

A golden laser lens is the central focus, surrounded by several green, faceted geometric shapes that resemble crystals or optical components. The background is a light blue gradient.

The Power of Choice

L A S E R S B Y T R U M P F

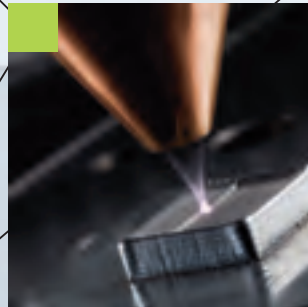
The Power of Choice.

Modern laser technology can achieve outstanding results in almost any manufacturing process while making efficient use of resources. When it comes to developing new products, you can rely on light to provide the right tool for your production environment. To ensure you get exactly the technology and support you need, TRUMPF offers a unique range of lasers and laser systems combined with global application consulting, integration support, and comprehensive after-sales service. Put simply, that's the Power of Choice.



How laser technology from TRUMPF is helping to shape some of the biggest trends in manufacturing and society.

Industries and Trends 4–7



How to find out which laser technology offers the best solution for you.

Applications and Technologies 8–9



How TRUMPF can help you transform a product concept into a manufacturing process.

Knowledge and Support 10–11



Learn more about the benefits of each laser type in the TRUMPF product range.

Laser Beam Sources 12 – 33



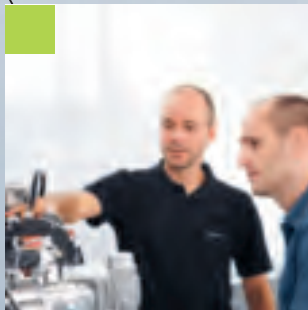
How to equip your laser with focusing optics and sensors to make your manufacturing process even simpler and more reliable.

Components 34 – 41



How interfaces and control options on TRUMPF lasers ensure smooth integration in your production environment.

Integration 42 – 43



How to get the right support at the right time from TRUMPF – and delve even deeper into the wonderful world of TRUMPF.

Services 44 – 47



Discover the wide variety of TRUMPF laser technologies in our video “**The Power of Choice**”: www.trumpf.info/fmpr6x



Your industry. Our motivation.

TRUMPF lasers are used in a variety of industries, from cutting thin shapes out of display glass to welding half inch thick metal for wind turbines. As a key technology leader, TRUMPF is continuously investing in research and development for new technologies and potential future applications. We are very much aware of the major trends shaping our society – and they give us the motivation to seek even better solutions for your innovative, efficient and high-quality production processes.

Mobility



We may not have reached the stage where our lasers can beam people from one place to another, but they have proven their ability to support the mobility and logistical requirements that keep our society moving. That includes making cars more efficient, trains lighter, aircraft safer, and ships more stable. Our lasers are also helping to shape frontline themes such as e-mobility.

– lbs.

Lightweight construction with finely rendered laser welded seams leads to reduced fuel consumption and lower CO₂ emissions.

13.5 nm

is the wavelength of the EUV light used to produce micro-chips, delivered by the TRUMPF Laser Amplifier.

Communication



Effective communication is a must in today's smart world. Our lasers provide solutions for one of the key processes at the heart of modern technical communication systems – chip manufacturing. As part of Industry 4.0, TRUMPF is also pushing ahead with numerous solutions to digitally connect production environments.

15.5 in²/sec

is the ablation rate of our short pulsed lasers, which facilitate the cost-effective production of thin-film solar modules.

Energy

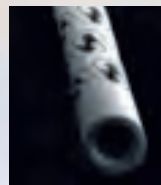


Is saving energy a key priority for you and your industry, too? Our highly efficient lasers open the door to energy-efficient production and help make your components lighter and tougher. TRUMPF lasers offer energy-saving solutions in the wind power and photovoltaic sectors, as well as in many other areas.

$1 \cdot 10^{-12}$ sec

Stents cut from nitinol or polymer using picosecond lasers reveal a high-quality, smooth surface which leaves no footholds for deposits to build up. This helps arteries stay open over the long term.

Health



TRUMPF lasers are used in medical device manufacturing to create precisely rendered micro-structures. The results have a major impact on people's health and quality of life. TRUMPF is also working together with the Max Planck Institute to develop attosecond laser technology that could, in the future, be used to detect tumors as small as 1 mm.

Your needs. Our support.

Whether you already know exactly what you want or are looking for a custom solution, we are at your side from the word go. The laser is a unique tool – and we are passionate about the opportunities it offers. TRUMPF has Laser Application Centers (LACs) all over the world ready to cater to your needs because we believe you should always be able to find the right partner in the right place – with exactly the right technology to meet your needs.

Tap into TRUMPF as ...

... a project consultant

“We can provide you with advice and support from product conception through to production optimization. Along with helping define your production process in one of our LACs, we can help you find an integrator if needed, or work closely with your preferred integrator. We’ll work together with you to get the production running and optimized - until you are completely satisfied with the results.”

Antje Engler, Sales, Detroit



USA:
Farmington

Switzerland:
Grüsch & Baar

USA:
Plymouth



... a service partner

“Our custom packages of support and after-sales service help keep your business running smoothly. If something goes wrong, then our comprehensive remote services can quickly get things back on track. We also offer an extensive range of on-site training programs, upgrades and application services.”

Bastian Becker, Services, Ditzingen



... a technology developer

“We’ve been developing lasers at TRUMPF for more than 40 years. Time and again we have transformed visions into reality with the help of our research partners. Now you can use this extraordinary knowledge to gain a competitive edge. Take our innovative ultra-short pulsed lasers, for example. My project partners and I received the ‘German Future Prize’ for our work in this field – and it has already yielded a wealth of successful applications.”



Dirk Sutter, Head of Development Group for Ultra-short Pulsed Lasers, Schramberg

... an industry sector manager

“We take a unique industry sector approach that offers you support long before you start using our lasers in your production line. For example, I can give you ideas on how to design your product to make it well-suited for laser processing. I specialize in lightweight construction, helping customers from the automotive and other industries to take advantage of the full potential of laser technology and develop tailor-made solutions.”



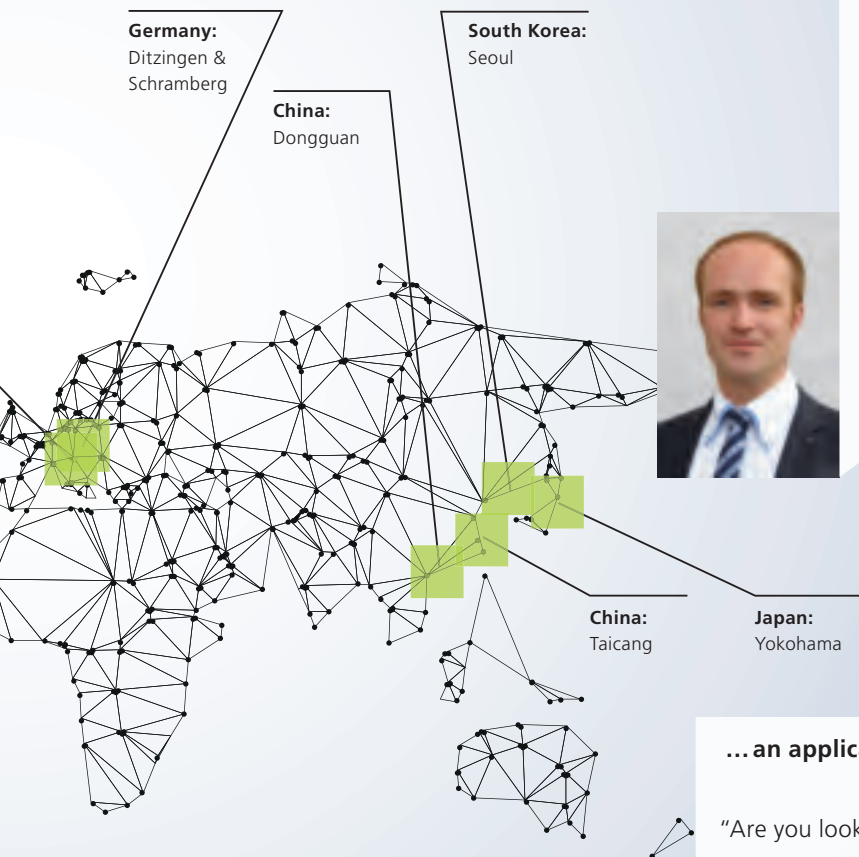
Marc Kirchhoff, Industry Manager for Lightweight Construction, Ditzingen

... an application specialist

“Are you looking for an industrially viable production method? If so, our LACs are a great place to start. Based on your requirements, we can produce sample parts and find the optimum combination of lasers, components and process parameters to ensure you get the best quality at the lowest cost. Our success stems from the close relationship we have with our customers. I moved to China for my specialist field of micro-processing.”

