PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS Nordic AB

December 2014
Issue 01

Dear Reader,

I am very happy to address you in this editorial of the very first Nordic Photonic News. Laser Components Nordic opened its doors in August this year and will serve customers in Sweden, Denmark, Finland, and Norway from its offices in Gothenburg and Stockholm. The months that have passed since the start have been exciting, intense and very rewarding.

I am happy to say that many of you have already found us! The recognition of the LASER COMPONENTS brand is already strong in our region, and the Scandinavian market has in fact become the third most important sales market for Laser Components – after the German speaking countries and the U.S. The opening of a Nordic sales office is therefore a very logical step and will ensure that you continue to get the attention and service your business needs.

The product portfolio we carry mainly includes products developed and manufactured by the Laser Components Group: emphasis will be put on components for IR applications, laser modules, laser optics, pulsed laser diodes, avalanche photodiodes, and fiber optic products. In addition, the portfolio also includes components manufactured by suppliers that have been represented by Laser Components for a long time. More will be added as time goes by, so please make sure to visit our webpage regularly.

I would also like to take the opportunity to thank those of you who spent time at our booth at the Optics & Photonics in Sweden 2014 in November. We hope to see you again next year! For other conferences and trade shows, please check our events calendar.

Yours,

Mikael Winters

Advanced Pyroelectric Detectors

High-Tech with DLaTGS

The basic material of pyroelectric detectors with the highest performance level is DLaTGS, deuterated and L-alanine-doped triglycine sulfate. The detectivity D* of DLaTGS is typically 2.5 times higher than in $LiTaO_3$ detectors, even at high frequencies. Furthermore, they have a wide spectral sensitivity range from UV to THz wavelengths that is only limited by the detector window used.

The Curie temperature of DLaTGS is 61°C and thus more than 10 K higher than TGS (triglycine sulfate). This is achieved by the process of deuteration, the complete replacement of all hydrogen atoms by deuterium atoms. Additional doping with L-alanine increases the sensitivity of detectors and prevents permanent depolarization when heating beyond the Curie temperature.

LASER COMPONENTS Pyro Group produces pyroelectric DLaTGS detectors - three series are available: One for users who would like to combine their detectors with their own electronics (LCDT-5000 series); the LCTDT-5100 series is designed for low-frequency applications in the range of 10..100 Hz, and the LCDT-5500 type with a low-noise JFET is designed for FTIR applications. All detectors possess thinned-out elements and optionally feature an absorbing black coating with a low thermal mass that offers a wide spectral response at a simultaneously high speed. All pyrodetectors are available with different diameters of their active surfaces and rectangular and square shapes as well. Standard housings include TO-5, TO-66, and TO-37.

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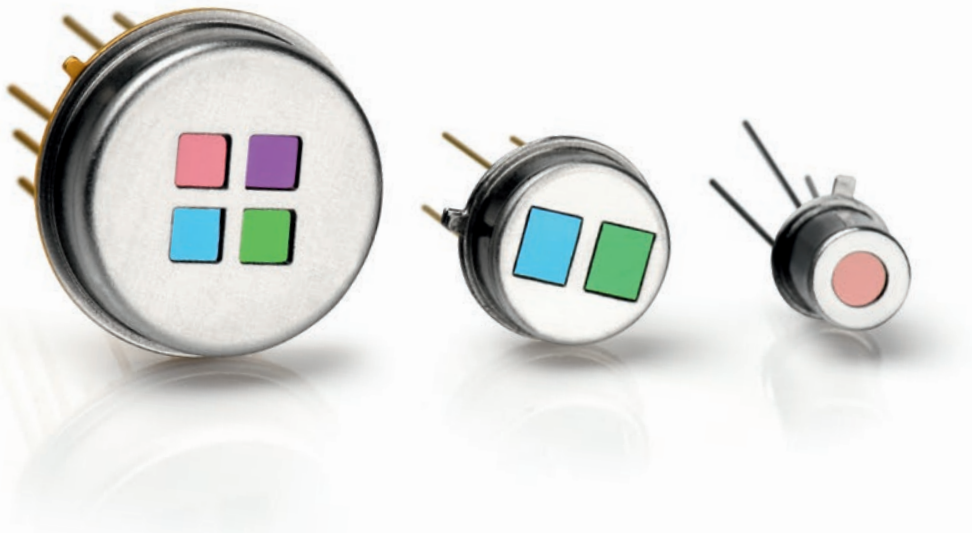

LASER COMPONENTS Pyro Group – We Manufacture Pyroelectric Detectors!

