic sensor consists of a laser diode and a receiver that can determine the position; position-sensitive detectors (PSDs) or CCD cameras are used for this purpose.

Object Recognition

Simply put, object recognition is carried out as follows: In the drawing, you will see sensors that are set up one after the other on the rear door wing to continuously measure the distance to the floor. As soon as the measured distance is reduced, a barrier is recognized and the door system stopped.

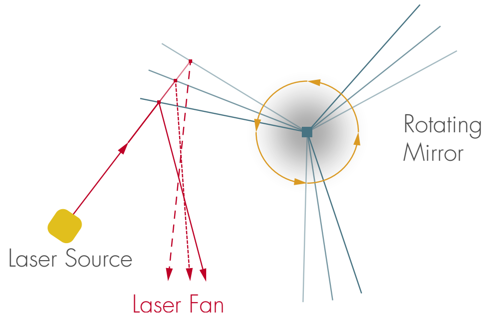


Laser Scanners

If high precision and speed are required, then it is necessary to utilize laser scanners instead of triangulation. In revolving doors, laser scanners are used to protect against trapping; in industrial automation, they are used to protect people from machines. The sensors recognize intrusion into a danger zone and trigger a (machine) stop.

Object Recognition with Laser Scanners

Laser scanners are based on optical time-of-flight measurements (see page 006). The typical assembly of industrial laser scanners requires a rotating mirror for the setup of a two-dimensional surface in order to capture the surroundings (see figure). This type of system achieves a high angular resolution that makes it possible to perform an exact distance measurement and provides a high degree of detail of the scan. Typically, industrial laser scanners capture an angular range of up to 270°; in automotive applications, 360° are captured.
In a three-sided mirror, the scanning area is scanned three times per rotation. If the mirror surfaces were tipped, it would even be possible to scan surfaces that are inclined toward each other rather than a purely two-dimensional surface.



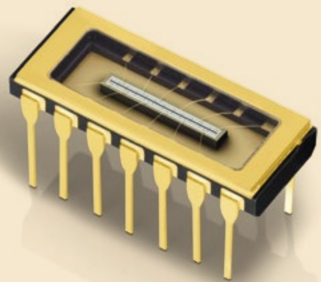
Quality Features of Pulsed Laser Diodes

Laser scanners are used to monitor very different distance ranges. As shown in the calculation on page 006, if an object is measured at a distance of 75 m and a time delay of 500 ms, the pulse for objects at a distance of 2 m is detected after just 13 ns.
Therefore, pulsed laser diodes are required that have the lowest pulse width possible for distance measurements at short distances. The shorter the laser pulse, the higher the precision. Typical versions have a width of less than 10 ns – novel technologies are already in the starting blocks.
However, at far distances, it is necessary to ensure that the pulse power is high enough to detect a returning signal.
For both requirements, the trick is to select the right components and switch the laser source and receiver properly. ■

APDs and PLDs for Your Measurements

For distance and speed measurements Pulsed Laser Diodes (PLDs) – at wavelengths of 905 nm – are used in combination with Si PIN or Si Avalanche Photodiodes (APDs).

LASER COMPONENTS manufactures these components and recently introduced a PLD with ultra-short pulses and an APD array, both ideally suited for laser scanners. Under the web code provided, you will find datasheets on the suitable time-of-flight components. ■



WEB N06-035

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Driving Under the Influence: Determining the Breath Alcohol Level

Breathalyzers Combined with Vehicle Immobilizers

"Driving under the influence" and vehicle immobilization are hot topics of discussion: Measurement apparatuses in automobiles are designed to lock the ignition when the driver's alcohol content is too high. It is not until the driver is able to blow an acceptable level into the "alcolock" breathalyzer that the motor can be started.

In Germany, data privacy activists are demonstrating against this measure, but Swedish employees are already being required – by employee contract – to utilize these measuring units [1]. In France, there has also been an attempt to initiate this measure: since the summer of 2012, every automobile has to have a breathalyzer on board; however, this finable regulation was repealed in the beginning of 2013 [2].

Alcolock Retrofitting

"Alcoguard" ignition locks can be ordered with Volvo as a special option; they even have a wireless version. Other car manufacturers offer vehicle immobilizers as a retrofitting package. The measurements are always based on breath alcohol content. Austria is discussing offering this retrofitting package as part of a probation model – in lieu of license revocation – by the end of 2017. This model has apparently been successful in Finland. Repeat offenses have been reduced by 2/3 with the integration of the alcolock [3]. Australia also introduced this system in 2015.