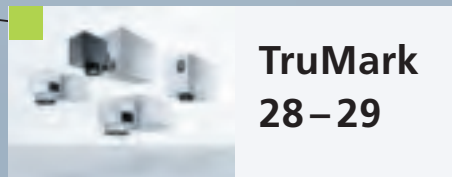
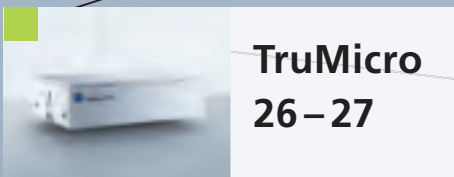
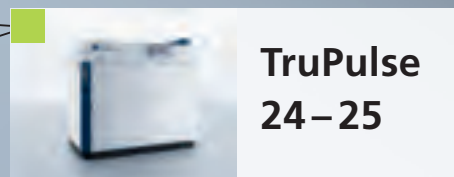
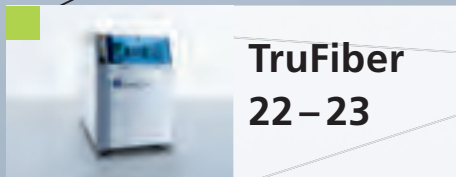
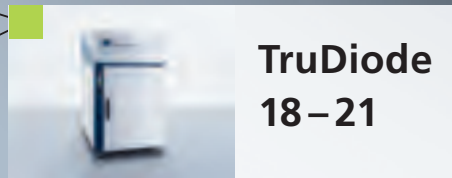
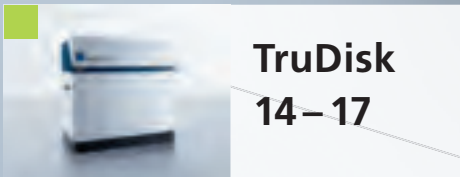


Severin Luzius, Group Manager, Laser Application Center, Taicang

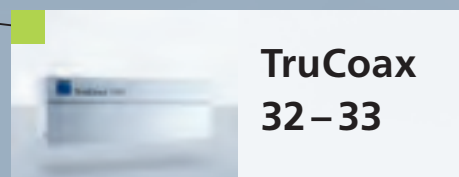
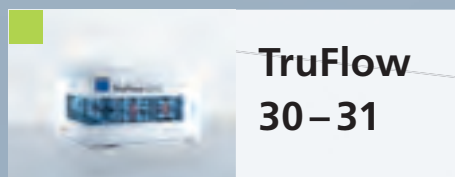


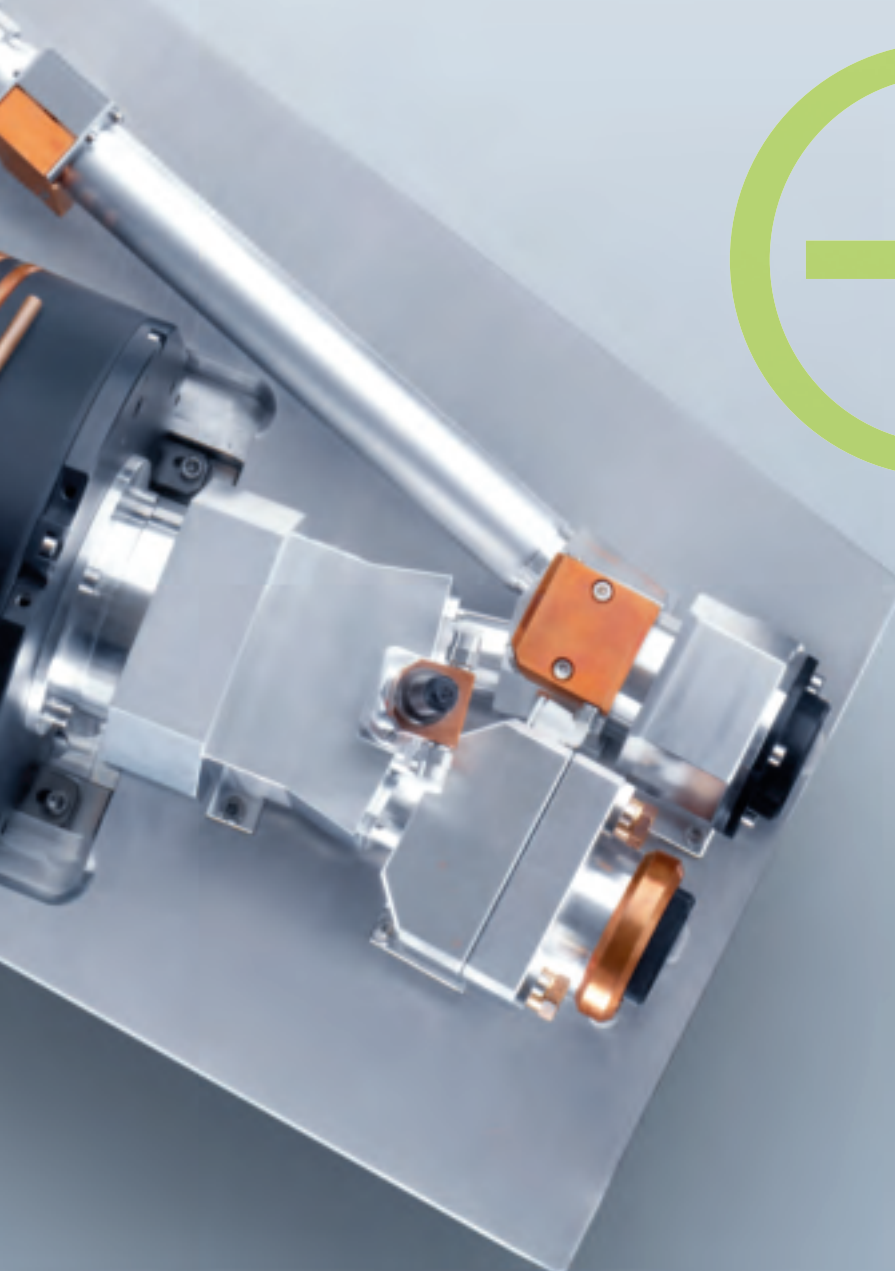
Your production. Our portfolio.

Solid-state lasers



CO₂ lasers





Why choose TRUMPF lasers?

- 1 Innovative solutions
- 2 Maximum precision and quality
- 3 Comprehensive range of products
- 4 Global application consulting
- 5 Decades of experience
- 6 Industry experts
- 7 High uptime / availability
- 8 On-site service and remote diagnostics
- 9 Customized services

	TruDisk	TruDiode	TruFiber	TruPulse	TruMicro	TruMark	TruFlow	TruCoax
Welding	■	■					■	
Precision welding	■	■	■	■				
Deposition welding	■	■						
Brazing	■	■						
Plastic welding		■						
Cutting	■						■	■
Precision cutting	■	■	■	■	■			■
Drilling and ablation				■	■	■		■
Hardening	■	■						
Additive manufacturing	■	■	■					
Marking					■	■		

TruDisk

01

100 % constant power
from the first millisecond

02

**Robust protection
against back reflection**
with our patented resonator design

03

Maximum beam quality
as a result of the disk geometry

04

Modular design
for reliable and versatile operation



For highly productive cutting and welding, look no further than the TruDisk all-in-one laser. Brazing and deposition welding are two of its key strengths, including highly reflective non-ferrous metals. The versatile TruDisk laser can be used in networks - shared by up to six machines or work cells.

08

Higher productivity
with variable beam splitting

07

More stable process results
with intelligent software options

06

Resource-efficient
with optimum availability

05

Six workstations
supplied with reliable laser power in
a network

01

100 % constant power

from the first millisecond

The laser power can be regulated in real time instead of being controlled manually. As a result, you get the best power stability on the market for the entire service life of your TruDisk laser. That means perfectly reproducible results around the clock – even in tropical conditions.



Precision-welded seams on a car body.

02

Robust protection against back reflection

with our patented resonator design

Your TruDisk laser can comfortably handle highly reflective materials. The patented resonator design provides robust and reliable performance even under extreme conditions.