Pyroelectric Detectors: Materials, Applications, and Working Principle

Pyroelectric detectors are thermal detectors: Temperature fluctuations produce a charge change on the surface of pyroelectric crystals, which produces a corresponding electrical signal. This temperature gradient can be created by the absorption of light.

There are different pyroelectric materials available, three of which are commonly used in pyroelectric detectors: DLaTGS, $LiTaO_3$, and PZT.

The table provides an overview of the materials' properties. Simply put, the figures mean the following:

1. The pyroelectric coefficient determines the ability to produce current from IR radiation. That is to say: the bigger, the better.
2. The dielectricity constant determines the capacitance, thereby affecting the noise. In voltage operation, the following is true: The larger the capacitance, the lower the noise. The dielectricity constant corresponds in the exact opposite manner.
3. The specific heat capacity determines the temperature increase in the crystal depending on the absorbed radiation. A low C_v means a larger temperature increase and thus a better signal.
4. The specific AC resistance is coupled with dielectric losses that, in turn, produce a kind of Johnson noise. A pure dielectric would not produce any noise. The lower the AC resistant, the better.

To compare materials with regard to their fundamental suitability for pyroelectric detectors, it makes sense to analyze them using the parameter pyroelectric coefficient specific AC resistance/dielectric constant specific heat capacity. DLaTGS and $LiTaO_3$ achieve the best results; thus, they are particularly well suited.

DLaTGS is the material with the highest performance level (approx. $2x10^9$ @ 10 Hz). The use of this material is widespread in IR measurement technology in the laboratory, especially in routine FTIR applications. Industrial applications are largely reserved for $LiTaO_3$ due to its thermal behavior (s. Fig. 1). PZT is primarily used in consumer products.

The Modes of Operation of Pyros

The IR crystal is modulated as a power source with a parallel capacitance and housed in a TO can with additional electronic components. There are two basic modes of operation of pyro detectors: voltage mode (VM) (Fig. 2) and current mode (CM) (Fig. 3).

Voltage mode (VM): JFET-based voltage mode has been widely used for a long time; however, it has critical disadvantages and can only be recommended for experienced users: It produces a relatively low signal on a strongly temperature-dependent offset. But this mode of operation also has some advantages: The highest value for D* can be achieved with the simplest design (approx. 0.5x109 @ 10 Hz), and the amplification is flexible.

Current mode (CM): In current mode, a high signal is produced on a low offset with relatively low temperature dependence. For current mode, OPVs are required that exhibit just a low electrical power consumption. With this version, beginners can most quickly and successfully develop their product. The low output impedance leads to additional EMC advantages.

D* achieves similar values to voltage mode with a slightly more complex design: A second blind detector element that is connected in an antiparallel manner is required for this purpose. For this configuration, the somewhat ambiguous term "temperature compensation" (TC) has become prevalent. This blind element attenuates undesired signals resulting from fluctuations in the surrounding temperature, but it does not compensate for physically predefined temperature dependencies, such as those shown in Fig. 1. Thus, it is more a signal stabilization or "temperature fluctuation compensation" (TFC).

		DLaTGS	$LiTaO_3$	PZT
Pyroelectric coefficient	δ [Coul/cm² °K]	$4,5 \times 10^{-8}$	$1,7 \times 10^{-8}$	$4,4 \times 10^{-8}$
Dielectricity constant	ε	18	51	180
Specific heat capacity	C_v [J/cm³ °K]	2,5	3,2	2,6
Specific AC resistance	ρ [Ω -cm]	$2,4 \times 10^{10}$	$4,2 \times 10^{10}$	$4,2 \times 10^{9}$
Figure of merit	$\delta\rho/\varepsilon C_v$	24	4,3	0,4

TFC increases the performance level in current mode; however, in voltage mode it is reduced by half. This is caused by the fact that in current mode TFC attenuates the tendency toward natural oscillation, thus allowing a larger amplification.

