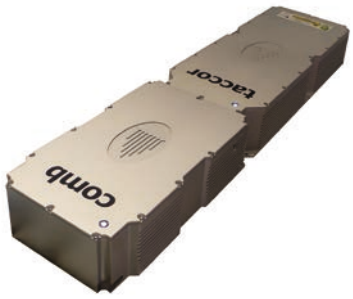
fs Laser Based Frequency Comb

Manufacturer: Laser Quantum.
Product: Femtosecond laser based frequency comb (LFC) "taccor comb" with a repetition rate of 1 GHz. The large mode spacing enables the generation of a supercontinuum with mode powers of up to 1 µW – a 100 fold increase compared to 100 MHz femtosecond laser systems.
Features: The frequency comb consists of a powerful turn-key Ti:Sapphire femtosecond laser system generating fs pulses at a repetition rate of 1 GHz, an extension module that generates a supercontinuum and a f-2f interferometer for carrier envelope offset (CEO) frequency detection with a signal-to-noise ratio of more than 40 dB. The CEO frequency is actively phase stabilized using a PID control loop. The fiber coupling for supercontinuum generation is designed for highest stability. Changes on the coupling efficiency on a longer timescale (days) can be compensated for using piezo actuators. – Like the successful 1 GHz femtosecond laser "taccor", the comb preserves the turn-key operation, the long-term stability and low-maintenance of the laser and is thus also attractive for users new to the field of LFC applications. The 1 GHz repetition rate is unique to the market and exceeds the performance of LFCs based on lower repetition rate lasers.
Application: Laser frequency combs have played a key role in high-precision optical frequency metrology for over a decade and have been used in a variety of applications in fundamental science on the macroscopic scale (e.g. astronomy) and the microscopic scale (e.g. studying optical transitions in atoms). As technology evolves, LFCs become more and more attractive for industrial applications where the main requirements, in addition to high precision measurements, are low-maintenance, long-term stability, flexibility and usability.



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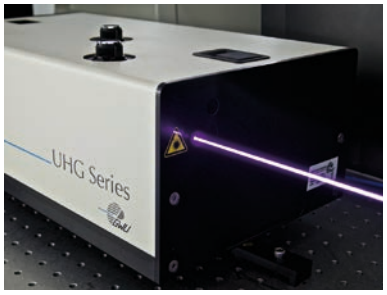
Frequency Conversion Modules for Mode-Locked Picosecond and Femtosecond Lasers

Supplier: GWU-Lasertechnik Vertriebsges.
Product: Versatile frequency conversion modules of the "UHG" series for mode-locked picosecond and femtosecond lasers. The series was developed to extend the wavelength range of ultrashort pulse Ti:Sapphire lasers into the visible and deep UV by means of second frequency generation (SHG), third harmonic generation (THG) and fourth harmonic generation (FHG).
Features: When equipped with the optionally available pulse picker, the UHG allows to select repetition rates of single pulses up to 8 MHz. All functions are available in a single compact housing. The combination of the "UHG" series with tunable short ultrashort pulse lasers (e. g. Mai Tai, Tsunami or InSight from *Spectra Physics*) allows the extension of the tuning range from the deep UV to the near IR, thus also enlarging the variety of possible applications.



GWU-Lasertechnik Vertriebsges. mbH was founded in 1988 as a sales company for lasers and laser accessories. Based on its experience in distributing non-linear crystals from *Castech Inc.* and *HC Photonics Inc.* and its expert knowledge in the field of nonlinear frequency converters, the company finally started to develop and manufacture laser beam sources. Besides the conversion modules, GWU offers OPOs for q-switched Nd:YAG lasers. Due to its expertise in non-linear optics, the company is able to provide customized solutions for generating, manipulating and characterizing ultrashort laser pulses for almost any wavelength.

