

TruMicro

Power and
precision

The industrial laser for microprocessing

For delicate and high-precision material processing, you need a tool that you can trust 100%, offering the highest quality with maximum availability and reliability. The industry-proven TruMicro short- and ultrashort-pulse lasers are the optimum solution.

Tasks and applications

The perfect microprocessing solution for your industry
4–5

Structuring, ablation, drilling, cutting, joining

Applications and materials for short- and ultrashort-pulse lasers
6–9

Cover: Micro drillings with diameters of 80 μm in 0.1 mm thick glass. Precise holes of this type are generated by ultrashort laser pulses and are used, for example, to create connections between circuit layers in electronic components that are separated by a glass layer (so-called Through Glass Vias).

Free choice of laser medium

Comparison of lasers with disk amplifiers and fiber amplifiers
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Find short- and ultrashort-pulse lasers here

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TRUMPF: A partner you can rely on

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The perfect microprocessing

Short and ultrashort laser pulses make for precise high-speed working in all industrial sectors.

Displays

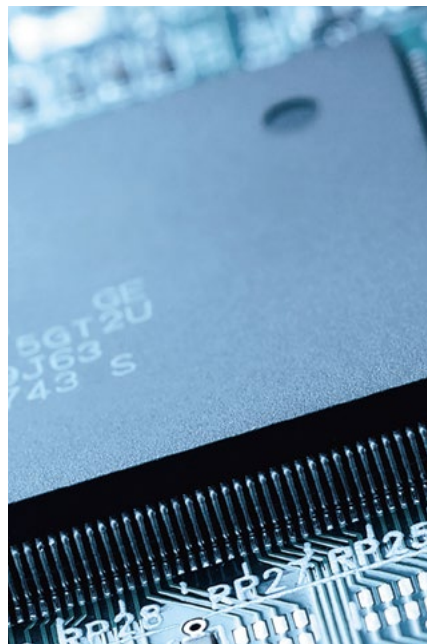
Whether it's handling huge quantities or fast processing with maximum process reliability: A large proportion of all smartphone and tablet displays world-wide are processed with TruMicro lasers. Various steps within the complex process chain are based on innovative laser technology from TRUMPF: glass cutting, film cutting (e.g. singulation), laser lift-off, and many more.

Electronics and microchips

The precision of TruMicro lasers can be put to profitable use, especially in the electronics industry. Being both reliable and easily integrated in automation systems, they allow for, among other things, the cutting and drilling of silicon wafers, flexible printed circuit boards, or entire electronic modules. Other laser applications include precise ablation of layers or marking of chips and other components.

Watches and jewelry

High quality and precision, as well as maximum freedom of design are the most important requirements in the production of watches and jewelry. The laser, with its flexibility and accuracy, is the ideal instrument for this. TruMicro is used for cutting of micromechanical components like hands or other micromechanical components, for microwelding on housings or metal bracelets, as well as for precise drilling on ruby jewel bearing.



solution for your industry

Medical technology

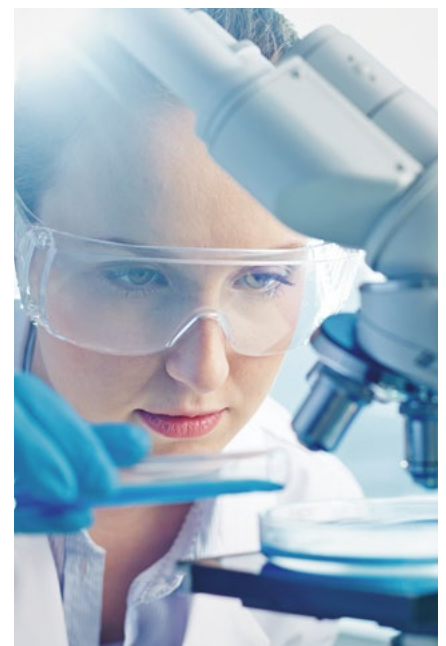
Short and ultrashort laser pulses process medical instruments without mechanical contact and with a high level of precision, reproducibility, and productivity. Welding of various materials, from stainless steel to plastic, is just as widespread an application in medical technology as the cutting and drilling of implants or medical surgical instruments. Laser marking is used in almost every medical technology process chain, due in particular to the change in requirements in terms of traceability (UDI).

Photovoltaics

To ensure that thin-film solar modules can be laminated and therefore protected against external influences, pulsed lasers remove the layer system at the edge of the solar cell. In addition, lasers provide high conversion efficiency and a high performance level through selective ablation of passivating layers.

Science

Scientific laser applications are incredibly diverse. Starting with basic physical research, lasers have become indispensable in many fields of research. They measure turbulence in clouds, visualize biological processes at molecular level, generate attosecond pulses to analyze electron movements, and process new materials.



The smaller they are, the stronger they get

The immense power of the laser pulses is due to the fact that they are incredibly short. Together with the good focusability, high pulse peak powers and average powers, this allows for intensities that open the door to completely new processes.

With pico- and femtosecond pulses, the intensities are so high that the material is ionized immediately. This results in precise processing without unwanted heat influence – this is called cold material ablation.