LASER COMPONENTS' Product Range

The LASER COMPONENTS Pyro Group manufactures both DLaTGS and $LiTaO_3$-based pyro detectors. All commercially-available options – from multicolor to miniaturized versions to detectors with a reduced microphonic effect – are represented and successively refined as the portfolio grows.

More detailed information is available from

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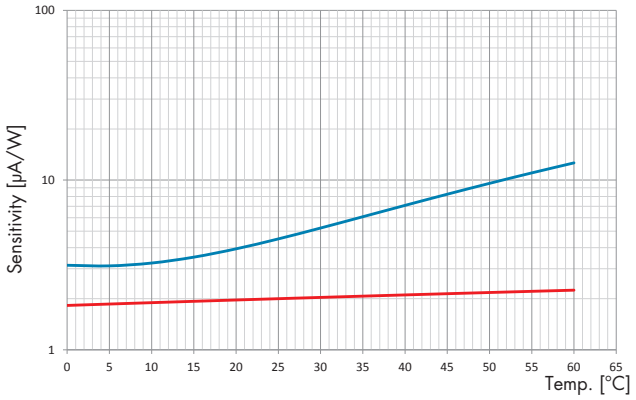
Good to Know

Detectivity D*

D* represents the signal-to-noise ratio for a certain electrical frequency and bandwidth if 1 watt of radiation power reaches a detector surface of 1 cm². The higher the D* value is, the better the detector is.

$$D^*[\mathrm{cm}\sqrt{\mathrm{Hz}}\,\mathrm{W}^{-1}] = \frac{\sqrt{\text{active detector area}}}{\text{NEP}}$$



Current Response [µA/W] vs. Temp. [°C] (DLaTGS & LTO)

Fig 1: Temperature coefficient $LiTaO_3$ ca. 0.35%/K; use a temperature-stabilized setup for DLaTGS.

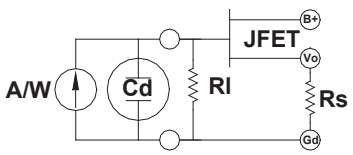


Fig. 2: Typical VM Circuit
Equivalent circuit of a detector in voltage mode (VM)

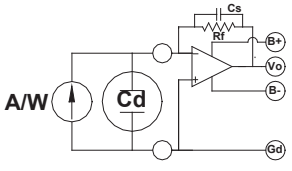


Fig. 3: Typical CM Circuit
Equivalent circuit of a detector in current mode (CM)

Plug&Play APD Modules up to 25 MHz

A-CUBE: Use APDs Easily

Optical power in the fW range can be easily detected using avalanche photodiodes. For easy plug&play application, we are introducing our A-CUBE APD modules: these small modules detect light quickly and reliably in the spectral range from 400 nm to 1700 nm.

The heart of the A-CUBE is a low-noise Si or InGaAs avalanche photodiode with a preamplifier and an integrated high-voltage power supply. Temperature compensation is also integrated that allows operation across a wide temperature range at a constant amplification.

InGaAs detectors allow measurements in the spectral range between 1000 nm and 1650 nm; the silicon versions allow measurements between 400 nm and 1100 nm. Both versions are available in different bandwidths: from DC to 25 MHz.

This shielded housing with an edge length of just 40 mm can be integrated into optical benches with a single click. It only requires an additional 12 V power supply to operate the APD. With this setup, detection of the smallest amount of light is child's play. The A-CUBEs are available on an optional basis with an FC connection.