"Breathe!" Breathalyzer as Opposed to Blood Sample

Alcohol consumption can be detected in the blood: reabsorbed ethanol enters the bloodstream through the oral mucous membrane, the stomach, and especially the small intestine. In the lung alveoli, there is an exchange of gas between the alcohol from the arterial bloodstream and the air breathed; therefore, alcohol consumption can be determined via breath gas analysis. It is even possible to determine the concentration of alcohol because there is a physiological correlation between the breath alcohol content (BrAC) and the blood alcohol content (BAC) (Henry's law: average partitioning factor of 1:2100).

Because an exact conversion depends on many influential factors and is, therefore, not legally watertight, German jurisprudence introduced two limits: one for blood alcohol content and one for breath alcohol content. This is based on a conversion factor of 1:2000, which favors the breath alcohol content measurement. Thus, the following applies: 0.5 ‰ BAC = 0.25 mg/l BrAC

➔

And this is how breath alcohol content is measured…

In the measurement of breath alcohol content (BrAC), the ethanol content is determined per liter of breath gas in the unit of mg/L. "Conclusive" breathalyzers offer two independent measurement methods in a unit and combine an electrochemical sensor and an infrared sensor.

Electrochemical Sensor

In the electrochemical detection of alcohol, the current produced in the chemical conversion of ethanol is measured.

An electrolyte and at least two opposing electrodes are located in a measuring chamber; these electrodes are connected to an ammeter. A defined air volume is blown into the measurement cell: If ethanol can be detected, a measurable current is produced via a redox reaction: one reaction partner is oxidized (i.e., it releases electrons) and the other is reduced (i.e. it absorbs electrons). The current flow produced in the chemical reaction is equal to the alcohol concentration.

One problem with electrochemical sensors is the measurement accuracy, which is reduced with increasing operating hours.

IR Sensor

The easiest method is to use so-called non-dispersive infrared (NDIR) sensors to detect gases. In this method, a measurement cell is irradiated with infrared light, which is collected on the opposite side by a detector. Narrow bandpass filters (interference filters) are mounted in front of the detector.

Gases have characteristic absorption lines that make clear identification possible with the help of absorption spectroscopy. Even the gas concentration can be determined. The Lambert-Beer law, which describes the correlation between a reduction in the beam intensity and the concentration, applies here. Simply put, the light intensity at the detector is reduced, the more alcohol is found in the chamber. This system exhibits long-term stability. ■

A Glimpse into the Future

Driven by the automobile industry, very different methods of measuring alcohol levels and integrating these methods into automobiles are currently being discussed. In addition to the established methods already introduced, laser-based approaches are also being tested. Standard fitting in automobiles is being tested through research programs in the U.S.A.

Creative approaches are also being sought for the measurement apparatuses as well: Instead of a mouthpiece, breath gas can be used for direct measurements. The major challenge to this approach is in all certainty being able to identify the actual driver to exclude fraud. In Australia, camera systems and measurements are currently being combined to properly identify the driver. ■

[1] www.zeit.de/auto/2011-04/alkoholtest-fahren
[2] http://www.ambafrance-de.org/Nichtmitfuhren-eines-Alkoholtests
[3] https://www.ace.de/presse/medien-service/grafiken/datei/factsheet-alkohol-im-strassenverkehr.html?eID=nfcmedialibrary&tx_nfcmedialibrary_pi1%5Bdownuid%5D=27957
[3] http://www.tt.com/panorama/unfall/11643807-91/alkolock-darf-kein-privileg-f%C3%BCr-reiche-sein.csp

NEW
Standardfilter for Alcohol-Measurement
more on page 12

Components for Measuring Breath Alcohol Content

Select a Suitable Detector and an Appropriate Filter

Finding a suitable detector for a specific gas measurement still seems theoretically trivial. In order to measure the breath alcohol content (BrAC), the absorption lines of ethanol gas have to be analyzed. They are approximately 9.5 µm, 8.1 µm, 7.2 µm, and 3.4 µm. Theoretically, it would be sufficient to measure the detector signal at a single absorption line; however, it is important to make sure that a cross-sensitivity to other substances that are also in the breath (water, methane, and ethanol) does not exist.