Short-pulse laser

Pulse duration in the range of nanoseconds

$$10^{-9} \text{ s}$$

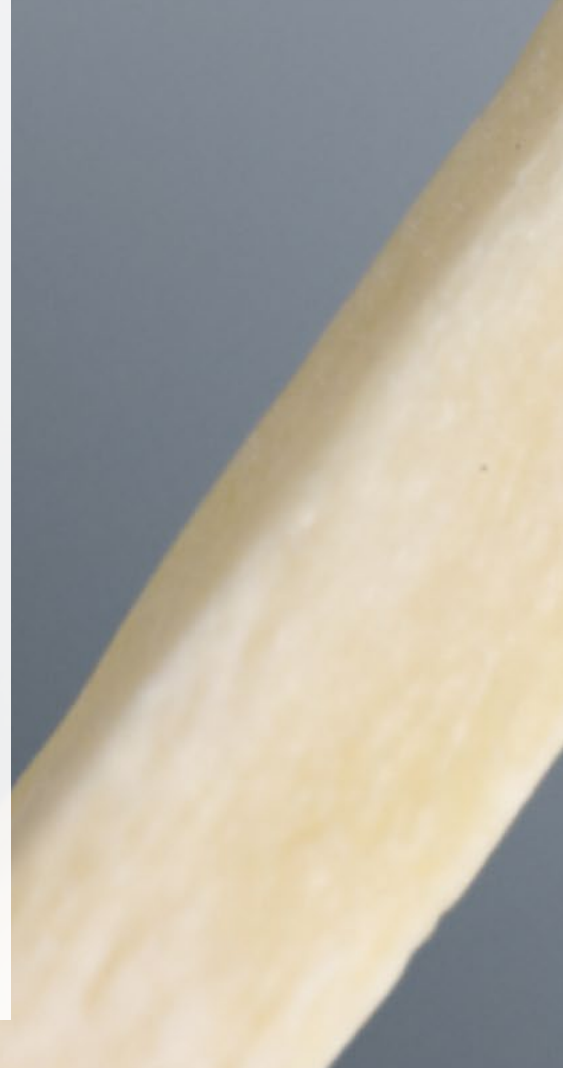
Ultrashort-pulse laser

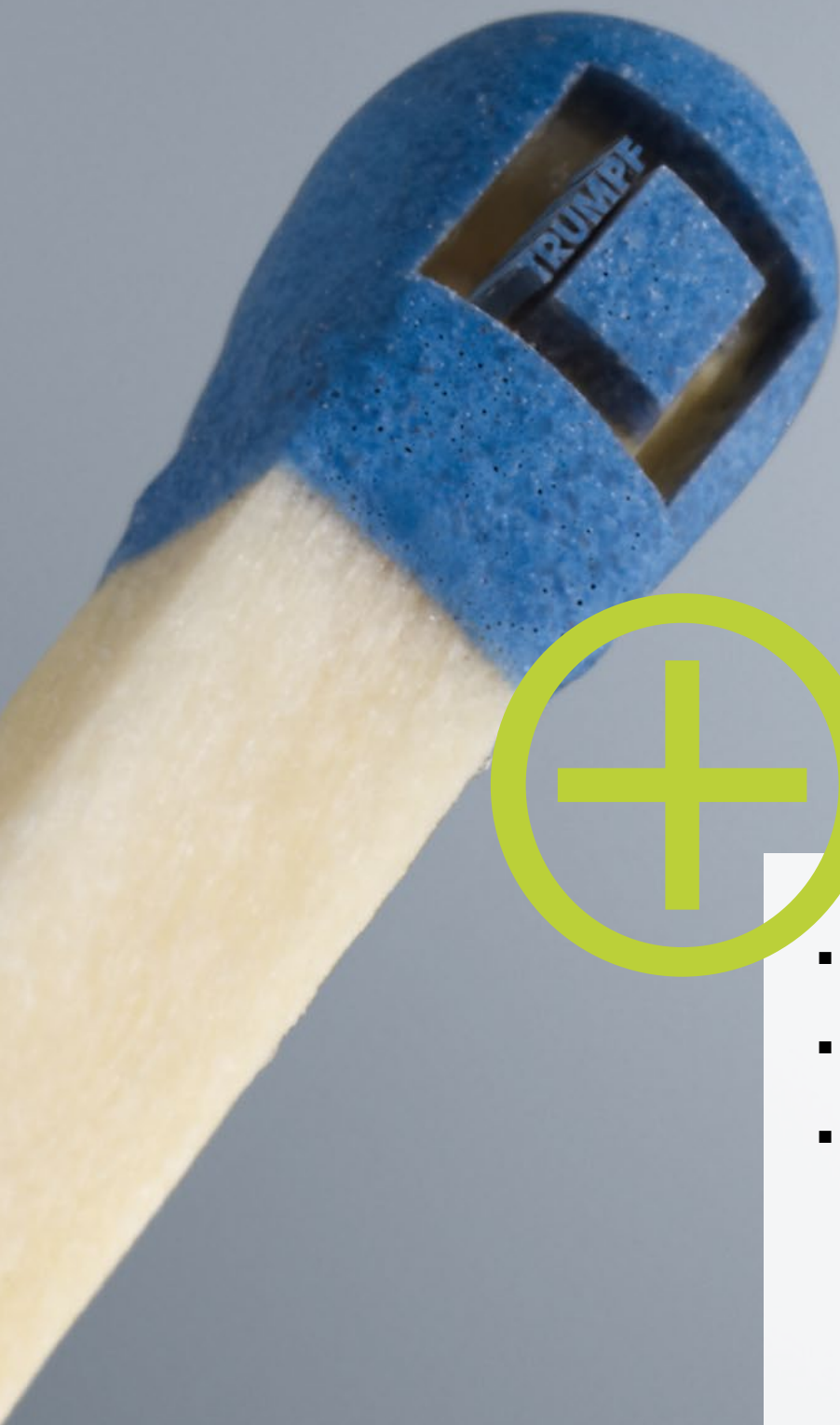
Pulse duration in the range of picoseconds

$$10^{-12} \text{ s}$$

and femtoseconds

$$10^{-15} \text{ s}$$

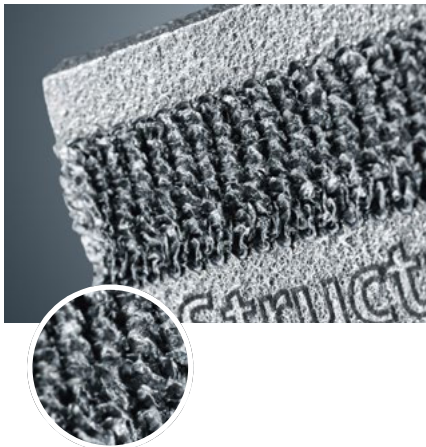




- Unparalleled high peak pulse power
- Cold processing with virtually no heat input
- The most precise micro-processing, even with sensitive materials

Applications

Short and ultrashort pulses open up a world of different processing possibilities.



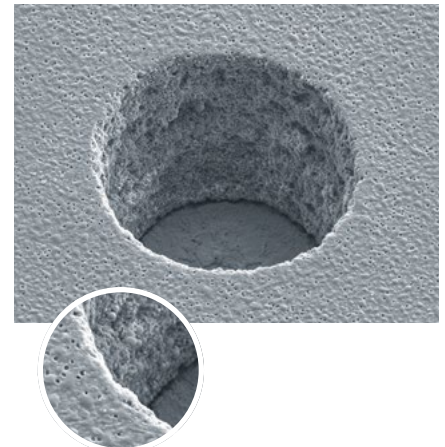
Structuring

Micrometer-sized geometric structures change the properties of surfaces. For example, this can result in higher adhesive strength, water-repellent surfaces, or better running properties for lubricants.



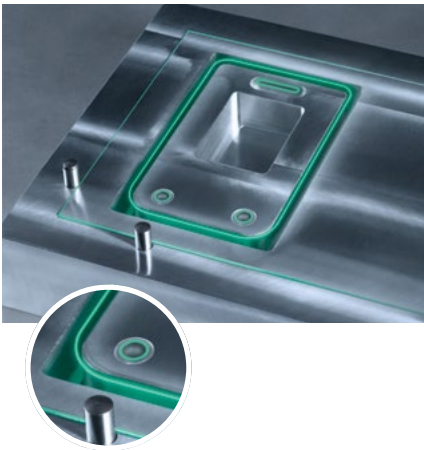
Ablation

Laser pulses ablate thin layers selectively, for example when trimming resistors, for marking, or during cleaning and welding preprocessing.



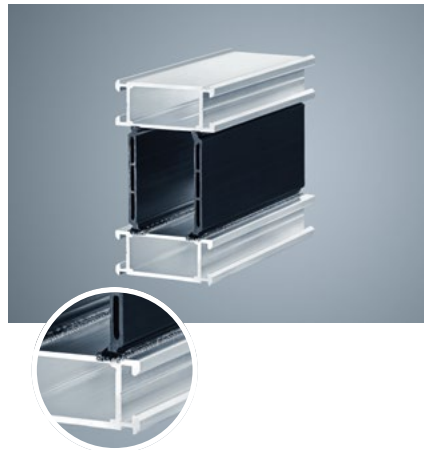
Drilling

The high peak pulse powers of short- and ultrashort-pulse lasers allow for precise drilling, even in sensitive materials. Percussion drilling, trepanning, or helix drilling make it easy to affect the shape of the drill hole.



Cutting

Cold processing using the TruMicro Series lasers separates all materials cleanly and without any thermal influence. Delicate cuts, such as on medical stents, are simple to carry out. Transparent and brittle materials such as glass and sapphire or ceramics are processed with high edge quality.