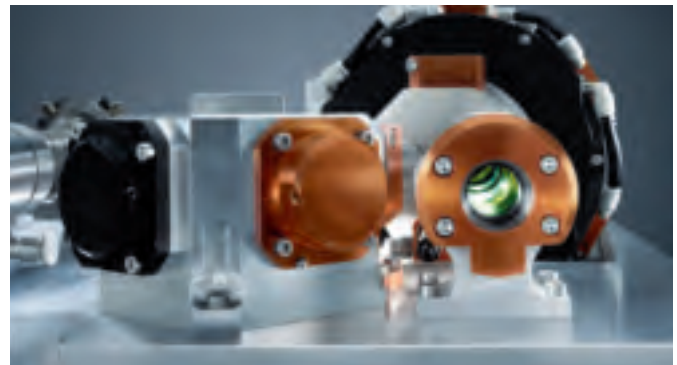
The TruDisk laser can cut a range of different materials and thicknesses.

03

Maximum beam quality

as a result of the disk geometry

Disk lasers offer outstanding beam quality, with the TruDisk achieving figures of 2mm·mrad and up. Delivering between 1 and 16 kW of power, TruDisk lasers produce optimum results for processes as diverse as laser welding and laser cutting. They are also a great choice for deposition welding, hardening and additive manufacturing.



The robust optics module in the TruDisk disk laser.

04

Modular design

for versatile and reliable operation

The TruDisk features a simple, compact and modular design. This ensures maximum uptime and makes it easy to service and maintain. If your needs change later down the line, it's no problem to upgrade your laser power or add fibers to serve multiple workstations from a single laser source.



Satisfyingly simple – the optics layout in a TruDisk disk laser.

05

Six workstations

supplied with reliable laser power in a network

Your TruDisk can serve up to 6 different workstations in a laser network – either switching the beam between workstations, or by splitting the beam to two outputs simultaneously. Whichever option you choose, the result is a steady and reliable beam quality at each and every workstation, with everything you need compactly stowed under a single laser hood. You get the most from your laser and make optimum use of all your machines.



The TruDisk can serve up to 6 machines in a network.

06

Resource-efficient

with optimum availability

With an efficiency rate of over 30 percent and intelligent energy management, the TruDisk can help you cut your resource consumption and reduce operating costs. TruDisk lasers are a reliable choice with no wear parts. They also feature an intelligent cooling system with a built-in heat exchanger. In many cases this eliminates the need for an external cooling solution – just one of the TruDisk's many benefits.

Grinding wheel with a laser cladded profile.



07

More stable process results

with intelligent software options

TruControl provides flexible support for all standard fieldbuses and automation control systems. Programmable pulse shaping enables tailoring to your specific application. CutAssist helps you achieve optimum processing results, and Quality Data Store enables archiving of process and production data.



The TruControl system helps you make the most of laser processing.

08

Higher productivity

with variable beam splitting

We can provide you with a custom beam guidance solution, enabling you to share or split the laser beam in whichever way you choose - for example, you could weld workpieces from above and below at the same time. By maintaining a more homogeneous distribution of energy in the workpiece, you can minimize distortion while simultaneously benefiting from higher throughput rates.



See the **TruDisk** in action at the company LICOS Trucktec GmbH: www.trumpf.info/epogtw



TruDiode



01

100 % constant power

regulated in real time

02

> 40 % efficiency

with minimal operating costs

Compact direct diode lasers are tremendously energy-efficient and produce outstanding results in applications such as deep penetration welding, heat conduction welding, deposition welding, brazing and plastic welding.

05

Extremely compact
and easy to maintain

04

Flexible upgrade options
and versatile uses

03

**Always ready
for action**
throughout its service life



01

100 % constant power

regulated in real time

The power of the TruDiode laser is regulated in real time and is completely independent of the laser’s environment and service life. With its high beam quality and power levels ranging from 150 to 6,000 watts, the laser guarantees optimum and reproducible workpiece results from the very first millisecond. All of this at a low capital cost and with minimal operating costs!



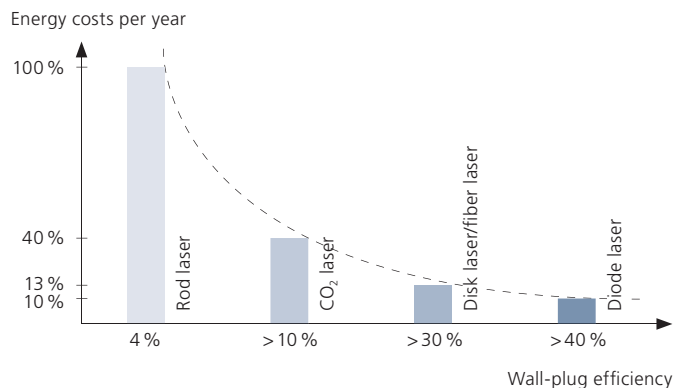
High-quality weld seams: welding plastic with a TruDiode.

02

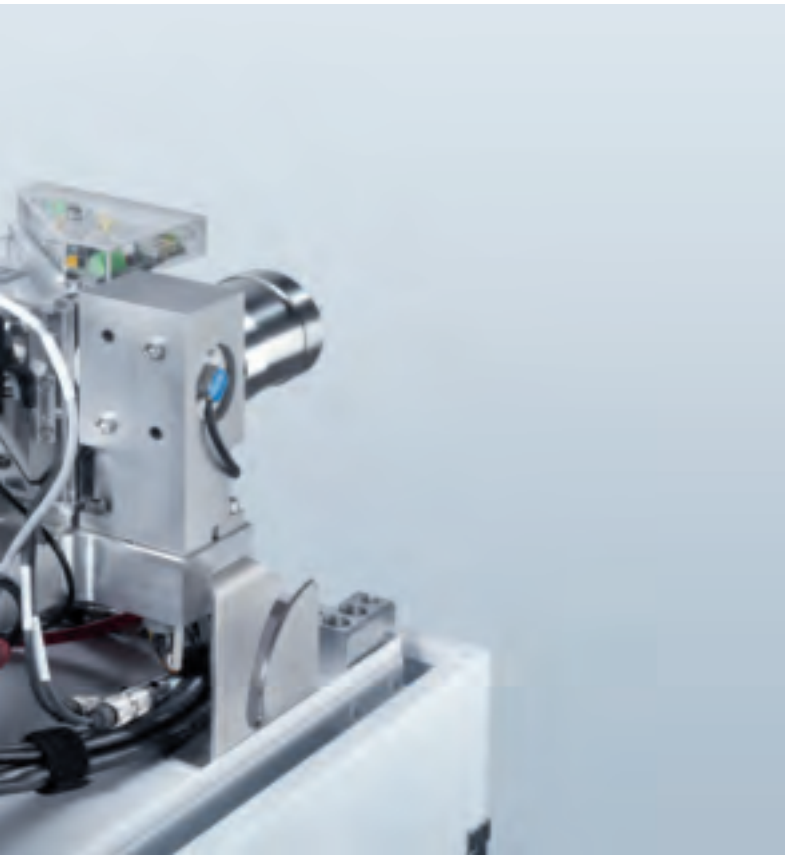
> 40 % efficiency

with minimal operating costs

TruDiode lasers are extremely energy-efficient and feature very high wall-plug efficiency. The intelligent cooling system with a built-in heat exchanger often eliminates the need for an external cooling solution. You’ll be amazed by the low operating costs of your direct diode laser.



Comparing lasers of the same power.



03

Always ready for action

throughout its service life

Passively cooled diode modules maximize the laser’s service life. The diode cooling water is also used to cool the optics and laser light cable – a reliable, non-corroding solution. You also benefit from the wear-free properties of laser processing and a steady, constant application of energy to the workpiece.



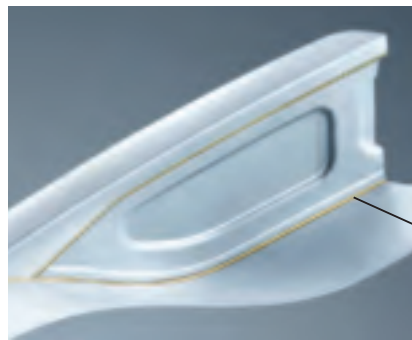
Compact 19" version of the TruDiode 301.

04

Flexible upgrade options

and versatile uses

It’s easy to upgrade your TruDiode laser even after it’s been installed. For example, you can make on-site adjustments to both the laser power and the number of workstations served by the laser. And, the TruDiode is just as versatile when it comes to applications, welding plastics or metals either with or without filler material.



A laser brazed component.

05

Extremely compact

and easy to maintain

With its modular, space-saving design and a footprint of just one square meter, you’ll find it easy to integrate the TruDiode into your existing production systems.



Optical arrangement from a TruDiode 6006.



