PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS (UK), Ltd.

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#58 ▪ 06|17

Drones: Opportunities and Challenges

Safety with Laser Scanners

Breath Alcohol Content Measurement

New Products

Imprint

LASER COMPONENTS (UK), Ltd.

Goldlay House 114 Parkway
Chelmsford Essex CM2 7PR
United Kingdom

Tel.: +44 1245 491 499
Fax: +44 1245 491 801

www. lasercomponents.co.uk
info@lasercomponents.co.uk

Managing Director: Chris Varney
Registered Company 2835714
Editor: Kay Cable

Dear Reader

Drones and more drones, they are part of our modern day lives, whether for amateur airborne camera shoots, military reconnaissance or seeking out the best oil reserve to extract. Efficient propeller design and longer life power sources finally allow realistic flight times and thus more sophisticated on board sensors, most notably object avoidance.

Using flight of flight (ToF) technology, low power and light weight pulsed lasers and detectors (avalanche photo diodes or APDs in fact) bring together a pulse of light that reflects off an object to be captured by the APD and using simple sums the distance of the object can be determined. Multiple ToFs on board gives the drone 'awareness' or 'intelligence' to avoid objects during its intended destination using additional GPS technical.

Enclosed in this new newsletter format we feature ToF applications with drones, autonomous flight and automotive door safety. There are many other applications, for later issues to reveal more, most obviously autonomous vehicular transport including personal travel. Here we can see entering a 'pod', entering our desired destination then sit back and enjoy a DVD or read the e-paper as we travel to and from work. Once roads and motorways have been upgraded to allow on board sensors to locate position, it is probably less than 10 years away before 'pods' are common and no one will use a steering wheel.

We also lend insight to blood alcohol measurement, which may be less relevant for autonomous travel, unless our legal system still requires the driver, or passenger, to be 'in charge' of the vehicle. Here we address non-dispersive infrared (NDIR) technology to measure spectral absorption of alcohol, which includes at least four NIR wavelengths to choose from to measure. A broadband NIR source, optical filter at the chosen wavelength and suitable detector completes the NDIR sensor, which can be as small as a cube of sugar, or smaller still!