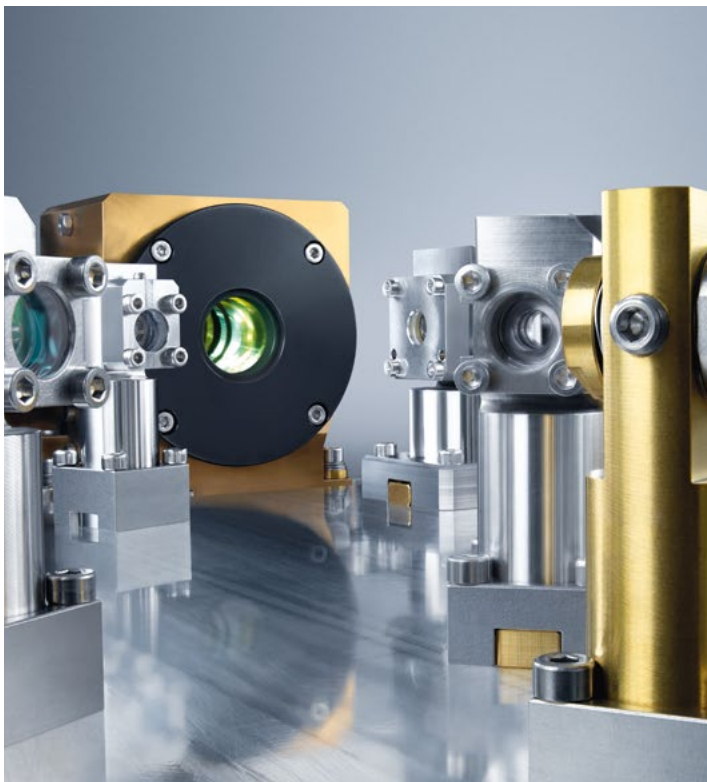
Joining

Short and ultrashort laser pulses help you achieve extremely delicate welding. Differing materials can also be joined using this technology, for example plastic-metal joints for lightweight designs.

No need for compromises

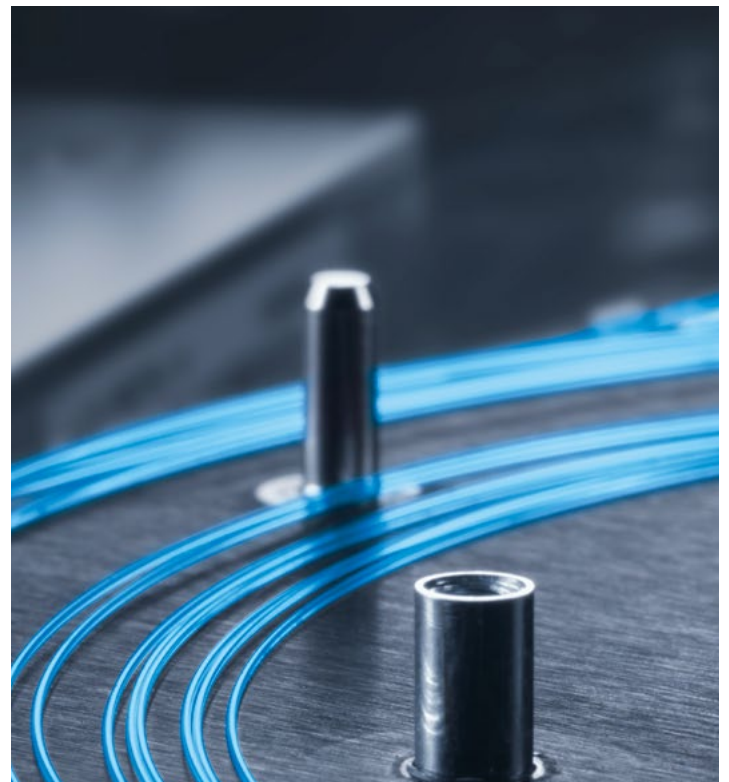
Lasers with disk amplifier or fiber amplifier – you're free to choose at TRUMPF.
Use whichever laser architecture is best suited for your application.

Due to their geometrically easy-to-cool shape, both disk and fiber lasers combine highest beam quality with very high power. Nevertheless, both laser concepts offer different advantages in industrial applications. TRUMPF is the only manufacturer of industrially suitable disk laser technology in the world, and is therefore also the only laser manufacturer offering disk and fiber amplifiers for highly efficient series production.



Disk amplifier

- Efficient scaling of pulse energy and average power
- Highest average power and pulse energy
- Best pointing stability
- Excellent beam quality



Fiber amplifier

- Excellent beam quality
- Flexible pulse frequencies
- Full single-pulse energy in all burst pulses
- Most compact design

Short- and ultrashort-pulse lasers for your application

TRUMPF TruMicro lasers are robust, reliable, and easy to operate – which makes them 100% suitable for industry. You can find lasers here to best suit your application.



TruMicro Series 2000

Fiber-based, highly-flexible compact pico- and femtosecond lasers.



TruMicro Series 5000

Disk-based pico- and femtosecond lasers for highly productive microprocessing.



TruMicro Series 7000

High-powered nanosecond disk lasers for large-area processes such as cleaning and structuring.



TruMicro Series 8000

The most powerful UV solid-state laser in the world for large-area applications with short wavelengths.



TOP Cleave

Innovative processing optics for quick and intricate separation of transparent materials like glass or sapphire.



Dira Scientific Laser

Disk-laser-based research tool meeting the highest demands for long-term stability at high pulse energies and high power.

TruMicro Series 2000

Compact pico- and femtosecond laser with maximum flexibility.

01

Utilize full flexibility

with ultrashort pulses



02

100% customized pulses

with power modulator accurate to a single pulse

03

Easy to integrate

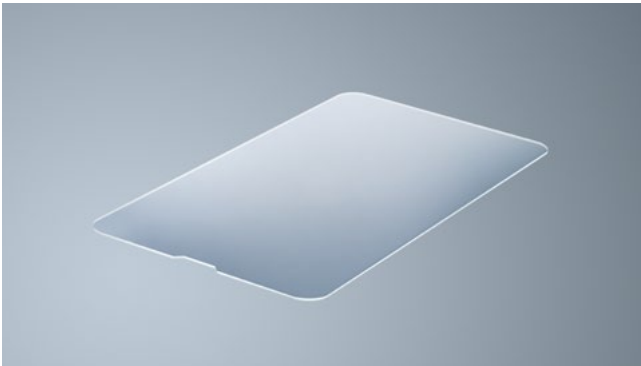
due to compact design and all relevant interfaces

01

Utilize full flexibility

with ultrashort pulses

The TruMicro Series 2000 gives you full flexibility in your plant or in your production facility – with the linear amplifier, you can freely select the pulse frequency independent of the pulse energy used. The laser can be mounted both horizontally and vertically, and no pump light cable is required.



Laser pulses cut even the most delicate of films to size.

02

100% customized pulses

with power modulator accurate to a single pulse

Power and pulse energy – you can adapt the pulses to your needs, for example with the patented quadruple-loop feedback control that ensures maximum stability – with monitored pulse energy for each individual pulse. The power can be regulated from 2 to 100%, even during the process itself.



Structured application without enamel ejection.

03

Easy to integrate

due to compact design and all relevant interfaces

The TruMicro Series 2000 lasers are especially easy to integrate into your system and production line. The compact design ensures a small footprint and numerous interfaces facilitate integration into your production system.



No matter whether they're installed horizontally or vertically: The compact TruMicro Series 2000 lasers are the ideal choice.



Discover more about working with flexibility with the TruMicro Series 2000:
www.trumpf.com/s/6eitsc

TruMicro Mark Series 2000

The turnkey and complete solution for high-quality, productive marking.