Watch a **TruDiode** laser perform deposition welding:
www.trumpf.info/g6tlkq



TruFiber

Designed for precision tasks, fiber lasers can meet your requirements for high process speeds, small kerf widths, and narrow weld seams.

01

**Kerf width <math>< 100\mu\text{m}</math>
in precision cutting**
as a result of optimum beam quality

04

Intelligence included
as part of the package



02

100 % constant power
throughout the laser's entire service life

03

With CutAssist
you can easily machine the
toughest spots

01

Kerf width <math>< 100 \mu\text{m}</math> in precision cutting

as a result of optimum beam quality

A resonator made of fibers gives you optimum single-mode beam quality for high-precision contours. The typical focus diameter is between 10 and 50 μm . The beam quality produces very high power density at the workpiece, which you can use to achieve high processing speeds and productivity, especially in thin sheet applications.



Optical arrangement in a TruFiber fiber laser.

02

100 % constant power

throughout the laser's entire service life

The built-in system for actively controlling laser power ensures you get stable processes and reproducible processing results. The laser power is controlled automatically and in real time throughout your laser's entire service life – regardless of the ambient conditions.



A watch hand cut with precision – as a result of real-time power control.

03

With CutAssist

you can easily machine the toughest spots

The CutAssist option is designed to help you with precision cutting and welding. It automatically adapts the laser parameters to the cutting speed, ensuring high-precision results even for sharp corners and curves without having to search for new parameters.



Untidy edges without in-line tailoring of laser parameters.



Precision laser cutting with CutAssist.

04

Intelligence included

as part of the package

Whether you choose the free-standing version or the 19" housing for integration into your existing facilities, your TruFiber laser comes with an intelligent, easy-to-use control system we call TruControl. This includes a frequency generator, pulse shaping, real-time power control, a variety of interfaces, a two-channel emergency stop circuit and software.



Stand-alone version of the TruFiber laser with built-in cooling system.



Watch the **TruFiber** working on e-mobility products:
www.trumpf.info/kule0d



TruPulse

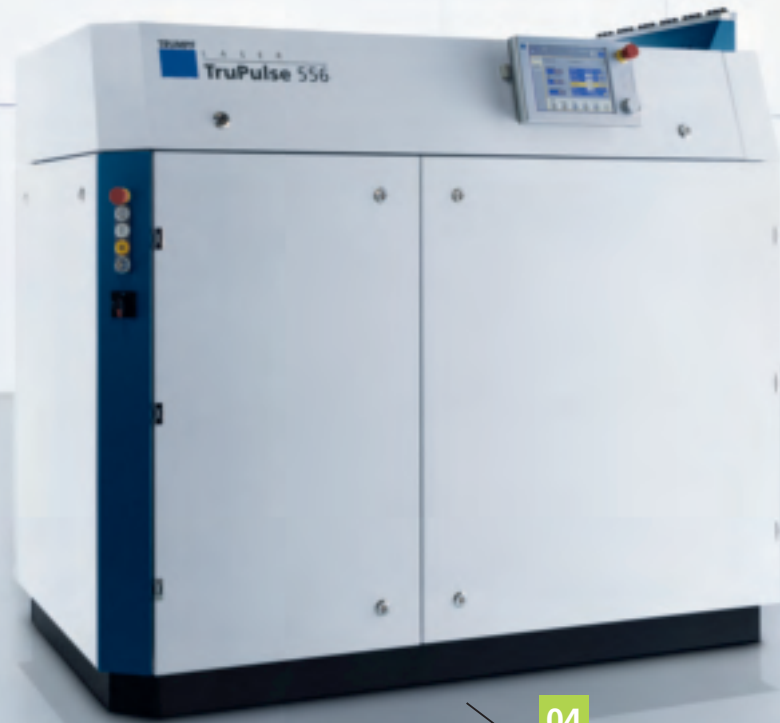
Pulsed solid-state lasers emit short, powerful bursts of light. This makes them perfect for spot and seam welding as well as cutting.

01

Versatile and easy to maintain
as a result of its modular design

05

Welding expertise
built in



02

100 % constant power
keeps your processes stable

04

100-fold higher peak pulse power
for higher productivity

03

High-precision 10 μ s pulses
get the job done where others fail

01

Versatile and easy to maintain

as a result of its modular design

The TruPulse portfolio features a wide range of products and whichever model you choose can be tailored precisely to your manufacturing environment. As a result of the modular design of the TruPulse system, all of its components can be repaired or replaced on site should the need arise. Equipped with up to six laser fibers, the versatile TruPulse can serve one or more processing stations at a time through energy or time sharing configurations.



As a result of their modular optics system, TruPulse lasers can be adapted to each and every requirement.

02

100 % constant power

keeps your processes stable

Real-time power control ensures that the output power reaching the workpiece matches your settings perfectly. This creates stable processes and reproducible results over the entire service life of your laser – regardless of the ambient conditions. This makes the TruPulse the perfect tool for even the trickiest applications.



Stable process parameters are a must when it comes to creating non-porous, helium-tight weld seams in pacemakers.

03

High-precision 10 μs pulses

get the job done where others fail

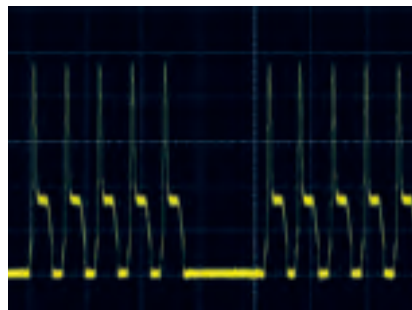
With high speed feedback and control at the μs time scale, TruPulse lasers closely match the actual pulse shape to the desired pulse shape. This means you always get the graphically programmed shape and superior pulse-to-pulse stability. Millisecond pulses with a pulse power of several kilowatts enables welding and cutting in situations outside the limitations of other methods.

04

100-fold higher peak pulse power

for higher productivity

The burst function operates like a dam. The system 'stores up' power and then releases it, briefly exceeding the average power many times over. This yields a 100-fold higher peak pulse power. The resulting laser pulse reduces the cycle time, making your work far more productive. In many cases you only need a laser with low average power, which means even more savings.



The burst mode minimizes the cycle time and maximizes the productivity of your production process.

05

Welding expertise

built in

The WeldAssist option recommends the best settings for the welding parameters, pulse shape and focus position depending on the material, thickness and weld depth. This reduces the time required to set up each new application. In addition, the system can store the parameters so that you can use exactly the same weld settings in the future.



Watch the **TruPulse** laser perform spot and seam welding:
www.trumpf.info/1ugirk



TruMicro

Whether you need them for patterning, ablating, cutting or drilling, industry-proven short and ultra-short pulsed lasers are a great addition to your micro-production facilities.

01

100 %
customized pulses

05

Endless
opportunities



02

All around versatility
with a cool head

04

Laser power
put to the very best use

03

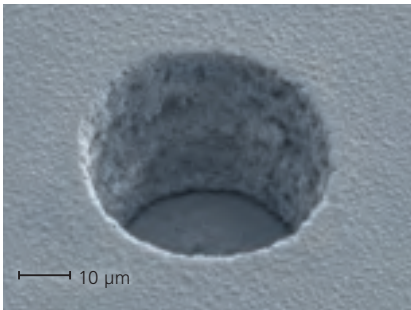
Integration
made easy

01

100 %

customized pulses

Smart work: the ultrafast power modulator keeps the power and pulse energy at exactly the required level, regardless of any external influences. As a result of the combination of pulse picking and precise control of the pulse energy and intensity, you can be confident that you always get exactly the pulse you need. And, when it comes to industrial applications, this means optimum results around the clock for even the most complex tasks.



The TruMicro 5000 features high-precision pulse control – perfect for cleanly drilling a hole in a circuit board.

02

All around versatility

with a cool head

The energy-rich, ultra-short laser pulses vaporize the material the moment they hit the workpiece. Therefore, the material doesn't heat up unless you specifically choose a targeted zone to heat. This 'cold processing' technique allows you to use lasers on temperature-sensitive materials and cut delicate patterns in whichever shape you choose.



With TruMicro you can make the impossible possible!



Its high peak intensity allows you to process brittle and transparent materials.

03

Integration

made easy

TruMicro lasers are designed to integrate easily into your current setup. Compatible with all standard interfaces and bus systems, they insert neatly into your existing production environment. The laser light is guided safely to the workpiece by our high quality beam guidance components and optics that are optimized for the peak intensity of ultra-short pulsed laser technology. Older models can be replaced by new lasers while still maintaining full compatibility.

