

LIGHT GOES DIODE

ease of use and service

mobile and compact

reliable and robust

electrical/optical efficiency more than 40 percent

excellent beam quality

easily integrated

low maintenance design

low investment and maintenance costs



DIODE LASERS FOR YOUR APPLICATIONS

As a leading manufacturer of diode lasers for material processing, the name Laserline has become synonymous with this type of technology. Diode lasers are deployed worldwide in production processes and prove their efficiency and reliability in a wide range of different applications.

The company Laserline was founded in 1997 as one of the pioneers in the world of diode lasers for industrial material processing. Within a short time, the company was able to establish and further develop its position as technology leader in the market. The newly expanded premises in Mülheim-Kärlich provides for continuing growth. With a total area of 4,300 m², over a fifth of the area is assigned as a clean-room.

Diode lasers can be used in a wide range of different applications from metal and plastics welding to surface treatment to the pumping

of fiber and disk lasers. To achieve this, we make use of the possibility to adapt spot size and laser power to suit the requirements of the application. The high efficiency of the diode laser allows to optimize conventional methods of production or to replace another type of laser.

Diode lasers from Laserline offer the highest levels of efficiency:

- High electrical/optical efficiency of more than 40 percent
- Low investment and maintenance costs
- Outstanding reliability and robustness
- Mobility and compactness
- Easy integration in systems for production
- Excellent beam quality
- Low maintenance design
- Ease of use and service
- Highest performance and reliability due to innovative, active cooling
- Inherent redundancy by stack management



APPLICATIONS –

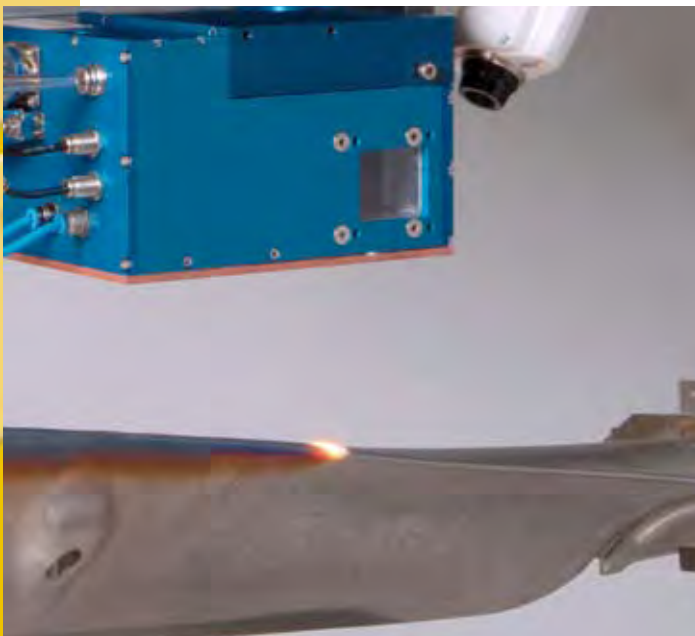
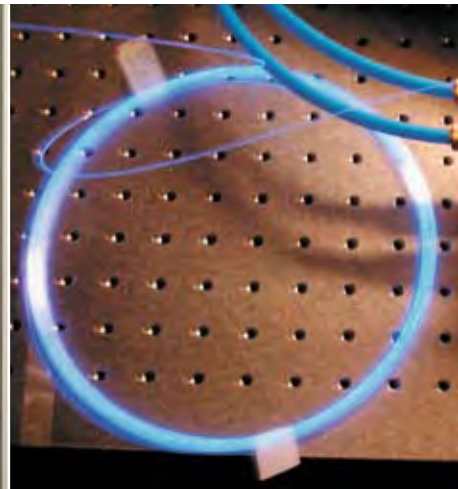


CLADDING AND COATING

There are many different ways of treating the surfaces of components to protect them from corrosion and wear. Diode lasers are increasingly used in cladding and coating applications as well as in repair welding. With a wide range of applications, they have proven themselves to be an extremely innovative technology. The advantage of diode lasers over conventional techniques can be summed up in two words: Better quality.

WELDING OF PLASTICS

Where high quality in terms of density, reliability, reproducibility or design is required, diode lasers with low or medium output power can be used for non-contact and fast welding of thermoplastics using transmission welding. Suitable areas of application include the automotive industry, medical technology and the electrical industry.



PUMP SOURCES

Modern, diode-pumped solid state lasers are used to cut thick sheets of metal or for beam scanner welding of metals. They are based either on single diodes or on arrays of diode lasers as a pump source. Diode lasers or diode laser heads from Laserline are particularly suitable as they achieve extremely high optical pumping efficiency with highest intensity and a narrow bandwidth.

HARDENING

Diode lasers reliably meet all hardening requirements for the protection of machine components, tools, accessories and other parts against wear. For this reason, diode lasers have long been used in the selective hardening of steel and cast iron – particularly in tool making.

Versatility = Diode lasers

BRAZING

Brazing and welding with filler wire are well established methods of joining metal components. Diode lasers are virtually maintenance-free and are particularly suited to applications such as the brazing of car body components in the automotive industry, especially in industrial mass production. Their low space requirements, mobility, high efficiency and process stability make diode lasers the most efficient tool in these applications.