01

Simple operation

Work with ultrashort pulses, even without knowledge of laser physics

04

Maximum reliability

with patented quadruple-loop feedback control

02

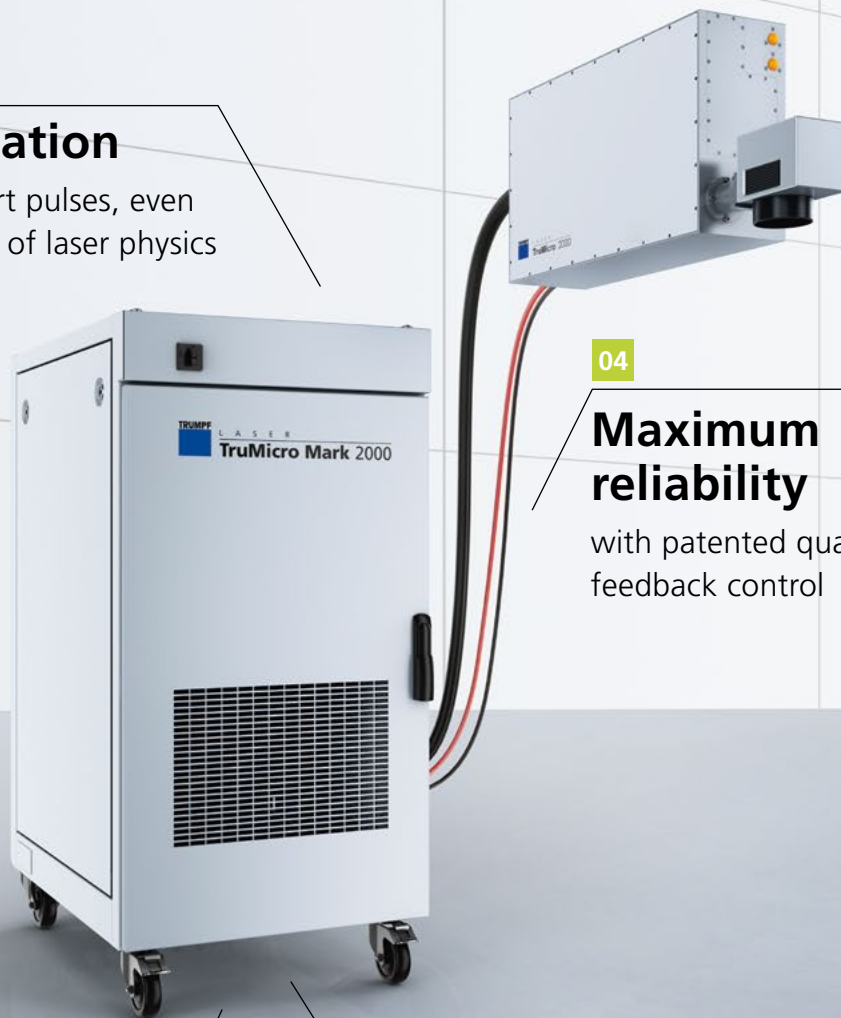
Durable, high-contrast markings

due to ultrashort pulses

03

Marking on highly reflective materials

with high peak intensities



01

Simple operation

Work with ultrashort pulses, even without knowledge of laser physics

The TruMicro Mark Series 2000 is purposefully designed to be a simple marking tool. No specialist knowledge about ultrashort laser pulses is required to use it. The intuitive operation of the TruTops Mark software with its customized user interface simplifies your work and yields the best results.



Interior glass marking.

02

Durable, high-contrast markings

due to ultrashort pulses

The ultrashort pulses produce nanometer-sized structures on the surface that act as light traps. This process, known as black marking, creates a very sharp black contrast regardless of the viewing angle. The marking is durable and absolutely corrosion-free – even with frequent disinfection – and is therefore ideal for steels used in medical devices.



Kidney dish made from surgical stainless steel with black-marked UDI code.

03

Marking on highly reflective materials

with high peak intensities

Marking stainless steel, chromium, copper, aluminum, or brass – not a problem with the TruMicro Mark Series 2000. The ultrashort pulses with high peak intensity have specific absorption characteristics. This produces brilliant markings, even on difficult materials.



Black marking on anodized aluminum – ultrashort pulses mean you can achieve brilliant markings, even on difficult materials.

04

Maximum reliability

with patented quadruple-loop feedback control

With features such as its flexible repetition rate and burst mode, the TruMicro Mark Series 2000 has proven to be a beam source you can use in industrial applications. Its patented quadruple-loop feedback control ensures maximum stability – with monitored pulse energy for each individual pulse. In this way, you can achieve top cold processing results, with almost no heat input in the material. This isn't just true for classic marking – you can also use the system for structuring or ablating surfaces.



With extreme peak pulse powers, the TruMicro Mark produces jet-black, corrosion-resistant markings.



You can find further information about marking with ultrashort pulses at:
www.trumpf.com/s/r3axsl

TruMicro Series 5000

Extremely cost-efficient working.

01

Perfect results every time

due to high pulse and performance stability

05

Complete flexibility

for all wavelengths and pulse durations



02

Simple integration

due to compatibility with all standard interfaces

04

Pulse power with full output

due to disk technology

03

Highly productive with sensitive materials

due to cold processing

01

Perfect results every time

due to high pulse and performance stability

A one-stop shop for your production: An external modulator, internal power reserve, active cooling of the laser carrier, and the disk-based amplifier all guarantee high pulse and power stability. In addition, a patented control monitors the average power. This means that power and pulse energy are always reliably available for your application.

02

Simple integration

due to compatibility with all standard interfaces

The fieldbus interfaces include Profibus, EtherCat, and DeviceNet, meaning your TruMicro Series 5000 can easily cope with all standardized protocols. Standardized software interfaces (Open Platform Communications) enable easy communication between lasers and production systems.

03

Highly productive with sensitive materials

due to cold processing

Benefit from the power of short pulses: With excellent beam quality and high average powers of up to 150 W, you can work with maximum productivity, even with the smallest features. Whether it's semiconductors, metal, plastics, or brittle materials – spatter, cracks, and material bulging are a thing of the past.



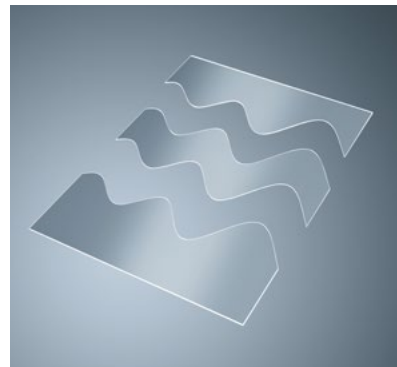
Laser precision cutting for brittle materials.

04

Pulse power with full output

due to disk technology

With the regenerative disk laser technology, 100% of the average power is available, even when using individual pulses. This also makes it possible to process brittle materials such as glass or sapphire effortlessly.



With the specialized TOP Cleave processing optics, you can cleave glass and sapphire a hundred times faster than normally and achieve complex geometries.

05

Complete flexibility

for all wavelengths and pulse durations

Use the full bandwidth of laser microprocessing: with the TruMicro Series 5000, you can work with infrared, green, or ultraviolet light, either with pico- or femtosecond pulses.



The TruMicro Series 5000 offers the best parameters for your process. Select a suitable combination from the varying pulse durations, pulse energies, and wavelengths.



Discover more about the benefits of the TruMicro Series 5000 here:
www.trumpf.com/s/td29k

TruMicro Series 7000

Built for high performance.