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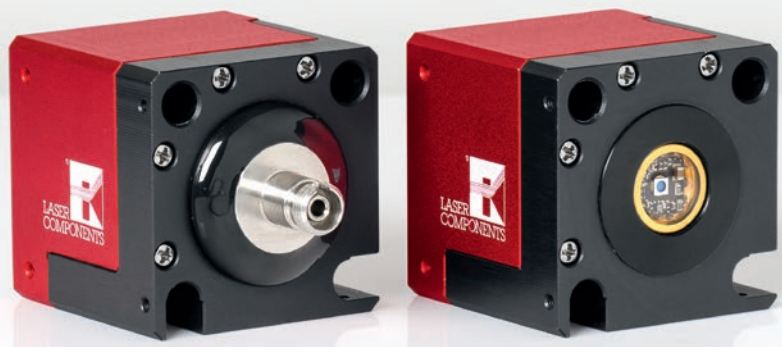

New World Record: Up to 650 Watts at 905 nm

Peak Performance of Pulsed Laser Diodes at 650 W in a TO-18 Housing

LASER COMPONENTS Canada has set a new world record with its pulsed laser diodes at 905 nm: peak power levels of up to 650 W emitted from a small TO-18 housing. They are based on "multi-junction" laser technology and are available on a standard basis.

This special laser technology contains several epitaxially integrated emitters with a total emitting area of 200 µm x 10 µm. At a pulse length of 150 ns, it is possible to achieve a peak performance of at least 70 W from a single chip. The metal housing allows a higher thermal load, which permits overdriving the diode and ultimately leads to the achievement of an output of up to 650 W from a stacked array design. Due to the combination of a small emitter area and an extremely high peak performance, the new 3J08 series is optimally suited for fiber coupling.

These pulsed laser diodes are used in low-level laser therapy, among other things. This is an alternative (veterinary) medical treatment that is carried out using monochromatic and coherent light. The goal of treatment is to reduce pain, accelerate the healing of wounds, and fight infections.

Further areas of application include rangefinding, speed guns, laser radar, security scanners, laser light curtains, and test and measurement systems.

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COUNT® S – The Inexpensive Photon Counter

Passively-Quenched COUNT®

Effective immediately, a new photon counter has been added to the COUNT series: The COUNT® S features the high quantum efficiency of the other models and a significantly larger active area of 500 µm. These photon counters are passively quenched and thus the most inexpensive alternative.

A dead time of approx. 1 µs yields a maximum count rate of up to 1 Mcps. The dark count rates of the COUNT® S series range between 1000 cps and 5000 cps and tie in directly with actively quenched COUNT®s.

Incoming photons produce electrical pulses in the detector that are then readout using the TTL output. A PSU, which is available on an optional basis, completes the plug-and-play module. All models are also available with an FC/PC fiber coupling.

Our passively-quenched COUNT® S series is particularly well suited for research and school internships, for example in the field of quantum optics and quantum information: Due to the large active area, they are easier to focus on than the actively-quenched COUNT® series and the price is significantly lower.

The following versions are available and differ only in their dark count rates: COUNT® 1000S, COUNT® 2000S, COUNT® 5000S.