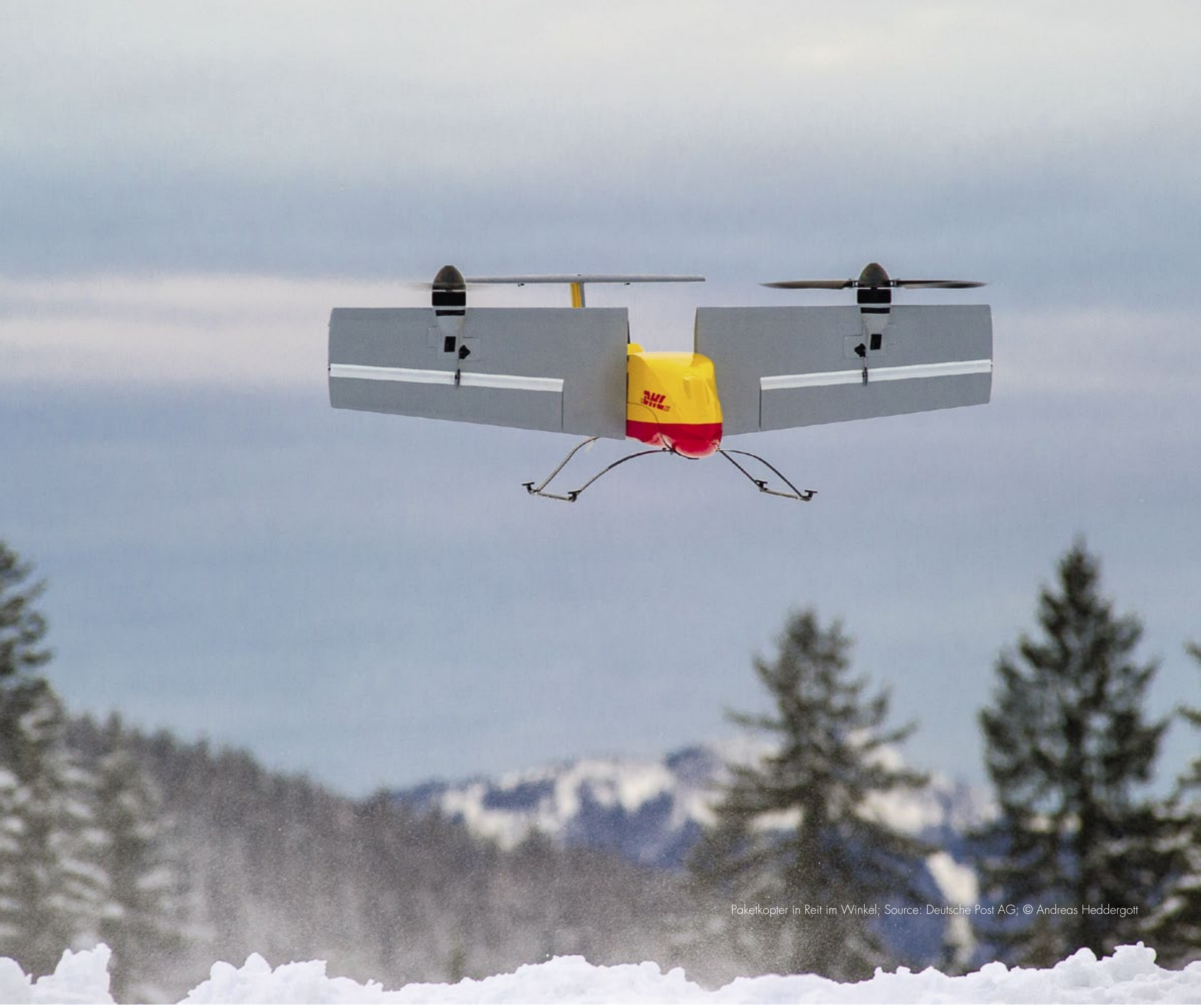
It may not have escaped the reader's notice that much of the above resides within the infrared spectrum, thus making all these technologies invisible to humans. Nevertheless there are some high optical powers involved especially if long range sensing is required and so eye safety must be considered. The IR WORKshop was one event addressing all these topics, and well worth considering if your career lies in this area.

Whilst we include some of our latest new products do please visit us at one of Europe's optoelectronic events such as Photonex Scotland Roadshow in Glasgow or LASER World of Photonics in Munich. We'd be delighted to meet you and discuss the best components for your applications. Enjoy!

Yours,

Chris Varney

Chris Varney



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

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 localise 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.

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.

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). ➔

Dangers of Drones

We will soon see the commercial application of autonomous drones, in which the control pilot does not have visual contact with the UAVs during flight. Another challenge will be tracking enemy drones.

Thus, not only is intelligent automation the focus of development of these flight systems, but also simultaneous drone detection in order to ensure reliable drone defence.

Drone Defense

Multi-sensors are already being used to monitor the airspaces above prisons, government buildings, industrial facilities, and stadiums. If a dangerous drone is detected, there are a few conceivable defense techniques available. The possibility of taking over or destroying a UAV system via electromagnetic fields is currently the topic of research. Attacks via jammers or spoofers could force the drone to return to its starting position, leave its current path, land, or crash. Counter-drones with capture systems would not be practical because they would have to be very large and controlled in a targeted manner.

The Dutch police are developing an unusual method. They are currently training eagles to catch small drones in flight. You will find a video showing the eagles in action here: youtube.com/watch?v=HifO-ebmE1s

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

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 analyse 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 UK58-0410

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 optimised for the wavelengths 850 nm and 905 nm, have a high quantum efficiency, and operate quickly.

