TruMicro:

Power meets precision.
Great results on a small scale.

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The Power of Choice

LASERS BY TRUMPF

The TRUMPF Group is a cutting-edge global leader for industrial lasers and laser systems. We offer the most comprehensive of portfolios, including welding, soldering, cutting, drilling, ablation, marking, and microprocessing. This ensures that we have the right laser for every application. By means of systematic research and development, we are expanding your competitive edge.

The short and ultrashort pulse lasers of the TruMicro Series allow microprocessing with an optimum combination of quality, productivity and profitability, demonstrating unrivaled reliability in industrial use. As such, the laser tool is indispensable when it comes to microproduction technology.

The bandwidth comprises short-pulse lasers with pulse durations in the nanosecond range and ultrashort pulse lasers with pulse durations in the picosecond and femtosecond range. The average powers span from a few watts to the kilowatt range.

In the Laser Application Center (LAC) we develop for you the basics of a feasibility study right to production consultation. Just tell us your requirements.

Visit us on YouTube. www.youtube.com/trumpftube

Discover the endless possibilities of TRUMPF laser technology in the video “The Power of Choice”: www.trumpf.info/6v1cuw
TruMicro Series 2000
Fiber-based, compact pico and femtosecond lasers. Maximum efficiency at moderate output power. Top flexibility and profitability in a compact design.

TruMicro Mark 2000
The TruMicro Mark 2000 turnkey marking unit with an ultrashort pulse laser for jet black, corrosion-free marking, even on highly reflective surfaces, and for micro processing.

TruMicro Series 5000
The disk-based pico- and femtosecond laser platform with high pulse energy and average power for top productivity when microprocessing.

TruMicro Series 7000
High-power fiber-guided nanosecond lasers based on disk laser technology, optimized for large-area material processing such as cleaning or structuring.

TruMicro Series 7000 UV
UV disk laser with maximum pulse energy and highest average power coupled with the benefits of a solid state laser. Multiple lasers can be synchronized for processes with yet greater productivity.

TOP Cleave
The processing optics for the quick cleaving of the tiniest of geometries and largest of contours in transparent materials such as glass or sapphire without any post processing.
Cold material processing.

Ultrashort pulses.

Using laser pulses that last only a few pico- or even femtoseconds, it is possible to efficiently process materials with virtually no thermal effects. The pulse duration determines the duration of energy input into material. Pico- and femtosecond pulses are short enough to rapidly ablate the material without any heat transferred to the surrounding material. This is commonly referred to as “cold processing”. For metals and many other materials, the ideal pulse duration is between a few hundred femtoseconds and under ten picoseconds.

In contrast to longer pulse durations in the nanosecond range, material heats up locally well above the melting point before the material evaporates. Residual molten material forms around the processed site, which subsequently hardens as burr or induces thermal shocks. Such processes can be successfully exploited, for example when ablating coatings from metals or glass while leaving the substrate unaffected.
Our expertise in stents.

Keep the flow.

Cardiovascular stents are medical implants that keep coronary blood vessels open. The decisive factor when manufacturing these stents is to achieve burr-free cut surfaces and edges. Depending on the size and location of the stent the implants are made of steel, nitinol or bioresorbable polymers. Nitinol is a shape memory alloy that always returns to its original shape after mechanical or thermal impact. In addition, nitinol stents are being better tolerated by the patient’s immune system.

Picosecond lasers enable nitinol stents to be manufactured without the need for subsequent reworking thereby significantly increasing the yield. Only with ultrashort pulse technology did it become possible to manufacture bioresorbable stents from extremely heat-sensitive polymers.
Durable and robust.

Chemically hardened glasses are used as extremely damage-resistant protective covers and as robust carrier substrates in the display industry. Hardened glass reduces the risk of scratches and other damage to the surface. In order to save weight and enable compact, slim designs, the glass covers for smartphones are becoming ever thinner. Picosecond laser cutting is currently the only non-damaging and flexible tool for cutting chemically hardened as well as non-hardened glass. The laser cuts the glass after the hardening process and delivers outstanding edge quality. Glasses can be separated after the hardening process, and the edge quality is outstanding. In contrast to mechanical methods, you can use an ultrashort pulse laser to flexibly cut 2D and 3D geometries free of wear and contact.