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New Turbomolecular Pumping Station

Manufacturer: Edwards.
Product: New class leading "nEXT85" turbomolecular pump extending the range of turbomolecular pumping stations. These stations have been developed to provide a comprehensive vacuum solution with the latest technological advances for easy installation and operation.
Features: The turbomolecular pumping station range gives the customer wide choice of turbomolecular and backing pumps meaning the customer's system can be completely configured to his or her needs. The popular compact "T-Station" has been updated with "nEXT85" turbomolecular pump to become the "T-Station 85". Seamlessly combining the new "nEXT85H" turbomolecular pump with either a dry diaphragm or oil sealed backing pump, and a simple to operate intuitive controller, that includes the ability to control a vacuum gauge, the "T-Station 85" provides class leading pumping in a ready to go package.
For those needing either more control, or bigger turbomolecular and backing pumps, the range of "nEXT" Turbomolecular Pumping Stations are available with a full range of nEXT turbomolecular pumps from "nEXT85" to "nEXT400" plus a range of "RV" and "nXDS" backing pumps. They all come with a TIC turbo and instrument controller, enabling system start/stop from the control panel, easy integration of "Active Gauges" and full serial communications.

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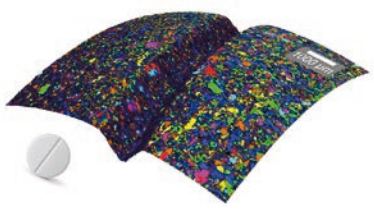
Optical Profilometer for Topographic Raman Imaging

Manufacturer: WITec.
Product: New generation of the patented "TrueSurface" optical profilometer. The combination of surface analysis and Raman spectral acquisition enables topographic Raman imaging on rough and uneven samples. One-pass simultaneous operation makes 3D Raman chemical characterization easier and faster than ever before.
Features: With the "TrueSurface" option, Raman spectra are acquired precisely along a surface, or at a set, in a user-defined distance from a surface. This feature makes the distribution of chemical components within the sample visible in three dimensions. Rough, inclined or irregularly-shaped samples can be investigated with the same ease as standard samples.



Thus, the requirements of sample preparation are drastically reduced. As the sensor actively monitors and maintains a set distance between the objective and sample surface, its closed-loop operation can compensate for any variations during measurements with long integration times. This keeps the measurement area in focus at all times and produces sharp chemical Raman images with sub-micrometer resolution.
Applications: Investigations on pharmaceutical tablet coatings, geological samples, composite emulsions, complex semiconductor structures and many other applications can benefit from the ease of use, accelerated workflow and methodological advantages provided by the new system.

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Lock-in Amplifier with Tip-Protection

Manufacturer: Zurich Instruments.
Product: Powerful "Threshold Unit" to enhance the "MFLI" 500 kHz/5 MHz lock-in amplifier. It can be used to monitor the scanning feedback signal and trigger a threshold-dependent output to maintain safe boundaries. Acting in this tip-protection role, the unit reliably prevents tip crashes and keeps valuable tips sharp.
Features: The "Threshold Unit" allows up to four measurement and control signals to be continuously monitored in real-time. If these signals exceed or fall below a configurable level, a digital signal output is toggled. It converts the initially analog measurement signals such as the demodulated signal and PID feedback signals into a digital state. A configurable low-pass filter helps to avoid false alarms due to short-lived signal loss or spikes. The digital signals can be combined using Boolean functions such as AND, OR and XOR. This allows the simple set-up of complex logical frameworks which can reject signals that do not meet required criteria. This functionality is available on all "MFLI" and "MFIA" instruments, simply by upgrading to the latest version of the "LabOne" software.
Applications: The "MFLI" Lock-in amplifier with Quad-PID controller is a powerful instrument for SPM applications. For FM-KPFM applications, the Modulation Option can output modulated amplitude and frequency signals and demodulate the incoming measurement signal. In combination with the "LabOne" imaging module, this option represents a complete package of tools for SPM to improve measurement quality and uptime of the tool.

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Portable Spectral Camera

Manufacturer: Specim (Finland).
Distribution: LOT-Quantum Design.
Product: Portable spectral camera "FX10" that boasts the high-quality optical components of the finnish market leader while at the same time featuring the small footprint and speed of any industrial camera.
Features: The optic with F/1.7 aperture is so fast, it rarely needs any external light when combined with a highly transmissive spectrometer. This ensures fast imaging sequences at very short integration times and prevents extraordinary heat loads to the objectives. The very quick camera boasts 330 frames per second full range. This rate can go up to 10000 frames per second in some areas of the detector (decrease of the number of analyzed spectral bands). Spectral bands may be flexibly selected in both number and spectral range. For example, the user could select 20 bands of interest thus switching from hyperspectral to multispectral, orient these bands toward the interesting wavelengths and increase the frame rate to more than 2200 frames per second. A CameraLink interface is used to ensure highest possible data rates. The camera is alternatively available with a GigE interface.