Inexpensive Pulsed Laser Diodes

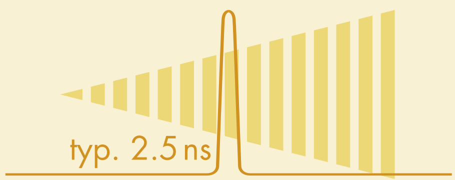
The UA series pulsed laser diodes are a good counterpart to the inexpensive APDs, featuring power levels of up to 75 W. They are as inexpensive as comparable PLDs in a plastic housing; however, they are of a higher quality with their ultra-precise mechanical tolerances. The hermetically-sealed metal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

Dave Barry +44 (1245) 49 14 99
dbarry@lasercomponents.co.uk



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 recognise 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:

$$c = 299{,}792{,}458 \text{ meters/second}$$

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).

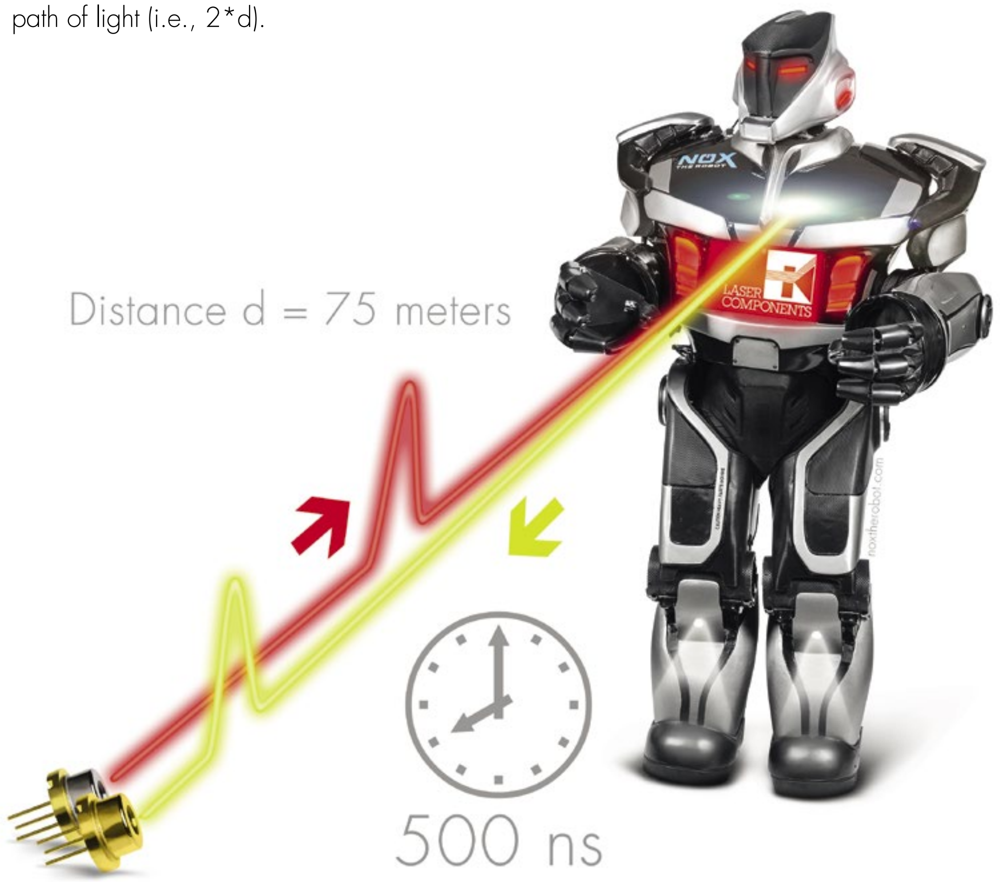
The distance can be measured in your head if you allow for the following approximate values:

$c = 300{,}000{,}000 \text{ m/s} = 3*108 \text{ m/s}$
$n = 1$

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

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

It is impressive to realise 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?