01

High throughput

due to an ideal combination of short pulses and high power

04

Even more reliable

Disk laser technology with optimized features



02

Extensive applications

with high average power

03

Full pulse energy

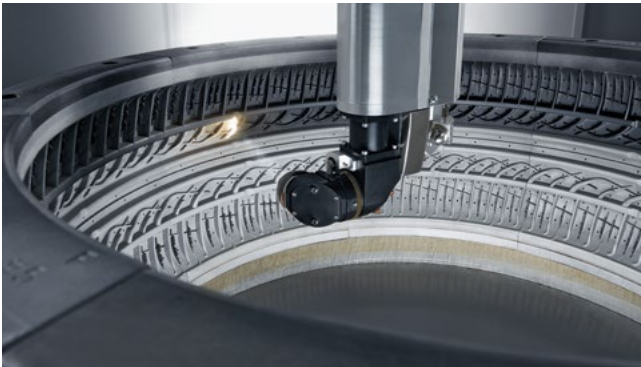
with internal power regulation

01

High throughput

due to an ideal combination of short pulses and high power

The high-power short-pulse lasers in the TruMicro Series 7000 are based on disk laser technology and combine short pulses and high pulse energy, even with high frequencies. This means you can ablate layers and contamination quickly and reduce your cycle time. Additionally, optimize your processes by varying the repetition rate with the same pulse duration.



Short-pulse lasers of the TruMicro Series 7000 are the ideal tool for the efficient and profitable cleaning of tire moulds.

02

Extensive applications

with high average power

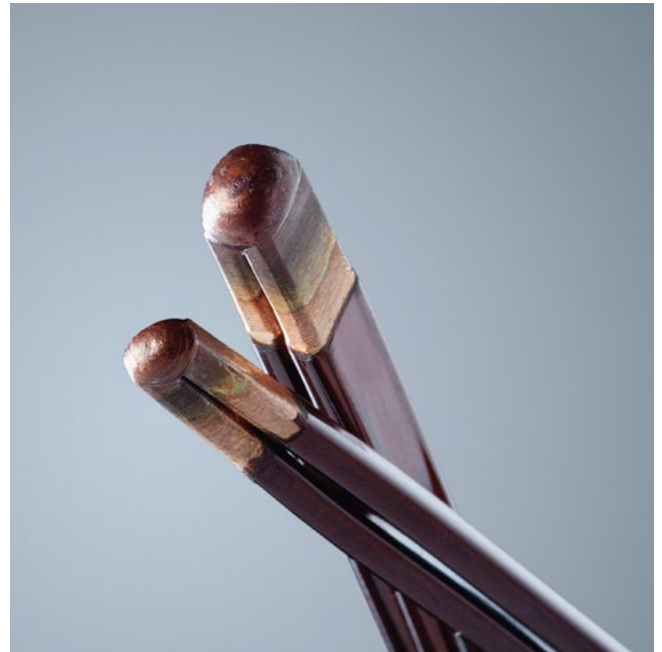
Ablation, cleaning, annealing: TruMicro Series 7000 lasers show their full potential in large-scale applications. With pulse energies of up to 100 mJ, you can achieve enormous decoating rates. A scanner ensures excellent utilization of the power. Flexible laser light cables transport the light to where it needs to get to and make laser integration easier.

03

Full pulse energy

with internal power regulation

With up to 2000 W, TruMicro Series 7000 lasers give you the highest power for microprocessing. Due to internal power regulation, you have the full pulse energy for your process at all times and without limitations.



Hairpin welding for electric drives: In preparation for hairpin welding, short-pulse lasers are used to ablate the insulating varnish layer without damaging the copper underneath.

04

Even more reliable

Disk laser technology with optimized features

The new TruMicro 7070 boasts well-established disk laser technology with even more of everything: improved beam quality, three times higher average power, a higher repetition rate, and higher pulse energy.



Discover more about the excellent performance of the TruMicro Series 7000 here: www.trumpf.com/s/fbc0qa

TruMicro Series 8000

Ultraviolet pulses for flexible OLED displays.

01

The most powerful UV solid-state laser in the world

with high pulse energies and short pulse durations



02

High productivity for OLED displays

due to innovative applications
with disk technology and UV

03

A wealth of processing options

with UV wavelength

01

The most powerful UV solid-state laser in the world

with high pulse energies and short pulse durations

The TruMicro Series 8000 lasers are by far the most powerful industrial UV short-pulse lasers based on solid-state technology: they combine short pulses, high pulse energies, and power with ultraviolet wavelength so you can harness all the advantages of a solid-state laser.



Due to special beam guidance and shaping elements, the workpiece receives exactly the right pulse, even at peak intensities.

02

High productivity for OLED displays

due to innovative application with disk technology and UV

The production of OLED displays is significantly more economical with the unique lift-off process – with short UV pulses, you can detach the polyimide film much better from the glass substrate than with an excimer laser. Increase your productivity and benefit from the low-maintenance process due to robust disk technology and no time-consuming gas exchange.

03

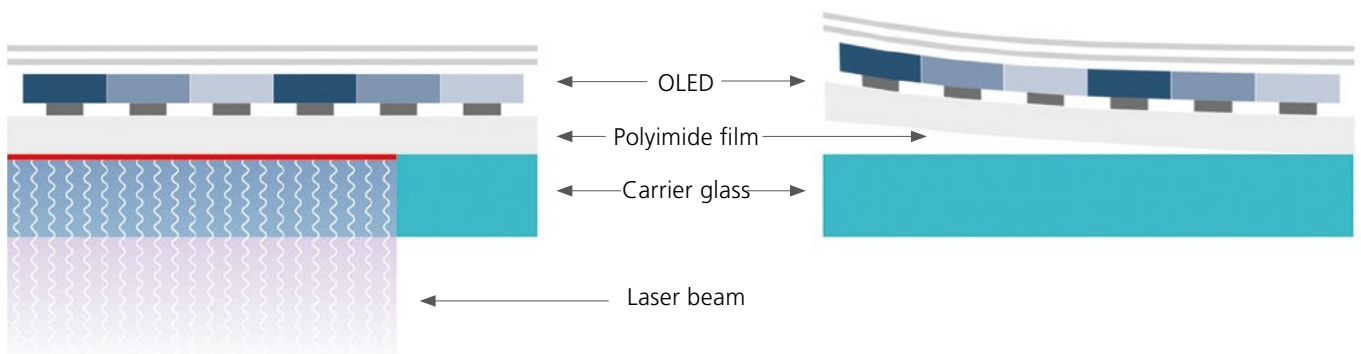
A wealth of processing options

with UV wavelength

Use the wide variety of processing options with UV laser pulses in a wide range of applications: modify the surfaces of carbon fiber reinforced plastics (CFRP) easily and productively, or activate surfaces in architecture, medical technology, and the semiconductor industry.



Read all about UV pulses for your production here:
www.trumpf.com/s/s13d8t



The laser lift-off method detaches the polyimide film from the substrate glass without destroying the covering semiconductor layer by way of heat or lattice vibration.

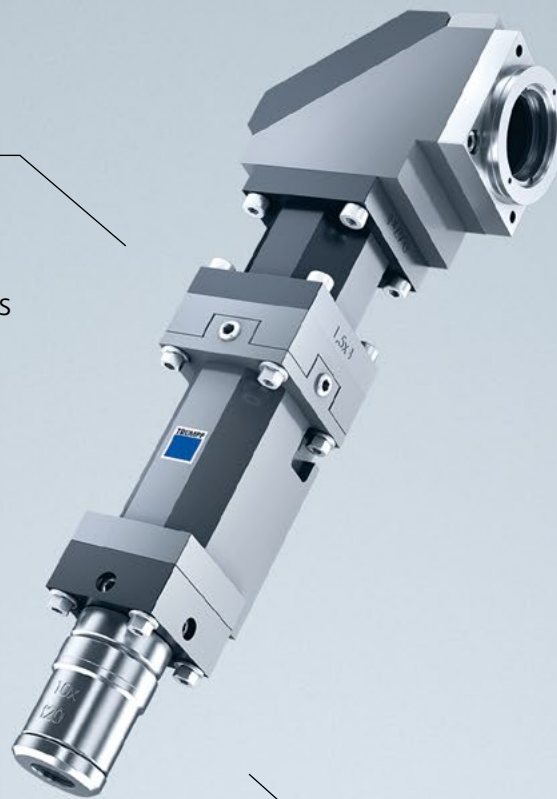
TOP Cleave

Processing optics for high-speed cutting of glass and sapphire.