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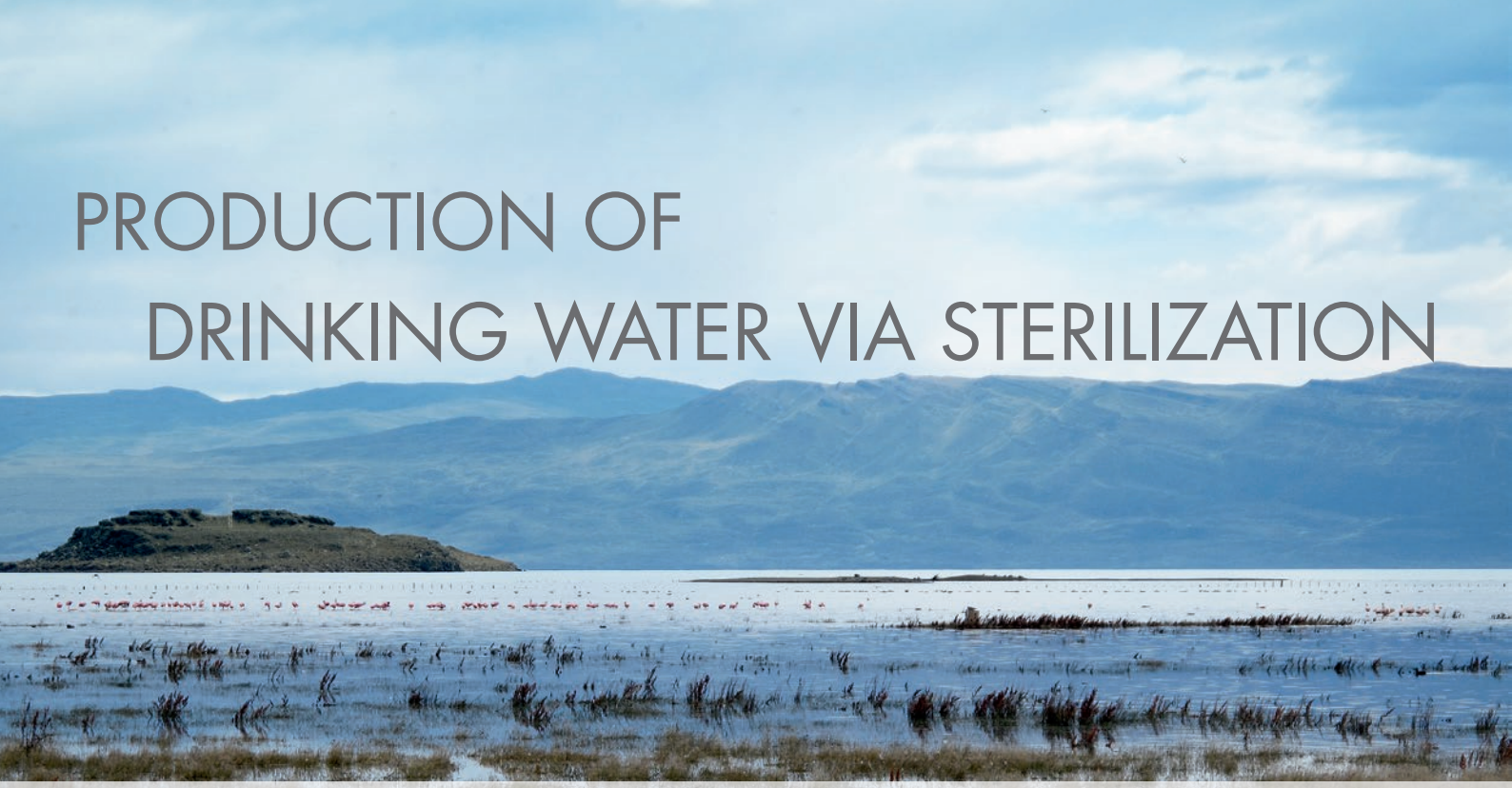
PRODUCTION OF DRINKING WATER VIA STERILIZATION



Humans can survive several days without food but only a few days without water. Thus, drinking water is the most important source of nourishment, and there is plenty of water available on the Earth; in fact, if you took all of the water resources available on the earth and shaped them into a cube, the cube would have an edge length of 1180 kilometers [1]. Only a few thousandths of these resources are available as fresh water and can thus be used as potential drinking water. Drinking water is processed fresh water and has a high degree of purity. It is safe for consumption, does not contain contaminants or pathogenic microorganisms, and ideally contains minerals.

Preparation of Drinking Water via Disinfection

Drinking water is not available everywhere in sufficient quantities: In some regions, fresh water is only available from precipitation and is thus contaminated. Polluted water can lead to diseases, and even death. To be fit for consumption, it is necessary to treat and sterilize this water.

Different methods are used to sterilize water; one such method is sterilization via UV radiation. This process is particularly advantageous because it is neutral in taste and economical.

Sterilization via UVC Radiation

Radiation in the wavelength range between 100 nm and 280 nm is referred to as UVC radiation. This very short-wave radiation is absorbed by the Earth's atmosphere; thus, it does not reach the Earth's surface. If this radiation comes into contact with microorganisms, their DNA is damaged within a very short period of time, reproduction is no longer possible, and the viruses and pathogens are wiped out.

Studies performed by Prof. Dr. Hellmann from the University of Applied Sciences in Aschaffenburg have shown that sterilization was most effective when the bacteria under examination were illuminated with a wavelength of 280 nm. The following bacteria were tested: Escherichia coli, Enterobacter cloacae, and Kebsiella pneumoniae [2].