You can find more helpful information about cutting glass with lasers here: www.trumpf.com/s/y9f5gz
Finely detailed colored markings.

Ultrashort pulse lasers can produce markings below the surface of even the thinnest glass substrates. The ultrashort pulses enable the individual dots to be placed so close together that they cannot be distinguished separately by the naked eye. In this way, it is possible to create filled-in areas of color in glass with a thickness of only a few hundred micrometers. By selecting the right process parameters, it is even possible to create a rainbow effect by using the ultrashort laser pulses to modify the diffraction properties of the glass. Thanks to the localized energy input, the amorphous structure of the glass remains intact.

Corrosion-resistant markings.

The annealing effect of laser processing causes metals to change color, resulting in darkened areas of different shades extending to almost black. If these markings are created deliberately using ultrashort laser pulses, the darkened areas remain corrosion-free, because the heat input required to structure the surface is extremely low. Corrosion-resistant markings are required in numerous industrial applications, ranging from medical implants and surgical instruments to automotive parts and household goods. There are virtually no limits to the type and shape of these markings. The possibilities include serial numbers, Data Matrix codes for product traceability, micro-engraved security features no wider than a few micrometers, and complex filigree graphics.
Our expertise in sapphire.

Transparent and resistant.

Sapphire is a material with very interesting properties: It is extremely resistant to chemicals, extremely hard, and highly transparent for visible light. For decades it has been used as a protective glass for luxury watches and in the chemical industry.

In the manufacture of light-emitting diodes (LEDs), sapphire is used as a substrate on top of which the light-emitting layers are grown. This makes it possible to produce efficient light-emitting diodes in high quantities at low cost. The growing demand for LEDs is leading to an increase in the supply of low-cost sapphire. This low-cost sapphire makes new applications economically viable: One example is that today sapphire protects high-resolution cameras in smartphones.

The very properties that make sapphire attractive for many applications make it a very difficult material to machine using conventional methods. However, with the TruMicro Series 2000 and 5000 you can achieve a quality that requires no post-processing. Moreover, the high average power of the picosecond lasers ensures maximum productivity.
A material for high performance.

Ceramics are high-performance materials. Favorable electrical insulation properties and high temperature resistance make ceramics such as aluminum nitride, aluminum oxide, silicon nitride, and zirconium oxide popular materials for a wide variety of applications. Ceramics are an integral part of modern mobile phone antennas and high-performance light-emitting diode packages.

Drilling and cutting thin ceramics is a picosecond laser specialty, enabling you to obtain very small high-quality geometries. The holes impress with their cylindrical shape, smooth inner walls, and minimal debris. Thanks to the high output power of TRUMPF picosecond lasers, you can achieve high productivity rates for drilling, as well as for scribing and breaking.

TruMicro Series 5000: Laser processing of ceramics. www.trumpf.info/x4mhd6
Multi-layered and compact.

Modern printed circuit boards (PCBs) are constructed of several layers, making them especially compact. PCB substrates are made either of organic material reinforced with glass fiber for maximum mechanical stability or else of flexible polyimide films. Copper-lined holes connect the tracks across the different levels. This requires holes to be drilled with diameters often less than 100 µm.

These requirements stretch established production methods to their limits. With a picosecond laser, however, you can process PCBs in just a single operation. The high peak powers allow you to obtain the required geometry and quality at extremely high productivity rates.
Highly accurate laser structuring.

The laser is an important tool in the manufacture of thin-film solar cells and modules. It is increasingly replacing mechanical methods on account of its quality and productivity advantages. An example of this is the structuring of CI(G)S cells. CI(G)S stands for the elements used: copper, indium, gallium, sulfur, and selenium. These solar cells require higher demands from the laser process compared to nanosecond laser structuring of other thin-film materials. When heat is input, their molybdenum layer tends to form cracks and in extreme cases to delaminate. In addition, the photoactive CI(G)S layer reacts extremely sensitive to excessive heat input. All this makes picosecond lasers ideal tools for processing CI(G)S cells, as they narrow the track width significantly while at the same time minimizing the heat input. The resulting gain in surface area makes the solar cell much more efficient and thus a better value.

Laser edge deletion instead of sandblasting.