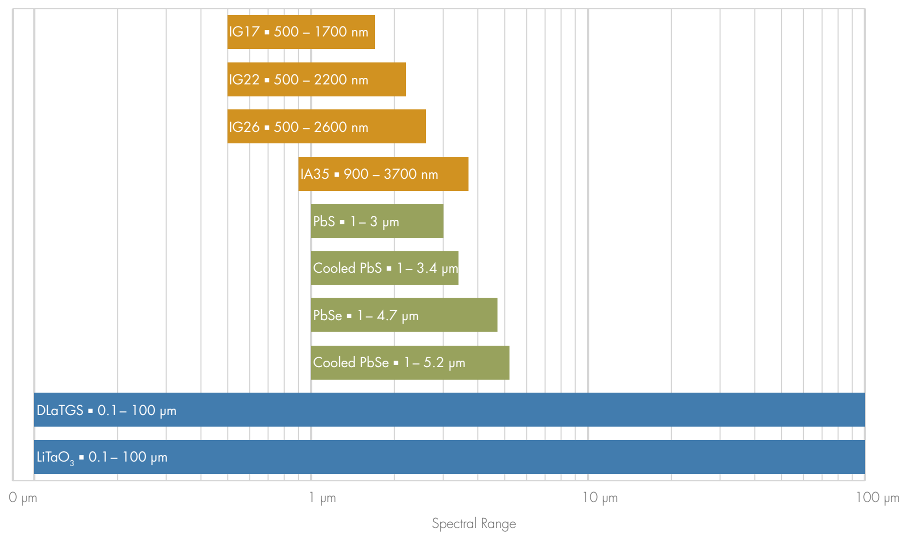
Filter Selection

IR detectors are polychromatic. A suitable filter is required to detect a specific gas or measure a specific wavelength: Bandpass filters only allow the beams of a specific wavelength range to pass. Thus, the success of the measurement always depends on the quality of the filter: the spectral width must line up precisely with the absorption line being measured, and the transmission of the filter should be as high as possible.
For BrAC measurements, analysis of the wavelengths 3.4 µm and 9.5 µm has become the standard.

Detector Selection

The shorter wavelength could be identified using different detector types: According to the overview, InAs, PbSe, cooled PbS and PbSe, and pyroelectric detectors are all suited for use. Exclusive observation at 3.4 µm is critical, because the absorption lines of water vapor and methane gas are approximately equal.
The air in the breath contains moisture. In a worst-case scenario, it would not be possible to strictly separate ethanol and water vapor at 3.4 µm. As a greenhouse gas, methane can also be detected in the air; thus, the problem is the same.

Measurement at the wavelength of 9.5 µm is more significant, thus the selection of pyroelectric detectors is more likely.
The pyros can house up to four independent detector chips with an integrated bandpass filter in a single housing. One channel often serves as a reference, and the others are there for gas detection.
The simultaneous measurement of a gas using two filters would be possible and is actually carried out as such in practice when a high dynamic range is required for measurement. ■



Production Capacity of Pyroelectric Detectors Expanded

$LiTaO_3$ and DLaTGS Detectors can be Manufactured in Large Quantities with all Standard Filters.

WEB N06-033

LASER COMPONENTS Pyro Group's production capacity has been expanded: they are now able to manufacture all standard pyroelectric detectors in large quantities.
A new modular design ensures the rapid availability of all versions.

"Standard" refers to all components listed in the catalog and on the datasheets: this includes detectors in voltage and current mode; one, two, three, and four-channel detectors based on $LiTaO_3$; and DLaTGS pyros for FTIR applications.

The range of standard filters is impressive. We have seventeen different types of filters and thus the largest standard assortment available on the market. We are proud of our new bandpass filters, which were developed for current trends in gas measurement technology. ■

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Massive Impact

80 Participants, 11 Nations, 42 Presentations

The purpose of the **"International IR WORKshop,"** which was last held in November 2016, is to share the latest news and developments from the infrared world. Forty-two presentations in two consecutive days was very demanding on the wide international audience. In a concentrated working environment, the main players from the infrared world presented the latest developments from their specialized fields followed by a brief Q&A session. Short two to three-minute presentations just before the breaks rounded off the program.

This sector is self-confident, has a growing number of young people, is fond of discussion, and has a clear, commercial focus. Fittingly, the French market researcher and expert in optics and photonics Thierry Robin opened the IR WORKshop with his contribution.

IR Detectors. The IR WORKshop proceeded to a classic session on "IR Detectors," providing a variety of information that ranges from non-invasive glucose measurement via semiconductor alternatives to Mercury Cadmium Telluride (MCT), then to increasing the performance of pyroelectric detectors, and finally to trendsetting in the Internet of Things (IoT).