01

Lightning-fast cutting

with even simpler process steps



02

The smallest geometries in tempered glass

due to innovative cutting technology

03

No reworking

due to low surface roughness

01

Lightning-fast cutting

with even simpler process steps

TOP Cleave optics make your work easier. Instead of separating and then tempering each individual part, you can reverse the order to make the process more practical: Simply temper the entire sheet first. Then cut out the shape you want. The cutting process is faster than ever: up to 1,000 mm/s – that's a hundred times faster than ablative cutting processes.

02

The smallest geometries in tempered glass

due to innovative cutting technology

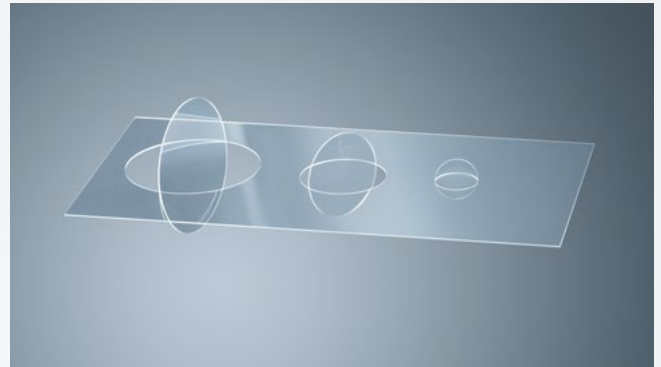
With the modification cutting technology developed by TRUMPF, you can achieve the most delicate geometries in glass, even with very thin, tempered glass. The ultrashort laser pulses change the internal makeup of the glass, so that it is split at the desired point in a controlled and crack-free manner – using freely selectable contours accurate to a hundredth of a millimeter.

03

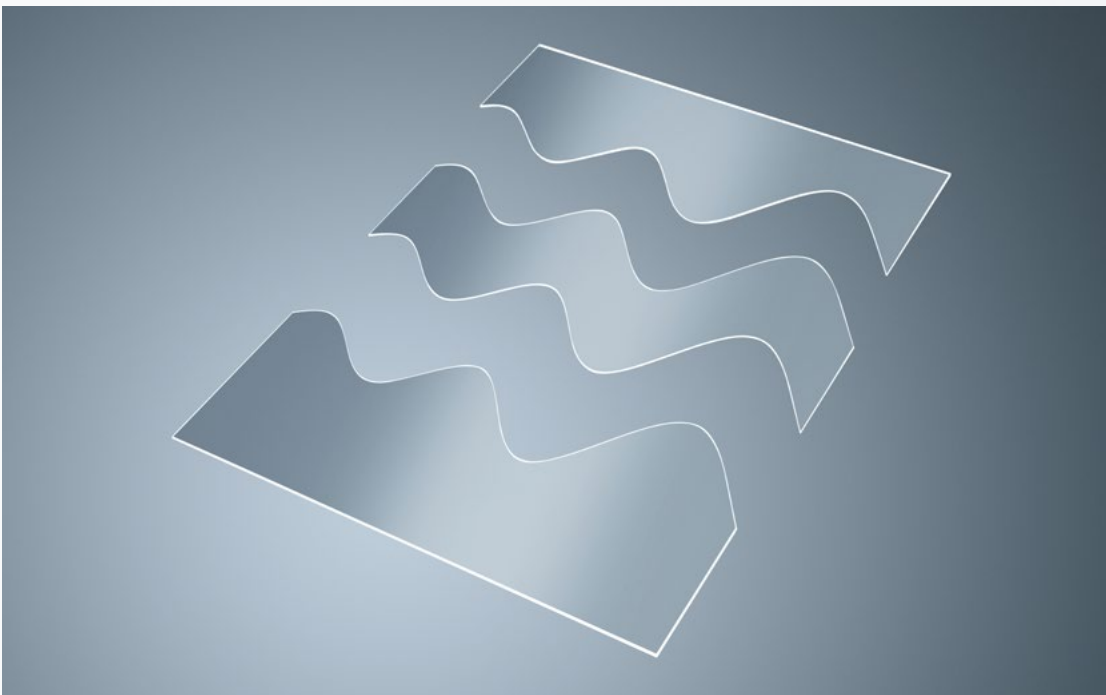
No reworking

due to low surface roughness

Save time-consuming reworking such as grinding or polishing in the future: TOP Cleave optics allow you to automatically achieve clean separating edges with a surface roughness of under 1 µm.



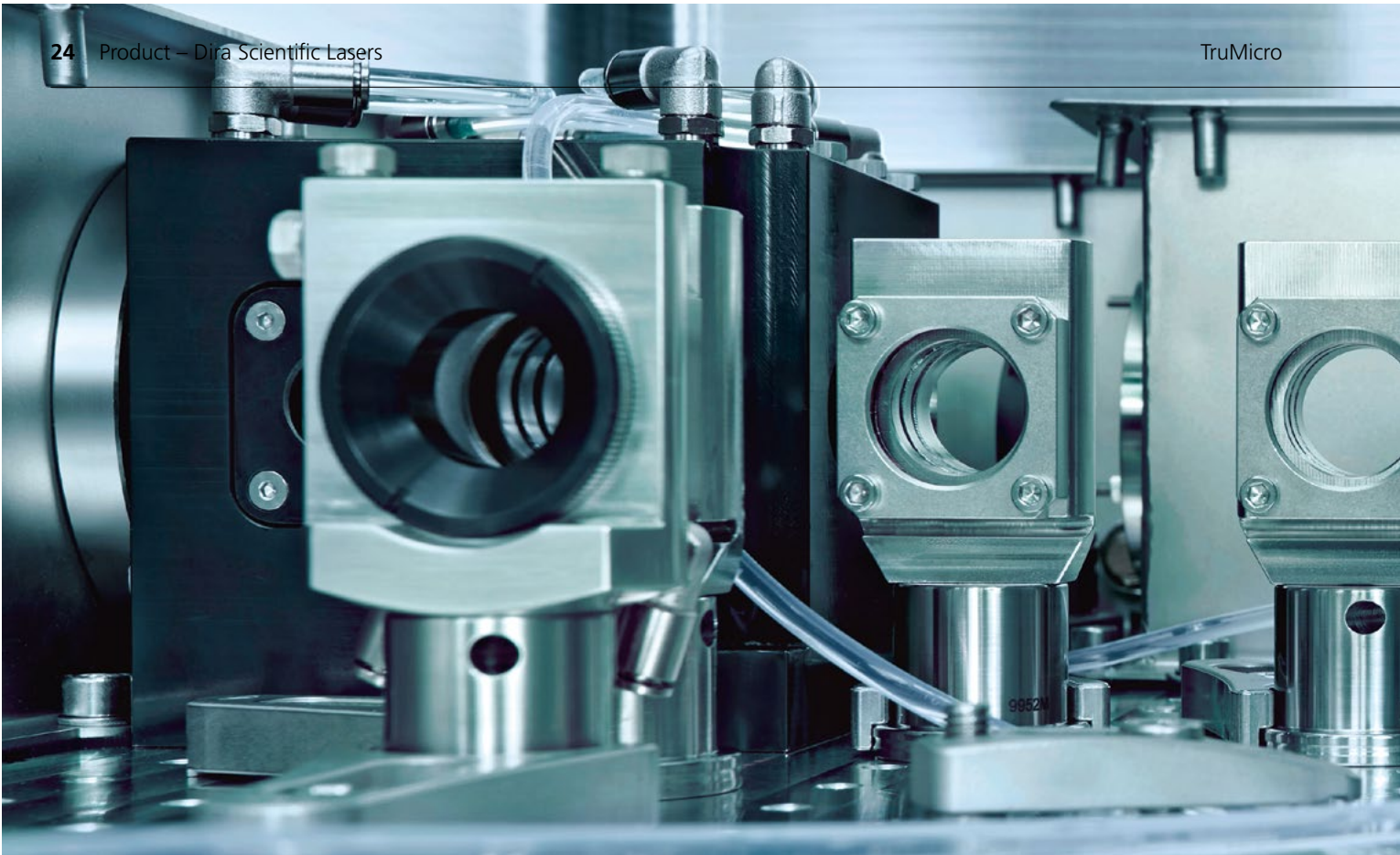
TOP Cleave optics enable glass cutting a hundred times faster than with standard ablative cutting processes.



