

# Laserline

## High Power Diode Lasers



# From Vision to Innovation

With over 4,000 installations worldwide, Laserline diode lasers are among the world's most successful beam sources for industrial applications in the multi-kilowatt range. Customers worldwide appreciate their modular design, high efficiency, maximum reliability and low maintenance costs.

Since the establishment of Laserline in 1997, the two managing directors Dr. Christoph Ullmann and Dipl.-Ing. Volker Krause have been pursuing a single goal: Developing customized industrial lasers for materials processing that can replace conventional lasers. Following their vision, they have been able to achieve their objective. Within a few years, the company established itself as a leading manufacturer of innovative products, setting new standards for high power diode lasers. The move from Technologiezentrum Koblenz to purpose-built premises in 2002 was the logical consequence of the company's rapid growth. At its new headquarters in Mülheim-Kärlich, Laserline now has sufficient space for the further sustainable expansion of its business.

With the completion of the latest extension of the Laserline premises, the company site now covers nearly 15,000 m<sup>2</sup>, including state-of-the-art production equipment and R&D labs. More than a fifth of the production facilities are designed as clean rooms.

## Innovation and creativity

By pursuing new ideas and technologies, Laserline continuously follows the pioneering spirit of its founders. The competence of its employees is the key to its success. Specialists in various fields work together to create innovative and technologically advanced products that are designed for continuous operation in industrial applications.

Thanks to Laserline's innovative drive, the maximum output power and the beam parameter product of its lasers has been extended into the multi-kilowatt range and excellent beam qualities.





- > Established in 1997
- > Headquarters in Mülheim-Kärlich, Germany
- > Subsidiaries in the USA, Japan, China and Korea
- > 280 employees in 6 countries
- > Technology leader in high power diode lasers



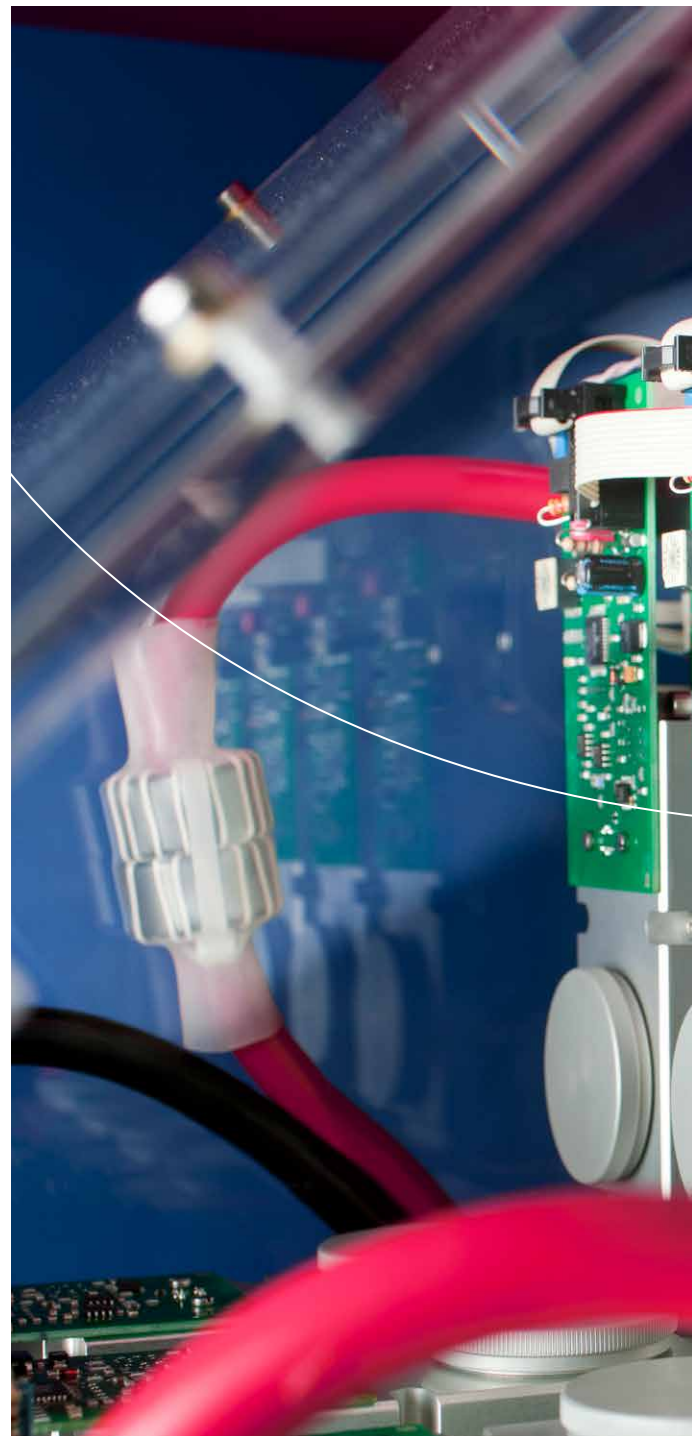
# Laserline Diode Laser: A Paradigm Shift

For twenty years, Laserline has been a major contributor to the continuous development of diode laser technology.