IR Components. The second of three sessions provided insights on advances in „IR Components". Research in chalcogenide glasses is heading in the direction of aspheres and free-form optics. The goal here is the development of lighter and more robust IR cameras for use in aerospace and driver assistance systems.

The main focus regarding the emitters was on broadband light sources because the enormous advances made by Quantum Cascade Lasers (QCLs) could even be the subject of a whole conference in itself.

Applications. Finally, novel applications were presented. The versatility of it best shows that IR technologies are leaving their niche markets. Spectral skin measurements were the subject of discussion, as well as identifying hot and cold spots on train tracks to detect defective brakes.

IR WORKshop

ir-workshop.info

We expect to see the miniaturization of IR measurement methods and their further integration into smartwatches and smartphones – and not just for so-called health applications. Discussions also ensued during the introduction of an app for the detection of moisture in flour or the research of automobile gas emissions at toll stations. ■

A more detailed report is available under the following web code:

WEB N06-IR

Coming Soon in the USA

After the third event, our IR WORKshop has become firmly established among leading IR experts. In the future, this event will take place in a similar format in the USA as well. In even years the WORKshop will stay in Olching/Munich, Germany.

Further information can be found on our website: www.ir-workshop.info

New Products

Customized APD Arrays for LiDAR Applications

Configuration and Size of Pixels can be Selected Freely

WEB N06-135

LASER COMPONENTS Detector Group introduced its first APD array at Photonics West: A line array with twelve elements in a DIL housing that is ideally suited for LiDAR applications.

The new arrays are based on fast, low-noise avalanche photodiodes made of silicon that are arranged in a monolithic row. The sensitivity was optimized for the wavelength range from 800 nm to 900 nm; additional features include a low temperature coefficient and a very small gap (of just 40 µm) between the elements.

The linear Si APD arrays are developed according to customer specifications; both the number and size of the elements can be defined individually.

Two-dimensional matrix arrays will be available soon. ■

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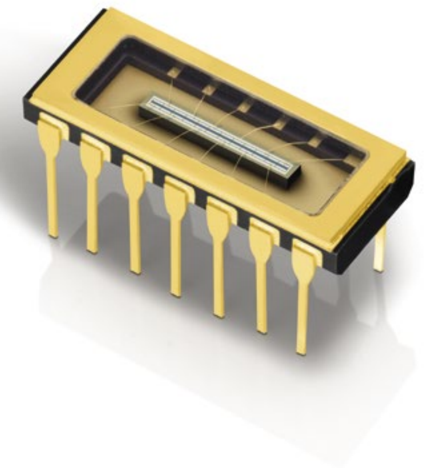

Five New Bandpass Filters for Pyroelectric Detectors

Well Done! It has Never Been so Easy to Equip Your Detector for Different Gas Measurements

WEB N06-133

Bandpass filters for IR detectors: With five new products, we offer the largest range of standard products worldwide so that you may measure whatever you want! There are seventeen different filters in total.

IR detectors are polychromatic. This means that they not only detect a wavelength but a whole bandwidth, which ranges from 0.1 µm to 100 µm in pyroelectric detectors.

These bandpass filters are either directly mounted to the fixed cap of the detector or are available as a separate cap that can be attached to an existing pyroelectric detector. We will introduce our five new filters here:

Filter B: Reference Filter
A reference filter should not have gas absorption bands. The tested and proven H filter generally does not have these bands, unless there is SO_2 in the gas mixture. In this case, use the B filter:
$\lambda_{peak} = 3.86\,\mu m$, $\Delta\lambda = 90\,nm$

Filter A: CO_2 Filter
We have worked for over a year with a manufacturer of CO_2 sensors to find the ideal CO_2 filter with the best signal possible and a simple linearization for regulation of air-conditioning systems. The following specification has been proven to be the best:
$\lambda_{peak} = 4.265\,\mu m$, $\Delta\lambda = 110\,nm$

Filter M: Water Vapor Filter
Water vapor is found in almost any mixture, and it often leads to an interfering background. Attempts to measure this with a 2.94 µm filter, for example, are faced with the problem of CO_2 cross-sensitivity. The M filter has been proven to be reliable in practical applications:
$\lambda_{peak} = 5.78\,\mu m$, $\Delta\lambda = 180\,nm$