© istock.com/choja

One-way Light Barriers

A simple safety system is the one-way light barrier, which recognises 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

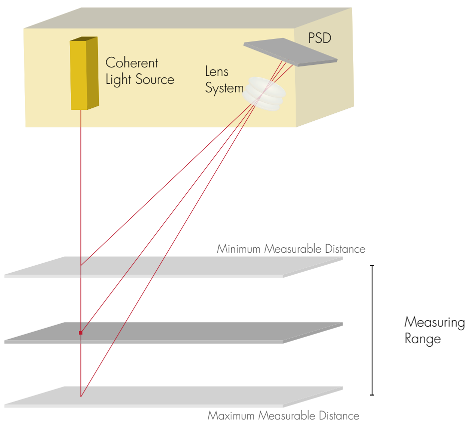
Triangulation and Time-of-Flight Measurements

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 recognised and the door system stopped.

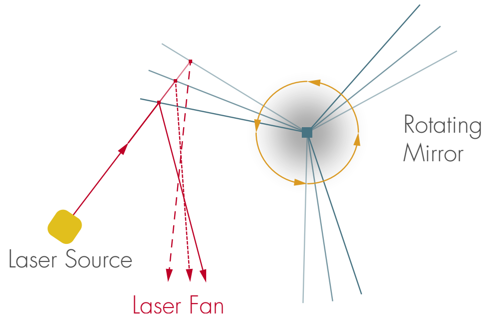


Laser Scanners

If high precision and speed are required, then it is necessary to utilise 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 recognise 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 007, 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. ■

NEW
Standard Filter for Alcohol-Measurement
more on page 14

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 analysed. 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.

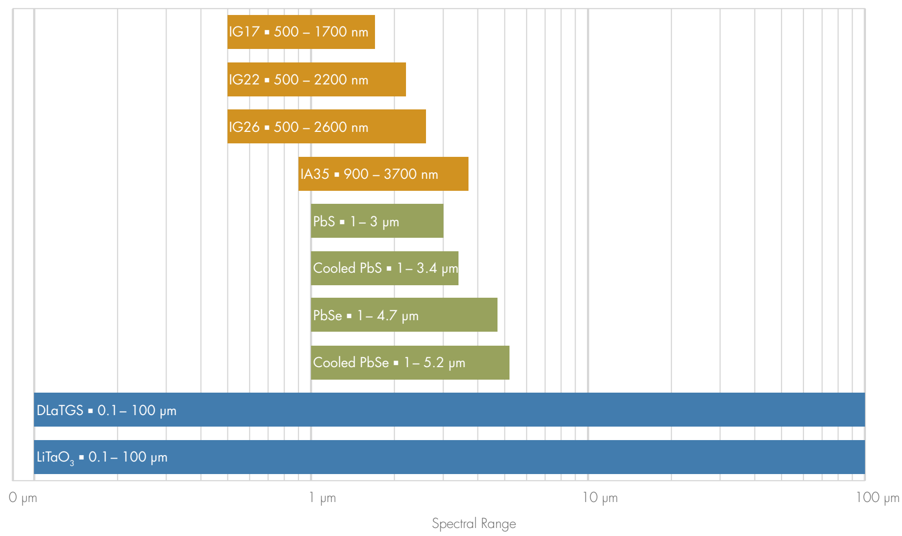
Filter Selection

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 UK58-0330

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 catalogue 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. ■

Dr. Tony Hornby+44 (1245) 49 14 99
thornby@lasercomponents.co.uk

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 programme.

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 miniaturisation 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 UK58-0311

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

1 **B001 Platform** Optical Fibre Amplifier ■
2 **Diffractive Optic** Double-Spot-DOE with an efficiency of 97% ■
3 **APD-Arrays** Created for LiDAR Applications ■
4 **FLEXPOINT® mini** now available at 520 nm ■
5 **IR Filter** 5 new Standard-Filters for interesting measurements ■
6 **Side-Light POF** Modern Plastic Fibres for Design-Illumination ■
7 **DBR Laser Diodes** High Performance from Photodigm ■

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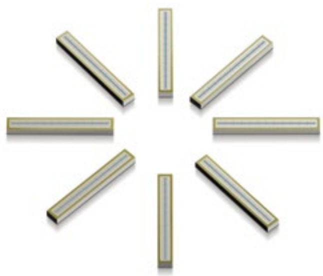