Light Sources

Mercury vapor lamps are primarily used as UVC light sources. They will soon be replaced by UV LEDs, which are now available commercially.

The Advantages of UV LEDs

Even though UV LEDs have a low efficiency, they will become the most promising sources of sterilization with UV light. They are much smaller than mercury vapor lamps, and the greatest advantage is their particularly undemanding power supply: UV LEDs can be operated with a direct current and thus directly connected to solar cells. They can, therefore, be used anywhere – even in areas without a reliable electricity supply.

A Look at the Future

UVC LEDs possess great market potential. These products are not yet superior in terms of efficiency and lifetime but still well suited for use in mobile water sterilization. In the future, they will surely be used in critical environments, such as, for example, hospitals to avoid further use of the hazardous material mercury.

Did you know that UVC radiation is also used in air disinfection?

280 nm UV LED

LEUVA77G00HF00, LEUVA66B00HF00

We have two UV LEDs at a wavelength of 280 nm, both of which are based on InAlGaN light diodes.

The wavelengths in the UVC range are produced from an alloy of gallium nitride and aluminum nitride. The efficiency is still just a few percentage points and the output power in the milliwatt range; however, it will not be long before the output power is increased and an alternative to mercury vapor lamps arises.

UV LEDs do not need to warm up, have a long lifespan, and are light and compact. Thus, they are perfectly suited for effective use in remote and off-grid sterilization systems, such as, for example, airplanes. Due to direct current operation, a solar installation can also be used as the power supply.

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Sources: [1] lexikon.wasser.de/index.pl?begriff=Wasservorkommen&job=te,
[2] elektor Special Project: LEDs 2, S. 40 ff, www.hab.de/uploads/media/WasserentkeimungUV.pdf

Made for Image Processing

LEDs with Pattern Generators

LASER COMPONENTS has offered FLEXPOINT® MV series image processing lasers for 3-D triangulation for many years.

Structured light – such as for example line, grid, and cross-hair patterns – is often required for measurement tasks. We are asked time and again about sources that do not exhibit speckle effects such as those common to lasers. To be able to meet the needs of our customers, our partner Blau Optoelektronik developed LED-based illumination sources with pattern generators. These patterns can be produced according to customer specifications – even for single pieces. They include simple lines, parallel multi-lines, grids, and cross-hairs; other patterns can be generated on short notice.

For our product launch, we offer modules with wavelengths in red, green, or blue and with different patterns.

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Image Processing Trend: 450 nm FLEXPOINT® High-Power Laser

Laser Modules for the Steel and Food Industries

MV giga series high-power line lasers are available in the blue, red, and infrared spectral range with an output of up to 1 watt.

For the steel industry, the blue wavelength is particularly well suited at 450 nm. In red glowing materials, it achieves a high contrast and thus excellent measurement results. The 450 nm MV giga's main applications include measurement tasks in steel mills and steel processing plants.

In addition, the short-wave laser radiation of 450 nm does not penetrate organic materials very far and is, therefore, preferred for use in industries in which this characteristic is relevant: Examples include the woodworking industry and the food industry.

Test it! We will send you an MV giga demo unit with 450 nm for test measurements.

In addition to high-power versions, other 450 nm MV modules are available at up to 70 mW, for example in the MV nano, MV pico, and MV micro series. These series are also available with 405 nm and up to 100 mW.

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MV giga
High-power laser up to 1 watt

MV LASERS

MV femto
With a housing measuring only 40 x 8 mm this is the smallest image processing laser of the world

MV pico
With its 53 mm x 10 mm housing this is the standard for integration in 3D sensors

MV nano
The most universal laser with the most options to choose from

MV micro
At a housing diameter of 19 mm, this is the laser for stand-alone applications

MV 12
A laser with M12 thread for easy mounting

MV microline
Creates ultra-thin lines down to 5 µm in width

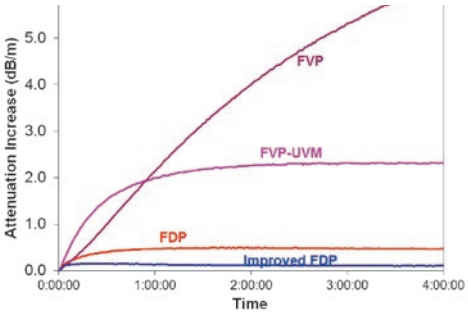
Solutions for the Fiber Optical Transmission of Ultraviolet Light

Transmission of UV Light with Optical Fiber

The use of fiber optics in the transmission of light in the UV spectrum is gaining importance. Fields of application include, for example, the spectroscopic examination of ions and atoms; however, analytics also provides interesting application options. Further fields of application include laser medicine, such as in the treatment of psoriasis in dermatology or the correction of vision problems in ophthalmology.