High-speed glass cutting.



Discover more about TOP Cleave focusing optics here:
www.trumpf.com/s/27rbeu



Dira Scientific Lasers

Customized lasers for the scientific community based on industrial TRUMPF disk laser technology.

Flexible, modular design

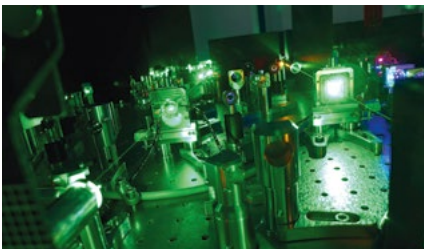
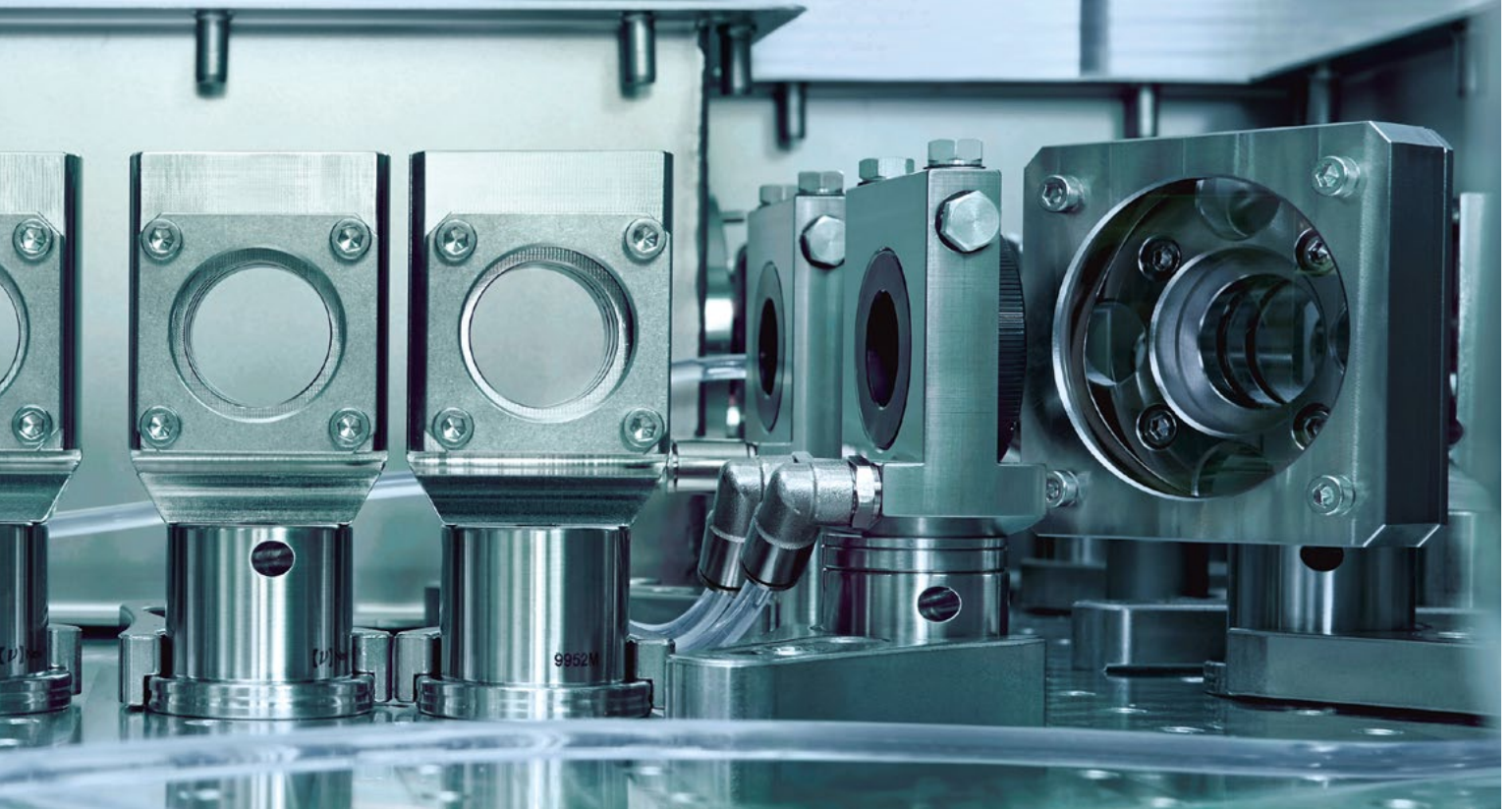
tailored to individual customer needs

Amplifiers of Dira Scientific Lasers can be tailored to meet customer's needs due to their modular design. Various pulse durations, repetition rates, wavelengths, and power classes are available.

High level of comfort

due to customized control

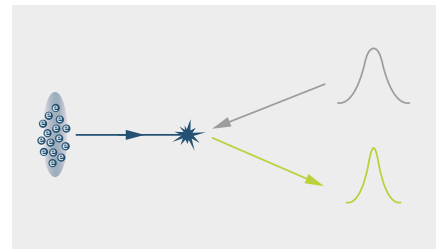
Dira laser control optimizes and monitors all system parameters offering a simple and flexible interface for laboratory operation.



Dira Scientific Laser systems were originally developed as pump lasers for optical parametric amplifiers. They create high-power femtosecond pulses.



In atmospheric research, ultrashort-pulse lasers are used to create laser filaments in air. This technology enables triggering and guiding of lightning.