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Diaphragm Pumps for Backing Turbo Molecular Pumps

Manufacturer: VACUUBRAND.
Product: High vacuum pumps, such as those used for many applications in physics, commonly require backing pumps. These roughing pumps must fulfill specific demands in flow capacity and ultimate vacuum and are commonly expected to provide continuous service over several years without interruption. The company offers a broad selection of pumps for this application, namely the "VARIO" series of diaphragm pumps.
Features: Diaphragm pumps run oil-free and therefore are the perfect backing-pump solution for wide-range turbo molecular pumps. Compared to rotary vane pumps, the risk of contamination of the high vacuum system with oil is eliminated completely. Oil changes and waste-oil disposal are not required at all. The diaphragm pumps offer a unique combination of modern control electronics with high performance mechanics. During the pump down stage, significantly higher pumping rates are achieved via increased motor speed. Furthermore the patent-protected automatic rpm-optimization improves the ultimate vacuum performance, whilst noise-level, power consumption and vibrations are reduced through low rpm operation. Additionally, the lifetime for diaphragms and valves is significantly enhanced. The resulting, increased service life and associated extended service intervals make them perfect for use as backing pumps for turbo molecular pumps.

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Laser Diode for Data Transmission and Sensor Technology

Manufacturer: QD Laser.
Distribution: IMM Photonics.
Product: Fabry-Perot Laser diode in an 830 nm version.
Features: The laser diode emits transversal waves in single mode and supplies an optical performance of up to 220 mW in continuous wave mode (cw). A photo diode has been integrated for performance monitoring. The beam angle is given as 9 × 18 degrees. Two circuit versions are available: In the first one, the anode of the laser diode is connected to the housing potential; with the second version, the cathode is coupled with the housing.
Applications: The laser diode can be deployed in data transmission and sensor technology.

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Fast and Easy Controllable LED Illumination

Manufacturer: AHF analysentechnik.
Product: New LED illumination "pE-300ultra" that combines the benefits of a simple LED white light source with the option of inline filter holders. The user is free to control the level of excitation intensity on each channel to balance the dye intensities.
Background: Intensity from a conventional short-arc lamp decreases through its life time, which means that illumination varies dramatically over time. The lifetime of LEDs by far exceeds that of those lamps, and intensity remains broadly constant throughout its life providing stable and repeatable results.
Features: No separate filter wheel will be necessary to change between different light channels. The manufacturer offers corresponding triple band filters in combination with their excitation filters ('sbx' multi band versions) allowing a precise match to different dye combinations, e.g. DAPI/FITC/TRITC or DAPI/FITC/Texas Red. The light source includes a "Sequence Runner" multiple channel excitation mode. Users can define the order of their fluorophore capture using their Control Pod; the light source can accept a single TTL output from the experiment's set-up camera to initiate the step-through of a sequence of excitation channels. This feature is independent of the individual channel TTL inputs on the light source. This offers users the facility to run through a sequence of excitation channels using a camera that has only a single TTL-out.
Applications: Fluorescence, optogenetics, electrophysiology and high speed microscopy.

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FIB Nanofabrication Instrument

Manufacturer: Raith.
Product: Second generation of its Focused Ion Beam (FIB) nanofabrication instrument "ionLINE". The new "ionLINE Plus" is high-resolution and versatile focused ion beam instrument which combines various direct FIB processing techniques with the stability, automation, and reproducibility of a lithography instrument.
Features: The instrument features the latest-generation ion column ("nanoFIB Three") which ensures long-term stability due to its liquid-flow optimized ion source and patented emission control, and is further optimized to deliver excellent placement accuracy and unmatched high resolution. The new 50 MHz 20 bit nanofabrication platform permits dynamic beam corrections, while the new chamber enables configurable setups with upgrade paths and future options to be implemented. Fast in-situ process development is simplified by the possibility of monitoring the FIB process instantaneously through live images and endpoint graphs, and the additional process recording functionality.
The "ionLINE Plus" is equipped with a Laser Interferometer Stage with unique features, such as patterning beyond a single write field by means of precise stitching and truly continuous writing strategies. The field-proven "IONselect" multi-species technology provides stable delivery of gold, silicon, and other ions with nanometer beam diameters. Other options like single and multi-line gas injection systems, nanomanipulators and a nanoprofilometer are provided as well.
Applications: Simplified R&D nanofabrication with fewer processing steps and flexible process development.