Filter S: Methane Filter
Methane has generally always been measured at 3.33 µm; however, this is not very specific. To improve upon this, a correct spectrum can be measured or laser methods used. Alternatively, an S filter can be used that operates at a longer-wave band:
$\lambda_{peak} = 7.91\,\mu m$, $\Delta\lambda = 160\,nm$

Filter O: Alcohol Filter
Measuring the alcohol level is becoming more and more popular, which just screams for a standard filter:
$\lambda_{peak} = 9.50\,\mu m$, $\Delta\lambda = 450\,nm$ ■

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Dual-Band Mirrors for CO_2 Lasers and Pilot Lasers

Silicon-Based Beam-Guiding Components Transmit Several Wavelengths at High Efficiency

WEB N06-001

Pilot lasers are used in systems with invisible CO_2 processing lasers to determine the beam's point of impact. The beam guidance of both lasers is the same, which leads to problems: If the beam-guiding components are not optimized for the wavelengths used, they "swallow" light. In silicon mirrors, the light of the pilot laser was almost not visible anymore.

A novel dual-band coating on silicon substrates creates mirrors that offer high reflection values for the processing wavelength 10.6 µm and simultaneously reflects the light of red pilot lasers with a high yield. At an angle of incidence (AOI) of 45°, the following values can be achieved:

$R_{(10.6\ \mu m)}$ > 99,8%
$R_{(600-700\ nm)}$ > 90,0%

The low phase shift of approximately ±2° is also noteworthy.

In addition to silicon mirrors, copper mirrors are also used for light of the wavelength 10.6 µm. However, silicon substrates have major advantages: Unlike pure metal mirrors, they are significantly lighter. Furthermore, silicon mirrors are free of thorium and have a surface resistance that does not scratch as quickly during cleaning. ■

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HEDS – High-Efficiency Double-Spot DOEs

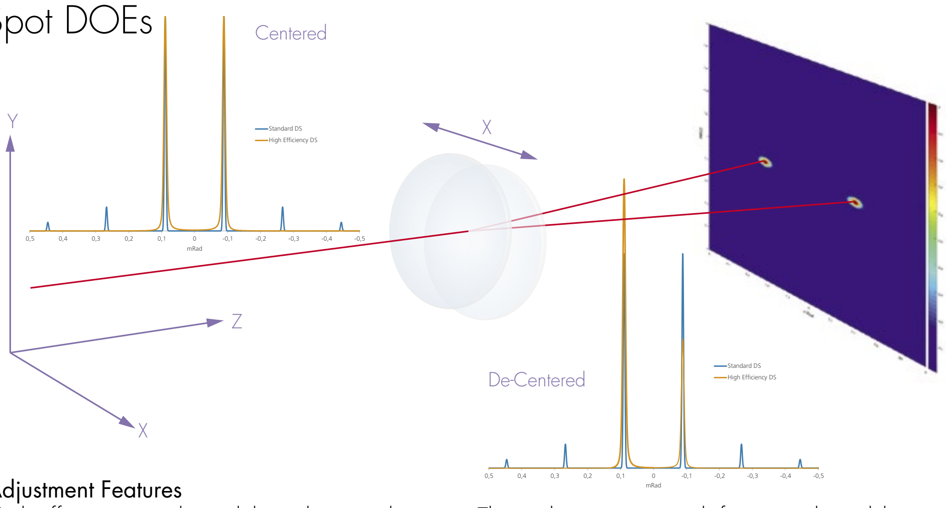
Special Beam Splitter for High Efficiency

WEB N06-002

The new diffractive double-spot elements from Holo/OR have an efficiency of 97%; previous standard versions only achieved 81%.

High-Efficiency Double-Spot (HEDS)
Diffractive beam splitters split the incoming beam into beams with equal properties. The intensity of all partial beams corresponds approximately to the total intensity of the incoming beam. For the new "high-efficiency double-spot DOEs," this means that each partial beam is >48% of the total intensity!

Advantage: No Higher Diffraction Orders
In previous versions, part of the light had higher diffraction orders; this is shown in blue in the graph. The HEDS elements have higher diffraction orders that are negligibly small: This is an advantage in critical applications.
HEDS are available for wavelengths from 193 nm to 10.6 µm.



Adjustment Features
High efficiency is achieved through a novel design that requires the centering of the HEDS in the beam path. When shifted, the spot shape and total efficiency of the element remain unchanged; however, the power distribution between both spots changes. This property can be used advantageously for the fine adjustment of the split ratio; for example, instead of a 50:50 ratio, a ratio of 47:53 could be set.