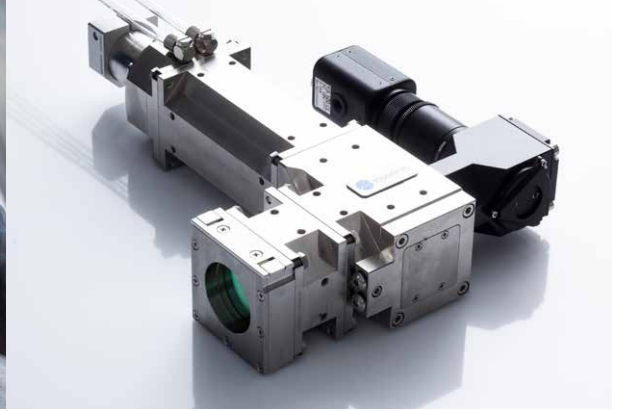
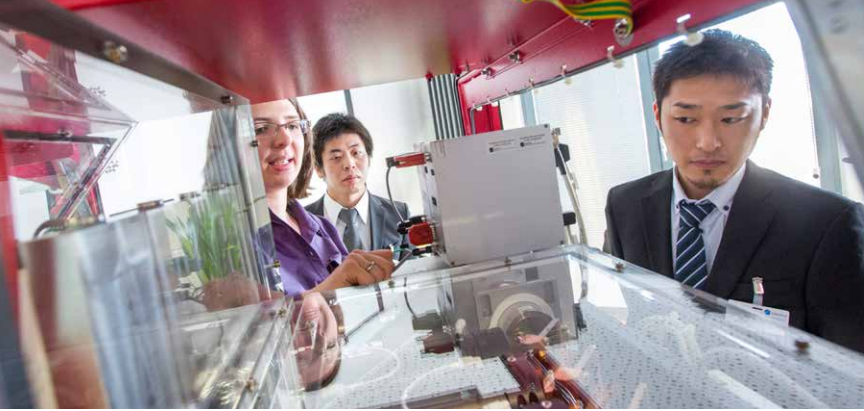
The first lasers used in materials processing, such as gas and conventional solid state lasers, were large, stationary units of low efficiency. They were primarily used for the cutting and welding of metals. Just as the last century saw the move from the vacuum tube to the transistor, a similar transition is now taking place as the laser industry moves toward high power diode lasers or diode-based lasers.

## Turning electricity into light

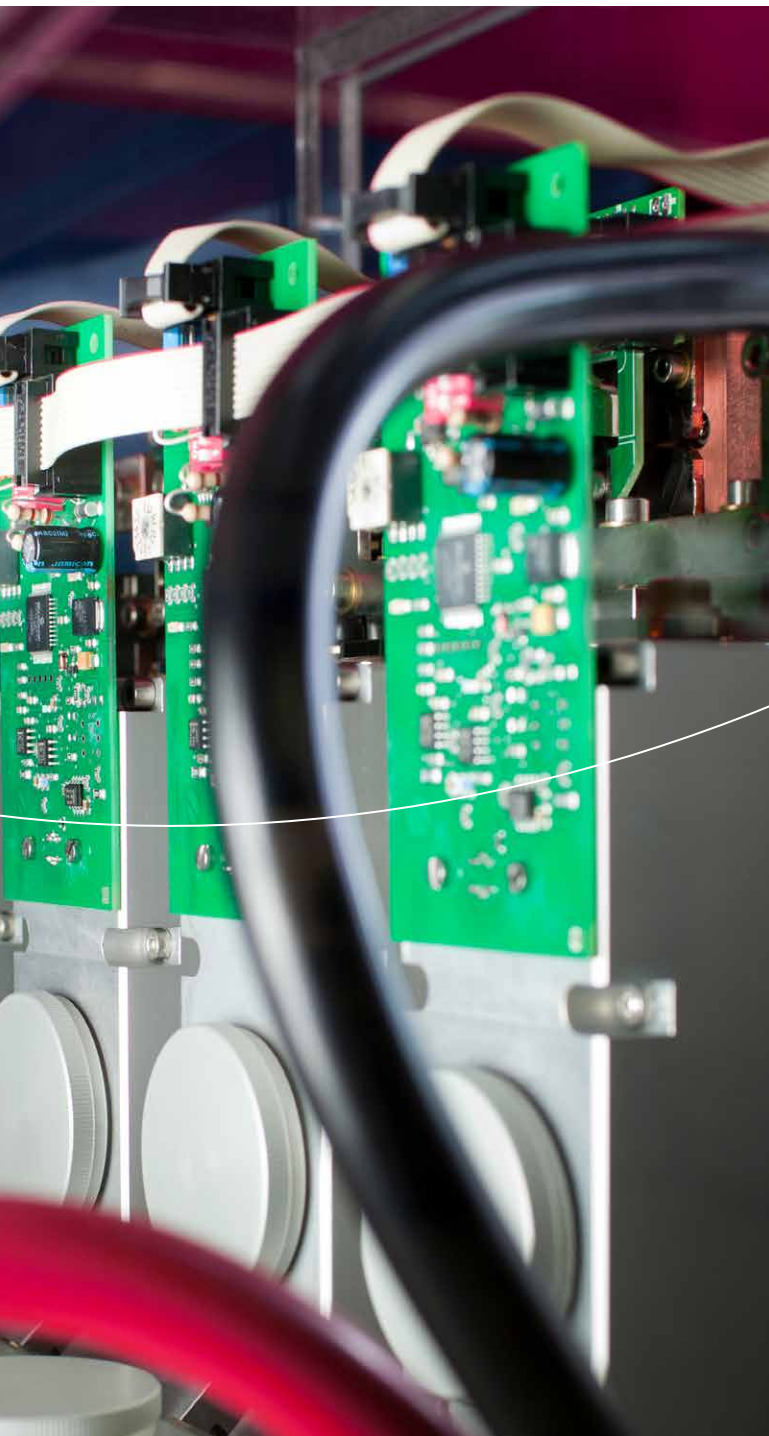
A key characteristic of Laserline lasers is the use of diodes as the most efficient source for the laser beam generation. The key advantage of diode lasers is their ability to convert electric current into light without the need for a pump medium. This makes diode lasers more efficient and compact than conventional lasers, which makes them easier to handle and more mobile. Diode lasers have a long service life and are virtually maintenance-free.







The output of Laserline lasers now extends into the multi-kilowatt range.  
At the same time, the company has been able to significantly improve the beam quality.



## Versatile solution for materials processing

Thanks to their adaptability, diode lasers cover a wide range of applications in production processes. Today diode lasers are well established in many industrial sectors. They are primarily used for the welding of steel and aluminum, cladding, coating and repair welding as well as hard soldering and hardening. Diode lasers are also the preferred option for the welding of fiber composites or 3D printing.

The tailor-made systems from Laserline are available as stand-alone units or for integration into industrial production and manufacturing plants. Creative and consequent transformation of ideas into industrial innovations guarantees the production of top-quality products.