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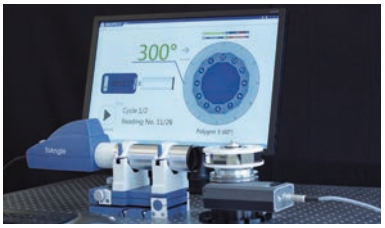
Electronic Autocollimators for High-precision Rotary Table Measurement

Manufacturer: Trioptics.
Product: Electronic autocollimators from the "TriAngle" series; these highly accurate optical angle measurement instruments enable the precise adjustment of optical or machine components. Angle shifts measured by means of a camera sensor are evaluated by software with an accuracy of significantly greater than 1/10000°.
Features: To perform the measurement, a certified reference polygon is fastened to the rotary table that is to be measured and the electronic autocollimator is positioned. The "Laser Alignment Tool" performs the alignment. Measurement of positioning accuracy is based on the difference between the target and actual angle of the rotary table. The actual positioning angle is given by the rotation and simultaneously transferred to the polygon, as this is permanently connected to the rotary table. The autocollimator's software analyzes the angle differences of the successive polygon surfaces and can calculate the positioning accuracy. In order to compensate for the influence of the polygon, its angle deviation is certified in



the factory and taken into consideration in the software. At the end of a measurement, the user receives an overview of the deviation of the actual values from their specifications, which serves as a measure of the rotary table's accuracy.
The limiting factors for measurement accuracy are the accuracy of the electronic autocollimator, the accuracy at which the polygon was measured and the grid point resolution of the polygon. The grid point resolution is limited by the angular division of the polygon. In practice, this means that the number of measured values per rotary table rotation corresponds to the face count of the polygon. This limitation can be handled in several ways. First of all, it is possible to use polygons with smaller angular division. Secondly, it is also possible to begin multiple measurement series at different starting points (offset). As a third option, the software offers interpolation between grid points by means of a Fourier series.
After completing the saved measurement plan, the software automatically displays all important parameters on a results page. For a quick overview, the customer receives a chart of the positioning accuracy as a function of the rotation angle and a table with measurement values and indicators. The output of these measurement values can be adapted to various standards, such as ISO 230 or VDI 3441. The measurement values can also be saved for later analysis or exported in a measurement certificate.
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TOPTICA-Spin-Off

In order to serve high complexity laser projects more efficiently, *TOPTICA Photonics AG* has founded its new subsidiary *TOPTICA Projects GmbH*. The new company will be focusing on customized laser solutions, innovation and technology development. In addition, it will become the new home of TOPTICA's award-winning "Guide Star" laser activities. The office is also located in Gräfelfing near Munich. The current team of six employees combines more than a century of experience in development of specialty laser solutions covering the spectral range from deep UV to MIR. The expertise includes continuous wave diode lasers as well as ultrashort pulse fiber lasers for the low and high power regime. TOPTICA Projects will take over full responsibility for all existing and future Guide Star Laser activities of TOPTICA. Besides this already established business, TOPTICA Projects focuses on specialty laser systems that are beyond TOPTICA's off-the-shelf components and modules, i. e. laser systems with very high technical complexity and/or longer development times.
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Particle Analysis by Light Scattering

Manufacturer: Anton Paar.
Product: High-performance instrument "Litesizer 500" that determines the size and stability of nanoparticles and microparticles in liquids by using light-scattering. It combines key technological advances and ingeniously simple software and produces state-of-the-art particle analysis at the touch of a button.
Features: The device determines particle size, zeta potential, and molecular mass by using light-scattering technology, in combination with transmittance measurements. The *pièce de résistance* of the instrument is its ingeniously simple software. The user interface is a one-page workflow, where input parameters, results and analysis are all on a single page. The customer can set up measurement series, and produce the needed analysis and report at the touch of a button. Further technological advances include "cm-PALS", the novel patented technology for zeta potential measurements that allows the user to resolve several different particle sizes in a single suspension.
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Multi-Wavelength Laser Engine for OEM Life Sciences Instrumentation