The development in light sources has led to the increase in commercial interest of compact systems that offer UV fiber transmission. Inexpensive UV LEDs and UV lasers, such as excimer lasers, complement the classic range of deuterium and xenon lamps.

Fibers can be used to easily and flexibly transmit UV light for use in measurement, testing, or spectroscopy. Until not too long ago, there was one major problem with this application: In wavelengths shorter than 260 nm, UV light caused degradation in conventional fibers – a direct result of solarization effects.



Special Fibers for the UV Range

Our partner Polymicro has developed a wide range of UV-suitable fibers that can be used for very short-wave applications. The R&D department was successful in making these fibers extremely solarization proof.

Best Solarization Stability on the Market

The newly improved FDP fiber line exhibits the best solarization stability on the market.

The stabilization of the fiber material's 214 nm and 265 nm absorption bands creates new opportunities, for example, in biomedical diagnostics, minimally-invasive surgery, or medical sensor technology in humans.

Multi-mode fibers have a core diameter between 50 µm and 1000 µm and are available at different UV grades. It is also possible to develop fibers for the single-mode UV range.

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For Easy Laser Beam Guidance

Focusable Collimators for Coupling Light out of the Fiber

Laser beams can be flexibly transmitted to any point via optical fibers. The greatest challenge is efficiently coupling the light into and out of the fiber; it is absolutely necessary to collimate the laser beam during output coupling.

To make this process as simple as possible, we developed focusable fiber optic collimators, which are manufactured in Germany. Available in two diameters (11.5 mm and 19 mm), these collimators are suited for the following fibers: step-index fibers with a numerical aperture of NA=0.22, single-mode fibers, CO2 fibers with a core diameter of 750 µm or 1000 µm.

These collimators consist of lens systems that are coated for different wavelength ranges. Choose any of the standard wavelengths 350-700 nm, 650-1050 nm, 1050-1060 nm, or 10.6 µm.

Furthermore, the focal length of the system can also be selected. Depending on the application, the beam diameter requirements are very different. The correlation between beam diameter and operating distance can be taken from the datasheet.

All collimators can be equipped for the following connector systems: SMA, FC wide key, FC small key, FC/APC wide key, and FC/APC small key. Other connectors are available upon request.

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Laser Power Measurement in the kW Range

Large-Format High-Power Detectors

The HP series multi-kW detectors are now even better. As if that were not enough, Gentec-EO has gone a step further with its super HP series! This unique power technology is very convincing.

The new HP series. In the new HP series, you can choose between three standard models: up to 4 kW, up to 12 kW, or up to 10 kW with a cone reflector. Thanks to the particularly high damage thresholds, all of the aforementioned versions can withstand high amounts of power and feature apertures of up to 100 mm in diameter or 60 mm with a cone reflector.

The super HP series. If the above-mentioned parameters are too limiting, the super HP series is available. Both of the standard models can handle up to 10 kW or 25 kW. The effective aperture amounts to 280 mm x 100 mm or 210 mm x 210 mm. There are also versions available upon customer request with an aperture of up to 400 mm x 400 mm, or with even higher power. We would be happy to advise you.

Connectivity. Measure power in the kW range and display the results directly on your PC. In addition to the DB-15 connector for connection to all Gentec-EO monitors, the detectors introduced here can be connected directly to a Windows PC via a USB 2.0 interface. The corresponding software is included in delivery.

This is quality. The high thermal stability of these products is unique; no other detector in this power range is so unaffected by temperature fluctuations in the cooling water.