# From Diode to Beam

When it comes to industrial production, reliability and process efficiency are among the main requirements for machinery. Our products are designed for trouble-free continuous multi-shift operation, even under demanding operating conditions.

## Diode laser sources

The laser source is made of multiple diode stacks consisting of individual diode bars. The laser power and the beam quality are mainly determined by the number of bars per stack and the total number of stacks in the source. Using smart, patented Laserline technology, the beams emitted by the individual diodes are bundled into a single laser beam and coupled to an optical fiber.

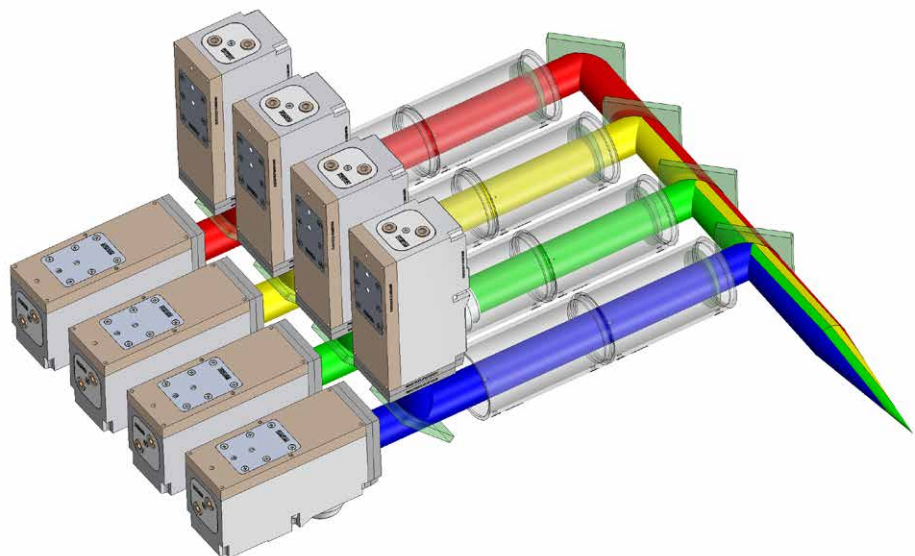
Most systems with modular laser heads allow for a subsequent further increase of the power by means of additional stacks.

## Intelligent stack management

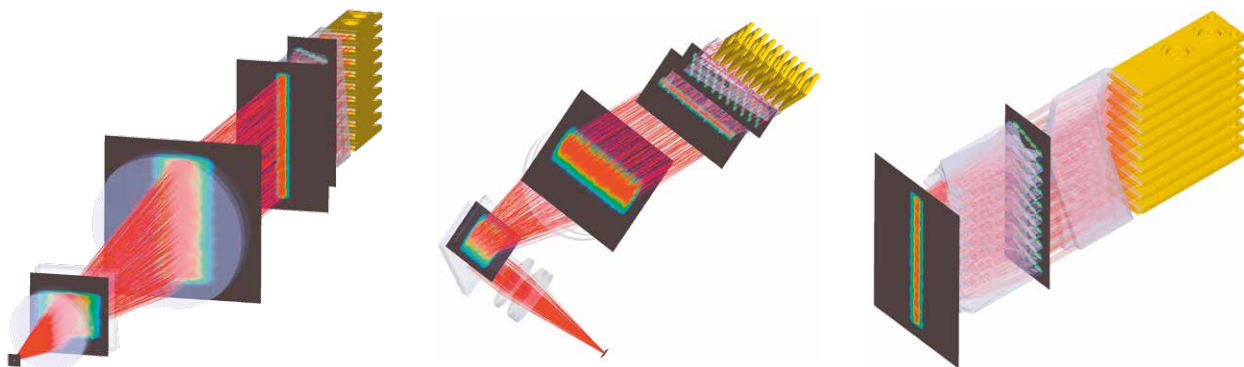
Each laser diode is designed for maximum reliability in the generation of the laser beam. Stringent criteria that far exceed industry standards and specially developed test methods enable Laserline to provide units with diodes that are of exceptional quality.

In the unlikely event of a laser diode failure, the electronic stack management system steps into action. This pioneering technology was first developed and marketed by Laserline. Laser heads from Laserline come with a 5-year warranty, which emphasizes the quality of the product.

Higher power/ beam quality  
with polarization and  
wavelength coupling







Diode stacks are the core of every Laserline laser



# System Technology - Smart Functionality

## Modular design

All diode lasers from Laserline are modular in design. This means that they are made of a few basic components: the laser source, the optical equipment, the supply unit and the control system with a control panel. Thanks to this modular design, diode lasers can be perfectly customized to suit the specific requirements of each customer while maintenance and spare parts costs are kept to a minimum.

## Connecting

The diode laser can be easily integrated into external control systems using standard bus communication such as PROFINET, DeviceNet, and EtherNet/IP, as well as analog and digital interfaces. The LDF lasers are controlled by an LCD display with touch screen technology and additional control elements.

## Power supply and control

The portable and compact supply unit comes with integrated control and monitoring functions for the laser head and the peripheral devices. All components required for the efficient and reliable operation of the diode laser, such as the power supply, the cooling unit and the control unit consist of individual modules that can be easily replaced. The supply unit also houses all customer interfaces and the connection for teleservice. The mobility of the supply units offers added flexibility in production and enables operators to quickly exchange lasers if required.