04

Laser power

put to the very best use

Regenerative disk amplifier technology ensures that 100% of the average power output makes its way into each individual pulse. The disk geometry keeps the high beam quality stable, the intensity distribution at the workpiece remains constant, and the pulse duration is independent of the repetition rate. All of this guarantees optimum processing results. In addition, all TRUMPF ultra-short pulsed lasers feature multi-pulse capabilities.

05

Endless

opportunities

Tap into the 'Power of Choice' to get a solution that is precisely tailored to your needs. The TruMicro Series of lasers ranges from economical entry-level lasers to highly productive nanosecond, picosecond and femtosecond lasers with high average power output for industrial-scale production. The lasers are available in all wavelengths from infrared to green and ultraviolet.



Watch the **TruMicro** in action:
www.trumpf.info/03hfc



TruMark

TruMark lasers make it faster and easier than ever to achieve perfect marking results. They can create customized, permanent, high-quality markings on virtually any material.

01

The freedom to choose
each and every time

04

Intelligent software
gives you all the support you need

02

Simple integration and automation
due to a broad range of functions

03

Intuitive operation
through innovative solutions



01

The freedom to choose

each and every time

Whatever material you need to mark – and however fast you need the marking process to be – the TruMark range product portfolio has the right solution in every power class. Depending on your application you may need a fiber laser with high average power or a rod laser with high peak pulse output. TruMark lasers are easy to integrate into your existing facilities and are available at all wavelengths from infrared to green and ultraviolet.



The TruMark 5010 is a compact, all-in-one solution.

02

Easy integration and automation

due to a broad range of functions

Whether you are looking to integrate a laser into your production line or install a laser workstation in a stand-alone capacity, TruMark offers you everything you need. Simply choose the optimum solution for your manufacturing environment from a wide range of models, interfaces and software options. We can cater to everything from a single part to mass production – and we're always here to give you the advice you need.



A laser marked circuit breaker.

03

Intuitive operation

through innovative solutions

TruMark lasers can be used quickly, easily and safely even by less experienced users. That's because they come with intuitive software and innovative solutions for setting up your processes, including pilot laser, focus finder, navigator and observer functions. These features offer a flexible, productive and cost-effective way to produce high-quality products.



The Observer ensures the marking is perfectly aligned on the work-piece.

04

Intelligent software

gives you all the support you need

The Module Interface (MI) software connects the marking software to user-specific databases or measurement and control systems. It also processes and coordinates the management of marking jobs, saving time on the transitions between orders – especially in the case of short production runs. The software can also be adapted to your specific needs by customizing its functions and user interface.



Single-point lubricating system marked using the Module Interface (MI) software.



See the **TruMark** in action:
www.trumpf.info/6mpr9y



TruFlow

Reliable and robust: CO₂ flow lasers offer an all-around solution for cutting and welding a wide range of materials.

01

Maximum stability
due to its compact, square design

05

Reliable laser operation
as a result of continuous monitoring of the mirror



02

20 % energy savings
as a result of cooling and energy management concepts

04

Integrated beam guidance
for perfectly aligned laser light

03

Minimal wear
due to superior technology

01

Maximum stability

due to its compact, square design

Every TruFlow resonator undergoes its basic lifetime calibration in the clean room. The resonator's key components are water-cooled, and its compact, square design makes it extremely robust. It is not affected by changes in the ambient temperature. All of the parameters remain constant even at high laser powers – and no other system can match the stability of the TruFlow's beam output angle.



The stable resonator can even be installed on moving gantries.

02

20% energy savings

as a result of cooling and energy management concepts

The new and improved cooling system in your TruFlow reduces energy consumption by up to 20% and makes the TRUMPF CO₂ laser one of the most energy-efficient machines in its class. This is boosted even further by the TruFlow's intelligent energy management system.

03

Minimal wear

due to superior technology

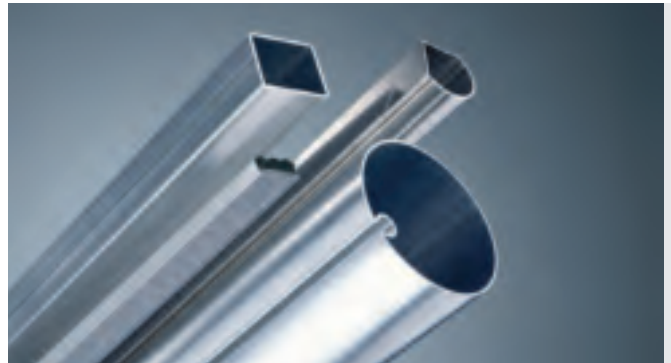
The TruFlow uses a wear-free system of gas circulation and radio-frequency excitation. The magnetically suspended turbo blowers ensure that no damage is caused by power outages or emergency shutdowns. Take advantage of the decades of development that have gone into this all-around laser processing solution.

04

Integrated beam guidance

for perfectly aligned laser light

The fully encapsulated built-in beam guidance system that comes with your TruFlow prevents any accumulation of dirt that could cause the laser power to drop and the focus geometry to fluctuate. Additional functions for beam widening, pilot laser and circular polarization are safely and compactly stowed under the hood of the laser machine.



Laser tube welding is also possible as a result of optimized beam guidance and beam shaping.

05

Reliable laser operation

as a result of continuous monitoring of the mirror

The output mirror is one of the most highly stressed components of your laser. That's why the TruFlow continuously monitors the mirror to check its temperature and detect any contamination. This keeps your laser working smoothly.



A truck axle welded with a CO₂ laser.



Watch the **TruFlow** laser cutting stainless steel:
www.trumpf.info/j6teqx



TruCoax

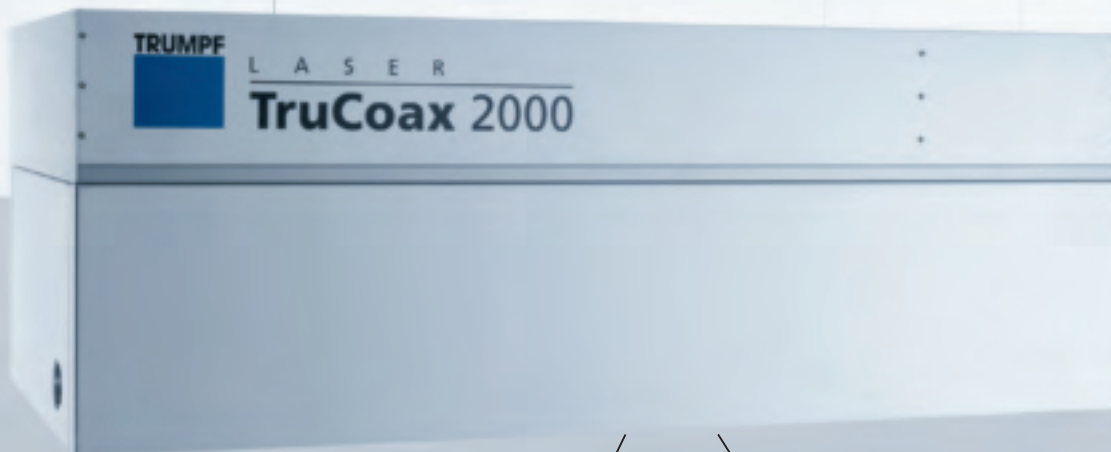
TruCoax diffusion-cooled lasers are lightweight, robust and virtually maintenance-free. With their high beam quality and process stability, they are the perfect choice for cutting and perforating non-metallic materials.

01

The best power stability on the market
due to wear-free technology

04

Stable pulses and high peak pulse power
for optimum processing results



02

Top-tier features
included as standard

03

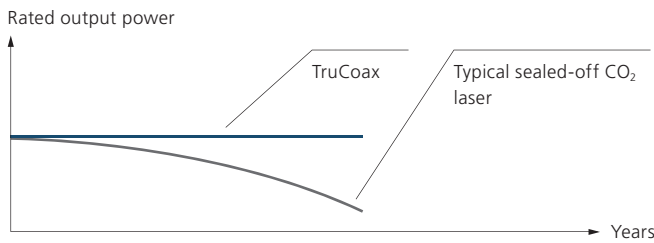
Small, compact
and easy to integrate

01

The best power stability on the market

due to wear-free technology

The TruCoax delivers reliable laser power year after year. A best-in-class choice in terms of power stability and maintenance, the TruCoax offers years of consistent, reliable laser power and stable processes without ever needing to replace the built-in cylinder of premixed gas. This is a major advantage over conventional sealed-off CO₂ lasers. The use of transistor-based excitation eliminates the need for wear parts such as tubes, and there is no need to fully overhaul the system at any point.