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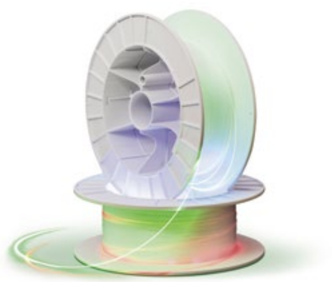

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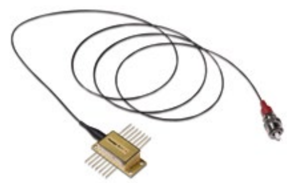


B001 Platform Optical Fibre Amplifier

Small Form Factor, Benchtop EDFA

WEB UK58-0190

LEA photonics introduce a new B001 platform for their optical fibre amplifiers. The new platform combines the advantages of an OEM module, being compact and robust, with the easy to use front panel interface of a benchtop. The new platform measures only 270 x 190 x 90mm, making it ideal to fit on a table, and weighs only 2.1kg, so it is easy to carry.

The amplifier within the B001 platform can be addressed directly, via a user friendly front panel interface, or remotely via a built Ethernet to RS232 converter port. The B001 platform is available as an option on a large range of LEA photonics models of optical amplifier, including random and polarisation maintaining versions, delivering optical output powers up to 23dBm. ■

Dr. Peter Bennett: +44 (1245) 49 14 99
pbennett@lasercomponents.co.uk

HEDS – High-Efficiency Double-Spot DOEs

Special Beam Splitter for High Efficiency

WEB UK58-0031

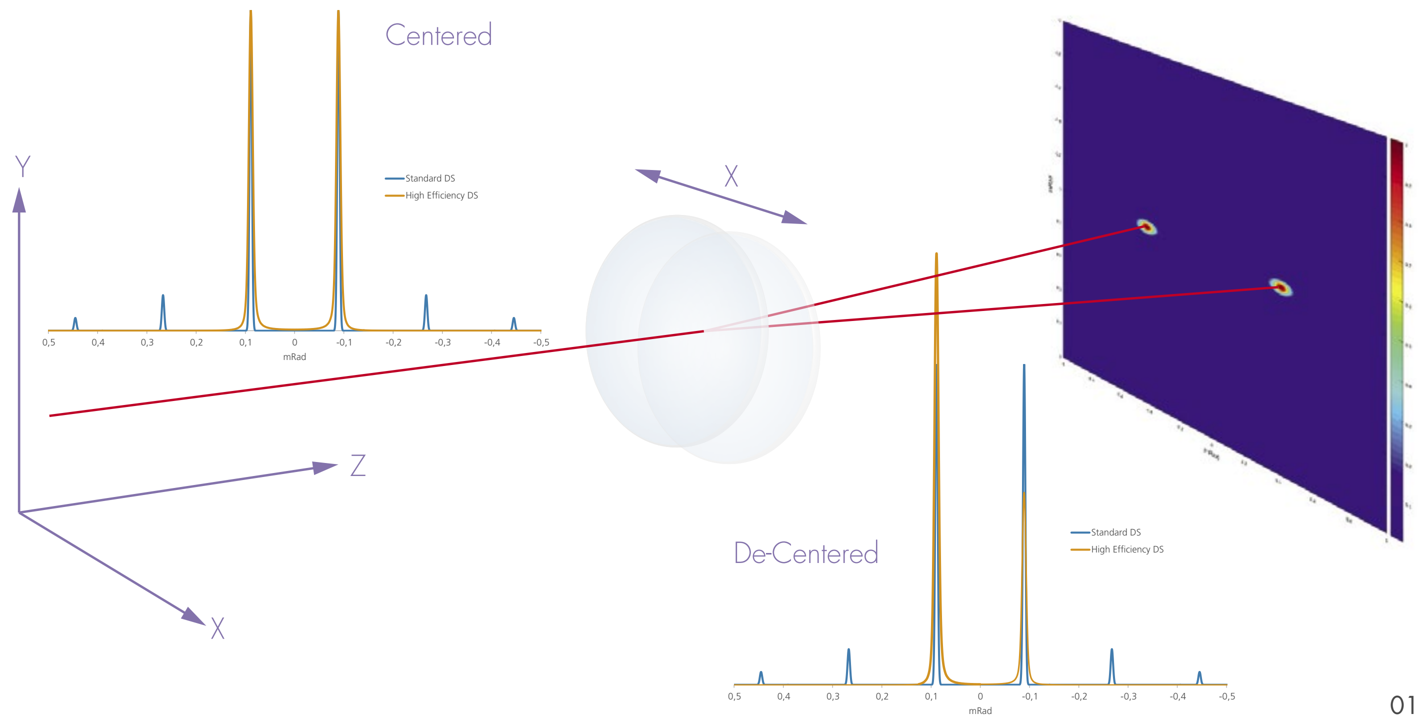
The new diffractive double-spot elements from Holo/OR have an efficiency of 97%; previous standard versions only achieved 81%.