In order to protect thin-film solar modules against corrosion and short circuits in the long run, the coating system is removed at the edge of the module. The solar module is then hermetically sealed in a lamination process, providing protection from weather conditions lasting decades. Laser processing with the TruMicro Series 7000 offers decisive advantages over conventional sandblasting. Eliminating costs related to purchasing and disposing of blasting media is one such advantage. Another is the extremely high ablation rate offered by TruMicro 7000’s processing characteristics. Unit costs are much lower than those of conventional methods.

*TruMicro: Laser edge deletion.*

www.trumpf.info/p3q7bu
Our expertise in microscale interlock.

Simple, strong connections.

To reduce their vehicles’ fuel consumption and CO₂ emissions, car manufacturers are increasingly turning to lightweight construction techniques. To save weight across the board, new production methods and various new materials are growing in importance. Hybrid metal-polymer composites, for instance, combine the strength and rigidity of metals with the low weight and design freedom of polymers. The TruMicro Series of high-power nanosecond lasers can join metals and plastics perfectly without additional materials such as bolts, rivets, or adhesives. Metal pretreatment and joining are performed separately, enabling processes to be optimized and allowing your manufacturing resources to be deployed more flexibly.

In microscale interlock, the TruMicro laser creates a rough surface on the metal. The nanosecond pulses melt the surface, and material is evaporated. The ejected material solidifies immediately, leaving behind a deeply undercut, rough surface. The molten plastic in the joining zone is pressed onto the metal and flows into the cavities. As the material cools, the metal and plastic fuse together, creating a very reliable connection.

TruMicro: Roughening metal surfaces.
www.trumpf.info/64jfit
Efficient coating removal.

In response to expectations that modern cars should consume less and less energy, auto manufacturers are turning to lighter materials. Hot formed steel technology is useful here, as it increases the strength of components while also making them lighter. The high-strength steels used are typically coated with aluminium-silicon (AlSi) for corrosion prevention. To obtain optimum weld strengths, the aluminum in the AlSi coating must be removed prior to welding.

Beam shaping and repetition rates make the high-power nanosecond lasers of the TruMicro Series 7000 ideally suited to ablating large areas of coating systems. The coating removal works most efficiently with square fibers and line foci. Moreover, the operating principle of the high-power nanosecond lasers permits constant pulse duration over the entire range of the repetition rates. This means that the pulse energy and pulse frequency of the laser can be adapted to the beam shape, resulting in ablation rates that perfectly match the feed rates in the subsequent welding operation.
TruMicro Series 2000

Simply flexible.

The TruMicro 2000 Series is distinguished by its compact and light design and at the same time its top flexibility. Your fiber technology is an ideal platform for ultrashort pulse lasers of moderate average power. With peak powers of 100 MW, these lasers are used in processes for which cold material processing is productive even at low average powers. Such processes include the cutting of films and ablating of thin coatings, for example. The variable settings of burst technology enable the number and frequency of pulses to be selected separately for optimally adapted processes. The sophisticated control ensures an exact control of the repetition rate and the pulse emissions (pulse on demand).

For maximum process stability over the entire output range, multiple loop feedback control paired with a patented fast external modulator guarantees the programmed parameters for every single pulse. And of course the space-saving lasers in the TruMicro Series 2000 also offer all the interfaces that are required for industrial applications.


1. **Highly flexible and process-reliable.**
2. **Light, compact design for easy integration.**
3. **High beam quality for absolute precision.**

Entry made easy: You can find out more about the TruMicro Series 2000 here: www.trumpf.com/s/6eitsc

Structured ablation without molten metal spatter.
## Technical data

<table>
<thead>
<tr>
<th></th>
<th>TruMicro 2020</th>
<th>TruMicro 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average output power</td>
<td>10 W</td>
<td>20 W</td>
</tr>
<tr>
<td>Beam quality $M^2$</td>
<td>&lt; 1.3</td>
<td>&lt; 1.3</td>
</tr>
<tr>
<td>Wavelength</td>
<td>1030 nm</td>
<td>1030 nm</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>&lt; 400 fs–20 ps</td>
<td>&lt; 400 fs–20 ps</td>
</tr>
<tr>
<td>Max. pulse energy</td>
<td>50 µJ</td>
<td>50 µJ</td>
</tr>
<tr>
<td>Min. repetition rate</td>
<td>Switching down to the single pulse</td>
<td>Switching down to the single pulse</td>
</tr>
<tr>
<td>Max. repetition rate</td>
<td>2000 kHz</td>
<td>2000 kHz</td>
</tr>
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</table>