These elements are used, for example, in lithography, perforation, laser cutting, and other material processing applications. ■

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FLEXPOINT® Mini Available at 520 nm

New Wavelength for the Smallest Laser Module

WEB N06-074

The FLEXPOINT® Mini series is now also available with laser diodes at a wavelength of 520 nm.

The output power level can be customized to meet your needs: Values between 0.4 mW and 5 mW are available.

Depending on the output power level selected, the laser modules fall into the laser class 1, 2, or 3R.

Upon customer request, a digital modulation can be integrated to turn the laser on and off quickly.

These laser modules are particularly handy: The housing is only 40 mm long and has a diameter of 8 mm. The modules are operated at a supply voltage of 4.5 V to 6 V. ■

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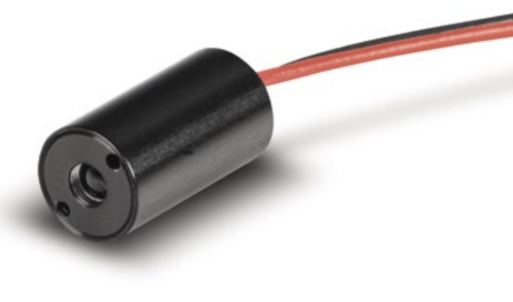

New Hexapod from Aerotech Targets Medium-Load

Ultra-Precision Applications

WEB N06-201

Aerotech's HexGen™ hexapods represent a significant advance in six-degree-of-freedom positioning performance. The newest member of the HexGen™ family, the HEX300-230HL, is targeted at medium-load, ultra-precision applications ranging from sensor testing to synchrotron sample manipulation. Aerotech's HexGen™ hexapods are the only hexapods on the market today that provide guaranteed positioning accuracy specifications below 5 µm. The HEX300-230HL's superior structural design offers the user a generous load capacity of up to 45 kg. The platform and base can be easily modified with user-specific features or mounting patterns. It features a 100 mm diameter clear aperture in the platform, while a 60 mm diameter clear aperture in the base allows workpiece access from the bottom.

Driving the HEX300-230HL is Aerotech's award-winning A3200 motion control software. Built on years of experience with difficult kinematics applications, the A3200 controller allows easy programming and control of the hexapod in any user-defined coordinate system.

Aerotech's HexSim™ software gives users the ability to easily visualize and simulate the available workspace. Tight integration between HexSim™ and the A3200 motion controller provides real-time motion visualization in any user-defined coordinate system. An intuitive graphical interface permits selection of the active coordinate system for easy virtual pivot-point programming and motion. ■

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High-Power Laser Mirrors Reflect Three Wavelengths

Take Advantage of the Cost Benefit of Our New Coating Technology

WEB N06-101

Laser optics are commonly optimized for a single wavelength. If frequency-multiplying lasers are used, this must also be considered in the selection of beam-guiding components.

LASER COMPONENTS offers so-called triple mirrors in which three wavelengths are reflected. They are used, for example, in Nd:YAG laser systems that emit at the fundamental wavelength 1064 nm (IR) and have harmonic waves at 532 nm (green) and 355 nm (UV).

A new coating makes it possible to apply this complex layer design in one pass, especially in combination with an ion-assisted deposition (IAD) or ion beam sputter (IBS) coating. These ion-supported technologies allow a very exact and reproducible result that exceeds the precision of previous methods.

Old Method – Time-consuming and Costly

Coatings for three wavelengths used to have to be manufactured in two passes: For YAG laser mirrors, for example, a coating for 1064 nm and 532 nm was first applied to the substrate (double mirror) and then, in an additional run, a mirror coating for 355 nm was vapor deposited on top of the first coating.

The production of these mirrors was, therefore, relatively complex.

A similar method was necessary with mirrors that should reflect 1064 nm and 532 nm, as well as a pilot beam at 635 nm, for example. The additional reflection at 635 nm was coated in a first run, and then a second coating was applied for 1064 nm and 532 nm.

New Method – Fast, High Capacity, Attractive Prices

The new method not only results in higher specifications, but it also has the additional advantage of a shorter duration of production, which results from not having to carry out a second coating. Furthermore, the new applied coating unit contains more substrates than before, allowing larger amounts to be produced. This positively affects the unit price.

