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 Via).
Comparison of lasers with disk amplifiers and fiber amplifiers

An overview of all TruMicro Series products

TruServices. Your Partner in Performance

Technical data

Passion is what drives us
# 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 worldwide 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.

<table>
<thead>
<tr>
<th>Short-pulse laser</th>
<th>Ultrashort-pulse laser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse duration in the range of nanoseconds</td>
<td>Pulse duration in the range of picoseconds and femtoseconds</td>
</tr>
<tr>
<td>(10^{-9}) s</td>
<td>(10^{-15}) s</td>
</tr>
</tbody>
</table>
- 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 5000**
Disk-based pico- and femtosecond lasers for highly productive microprocessing.

**TruMicro Series 2000**
Fiber-based, highly-flexible compact pico- and femtosecond lasers.

**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
**TruMicro Series 2000 – Products**

**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.

**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.

**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.

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

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

Structured application without enamel ejection.

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

02
Durable, high-contrast markings
due to ultrashort pulses

03
Marking on highly reflective materials
with high peak intensities

04
Maximum reliability
with patented quadruple-loop feedback control
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.

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.

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.

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.

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

With extreme peak pulse powers, the TruMicro Mark produces jet-black, corrosion-resistant markings.
TruMicro Series 5000

Extremely cost-efficient working.

**01**
Perfect results every time
due to high pulse and performance stability

**02**
Simple integration
due to compatibility with all standard interfaces

**03**
Highly productive with sensitive materials
due to cold processing

**04**
Pulse power with full output
due to disk technology

**05**
Complete flexibility for all wavelengths and pulse durations
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.

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.

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.

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.

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.

Laser precision cutting for brittle materials.
TruMicro Series 7000

Built for high performance.

01 High throughput
due to an ideal combination of short pulses and high power

02 Extensive applications
with high average power

03 Full pulse energy
with internal power regulation

04 Even more reliable
Disk laser technology with optimized features
**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.

**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.

**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.

**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.
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.

![Image of laser processing](image)

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.

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.

Read all about UV pulses for your production here: [www.trumpf.com/s/13/81](http://www.trumpf.com/s/13/81)
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.

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

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.

Picosound 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.
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.
# Technical data

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

## TruMicro Series 2000

<table>
<thead>
<tr>
<th>Technical data</th>
<th>TruMicro Series 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TruMicro 2020</td>
</tr>
<tr>
<td>Average output power</td>
<td>W</td>
</tr>
<tr>
<td>Beam quality</td>
<td>M²</td>
</tr>
<tr>
<td>Wavelength</td>
<td>nm</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>ps</td>
</tr>
<tr>
<td>Max. pulse energy</td>
<td>µJ</td>
</tr>
<tr>
<td>Min. repetition rate</td>
<td>Switching down to the single pulse</td>
</tr>
<tr>
<td>Max. repetition rate</td>
<td>kHz</td>
</tr>
</tbody>
</table>

### Dimensions

| Laser head (W×H×D) | mm | 180 x 360 x 580 | 180 x 360 x 580 |
| Supply unit (W×H×D) | mm | 485 x 180 x 510 | 485 x 180 x 510 |

## TruMicro Series 5000

<table>
<thead>
<tr>
<th>Technical data</th>
<th>TruMicro Series 5000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TruMicro 5025, 5050, 5070, 5080</td>
</tr>
<tr>
<td>Wavelength</td>
<td>nm</td>
</tr>
<tr>
<td>Average power</td>
<td>W</td>
</tr>
<tr>
<td>Max. pulse energy</td>
<td>µJ</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>ps</td>
</tr>
<tr>
<td>Beam quality</td>
<td>M²</td>
</tr>
<tr>
<td>Repetition rate</td>
<td>kHz</td>
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</table>

### TruMicro Series 5000

<table>
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<tbody>
<tr>
<td>Wavelength</td>
<td>nm</td>
</tr>
<tr>
<td>Average power</td>
<td>W</td>
</tr>
<tr>
<td>Max. pulse energy</td>
<td>µJ</td>
</tr>
<tr>
<td>Pulse duration</td>
<td>fs</td>
</tr>
<tr>
<td>Beam quality</td>
<td>M²</td>
</tr>
<tr>
<td>Repetition rate</td>
<td>kHz</td>
</tr>
</tbody>
</table>

¹Depending 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

<table>
<thead>
<tr>
<th>Technical data</th>
<th>TruMicro Series 7000</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>TruMicro 7060</td>
</tr>
<tr>
<td>Wavelength (nm)</td>
<td>1030</td>
</tr>
<tr>
<td>Average power (W)</td>
<td>1000</td>
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<tr>
<td>Max. pulse energy (mJ)</td>
<td>100</td>
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<tr>
<td>Pulse duration (ns)</td>
<td>30</td>
</tr>
<tr>
<td>Min. beam quality (mm • mrad)</td>
<td>10</td>
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<tr>
<td>Repetition rate (tunable, kHz)</td>
<td>5 – 100</td>
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</table>