### Dimensions

<table>
<thead>
<tr>
<th></th>
<th>TruMicro 2020</th>
<th>TruMicro 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser head (L x W x H)</td>
<td>570 x 360 x 180 mm</td>
<td>570 x 360 x 180 mm</td>
</tr>
<tr>
<td>Power-supply unit (L x W x H)</td>
<td>510 x 485 x 180 mm</td>
<td>510 x 485 x 180 mm</td>
</tr>
</tbody>
</table>

Subject to alteration. Only specifications in our offer and order confirmation are binding.
Comprehensive solution for marking with ultrashort pulses.

Are you looking for a marking unit for laser marking with ultrashort pulses? Then, the TruMicro Mark 2000 is the perfect choice. The first turnkey comprehensive solution for an ultrashort pulse laser in a marking station doesn’t just come with a laser, but with a scanner, process cooler and software program as well. It is also available as turnkey solution in the well known TruMark Station 5000. With peak powers exceeding 100 MW, it is productive even at moderate average powers when used for cold material processing. The system boasts top process stability, monitoring the energy of every individual pulse. You use the industrially proven TruMicro Series 2000 with functions like flexible repetition rate and burst mode.

You can even mark highly reflective surfaces with ultrashort pulses. The multipulse technology enables the individual adjustment of pulse number and interval in freely configurable pulse trains. In this way you can mark chromed plastic without modifying the polymer layer. In medical fields you can put corrosion-resistant markings on implants or surgical instruments, for example.

You can find everything else you need to know about the TruMicro Mark 2000 here: www.trumpf.com/sr3axsl
### Technical data

<table>
<thead>
<tr>
<th></th>
<th>TruMicro Mark 2020</th>
<th>TruMicro Mark 2030</th>
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<tbody>
<tr>
<td>Average output power</td>
<td>10 W</td>
<td>20 W</td>
</tr>
<tr>
<td>Beam quality M²</td>
<td>&lt; 1.3</td>
<td>&lt; 1.3</td>
</tr>
<tr>
<td>Wavelength</td>
<td>1030 nm</td>
<td>1030 nm</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>&lt; 400 fs – 20 ps</td>
<td>&lt; 400 fs – 20 ps</td>
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<tr>
<td>Max. pulse energy</td>
<td>50 µJ</td>
<td>50 µJ</td>
</tr>
<tr>
<td>Max. repetition rate</td>
<td>2000 kHz</td>
<td>2000 kHz</td>
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</table>

**Dimensions**

| Laser head (L x W x H) | 570 x 360 x 180 mm | 570 x 360 x 180 mm |

Subject to alteration. Only specifications in our offer and order confirmation are binding.
Fast and economical.

Impressive features of the picosecond lasers from the TruMicro Series 5000 are extremely short pulse durations of below 10 ps and high pulse energies of up to 500 µJ. These picosecond pulses vaporize material so fast that no heat affects are discernible. Their patented two-stage laser-power regulation with an external modulator guarantees constant beam parameters and optimum output stability over the entire output range. The peak pulse power reaches up to 100 MW.

TruMicro 5000 Femto Edition uses the industry-proven TruMicro Series 5000 platform and offers pulse durations in the femtosecond range. This gives you peak powers of several hundred megawatts.

With the TruMicro Series 5000, you can process virtually any kind of material – from semiconductors to metals and from dielectrics to plastics. These lasers deliver a total cost of ownership which is unequaled in the industry.

TruMicro Series 5000: Benefits at a glance.

1. High beam quality for absolute precision.
2. Maximum productivity and profitability.
3. Highly stable for optimum, reproducible results.