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. ■

Samuel Thienel: +44 (1245) 49 14 99
sthienel@lasercomponents.co.uk



Customised APD Arrays for LiDAR Applications

Configuration and Size of Pixels can be Selected Freely

WEB UK58-0350

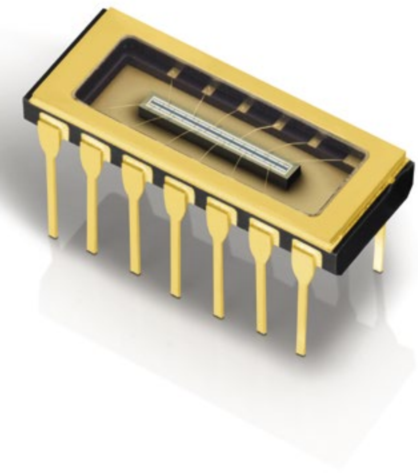
LASER COMPONENTS Detector Group introduced its first APD array at Photonics West: A line array with twelve elements in a DIL housing that is ideally suited for LiDAR applications.

The new arrays are based on fast, low-noise avalanche photodiodes made of silicon that are arranged in a monolithic row. The sensitivity was optimised 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. ■

Dave Barry: +44 (1245) 49 14 99
dbarry@lasercomponents.co.uk



FLEXPOINT® Mini Available at 520 nm

New Wavelength for the Smallest Laser Module

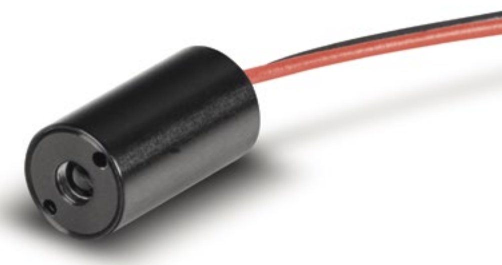
WEB UK58-0740

LASER COMPONENTS is proud to announce the popular FLEXPOINT® Mini laser diode module, now available in 520nm. The optical power can be set to any value between 0.4–5mW, and depending on the chosen optical power, the laser safety level will be either class 1, 2, or 3R.

The 520nm modules require 4.5-6VDC to operate and can be built with our optional integrated digital modulation circuit, allowing the laser to be turned on and off in quick succession.

The FLEXPOINT® Mini's small ⌀8x40mm housing makes this module particularly useful. ■

James Saxon: +44 (1245) 49 14 99
jsaxon@lasercomponents.co.uk



Five New Bandpass Filters for Pyroelectric Detectors

Set up Your Detector for Different Gas Measurements

WEB UK58-0330

LASER COMPONENTS introduces five new bandpass filters for pyroelectric detectors, increasing the number of standard filters available to an outstanding seventeen versions.

The new filters include reference filters (B) and filters for the detection of CO_2 (A), water vapour (M), methane (S), and alcohol (O), and are either mounted directly inside the fixed cap of the detector or available as a separate cap, which is then mounted to an existing pyroelectric detector.

A reference filter should not have any gas absorption. Filter B can be used when SO_2 is part of the gas mixture (λ_{peak} = 3.86μm, FWHM = 90nm).