The new triple laser mirrors are produced for very different wavelength combinations. Let us know your requirements, and we will provide you with a solution. In the example below, you will see the comparison of the calculated (green) and the measured (red) transmission values of an HR 1064+532+355 (AOI 45°, u-pol, uncoated backside) mirror. ■

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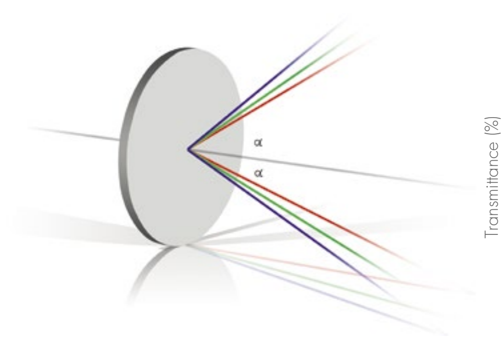

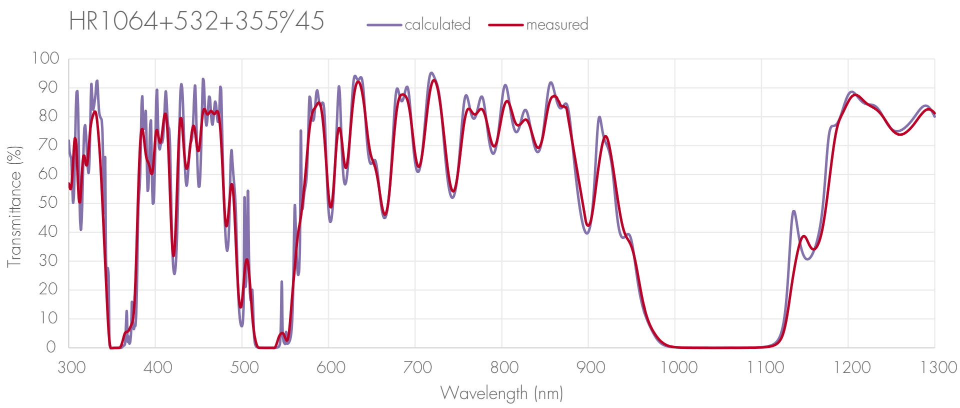

The New PRONTO-250-PLUS from Gentec EO

New Additions to the PRONTO Family

WEB N06-071

Gentec-EO's mobile PRONTO-250-PLUS laser power meter has what its name implies: a large PLUS on functions that is unique in this class of units.

This newly-introduced power meter complements the PRONTO series; however, compared to the "PRONTO-250" standard model, the measurement options have been expanded significantly:

The "PRONTO-250-PLUS" measures laser power levels between 0.2 W and a maximum of 8 W in cw mode without a time limit. The measurement value display, which has a resolution of 1 mW, updates automatically every 1.5 seconds. This truly facilitates adjustment work in the area of service. Furthermore, this device masters the so-called "single-shot" pulse energy measurement of individual pulses up to a maximum of 25 J and a maximum pulse duration of 88 ms.

Of course, short-term power measurement (i.e., a "brief snapshot" of the laser power level) is also possible up to a maximum of 250 W.

The compact dimensions and the design are also identical to the standard model. Measurement accuracy and wavelength range do not exhibit any differences either.

The "PRONTO-250-PLUS" is generally delivered with a traceable calibration that is based on the NIST standard for wavelengths from 248 nm to 2.5 µm and 10.6 µm; therefore, it is also suited for CO2 lasers. Of course, each unit has an individual calibration certificate.

So, the next time you are looking for a compact laser power meter: How about a little more this time? ■

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Power and Energy Detectors with a Direct PC Connection

The New INTEGRA Series – Now Available with an RS-232 Connection

WEB N06-171

Normally, the power and energy detectors from Gentec-EO have to be readout using a separate display unit; however, this is not the case with the INTEGRA series. These products can be connected directly to the computer.

Gentec-EO would like to introduce its new product generation: the INTEGRA detectors are now available not only with USB but also with an RS232 interface, which makes them ideal for applications under "industrial conditions."

Oftentimes, production facilities and processing machines do not have USB interfaces available, or they cannot be used in systems-critical data transfers due to their susceptibility to interference.

The INTEGRA RS-232 version is a compact and reliable alternative that is now available. The readout of the detector does not depend on a certain operating system. Thanks to the direct control using serial commands, this version requires neither a driver nor special software. This allows the RS-232 version of the INTEGRA series to also be operated under LINUX or directly from a PLC.