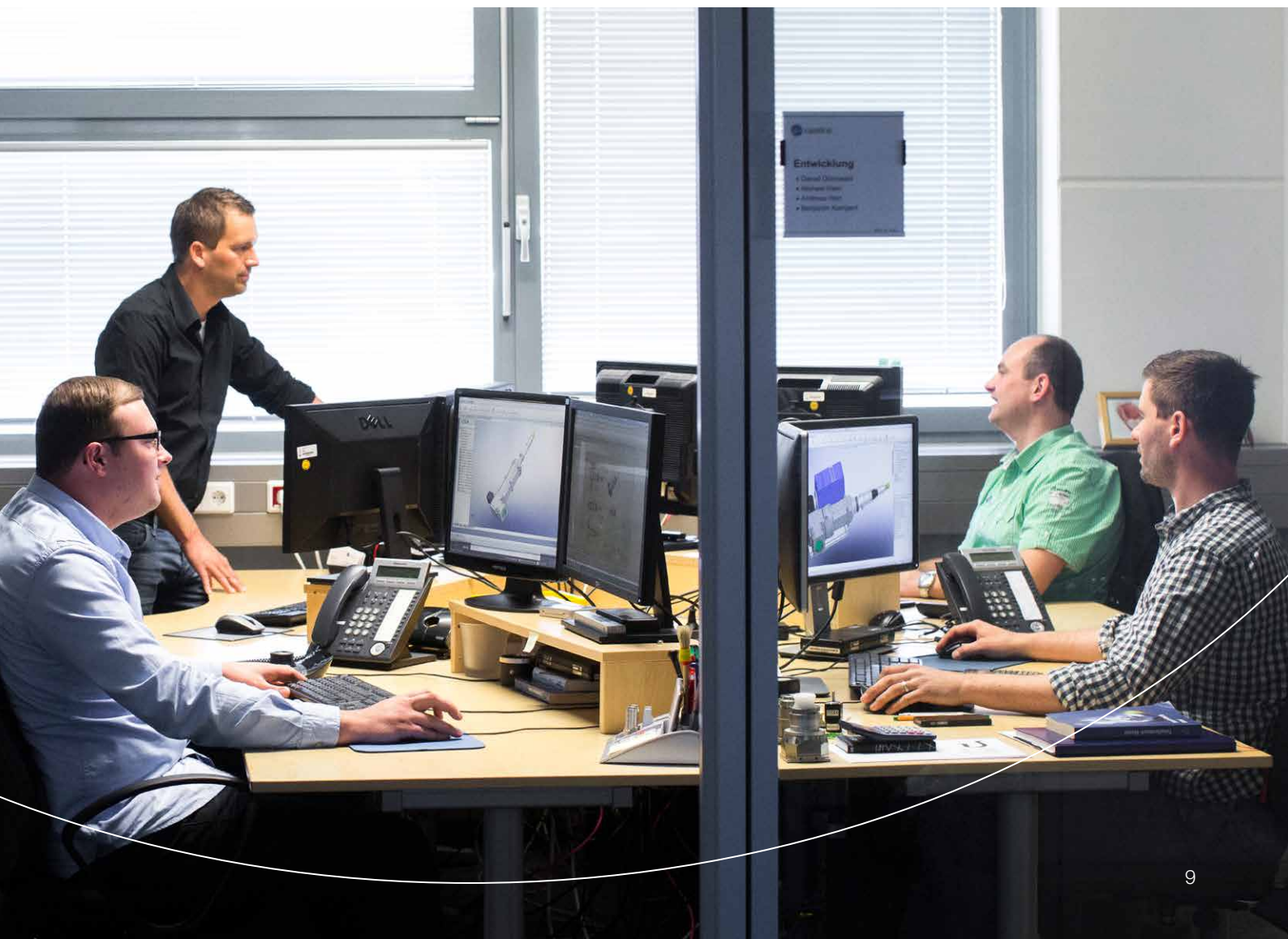
Laserline's comprehensive system management continuously monitors more than 70 operating parameters, from the laser head to the cooling system, ensuring 24/7 availability of the device. A two-stage fault management system issues instant warnings and error messages to prevent damage caused by faults.







- > High electrical efficiency of up to 50 percent
- > Low investment and operating costs
- > Outstanding reliability and robustness
- > Mobility and compactness
- > Easy integration into systems for production
- > Excellent beam quality
- > User-friendly control interface, service-friendly design



# Tailor-Made Laser Sources

From the generation of the laser beams to the application on the workpiece - Laserline offers a comprehensive range of system solutions for industrial materials processing, from 19" rack models and portable devices with integrated or external cooling units to highly specialized optics.

## LDM diode laser

The LDM fiber-coupled diode lasers are an excellent choice for OEMs that need small, cost-effective yet powerful laser sources designed for product plant integration.

The compact, 19" rack mount is the size of a standard PC and houses the laser head with the fiber-coupling unit, the power supply, and the microprocessors that monitor and control the laser. Scaled back to the basic functions and forgoing a graphical user interface, the lasers of the LDM series offer a compact solution, meeting the most stringent reliability standards.

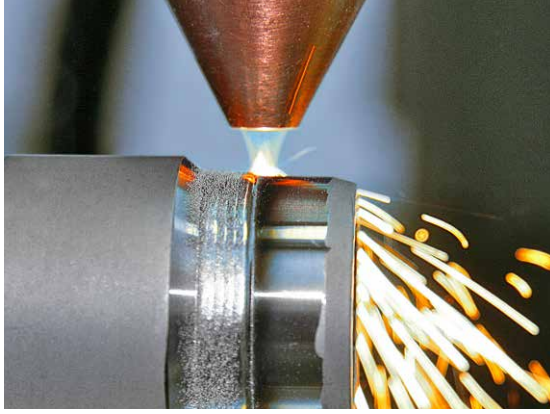
## LDF diode laser

The LDF diode lasers from Laserline are industrial workhorses. The laser head is integrated into a compact supply unit whose sensors monitor the performance of the laser, optical fiber, and auxiliary components. Thanks to its modular design, the laser system can be extended at any time and customized to suit the actual application, for instance by adding more diode laser stacks.

The diode lasers of the LDF series are particularly well suited for multi-station operation, with beam switches and fibers of up to 100 m in length. The mobility and compactness of the diode lasers allow for innovative redundancy strategies in serial production with multiple stations.