The CO_2 filter A with a λ_{peak} = 4.265μm is the filter with the best possible signal and simple linearisation (FWHM = 110nm).

Water vapour is in almost every gas mixture, which often leads to a disturbing background noise. An attempt to measure this with a 2.94μm filter, for example, leads to problems of cross-sensitivity with CO_2. The M filter has proven more reliable in such practical applications: λ_{peak} = 5.78μm, FWHM = 180nm.

Methane is primarily measured at 3.33μm; however, this is not particularly specific. An excellent alternative is the S filter, which operates at a longer-wave band: λ_{peak} = 7.91μm, FWHM = 160nm.

Breath alcohol measurement is becoming more and more popular. The new standard filter has the following specifications: λ_{peak} = 9.50μm, FWHM = 450nm. ■

Dr. Tony Hornby: +44 (1245) 49 14 99
thornby@lasercomponents.co.uk

Side-Light POF

A Special Design of Plastic Optical Fibre for Illumination

WEB UK58-0130

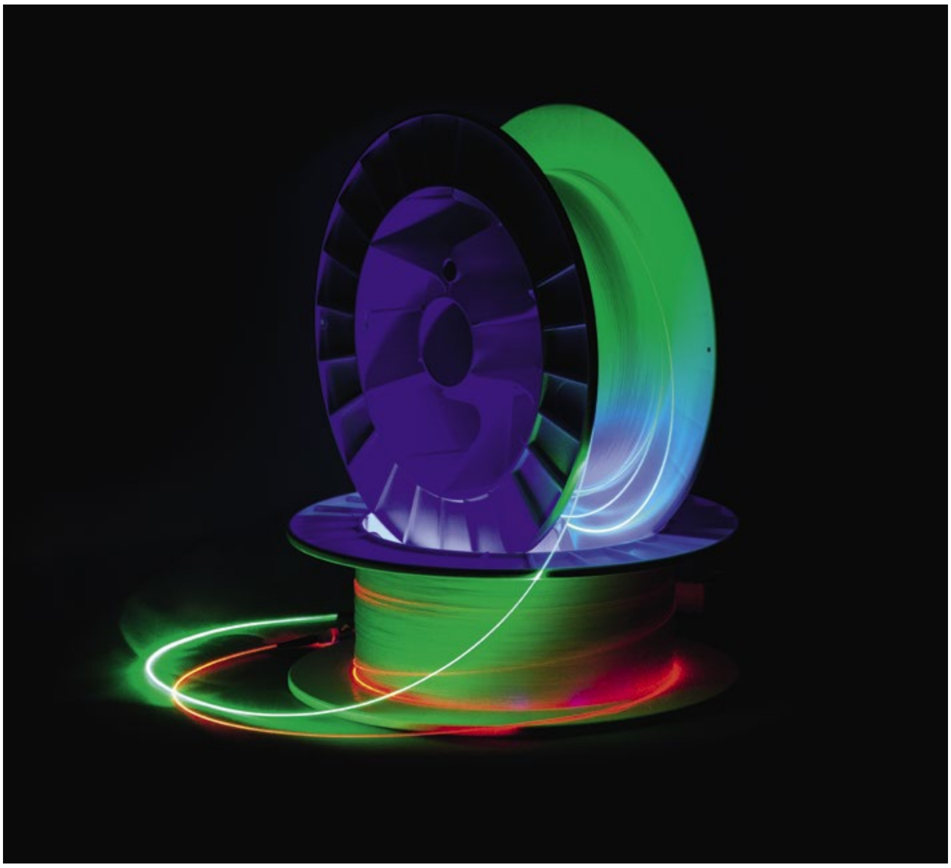
LASER COMPONENTS offers polymer optical fibres that emit light sideways along the entire length of the fibre.

This property is extraordinary because normally the coupled light is transmitted within the optical fibres and only decoupled at the fibre end face. Conventional fibres are designed to keep the decoupled side light (leakage) to a minimum.