### TruMicro Series 8000

<table>
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<tr>
<th>Technical data</th>
<th>TruMicro Series 8000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TruMicro 8320</td>
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<tr>
<td>Average output power (W)</td>
<td>200</td>
</tr>
<tr>
<td>Beam quality (M²)</td>
<td>22.5 ± 2.5</td>
</tr>
<tr>
<td>Wavelength (nm)</td>
<td>343</td>
</tr>
<tr>
<td>Pulse duration (ns)</td>
<td>15 ± 3</td>
</tr>
<tr>
<td>Max. pulse energy (mJ)</td>
<td>20</td>
</tr>
<tr>
<td>Repetition Rate (kHz)</td>
<td>10</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>Laser head (W x H x D) (mm)</td>
<td>450 x 810 x 2131</td>
</tr>
<tr>
<td>Supply unit (W x H x D) (mm)</td>
<td>1090 x 1798 x 650</td>
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</table>

### TruMicro Mark 2020, 2030

<table>
<thead>
<tr>
<th>Technical data</th>
<th>TruMicro Mark 2020, 2030</th>
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</thead>
<tbody>
<tr>
<td>Beam quality (M²) / intensity distribution</td>
<td>&lt;1.3/TEM₀₀</td>
</tr>
<tr>
<td>Wavelength (nm)</td>
<td>1030</td>
</tr>
<tr>
<td>Pulse repetition frequency (kHz)</td>
<td>Max. 2000</td>
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<tr>
<td>Min. focal diameter (f = 100 mm) (µm)</td>
<td>30</td>
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<tr>
<td>Max. marking field size (f = 250 mm) (mm²)</td>
<td>180 x 180</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>Processing unit dimensions (W x H x D) (mm)</td>
<td>180 x 375 x 840</td>
</tr>
<tr>
<td>Supply unit dimensions (W x H x D) (mm)</td>
<td>600 x 1225 x 825</td>
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<tr>
<td>Installation</td>
<td></td>
</tr>
<tr>
<td>Safety class</td>
<td>IP</td>
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<tr>
<td>Permissible ambient temperature (°C)</td>
<td>15 – 35</td>
</tr>
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</table>

### Dira Scientific Lasers

<table>
<thead>
<tr>
<th>Technical data</th>
<th>Dira 200-100</th>
<th>Dira 200-5</th>
<th>Dira 200-1</th>
<th>Dira 500-10</th>
<th>Dira 750-5</th>
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<tr>
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<td>1030</td>
<td>1030</td>
<td>1030</td>
<td>1030</td>
<td>1030</td>
</tr>
<tr>
<td>Max. average power (W)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>500</td>
<td>750</td>
</tr>
<tr>
<td>Max. pulse energy (µJ)</td>
<td>2</td>
<td>40</td>
<td>200</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Pulse duration (ps)</td>
<td>&lt; 2</td>
<td>&lt; 2</td>
<td>&lt; 2</td>
<td>&lt; 2</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Repetition rate (kHz)</td>
<td>± 100</td>
<td>1 – 100</td>
<td>1 – 100</td>
<td>1 – 100</td>
<td>5 – 100</td>
</tr>
<tr>
<td>Beam quality (M²)</td>
<td>&lt; 1.2</td>
<td>&lt; 1.3</td>
<td>&lt; 1.4</td>
<td>&lt; 1.4</td>
<td>&lt; 1.4</td>
</tr>
</tbody>
</table>

Subject to alteration. Only specifications in our offer and order confirmation are binding.
Passion is what drives us

Whether it’s production and manufacturing technology, laser technology, or material processing: We develop highly innovative products and services which are suitable for industry and absolutely reliable. We put everything we’ve got into giving you a compelling and competitive edge: expertise, experience, and a lot of passion.

**Industry 4.0 – solutions to safeguard your future**

The fourth industrial revolution is changing the world of production. How can you stay competitive internationally? Benefit from the opportunities digital networking can present: We accompany you step by step on the way to your networked production with pragmatic solutions, and help you to make your processes more transparent, more flexible and, above all, more economical. This helps you make full use of your resources and make your production future-proof.

TruConnect is TRUMPF’s answer to Industry 4.0. The range of solutions links man and machine with information. It covers all steps in the production process – from the offer right through to the shipping of your parts.
Lasers for manufacturing technology

Whether on a macro-, micro-, or nanolevel: We have the right laser and the right technology to produce innovatively and cost-efficiently in every industrial application. Beyond the technology itself, we also support you with system solutions, application knowledge, and consulting.

Power supplies for high-tech processes

From semiconductor manufacturing to solar cell production: with our RF and MF generators, the current for induction heating, plasma and laser excitation is given a defined frequency and power – with high reliability and repeatability.

Machine tools for flexible sheet metal and tube processing

Whether it’s laser cutting, punching, bending, or laser welding: we offer tailor-made machines and automation solutions, including consulting, software, and services, for all processes in flexible sheet metal processing – so you can reliably manufacture your products to exacting quality standards.
TRUMPF is certified to ISO 9001
(Find out more: www.trumpf.com/s/quality)