In contrast to a typical sealed-off laser, the laser power of the TruCoax remains constant over many years due to the built-in cylinder of premixed gas.

02

Top-tier features

included as standard

The functions and safety features included as standard with the TruCoax are tough to beat. Its pilot laser simulates the laser beam, making it easier to position the workpiece. The compressed air filter units and the two-channel shutter ensure robust laser performance in everyday industrial operation.



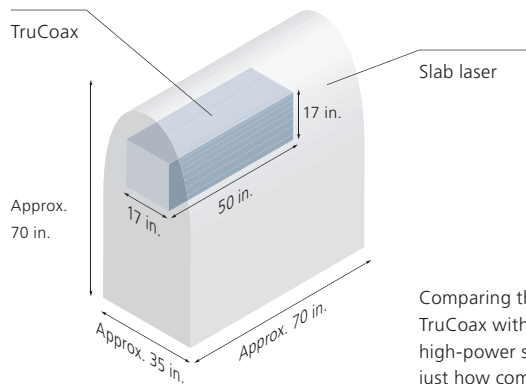
A resonator from a TruCoax.

03

Small, compact

and easy to integrate

The TruCoax laser is extremely compact thanks in part to the stable design of the resonator and the transistor-based excitation integrated into the laser head. The laser's power supply components come in a handy 19-inch format, which means they can be housed in your existing switch cabinet.



Comparing the size of the TruCoax with that of a typical high-power slab laser shows just how compact it is.

04

Stable pulses and high peak pulse power

for optimum processing results

The power and the beam position of the TruCoax remain extraordinarily stable from one pulse to the next. So you can be assured of getting the most accurate results. It also features constant peak pulse power regardless of the repetition rate – and this peak pulse power is extremely high, which maximizes your process speeds.



A laser cut pipe connection piece.



Watch the **TruCoax** at work in non-metal applications:
www.trumpf.info/dna0oc



Programmable focusing optics

The processing optics are often the most critical factor when it comes to applying laser technology in your production environment. Programmable focusing optics (PFO) from TRUMPF offer a number of advantages.

01

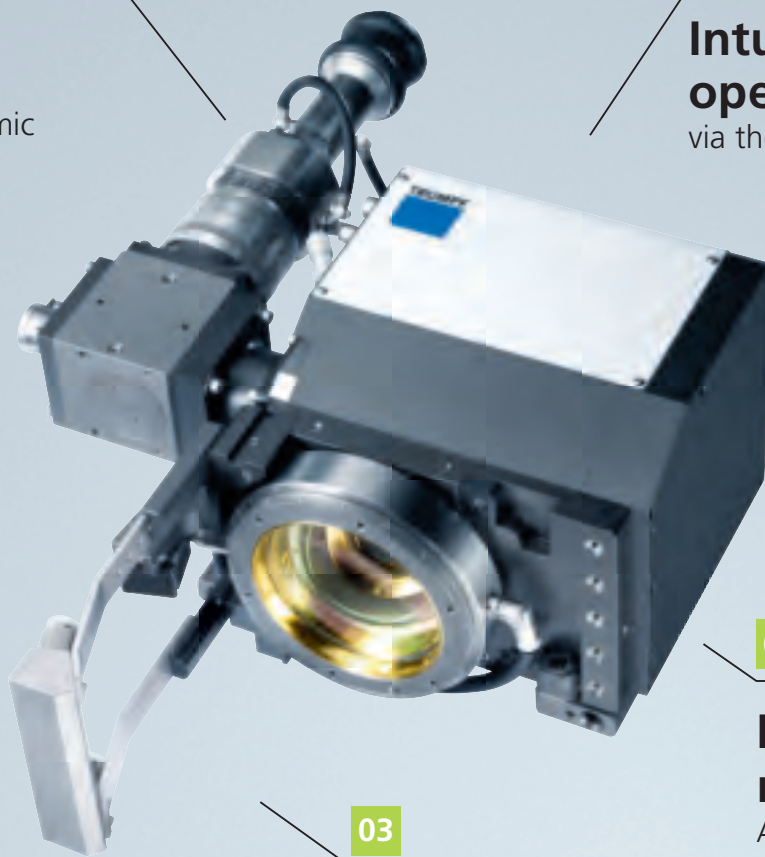
Fast and accurate

as a result of dynamic motor control

05

Intuitive operation

via the PFO SmartTeach app



04

Process reliability

A control loop between the laser, PFO and sensors

03

A broad choice

for any application

02

On-the-fly capabilities

through real-time synchronization of the scanner and robot

01

Fast and accurate

as a result of dynamic motor control

The use of cutting-edge digital motors within the PFO guarantees fast and accurate machining results.

02

On-the-fly capabilities

through real-time synchronization of the scanner and robot

Intelligent, real-time synchronization of the robot, laser and PFO ensures precise positioning of the laser beam – that's welding on-the-fly at its best!

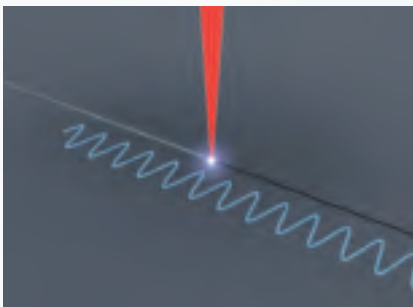


03

A broad choice

for any application

The PFO portfolio includes focusing optics for any applications that use low-power or high-power lasers from the first to the third dimension, with up to 8 kW in cw mode and significantly higher output powers in pulsed operation. Individual optics are optimized for specific applications. For example, the PFO 1D is optimized for wobble. The ability to specifically adjust the wobble movement leads to optimum weld seam quality.



You can tailor the wobble geometry to meet your specific needs.

04

Process reliability

A control loop between the laser, PFO and sensors

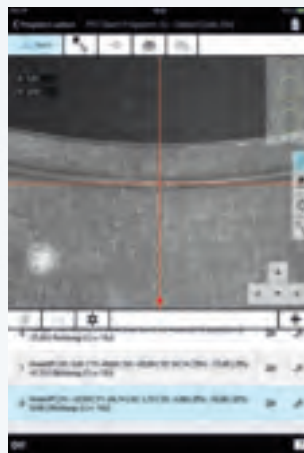
The programmable focusing optics can be equipped with interfaces for TRUMPF sensor technology solutions such as CalibrationLine and VisionLine, as an option. CalibrationLine calibrates the beam position and laser power at the workpiece, while VisionLine detects the position of the workpiece and corrects the beam path. This interaction between the laser, PFO and sensor system makes it possible to adjust your processes in real time, significantly boosting process reliability. External process sensors can also be connected to the PFO.

05

Intuitive operation

via the PFO SmartTeach app

You can use the PFO SmartTeach app to set up your laser welding and cutting programs quickly and intuitively using a mobile device. The camera mounted on the PFO transmits a live image directly to the app, and the app synchronizes your new or modified programs directly with the laser.



The PFO SmartTeach app is available from the Apple App Store. Users of the TruControl software will quickly feel at home with the familiar features.



Watch the **PFO 1D** in action:
www.trumpf.info/c81dxh



Focusing Optics

Whether you're welding, cutting or drilling, TRUMPF has the right processing optics to meet your needs. With their modular design, TRUMPF optics can be tailored to your exact requirements.

01

The perfect optics every time

due to modular components

05

Easy to integrate

into your production lines



02

Perfect seams

on all sides

03

Robust and reliable

in everyday industrial settings

04

Intelligent monitoring

Keeping an eye on your process media

01

The perfect optics every time

due to modular components

Up to 16 kW of output power for a focus diameter of just 10 μm – you can be sure of achieving optimum results with the right optics. Plenty of different options are available to ensure you find the best solution for every job, from right-angled optics to bifocal versions. TRUMPF also offers special optics for deposition welding with powder feed and for linear laser spots.

02

Perfect seams

on all sides

The combination of top-quality lenses and protective glass monitoring ensures minimal focus shift and homogeneous welding results. Crossjet – a jet of gas that runs from one side to another in front of the lens protection module – also protects the lenses from contamination, while the patented metal vapor effect nozzle produces more stable welds. That ultimately makes for perfect seams on both sides of the weld.

03

Robust and reliable

in everyday industrial settings

More than 10,000 focusing optics systems from TRUMPF are in industrial use worldwide – and customers rely on them to perform year after year. Offering an impressively long service life, they are highly robust and resilient against back reflections.