The side-light plastic optical fibre was created for illumination tasks in which light must leak out equally across a certain length. For example, in the automobile industry, these fibres are suited for interior lighting in the middle console or the door frames. They can also open up new possibilities in the textile industry or for lamp designs.

The side-light POF is available with diameters of 250µm, 500µm, 750µm, and 1000µm. They are available both as single fibres and fibre bundles with up to sixteen fibres. ■

Dr. Peter Bennett: +44 (1245) 49 14 99
pbennett@lasercomponents.co.uk



Precision DBR Laser Diodes from Photodigm

High Performance, Narrow Linewidth Laser Diodes

Photodigm

WEB UK58-0830

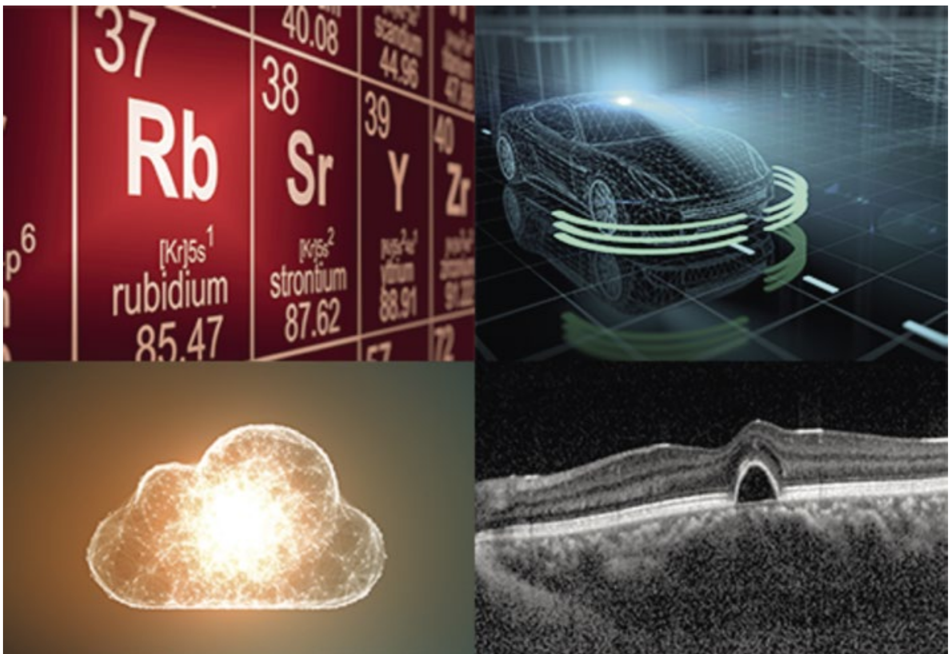
LASER COMPONENTS is delighted to announce a partnership with Photodigm - the world's leading specialist manufacturer of single spatial and longitudinal mode laser diodes.

Spanning the wavelength range from 760nm through to 1083nm and including critical wavelengths in spectroscopy for K, Rb, Cs, He and O_2, these highly reliable DBR devices really do set the standard of performance within a range of applications including Raman spectroscopy, atom cooling and trapping, biomedical diagnostics, difference frequency and frequency doubling, LiDAR, oxygen and water vapour sensing. Custom wavelengths are available on request. Devices are available in a range of packages including C-mount, butterfly, TO-8 and as chips on submount.

Photodigm's PreciseMode™ delivers a nearly circular, weakly divergent beam with a >2nm mode-hop-free tuning range. Also, as an OEM solution for high power application, the Mercury™ TOSA package is available, specialised for cooled laser operation.

Emitting diffraction limited beams, devices from Photodigm can provide outputs approaching maximum theoretical brightness with higher wavelength options demonstrating output powers of up to 400mW. Couple this power capability with the high modulation capability (up to 6.8GHz), short pulse durations (<100ps) and narrow Gaussian linewidths (<500kHz), Photodigm DBR lasers are used as important frequency standards, calibration references and spectroscopic sources. ■

Dave Barry: +44 (1245) 49 14 99
dbarry@lasercomponents.co.uk



TRADE SHOWS

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