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Gentec-EO Available Exclusively at LASER COMPONENTS

Integra: For Direct Connection to a PC

gentec-eo

Laser power and energy measurements directly on a computer – the new INTEGRA series by Gentec-EO makes this possible.

Until recently, a monitor was required for the readout of Gentec-EO detectors; effective immediately, the most common detectors will be equipped with the so-called INTEGRA option: The measuring device is as small as a USB stick and is connected directly to a PC using a USB interface. Readout of the measurement data is carried out on a PC with the help of corresponding software – you can see the measurement results on your monitor within seconds.

Of course, all data that can normally be readout using a monitor can also be analyzed here: from pW to kW and from fJ to J. This all-in-one design is perfectly suited for the laboratory, OEM applications, and the service field because it does not require an additional measuring device. This also leads to a reduction in costs because one device means only one calibration.

The Integra option is available for thermopiles, pyroelectric detectors, and photodetectors. Simply inquire with us!

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Complex Coatings Applied on Both Sides

For Fewer Laser Optics in a System

Coated laser optics are used to optimize the characteristics of the emitted laser beam. However, losses are produced at each glass surface - thus the number of optics should be reduced to a minimum.

LASER COMPONENTS offers laser optics that have complex coatings on both the front and the back. From a technical standpoint, this was almost impossible to achieve for a long time in complex coatings: The coating process on the second side heated the first coating and often caused it to crack – the more complex the coating the more pronounced the problem as the number of layer rises with its complexity.

Complex coating designs are manufactured upon customer request, numerous combinations are possible: Laser optics, coated on both sides, are often requested for the usage in resonators or for polarizers.

For applications in resonators, it makes sense to use optics with a dichroic coating on the front, for example a coating that is highly reflective for 1064 nm and simultaneously allows the passage of pump light. The back can be highly or partially reflective for the same or another wavelength.

It is also possible to combine a polarization coating on one side and a mirror coating on the other side. It would be conceivable to use a thin-film polarizer at 45° for 1064 nm, the back side of which is also coated for coupling in another laser wavelength.

Polarization coatings on both sides of an optic are used if the polarization effect has to be increased and the highest extinction ratios are required that could not be achieved otherwise with a coating applied to just one side.

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I have a professional background and education from electronics engineering with +20 years of experience from both international and in-house semiconductor component processing and wafer production development at Ericsson and ABB, including external ASIC-production, assembly and test at foundries in Asia.

During my latest seven years as sales account manager for Nordic OEM's my main focus is on optoelectronic components such as laser diodes, laser modules, detectors and optics to determine suitable components for our customers wide range of optronic applications in various industries and market segments.

My previous jobs have also involved different positions in areas like component quality assurance, manufacturing, material planning, technical service, sales and customer support, that have contributed to my overall technical understanding, analytical view and respond to customer requirements throughout the complete development and supply process.

Please contact us to make your component inquiry for any new project or if you are looking for an alternative to the optoelectronic parts that you currently use, we will be glad to come back with an offer of what we can do for you!

Mikael Winters

My background is in Chemical Engineering (M.Sc). Following my graduation, I spent time as a Ph.D. student at the Department of Physical Chemistry at Chalmers University of Technology. During my doctoral studies, I worked mainly with laser-based spectroscopy such as time-resolved fluorescence and absorption techniques (TCSPC, ultra-fast pump-probe). I finished my Ph.D. in 2007 and went on to work with sales in the photonics industry. My main sales responsibilities were laser systems, opto-mechanics, and spectroscopic equipment. In 2010/2011 I had a position as a research fellow at Cambridge University, where I was a part of the Laser Analytics group at the department of Chemical Engineering. My main focus was Fluorescence Lifetime Imaging and I published work in collaboration with several groups at the University. During this time, I had a leave of absence from my employer to whom I returned in September 2011. In August 2014, I left to become a part of Laser Components Nordic.

As Managing Director for Laser Components Nordic I hope to make full use of my previous experiences as both a Buyer and Seller of Photonics products. In many situations, it is very valuable to have seen with the eyes of both parties and to know the challenges that each face. My ambition is to use this knowledge and experience for the benefit of our customers. Please contact us to learn how our products can help your business!

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