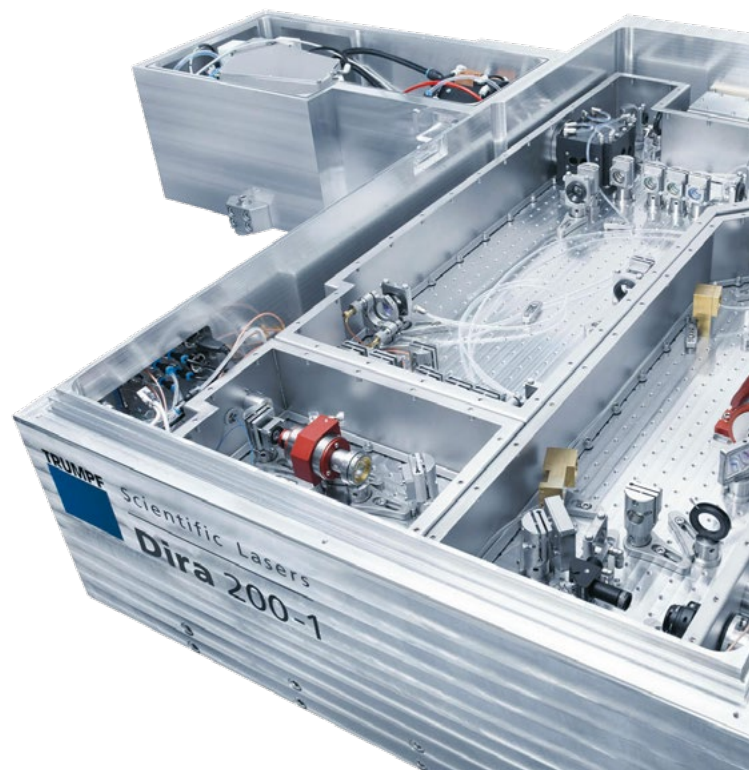


Picosecond regenerative amplifiers will be used for generating coherent X-rays for phase contrast imaging in medicine, thus revolutionizing X-ray examination.

Outstanding long-term stability

even extreme output powers and pulse energies

Dira Scientific Lasers generate picosecond pulses with up to 200 mJ of energy and output powers larger than 1 kW. Even at these extreme parameters, highest long-term stability will be given.



Discover more about TRUMPF Scientific Lasers here:
www.trumpf.com/s/scientificlasers

TruServices. Your Partner in Performance

Your laser is designed for high performance. Put your faith in services that put you ahead of the pack for the long term – together we'll find ways to sustainably maximize your value creation. With TRUMPF you have a reliable partner and can count on excellent support with complete custom solutions and service packages – helping you to produce at a consistently high level.



EMPOWER

We will help you to establish the best foundation for successful production.

IMPROVE

If you want to gradually focus your production on maximum value creation, we will achieve your goal together.

SUPPORT

We are at your side if you need utmost flexibility and plant availability in ongoing operations.

With TruServices, you receive exactly the products and services you need to be successful in the long term.

Technical Service



Our global network of service teams is here to help! Whether you produce in Europe, America, or Asia, you can count on fast and expert support worldwide, covering everything from installation to maintenance and repairs for short- and ultrashort-pulse lasers. Simply call our Technical Service team and talk with our specialists to decide which is the most efficient way to handle your particular case: an on-site visit by one of our service engineers or troubleshooting via remote support.

Training



Get a competitive edge with our comprehensive training program. Deepen your knowledge of products and solutions alike. Optimize your production sequences and boost productivity. Depending on the subject of the training, you will learn using the laser directly, in our modern training rooms or in the virtual classroom. We give you practical and effective expert knowledge about your production.

Service Agreements



Our service agreements offer a range of service packages to help make your production run more smoothly. Select the right scope of services for you with manageable costs: technical hotline, remote support, on-schedule maintenance, repairs including spare parts – you benefit from low package prices and less processing outlay.

Monitoring & Analysis



Do you want to keep an eye on the status and performance of your laser or your entire production at all times? TRUMPF offers monitoring and analysis products that take transparency to the next level. Monitor the machine status and processes in real time to see if your implemented measures are successful. Save time and money by preventing costly machine and production downtime and identifying potential savings.



Find out about our comprehensive package of helpful services:
www.trumpf.com/s/services

Technical data

We have summarized the technical data for the TruMicro lasers here for you:

TruMicro Series 2000

Technical data			
		TruMicro Series 2000	
		TruMicro 2020	TruMicro 2030
Average output power	W	10	20
Beam quality	M ²	< 1.3, optional < 1.2	< 1.3, optional < 1.2
Wavelength	nm	1030	1030
Pulse duration		< 400 fs–20 ps	< 400 fs–20 ps
Max. pulse energy	μJ	50	100
Min. repetition rate		Switching down to the single pulse	Switching down to the single pulse
Max. repetition rate	kHz	2000	2000
Dimensions			
Laser head (WxHxD)	mm	180x360x580	180x360x580
Supply unit (WxHxD)	mm	485x180x510	485x180x510

TruMicro Series 5000

Technical data				
		TruMicro Series 5000		
		TruMicro 5025, 5050, 5070, 5080	TruMicro 5225, 5250, 5270, 5280	TruMicro 5350, 5370, 5380
Wavelength	nm	1030	515	343
Average power	W	25/50/100/150	15/30/60/90	15/30/45
Max. pulse energy	μJ	500 ¹⁾	150 ¹⁾	751
Pulse duration	ps	< 10 ps	< 10 ps	< 10 ps
Beam quality	M ²	< 1.3, optional < 1.2	< 1.3, optional < 1.2	< 1.3, optional < 1.2
Repetition rate	kHz	100–1000	200–1000	200–1000
		TruMicro Series 5000		
		TruMicro 5025, 5050, 5070, 5080 Femto Edition	TruMicro 5250, 5270, 5280 Femto Edition	
Wavelength	nm	1030	515	
Average power	W	20/40/80/120	25/50/75	
Max. pulse energy	μJ	200	125 ¹⁾	
Pulse duration	fs	approx. 900	approx. 800	
Beam quality	M ²	< 1.3, optional < 1.2	< 1.3, optional < 1.2	
Repetition rate	kHz	100–1000	200–1000	

¹⁾ Depending on the power class.

More information at www.trumpf.com

- Technical data sheets available to download
- Clear comparison of up to three products
- Display-configured to suit all devices

TruMicro Series 7000

Technical data				
		TruMicro Series 7000		
		TruMicro 7060	TruMicro 7070	TruMicro 7240
Wavelength	nm	1030	1030	515
Average power	W	1000	2000	300
Max. pulse energy	mJ	100	100	7.5
Pulse duration	ns	30	30	300
Min. beam quality	mm • mrad	10	10	4
Repetition rate (tunable)	kHz	5–100	5–250	20–100

TruMicro Series 8000

Technical data		
TruMicro Series 8000		
TruMicro 8320		
Average output power	W	200
Beam quality	M ²	22.5 ± 2.5
Wavelength	nm	343
Pulse duration	ns	15 ± 3
Max. pulse energy	mJ	20
Repetition Rate	kHz	10
Dimensions		
Laser head (WxHxD)	mm	450x810x2131
Supply unit (WxHxD)	mm	1090x1798x650

TruMicro Mark 2020, 2030

Technical data		
		TruMicro Mark 2020, 2030
Beam quality (M ²) / intensity distribution		< 1.3/TEM ₀₀
Wavelength	nm	1030
Pulse repetition frequency	kHz	Max. 2000
Min. focal diameter (f = 100 mm)	µm	30
Max. marking field size (f = 250 mm)	mm ²	180x180
Dimensions		
Processing unit dimensions (WxHxD)	mm	180x375x840
Supply unit dimensions (WxHxD)	mm	600x1225x825
Installation		
Safety class	IP	54
Permissible ambient temperature	°C	15–35

Dira Scientific Lasers

Technical data						
		Dira 200-100	Dira 200-5	Dira 200-1	Dira 500-10	Dira 750-5
Wavelength	nm	1030	1030	1030	1030	1030
Max. average power	W	200	200	200	500	750
Max. pulse energy	µJ	2	40	200	50	150
Pulse duration	ps	< 2	< 2	< 2	< 2	< 2
Repetition rate	kHz	≥100	1–100	1–100	1–100	5–100
Beam quality	M ²	< 1.2	< 1.3	< 1.4	< 1.4	< 1.4

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

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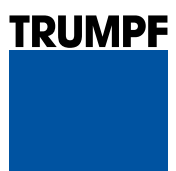


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