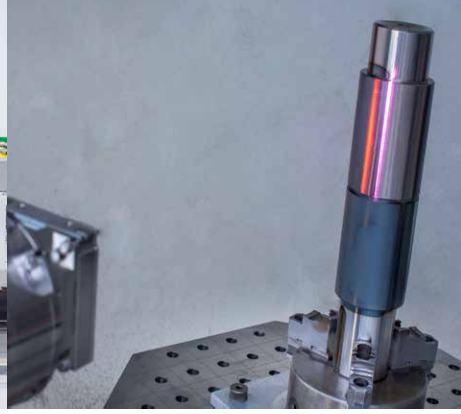
LDM diode lasers provide up to 4,000 W laser output power out of a 19" rack mount



LDF diode lasers with integrated cooling unit offer up to 25 kW laser output power in less than one square meter footprint







LDF diode lasers in different  
power classes with external  
cooling unit





With fiber-coupled diode lasers from Laserline, the laser beam with a power of up to 50 kW is transferred to the workpiece through an optical fiber. Depending on the actual laser power, Laserline uses optical fibers of 100  $\mu\text{m}$  to 2000  $\mu\text{m}$  in diameter.

## Optics

Laserline provides industrial system solutions for laser machining. For efficient laser applications, the optics must be perfectly adjusted to the diode laser source. Laserline's optic component range includes standard and specialized beam shaping optics as well as add-ons such as pyrometers and CCD cameras for process monitoring and control.

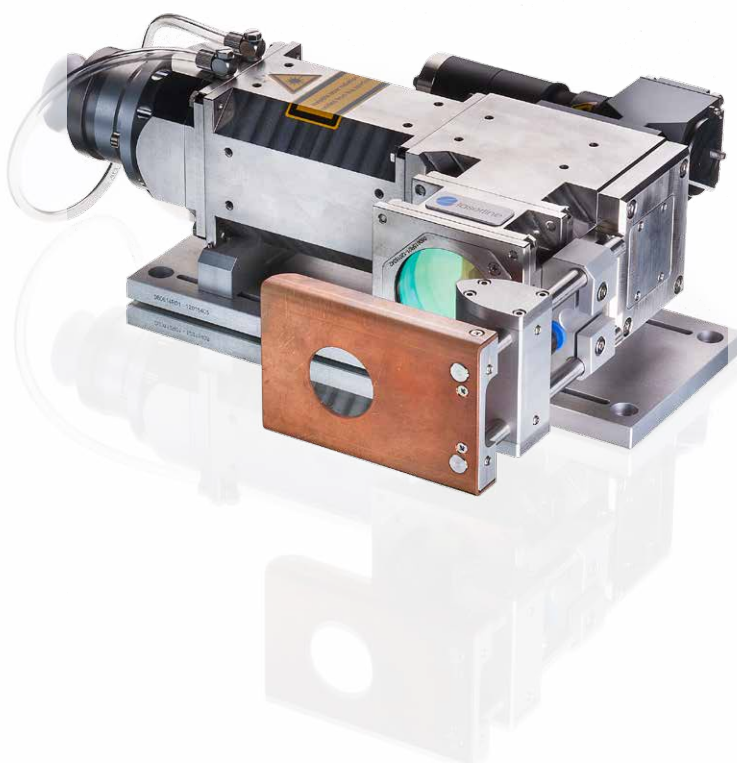
## OEM - customized power

In addition to its standard product range, Laserline offers customized solutions, including direct, non-fiber-coupled diodes as pump or beam sources, and custom beam shapes for highly specialized materials processing requirements.

External cooling unit,  
specially developed  
for LDF diode lasers



Processing optics OTS-5



# Solutions for your Applications

Diode lasers provide a particularly effective and compact heat source that can be adapted to a wide range of applications by means of add-on components and specialized optics.

## Welding of metals

Diode lasers are widely used for sheet metal applications industrial series production. Joints produced with Laserline lasers are particularly strong and show only minimum deformation. Welds produced at high machining speeds achieve an excellent weld surface in heat conduction welding but also in deep penetration / key-hole welding.

Deep penetration welding is widely used in the energy sector, for instance for gear components. Diode lasers achieve particularly smooth seams with low spatter.

Another important application is the welding of aluminum parts. Due to the short wavelengths near the absorption maximum of aluminum, this method is widely used in the automotive industry where high power diode laser systems are used for body-in-white applications.

Brazing in body-in-white applications







Hardening / heat treatment



Welding of aluminum



Welding of tailored blanks



## Welding of tailored blanks

A relatively recent application is the welding of tailored blanks with high power diode lasers. In this process, components made from different materials or different thicknesses are joined for subsequent forming, so that vehicle components can be optimized as regards their crash behaviour and weight.

## Brazing

Brazing and welding with filler wire are well-established methods for joining metal components. As diode lasers are virtually maintenance-free, they are particularly suited to applications such as the brazing of car body components in industrial mass production. Minimum space requirements, portability, high efficiency and excellent process stability make diode lasers the most efficient tool for such applications.

## Hardening / heat treatment

Components hardened with diode lasers meet all requirements as regards improved wear protection, which is crucial for many machine parts, tools and implements. As the hardening temperature can be accurately controlled throughout the process, it is possible to achieve an optimum hardness for each material. Laser heat treatment is also used to prepare high-strength materials for subsequent forming by reducing the hardness in well-defined areas.



Cladding



Additive manufacturing

Diode lasers often enable completely new methods of production when conventional techniques such as soldering and thermally assisted processes are limited or are not cost-efficient.

## Cladding and coating

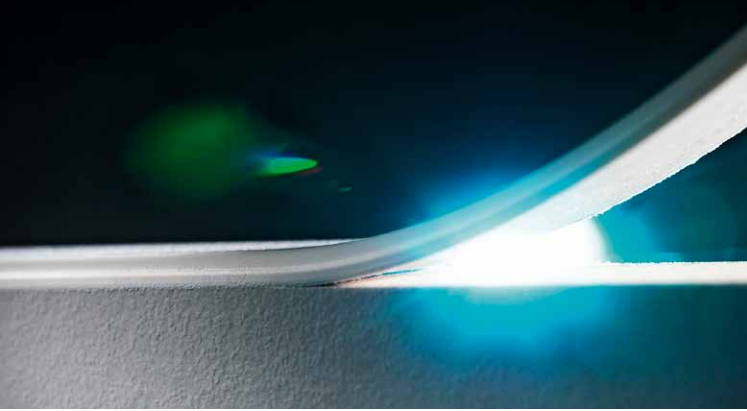
Over the last few years, fiber-coupled diode lasers have become very popular for cladding and coating tasks. Diode laser cladding offers many advantages over conventional techniques, such as higher cooling rates, cooling rates and less deformation for improved fine-grain structure and optimized adhesion. The resulting finishes are of excellent quality and require virtually no rework. Laser cladding using powder or wire is a highly efficient option for the repair of damaged coatings and the application of corrosion and wear protection layers on metal components.