Manufacturer: Coherent.
Supply: New family of flexible laser light engines "OBIS CellX" series. It delivers up to four separate laser wavelengths from a single module, thereby lowering the complexity and overall cost of laser integration in multi-wavelength life sciences instruments such as flow cytometers.
Features: The compact one-box source integrates the lasers, electronic control and beam conditioning optics are all completely integrated in a single package. It features a single controller board, common power and RS232/USB connections and a single I/O connector. Flexibility and utility are further enhanced by providing independent customer adjustment of the pointing and focus of each wavelength, allowing the TEM_{00} outputs to be aligned and positioned as needed for each specific instrument.

The device is based on the proven "OBIS" plug and play smart platform. It is available in two standard formats – a three-channel version with outputs at 405, 488 and 640 nm; and a four-channel engine that also includes 561 nm, with 50 mW or 100 mW output power per wavelength. Beam parameters are particularly well-suited to flow cytometry, suiting cell analysis as well as the higher powers needed for cell sorting. In addition, patent-pending optical accessories are available that convert the output into the focused, elliptical spots typically needed for flow cytometry.
Applications: The light engine is targeted at instrument manufacturers that need to incorporate multiple lasers together with their associated infrastructure and beam delivery. It offers a uniquely cost-effective solution that reduces development time and costs. Custom beam configurations and alternative wavelength combinations are also available for multi-unit orders.

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New Piezo Rotator with Large Aperture for Optical Applications

Manufacturer: attocube.
Product: Piezo-driven rotation stage "ECR5050" in an improved new high-stability version ("ECR5050hs"). It now has a higher torque and an aperture that can be used as a feedthrough for wires or for (optical) beams.
Features: The new rotation stage enables precise 360° endless rotation in both directions and is available for ambient conditions, high vacuum down to 10^{-8} mbar

or in a bakeable UHV version (pressure $< 10^{-9}$ mbar). Its optional optoelectronic sensor allows for a resolution of 0.01 m° and a repeatability of 1 m°. It can be combined with many other stages of the "Industrial Line" positioner portfolio without using adapters.

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Industrial Femtosecond Lasers with Higher Pulse Energy and Higher Repetition Rates

Manufacturer: Coherent.
Product: Improved "Monaco" series of industrial-grade femtosecond lasers with increased adjustable pulse repetition rate to a maximum of 50 MHz. Newly introduced high-energy models provide up to 60 µJ/pulse in the near infrared (1035 nm), or, optionally 30 µJ in the green (517 nm).
Features: The improvements provide enhanced performance in precision materials processing applications, particularly for delicate and/or tough materials, and also deliver increased frame rates in demanding multiphoton microscopy imaging applications. All "Monaco" lasers produce a high quality ($M^2 < 1.2$) beam, enabling tight focusing for high brightness and high spatial resolution. Additionally, the pulsewidth can be set from under 400 fs to over 10 ps.
The new model "Monaco 1035-40" provides 40 watts of average power in the near-IR (1035 nm), with the user selecting pulse repetition rates of 1, 2, 3, 4, 5, 10, and 50 MHz from a simple pull-down menu in the laser GUI, with no effect on output pulsewidth. The "Monaco 517-20" provides 20 watts of green output with the same operational and output specifications. The all-new infrared "Monaco 1035-60" and green "Monaco 517-30" provide an additional operating point at 670 kHz for users requiring very high pulse energy: 60 µJ in the near-IR, and 30 µJ in the green. These lasers are ideal for cutting thicker substrates and drilling deep holes in ceramics, glass, and materials used for bio-absorbable stents. The short pulsewidth ensures excellent edge and surface quality without the need for post-processing steps in most applications.
Applications: In bio-imaging applications, these high repetition rate lasers enable higher frame rates than competitive products, particularly for power-hungry applications such as photoactivation in optogenetic experiments. Here, the near-IR output can be used directly for two-photon excitation of red fluorophores such as mFruits. Or it can also be used to pump the Opera-F, a variable pulsewidth optical parameter amplifier (OPA) that then provides smoothly tunable output across the entire microscopy imaging spectral window.

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