You can work with the TruMicro Series 5000 for such a variety of tasks: www.trumpf.com/s/ltd29k
**Technical data**

<table>
<thead>
<tr>
<th></th>
<th>TruMicro 5025</th>
<th>5050</th>
<th>5070</th>
<th>5080</th>
<th>TruMicro 5225</th>
<th>5250</th>
<th>5270</th>
<th>5280</th>
<th>TruMicro 5360</th>
<th>5370</th>
<th>5380</th>
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<tbody>
<tr>
<td><strong>Wavelength</strong></td>
<td>1030 nm</td>
<td>515 nm</td>
<td></td>
<td>343 nm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Average laser power</strong></td>
<td>25</td>
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<td>100</td>
<td>150 W</td>
<td>15</td>
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<td>60</td>
<td>90 W</td>
<td>15</td>
<td>30</td>
<td>45 W</td>
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<tr>
<td><strong>Max. pulse energy</strong></td>
<td>500(^{\text{ii}}) μJ</td>
<td></td>
<td>150(^{\text{ii}}) μJ</td>
<td></td>
<td>75(^{\text{ii}}) μJ</td>
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<td><strong>Pulse duration</strong></td>
<td>&lt; 10 ps</td>
<td></td>
<td>&lt; 10 ps</td>
<td></td>
<td>&lt; 10 ps</td>
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<td></td>
<td></td>
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<tr>
<td><strong>Beam quality</strong></td>
<td>M² &lt; 1.3</td>
<td></td>
<td>M² &lt; 1.3</td>
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<td>M² &lt; 1.3</td>
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<td></td>
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<tr>
<td><strong>Repetition rate(^{\text{iii}})</strong></td>
<td>100–1000 kHz</td>
<td></td>
<td>100–1000 kHz</td>
<td></td>
<td>100–1000 kHz</td>
<td></td>
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<table>
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<tr>
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<th>TruMicro 5025</th>
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<th>5070</th>
<th>5080 Femto Edition</th>
<th>TruMicro 5250</th>
<th>5270</th>
<th>5280 Femto Edition</th>
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<tr>
<td><strong>Wavelength</strong></td>
<td>1030 nm</td>
<td>515 nm</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Average laser power</strong></td>
<td>20</td>
<td>40</td>
<td>80</td>
<td>120 W</td>
<td>25</td>
<td>50</td>
<td>75 W</td>
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<tr>
<td><strong>Max. pulse energy</strong></td>
<td>200 μJ</td>
<td></td>
<td></td>
<td>125(^{\text{ii}}) μJ</td>
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<tr>
<td><strong>Pulse duration</strong></td>
<td>approx. 900 fs</td>
<td></td>
<td></td>
<td>approx. 800 fs</td>
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<tr>
<td><strong>Beam quality</strong></td>
<td>M² &lt; 1.3</td>
<td></td>
<td></td>
<td>M² &lt; 1.3</td>
<td></td>
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</tr>
<tr>
<td><strong>Repetition rate(^{\text{iii}})</strong></td>
<td>100–1000 kHz</td>
<td></td>
<td></td>
<td>100–1000 kHz</td>
<td></td>
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\(^{\text{ii}}\) Depending on performance class.

Subject to alteration. Only specifications in our offer and order confirmation are binding. More parameters upon request.
TruMicro Series 7000

Built for maximum performance.

The high-performance short-pulsed lasers from the TruMicro Series 7000 are capable of stripping coatings swiftly and over large areas as well as drilling and cutting at maximum throughput. With pulse energies of up to 80 mJ, you achieve enormous ablation rates at excellent efficiency levels. The disk laser technology used combines short pulses and high pulse energies even at high frequencies. You can vary the repetition rate of the lasers independently of the pulse duration in order to optimize your processes. By means of scanners, large areas can be ablated with highest efficiency. The beam is guided through a flexible laser light cable for easy integration into workstations. This means you can also set up the laser unit separately. Thanks to the high beam quality of the lasers, you can cover large areas and use round, square, or rectangular fibers for beam guidance. This enables you to increase your ablation rates significantly.

TruMicro Series 7000: Benefits at a glance.

1. High output power for maximum productivity.
2. Higher process efficiency through flexible beam shaping.
3. Fiber-guided for very easy integration.