04

Intelligent monitoring

Keeping an eye on your process media

Setting limit values for your shielding gas or compressed air is simple, and it's equally easy to monitor them. An optional cartridge module offers additional peace of mind. And, you always have access to TRUMPF remote service to tackle any issues from the laser to the workpiece.

05

Easy to integrate

into your machining lines

The modular system and optional components can be used to create a range of different configurations. The result is, processing optics that are perfectly tailored to your machining environment and your specific needs.



BEO D70 processing optics with motorized swivel mount on a robot.

01

SeamLine Pro

monitors your entire welding process

02

VisionLine

for simple position sensing

03

CalibrationLinecontrols the focus position
and laser power

04

**Pyrometer temperature
control**monitors the temperature when
welding plastics

05

Remote services

increase your laser's availability



Sensors

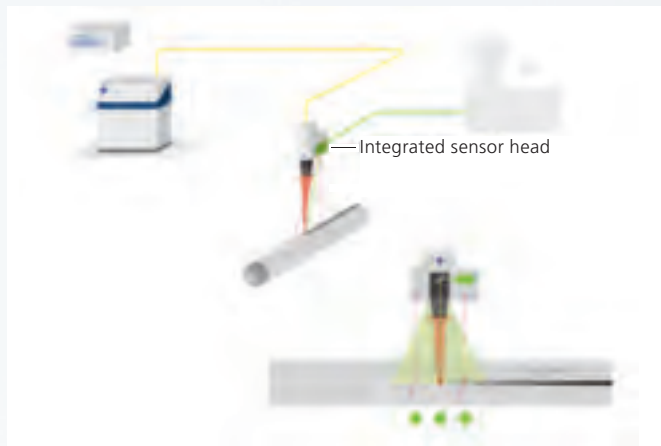
Stable processes are essential for efficient and cost-effective laser manufacturing. This is why you need sensors to monitor every aspect of your process without interruption. This saves time and provides reassurance of a reliable production process.

01

SeamLine Pro

monitors your entire welding process

SeamLine Pro continuously collects data on your welding process before, during and after welding and automatically moves the focus point to the desired weld position. This gives you perfectly reproducible results.



SeamLine Pro monitors the seam position, weld size and edge offset.



A live camera image showing the focal spot, melt pool and finished seam.



Discover how **SeamLine Pro** boosts productivity:
www.trumpf.info/y2hesk

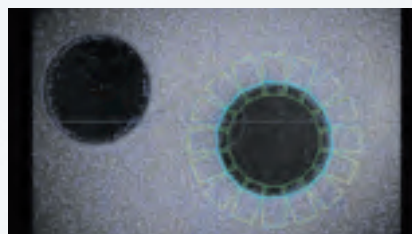


02

VisionLine

for simple position sensing

VisionLine visually monitors your processes and ensures that they always take place in exactly the right spot. The image processing sensor system automatically recognizes features such as edges and holes, helping to boost the process capabilities of your production line.



VisionLine tracks individual features to determine the component's position.



In the next step, VisionLine compensates for any component displacement.



Discover how **VisionLine** ensures accurate cutting:
www.trumpf.info/l60ewg



03

CalibrationLine

controls the focus position and laser power

The CalibrationLine sensor system checks the focus position and laser power at the workpiece at regular intervals and feeds back to the laser and optics, correcting as necessary to ensure the real-life process matches the program, to achieve perfect welding results.



Positioning the programmable focusing optics above the sensor.



Focus sensor for positioning the laser beam on the workpiece.



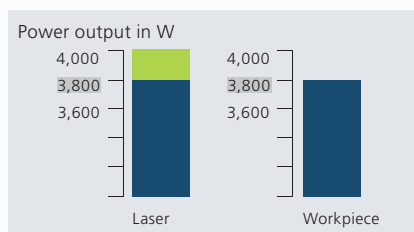
Measuring and calibrating the X, Y and Z position.



Sensor for measuring laser power.



CalibrationLine measures the output power and makes adjustments where necessary.



Adjusting the actual and target values in the laser.



Discover how **CalibrationLine** controls the focus setting:
www.trumpf.info/zr7j9b



Learn more about precise power control with **CalibrationLine**:
www.trumpf.info/rxs6hg

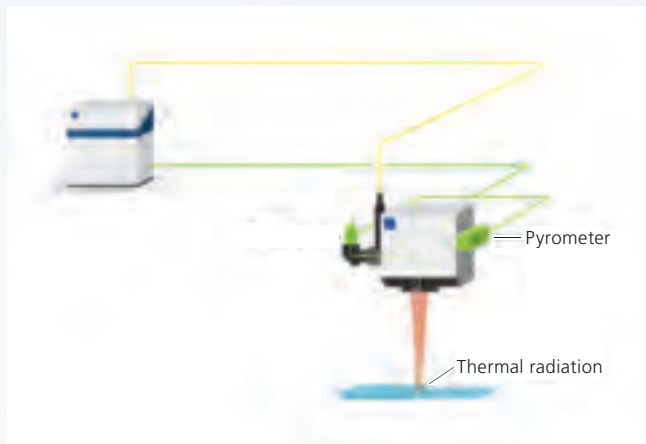


04

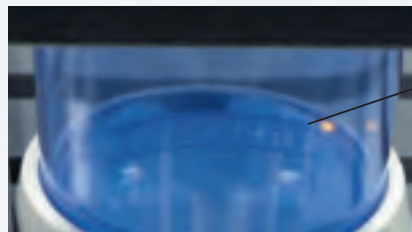
Pyrometer temperature control

monitors the temperature when welding plastics

The pyrometer ensures that your plastic is welded at an optimum and consistent temperature. The laser power output is adjusted dynamically to maintain a constant temperature at the workpiece, even with material and clamping variation. This results in highly accurate, reproducible results.



Mounted on the PFO, the pyrometer measures the temperature at the surface of the weld seam.



With temperature control you can easily reproduce weld seams of the same thickness.



Discover how the temperature is precisely controlled during plastic welding: www.trumpf.info/hcdyf0

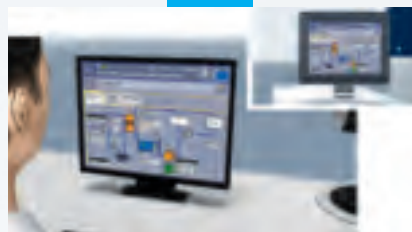
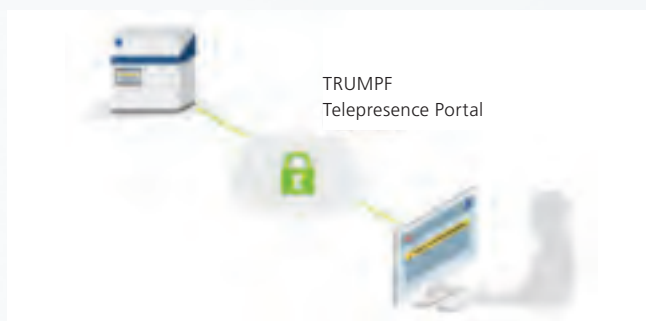


05

Remote services

increase your laser's availability

TRUMPF remote services maximize laser uptime. When you initiate a connection, TRUMPF maintenance experts can check the status of your solid-state laser via secure remote access, in the event of a malfunction, and actively adjust the settings. In many cases that means production can continue without requiring an onsite service visit, which keeps downtime to a minimum.



Temporary changes to limit values can enable production to continue.



A replacement part is dispatched at the same time as adjusting the limit values.



Discover how TRUMPF Remote Services maximize your laser's availability: www.trumpf.info/zw0rqq



Integration

TRUMPF solid-state lasers for welding, cutting and micro-processing include interfaces to all standard fieldbus systems, making it easy to integrate them into your production line. In addition, TruControl offers you a range of additional options to ensure the perfect control of your production environment.

01

Save energy
with intelligent energy
management

02

Save your quality data
to the Quality Data Store

03

A variety of interfaces
means easy integration

04

**Perfect cutting
and welding**
even in the toughest spots



01

Save energy

with intelligent energy management

TRUMPF lasers are renowned for their outstanding energy efficiency. Energy consumption can be reduced even further during idle periods with a choice of four different sleep modes. TRUMPF lasers can reduce their power consumption between shifts, after a pre-programmed idle time, as well as communicate in the intelligent PROEnergy network.



Programmable sleep modes for energy efficient laser operation.

02

Save your quality data

to the Quality Data Store

The Quality Data Store software module allows you to select relevant laser and processing optics parameters and archive or export them across the network during the laser process. Using unique data such as part numbers and shift information, you can track precise laser parameters to each part you produce.



The Quality Data Store helps you match each component to the laser settings used to process it.