Another INTEGRA version is available for energy detectors. In addition to a USB interface, this version has a BNC connection to transmit an external trigger signal.

The mechanical design of the INTEGRA controller was also reworked. The space required at the PC interface was minimized; furthermore, there is now a practical mounting hole available to attach the INTEGRA to an optical bench, for example.

The INTEGRA series works with the same software as the MAESTRO, Gentec-EO's flagship display unit. The current software version is available for free download on the manufacturer's website. ■

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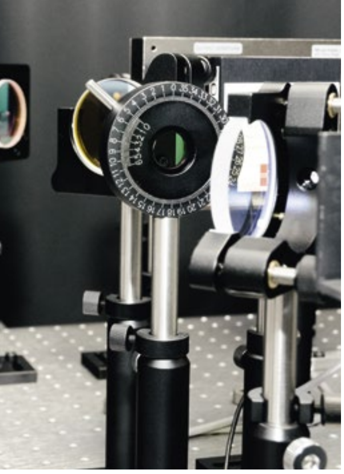
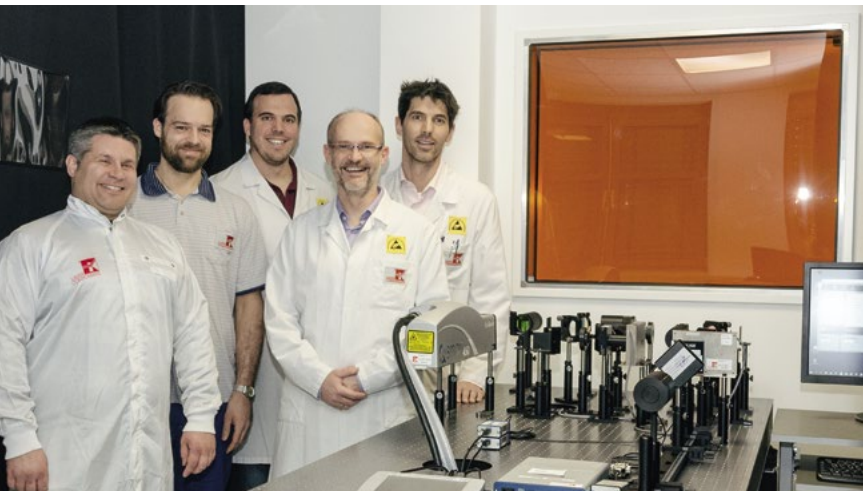




Do you have a certified quality management system? Then your testing equipment must be calibrated regularly to make it possible to trace the measurement and test results back to primary, national, and international standards.

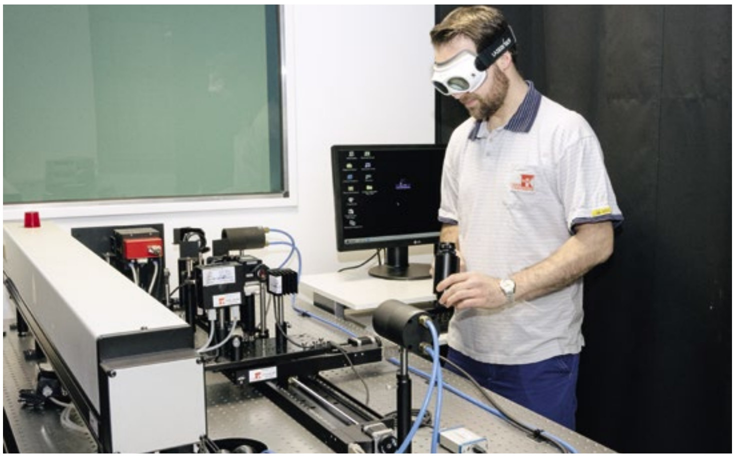
We offer a calibration service for the following devices:

- Thermal laser detectors
- Pyroelectric energy detectors
- Monitors

Our service includes the following

- Calibration according to a "golden standard" reference, traceable to NIST and PTB
- Storage of sensitivity values and correction factors in the EEPROM of the detector
- Determination of the individual wavelength profile
- Calibration certificate with the variance report

gentec-eo



CALIBRATION SERVICE

in Germany

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LASER COMPONENTS

TRADE SHOWS

Optics and Photonics Days 2017
Oulu, Finland
May, 29 – 31, 2017

LASER World of Photonics
Munich, Germany
June, 26 – 29, 2017
Booth B3.303

EuroExpo Industrimässor
Kongsberg, Norway
September, 6 – 7, 2017