Would you like full power? Then just read on: www.trumpf.com/s/fbc0qa

Many different possible applications.
<table>
<thead>
<tr>
<th>Technical data</th>
<th>TruMicro 7050</th>
<th>TruMicro 7060</th>
<th>TruMicro 7240</th>
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<tr>
<td>Wavelength</td>
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<td>515 nm</td>
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<td>Average laser power</td>
<td>750 W</td>
<td>850 W</td>
<td>300 W</td>
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<tr>
<td>Max. pulse energy</td>
<td>80 mJ</td>
<td>80 mJ</td>
<td>7.5 mJ</td>
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<tr>
<td>Pulse duration</td>
<td>30 ns</td>
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<td>300 ns</td>
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<tr>
<td>Beam quality</td>
<td>20 mm · mrad</td>
<td>20 mm · mrad</td>
<td>4 mm · mrad</td>
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<tr>
<td>Repetition rate (tunable)</td>
<td>5–100 kHz</td>
<td>5–100 kHz</td>
<td>20–100 kHz</td>
</tr>
</tbody>
</table>

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The lift-off process for flexible displays.

The high-power nanosecond laser works at an ultraviolet wavelength instead of infrared or green. These UV disk lasers play an ever more important role in the production of flexible OLED displays. With the unique lift-off process, you can remove the polyimide films of OLED displays from the glass carrier more efficiently than with excimer lasers. This is due to the shorter pulse duration. The UV disk lasers are not only more productive doing this, but they demand significantly less maintenance and thus less total cost of ownership and higher economic feasibility. The TruMicro 7300 Series is the strongest industrial UV solid state laser in the world, combining extremely high power and energy at UV wavelength with the benefits of a solid state laser.

Multifaceted UV photons.

The high power of the TruMicro Series 7000 also promises great benefits for other branches. In this way, carbon fiber reinforced plastic (CFRP) can be modified with UV lasers. Also in the fields of architecture, medical technology, or semiconductor production, pulsed UV solid-state lasers open up enormous possibilities for the activation of surfaces or particles.

See more about the advantages of the UV laser online: www.trumpf.com/s/s13d8t

TruMicro Series 7000 UV: Benefits at a glance.

1. Strongest UV solid state laser in the world.
2. Power and pulse energy of different lasers can be combined.
3. Disk technology for maximum reliability.

With the laser lift-off process, the polyimide film is separated from the carrier glass without destroying the semiconductor layer on it with heat or grid excitement.
**Technical data**

<table>
<thead>
<tr>
<th>Spec</th>
<th>TruMicro 7370</th>
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<tr>
<td>Average output power</td>
<td>180 W</td>
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<tr>
<td>Beam quality M²</td>
<td>22.5 ± 2.5</td>
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<tr>
<td>Wavelength</td>
<td>343 nm</td>
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<tr>
<td>Pulse duration</td>
<td>15 ns ± 3 ns</td>
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<tr>
<td>Max. pulse energy</td>
<td>18 mJ</td>
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<tr>
<td>Repetition rate</td>
<td>10 kHz</td>
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**Dimensions**

<table>
<thead>
<tr>
<th>Spec</th>
<th>Measurement</th>
</tr>
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<tbody>
<tr>
<td>Laser head (L x W x H)</td>
<td>2131 x 810 x 450 mm</td>
</tr>
<tr>
<td>Power-supply unit (L x W x H)</td>
<td>1090 x 650 x 1798 mm</td>
</tr>
</tbody>
</table>

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The TOP Cleave cutting optics.

The high-speed cutting of glass.

With the TOP Cleave processing optics you can cut the tiniest geometries and transparent materials such as glass or sapphire. Thanks to the patented technology, this process is substantially more effective, more precise and quicker than ablative processes. You also save individual process steps, because you coat the large disks directly and separate them later with the help of TOP Cleave. What’s more: The surface roughness is so low that cost-intensive post-processing is not necessary. They cut glass up to 4 mm thick with one single pass. With the high-power lasers of the TruMicro Series you achieve cutting speeds of up to 1,000 mm/s – that’s one hundred times faster than an ablative process.

TOP Cleave: Benefits at a glance.

1. High processing speed.
2. Processing of the tiniest geometries.
3. No refinishing required, thanks to excellent edge quality.


The TOP Cleave cutting optics cuts glass quickly and precisely.