See the **Quality Data Store** software module in action:
www.trumpf.info/skdw1p



03

A variety of interfaces

means easy integration

Robust industrial interfaces are key when it comes to integrating a laser into a machine or production line. All TRUMPF solid-state lasers support industry standard fieldbus systems from legacy to state-of-the-art. TruControl manages, controls and visualizes the interface assignment and benefits from a standardized control architecture that is consistent across all TRUMPF solid-state lasers.



Your TRUMPF solid-state laser can communicate with these fieldbus systems.

04

Perfect cutting and welding

even in the toughest spots

If the machine's advance rate changes (e.g. reduced velocity at the corners of a contour) you can use the software module to automatically scale down the laser output power in line with defined parameters. The processing mode can also be automatically tailored to the velocity, for example by switching from cw mode to pulse operation for sharp corners. This keeps the line energy constant, giving you perfect processing results.

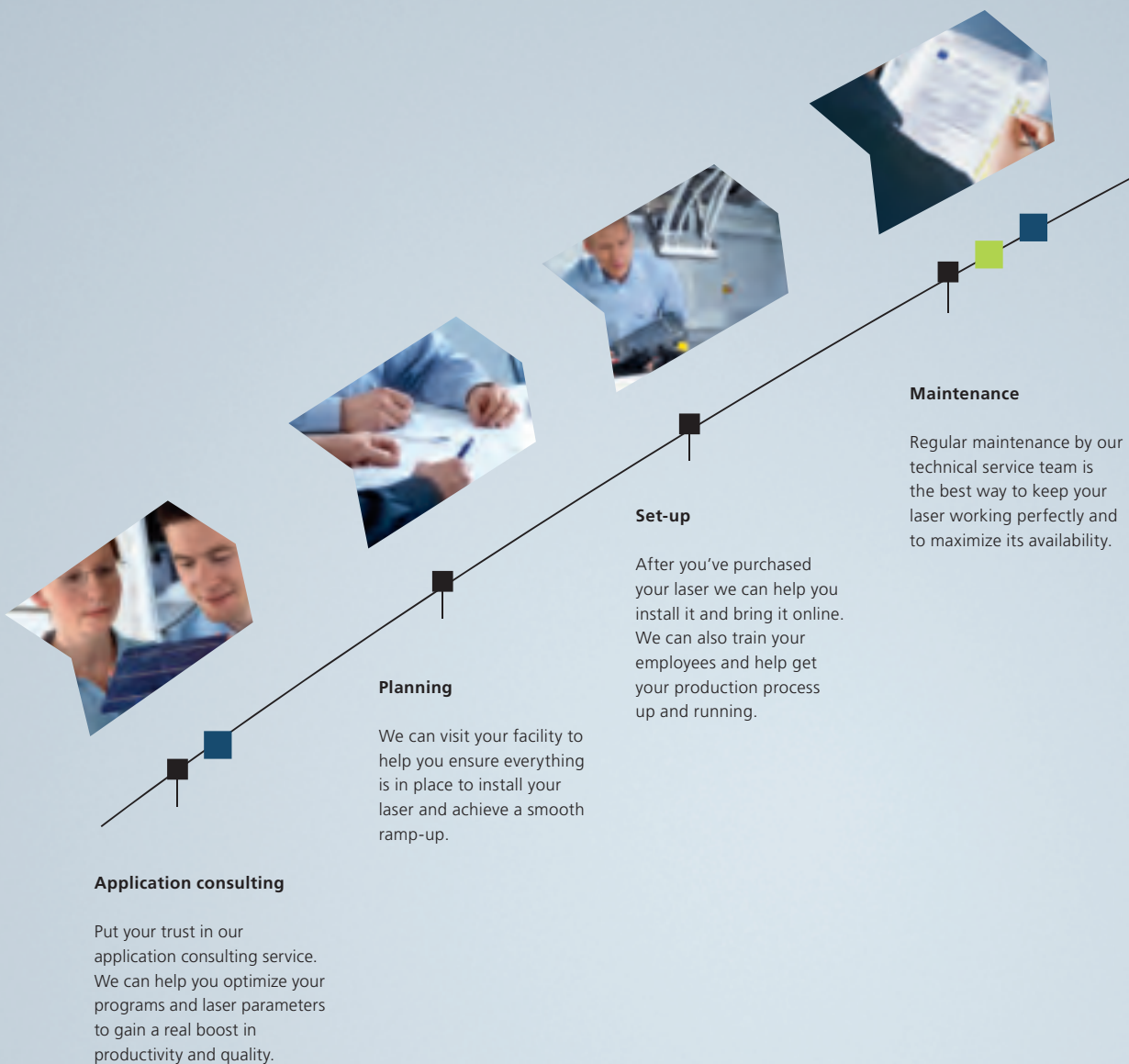


See the **CutAssist** software module in action:
www.trumpf.info/y9au73



TruServices: Your production. Our services.

TRUMPF offers a range of services to meet your individual requirements throughout your laser's life cycle. All over the world, our services help you achieve the best availability from your laser to make your manufacturing facilities even more productive.





Remote services

In the event of a malfunction, TRUMPF service experts can set up a secure remote connection to your laser and take steps to rectify it – with your permission, of course. We are often able to rectify the issue or modify the configuration of your laser so that you can keep working until a replacement part arrives.

On-site troubleshooting

Even if something unexpected goes wrong, our highly trained service engineers will be with you in no time – helping you keep non-productive time to a minimum.

Spare parts service

With replacement parts perfectly tailored to our laser machines and extremely efficient logistics, TRUMPF spare parts service maximizes the availability of your laser.

Feature upgrades

Your laser can keep pace with your changing requirements with its modular design and our software updates. It's easy to add new functions and upgrade existing features.

Relocation or resale

If you need to relocate your TRUMPF laser, we can help. And if you are looking to sell your laser, our Resale Center associates will be more than happy to provide assistance.

Training

Are you looking to train your machine operators and maintenance personnel? Do you need some advice on special applications? Whatever the case, we can help at our dedicated training centers or arrange a personalized training session at your location.

Service agreements

Our service agreements are designed to provide exactly the level of service you need – from remote services and preventive maintenance by the vendor, to discounted servicing or even full service agreements including spare parts. All of our service agreements feature modular service components that can be combined to create the exact package you want.

Your goals. Our company.

With TRUMPF you get everything from a single source – and not just when it comes to laser technology. We also offer everything else you need for a modern production environment that meets your company's current and future goals.

Industry 4.0 – Solutions for your future

The ability to combine innovation with proximity to our customers is something that defines our company – especially when it comes to developing innovative solutions in the context of Industry 4.0. With the right tools you too, can embrace the fourth industrial revolution in your production environment and secure an international competitive edge. We can make your manufacturing processes more flexible, more efficient and more transparent, helping you to make the best use of available resources and boost your overall productivity. Open interfaces and intelligent sensor systems have already opened the door to continuous status assessments, remote access and quality data storage. You can tap into these techniques to boost the availability of your production facilities and guarantee the traceability of the parts you produce. Laser marking turns the parts themselves into data media that can easily be connected to higher-level cloud solutions.

Innovations for your production line

TRUMPF is renowned for its innovative capabilities. We are constantly pushing ahead with research and development with a key focus on the future of production and manufacturing engineering, laser technology and materials processing. We transform ideas and visions into viable products which offer major benefits to our customers.

Lasers for manufacturing

From cutting, welding and marking to surface processing and additive manufacturing – we have the right laser and the right technology to achieve innovative and cost-effective production in any industrial application. Whether we're working on a macro, micro or nano scale, we are responsive to our customers' needs and skilled in providing them with appropriate system solutions, application expertise, and consulting services.



Power supply systems for high-tech processes

Advanced technology would be unthinkable without process power supply systems. That holds true for everything from semiconductor manufacturing to solar cell production. Our MF and RF generators supply electrical power for induction heating, plasma and laser excitation at a clearly defined frequency and output, with high levels of reliability and repeatability.

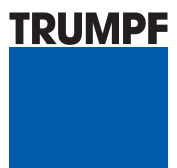


Machine tools for flexible sheet metal and tube work

We provide our customers with tailor-made machines and automation solutions, advice, software and services – in fact everything they need to reliably create high quality products. From laser cutting and punching to bending and laser welding, our customers process the sheet metal and tube components that are required in all areas of our daily lives, including industry, household, communication and transport applications.



TRUMPF is certified to ISO 9001:2008
(find out more at www.us.trumpf.com/en//about-trumpf/quality)



TRUMPF Inc.
www.us.trumpf.com