## Additive manufacturing

The integration of laser sources in machine tools is a recent development with huge potential. By combining additive and subtractive tools in a single unit, manufacturers can explore completely new machining processes. A recent example is a five-axis milling machine with integrated laser. The diode laser applies a powder coating onto the workpiece, providing a solid base for subsequent milling in selected areas. By switching between laser and mill, the workpiece can be reworked to a level of perfection that is simply not achievable by machining the finished part.

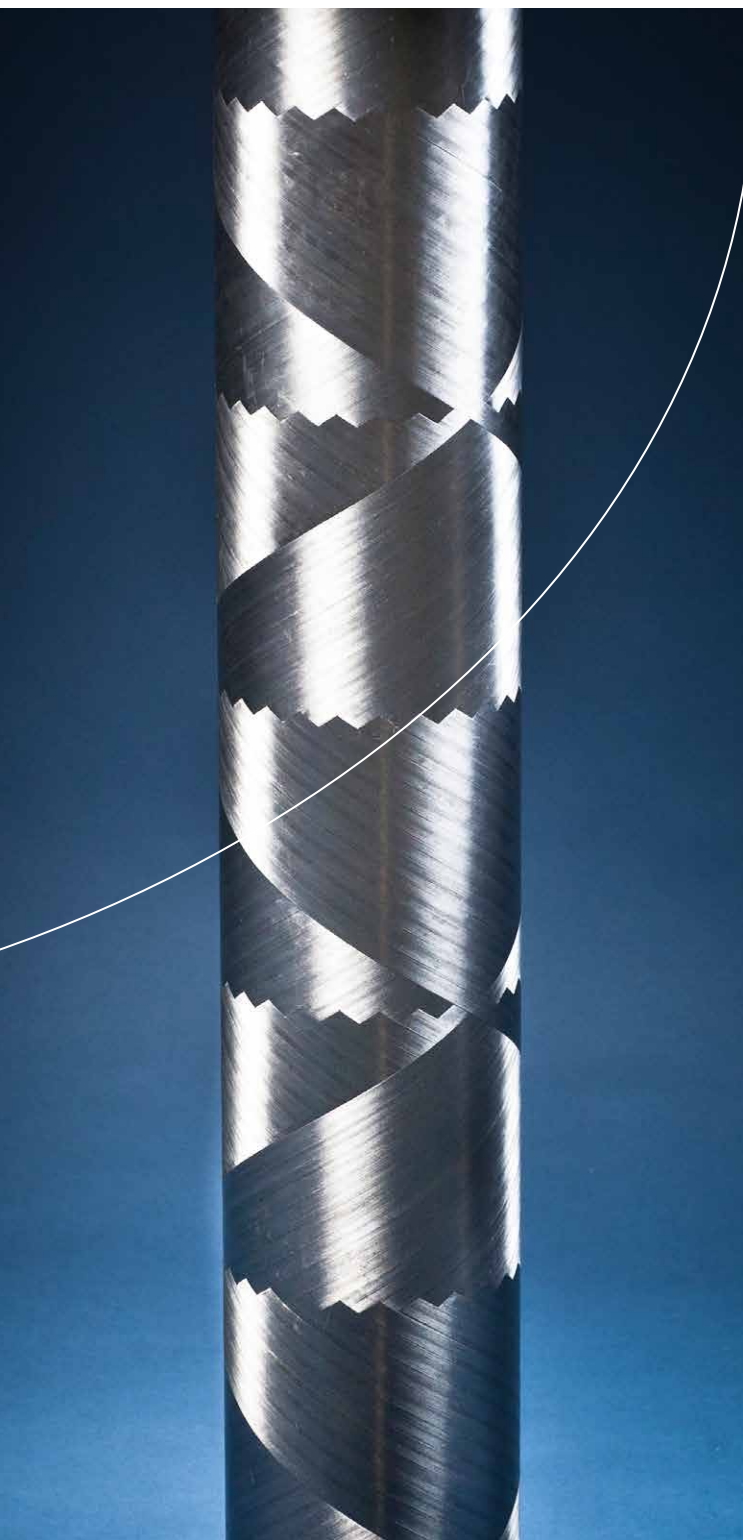
## Welding of plastics

For plastic products that need to meet stringent quality standards as regards reliability, reproducibility and design, diode lasers are the preferred option, as they allow for fast, non-contact laser welding of thermoplastics. This technology has found many applications in the automotive, medical and electronics industries. The localized application of energy results in fast and homogeneous melting of the material without causing damage to its structure and preventing fuzzing from dry friction. The welding process is monitored by displacement and temperature sensors that transfer the relevant data to the machine control system. Functional modifications to parts or new weld contour designs can be easily programmed at any stage.



Welding of plastics

Plastic welding of composite materials



## Fiber-reinforced components

Diode lasers have revolutionized tape placement (laying and winding) in fiber-reinforced composite materials. By temperature-controlled, localized melting of the thermoplastic matrix, it is possible to produce finished parts without costly follow-up hardening in a hot-air autoclave. Leading aircraft manufacturers are using diode laser tape placement for the production of their fiber composite fuselage and wing components.

## Pump sources

Modern diode-pumped solid state lasers are used to cut thick sheets of metal. They are also an excellent option for beam scanner welding of metals. These laser system use single diodes or diode arrays as their pump source. Laserline diode lasers and diode laser heads are particularly suited for such applications, as they offer outstanding optical pumping efficiency with high intensity and narrow bandwidths.