### Technical data

<table>
<thead>
<tr>
<th></th>
<th>TruMicro 5050 with TOP Cleave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
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<tr>
<td>Max. pulse energy</td>
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</tr>
<tr>
<td>Pulse duration</td>
<td>&lt; 10 ps</td>
</tr>
<tr>
<td>Beam quality</td>
<td>M² &lt; 1.3</td>
</tr>
<tr>
<td>Repetition rate</td>
<td>10–200 kHz</td>
</tr>
<tr>
<td>Processing speed</td>
<td>up to several m/s</td>
</tr>
<tr>
<td>Edge quality</td>
<td>&lt; 0.5 µm</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>98 x 480 x 86 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 5 kg</td>
</tr>
<tr>
<td>Material thickness</td>
<td>≤ 4 mm in one pass, and greater thickness possible with multipass</td>
</tr>
<tr>
<td>Available objectives</td>
<td>10 x, 20 x</td>
</tr>
</tbody>
</table>

Subject to alteration. Only specifications in our offer and order confirmation are binding.
From laser to optics.

Ultrashort laser pulses are not only extremely short but also reach outstanding values in other parameters such as pulse energy and peak intensity. To ensure that despite these peak intensities the pulses of light are guided precisely to the workpiece, special beam guidance and shaping components are required.

TRUMPF supplies beam switches, deflectors, beam expanders and polarization optics optimized for use with ultrashort pulsed lasers. Multifunctional beam monitoring can also be provided.

Easy integration into manufacturing processes.

For lasers and a manufacturing system to work well together, you need the right interface. From the very start of product development, we place the utmost emphasis on ensuring that our lasers will be easy to integrate.

The laser can be integrated into an existing programmable logic controller (PLC) via a galvanically isolated pin assignment or a parallel interface. Thanks to linearized output control, the laser power can also be varied via an external real-time interface in the voltage range of 0 to 10 V. A range of field bus interfaces, including Profibus, EtherCat and DeviceNet, allow easy communication by means of standardized protocols. You can expand the internal laser control system via adapter card with customized interface protocols.

TruMicro lasers permanently survey and log all relevant laser parameters like cooling water temperature and pump diode current. If parameters reach a predefined threshold the system will provide a warning message. The lasers also possess an OPC/UA interface (Object Linking and Embedding for Process Control Unified Architecture).
To be successful in the future, you need the right services to keep you on track for the long term. Whatever the case, we’re on hand to help you maximize your added value and lock those benefits in. TRUMPF is the right choice if you’re looking for a reliable partner that can support you with a wide range of custom solutions and service packages, ensuring that your manufacturing business continues to be a resounding success. You can learn more about our complete and comprehensive package of useful services here: www.trumpf.com/services.

**EMPOWER**
Looking to create the best conditions for successful manufacturing? We can give you the support you need.

**SUPPORT**
Are flexibility and machine availability top priorities in your ongoing manufacturing activities? We’re on hand to help.

**IMPROVE**
Do you want to gradually shift your production processes towards maximum added value? We can achieve that together.

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**Technical Service**
Do you want to get fast access to technical service? Or take proactive steps to maximize the availability of your TRUMPF system? Our global network of service teams is here to help – covering everything from installation to maintenance and repairs.

- Qualified TRUMPF service engineers.
- High standards of service worldwide.
- Fast responses and lower costs thanks to innovative services.
- On-site service missions or Teleservice, as required.

**Service Agreements**
Our service agreements offer a range of service packages to help make your manufacturing business run more smoothly. By bundling together different services, we can offer cheaper packages with less hassle and complexity, so you can simply choose the package that best suits your needs at a fixed price you can budget for.

- Periodic optimization of your machines.
- Consistently high production quality.
- Longer service life.
- Service from the manufacturer ensures machine availability.
Do you like the idea of constantly keeping tabs on the current status and performance of your machine tools, laser system, or entire production facility? TRUMPF offers monitoring and analysis products that take transparency to the next level.

- Identify potential ways of increasing productivity.
- Track whether the measures you take are successful.
- Data transmission is secure and easy to monitor.
- Full transparency for your productivity figures.

Training

We can give you useful insights into specific products and valuable solutions, helping you optimize your manufacturing activities and boost productivity.

- Experienced instructors, innovative training methods.
- Hands-on machine training.
- Effective learning thanks to a balanced mix of theory and practice.
- Broad selection of training opportunities ranging from beginners to experts.
- Multiple training centers worldwide.

Monitoring & Analysis