# Commitment to Customer Service - 24/7

From competent advice on the best beam source for a specific application to service contracts for diode lasers operated in three-shift production - Laserline assists its customers in any way it can, and around the clock.

Our team of experienced and dedicated application engineers are developing innovative solutions that meet and often exceed the expectations of our customers. Laserline is part of a global network that has brought together university research facilities and system integrators. These partners can be called upon for the development of new processes and specialized system designs.

## Diode laser training

By offering operator training, Laserline ensures efficient production from the very start, laying a solid foundation for long-term partnerships. Seminars on Laserline applications and equipment are held either at our facilities in Mülheim-Kärlich or at the customer's premises.



## Diagnosis via teleservice

Our service team is always available to answer queries and to help finding solutions for issues that might arise during production. All our customers have access to our 24/7 hotline. Our teleservice system enables us to diagnose any problems arising during production at any machine, anywhere in the world. In most cases, such problems can be eliminated on the spot through remote tools.

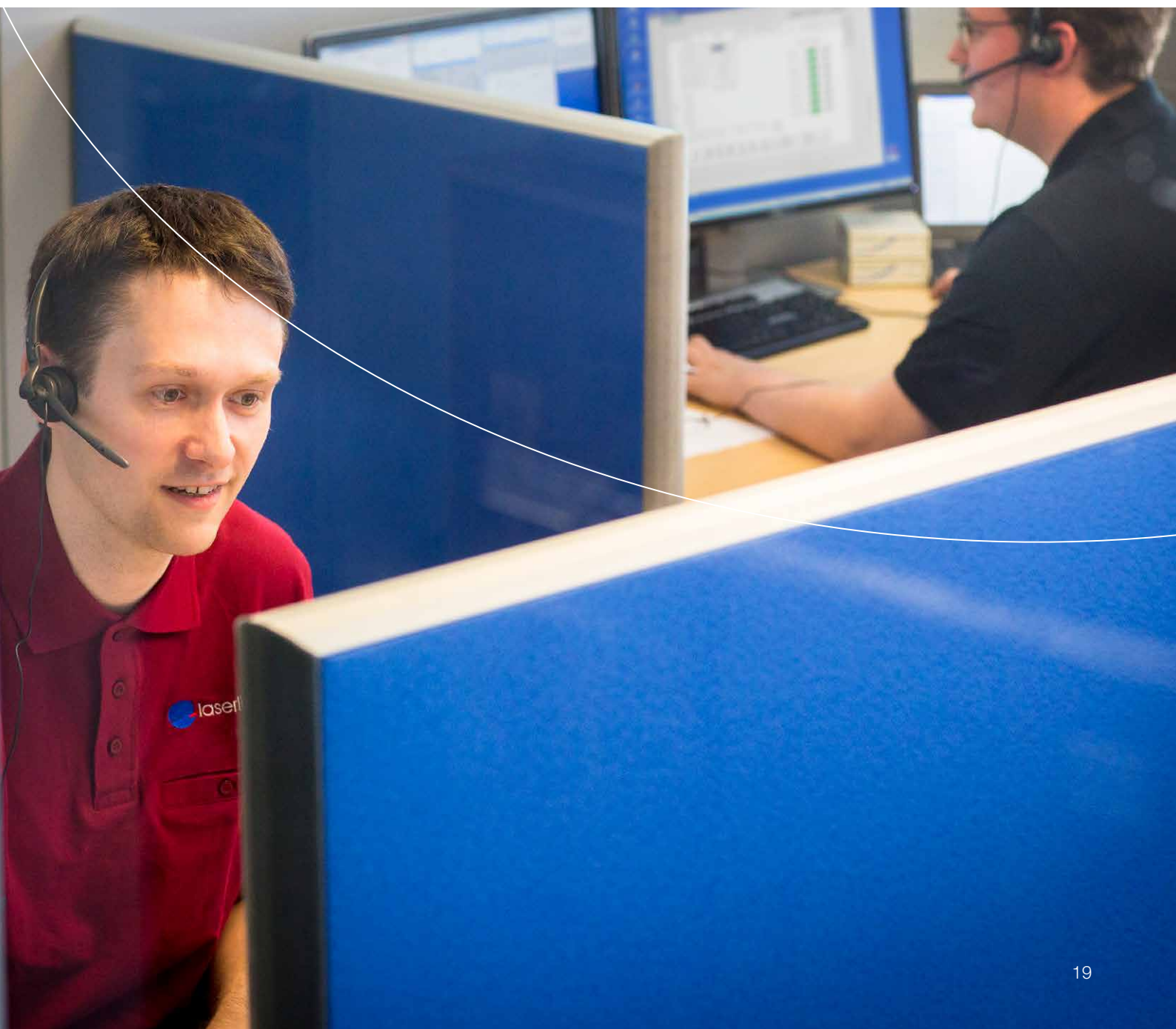
## Tailor-made after-sales service

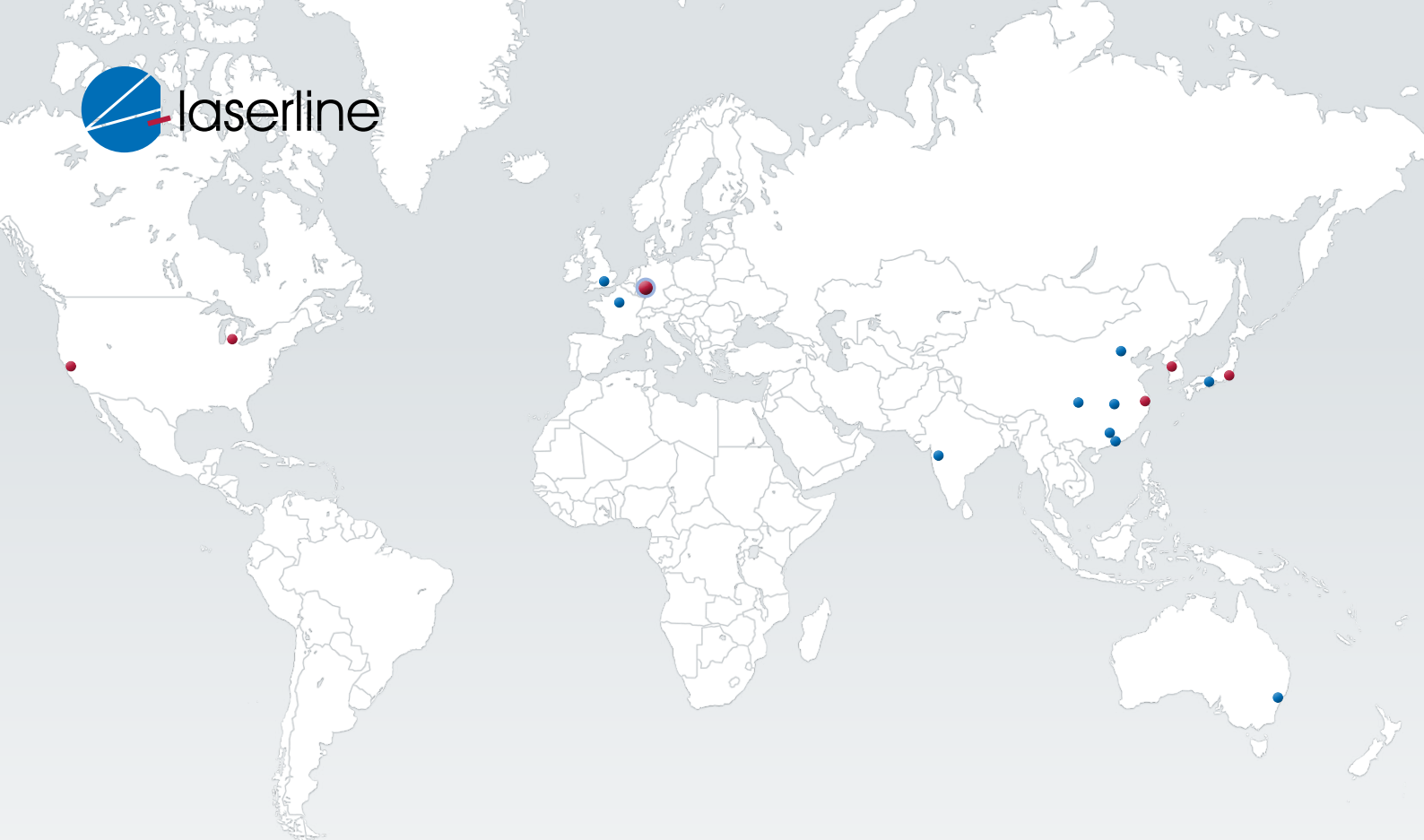
We stock almost all replacement parts so that they can be dispatched swiftly to anywhere in the world as needed. Thanks to the modular design of our diode lasers, the parts can normally be installed on site by the customer's own technicians. Operators benefit from reduced downtimes and thus greater efficiency of their laser systems.

Laserline also offers customized service and maintenance agreements aimed at minimizing planned and unplanned downtimes. As a result, Laserline diode lasers achieve availability ratings of more than 99.5 per cent.



- > 24/7 service hotline
- > Online diagnosis & troubleshooting
- > Service agreement, 99.5% reliability





● Headquarters ● Subsidiaries ● Representatives

Laserline has a worldwide presence, with subsidiaries and representatives in many countries.  
Please look up the Laserline contact in your country at [www.laserline.de](http://www.laserline.de)

#### **Laserline GmbH**

Fraunhofer Straße | 56218 Mülheim-Kärlich, Germany  
Tel. +49 2630 964 0 | Fax +49 2630 964 1018  
[sales@laserline.de](mailto:sales@laserline.de) | [www.laserline.de](http://www.laserline.de)

#### **Laserline Inc.**

1800 Wyatt Drive, Suite 9 | Santa Clara, CA 95054, USA  
Tel. +1 408 834 4660 | Fax +1 408 834 4671  
[info@laserline-inc.com](mailto:info@laserline-inc.com) | [www.laserline-inc.com](http://www.laserline-inc.com)

46025 Port Street | Plymouth, 48170, USA  
Tel. +1 248 826 5041 | Fax +1 248 826 5042  
[info@laserline-inc.com](mailto:info@laserline-inc.com) | [www.laserline-inc.com](http://www.laserline-inc.com)

#### **Laserline Do Brasil | Diode Laser Assistência Técnica LTDA.**

Condomínio Domo Business | Rua José Versolato, 111 | Sala 2127 - Torre B  
Centro - São Bernardo do Campo | SP - Brazil | Tel. +55 11 2355 1174  
[info@laserline.net.br](mailto:info@laserline.net.br) | [www.laserline.net.br](http://www.laserline.net.br)

#### **Laserline K.K.**

Oak Gotanda Bldg. 1F | 7-25-5 Nishigotanda | Shinagawa-ku | Tokyo, 141-0031 Japan  
Tel. +81 3 6417 4822 | Fax +81 3 6368 6185  
[info@laserline.jp](mailto:info@laserline.jp) | [www.laserline.jp](http://www.laserline.jp)

#### **Laserline Korea CO., LTD.**

Daehyun Techno-World. #1011 | 19, Ojeongonggeop-gil, Uiwang-Si | Kyunggi-Do (Zip. 16072), Korea  
Tel. +82 31-427-1780 | Fax +82 31-427-1781  
[info@laserline.co.kr](mailto:info@laserline.co.kr) | [www.laserline.co.kr](http://www.laserline.co.kr)

#### **Laserline Laser Technology (Shanghai) CO., LTD.**

Unit 105, Building 10 | 652 Changshou Rd | Putuo District | Shanghai, 200060, China  
Tel. +86 21 6266 2217  
[info@laserline.cn](mailto:info@laserline.cn) | [www.laserline.cn](http://www.laserline.cn)