CUTTING

Diode lasers have excellent beam quality which makes them particularly efficient for melt and blow as well as for oxygen cutting. Diode lasers offer the perfect synthesis between beam quality and efficiency with an unsurpassable electrical efficiency of over 40 percent. The compactness of diode lasers provides a whole new degree of mobility in this application.

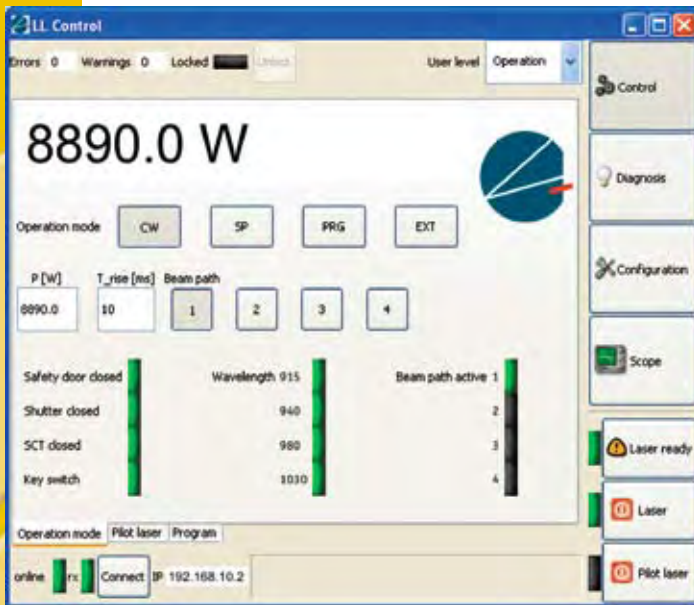
VARIETY OF APPLICATIONS

Diode lasers constitute a particularly effective and very compact heat source which can be adapted for a wide range of different applications by adding further components or special optics. Often the diode laser enables completely new methods of production that have come to a practical limitation with conventional techniques or that are not cost-efficient with other lasers. These include soldering and all thermally-assisted processes.

WELDING OF METALS

Diode lasers are used in a wide range of metal welding applications in industrial high volume manufacturing. The established applications are: precision and spot welding in the automotive industry to heat conduction welding in the consumer goods industry and to longitudinal seam welding of tubes. Diode lasers with good beam quality are now also ideally suitable for key-hole welding and welding of for example aluminium.





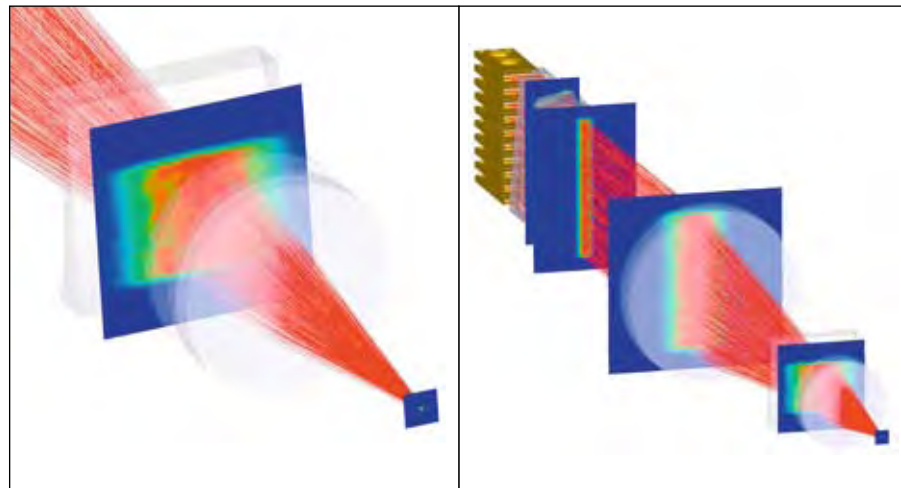
LL-Control: Ethernet remote control for diode laser

Based on a modular concept, all Laserline diode lasers consist of just a few basic components: The actual source of the beam with the diode laser stacks, the optical components and a supply unit with control and operator panel into which the beam source

is often integrated, depending on the requirements of the individual application.

and the required beam quality. Using a simple, patented technology, the beams of the diodes are overlapped to form a single laser beam that is coupled into a fiber optic cable or provided with optics for direct application. The laser head can also contain a pilot laser and a mechanical shutter. The lasers are delivered with standard or special wavelengths.

The modular structure of the laser head permits, in most cases, the



Supply unit with chiller, power supply and integrated laser head



The modular concept of these units allows diode lasers to be adapted optimally to the specific requirements of the customer, while simplifying maintenance and minimizing the stock of spare parts in a manufacturing operation.

BEAM SOURCE

The beam source contains several diode laser stacks which are built of individual diodes arranged over one another – some of which have an output power of over 100 W. The number of stacks depends on the laser output power

system to be fitted with further stacks in future in order to increase the power.

CONTROL AND SUPPLY

The compact, mobile supply unit controls and monitors the laser head and its peripheral equipment. All components needed to operate the diode laser, such as power supply, cooling unit and control are modular, easily replaceable components. The supply unit also contains the interfaces for the customer and the teleservice module.

Depending on laser power, type of laser and specific customer requirements, a range of supply units,

The Future: Now!

which are made up of identical individual components, such as standard PLCs and cooling units, is available. The mobility of the supply unit makes the design of the production line particularly flexible, even if several stations are used, as the diode laser can be moved and quickly replaced by another laser, if necessary.

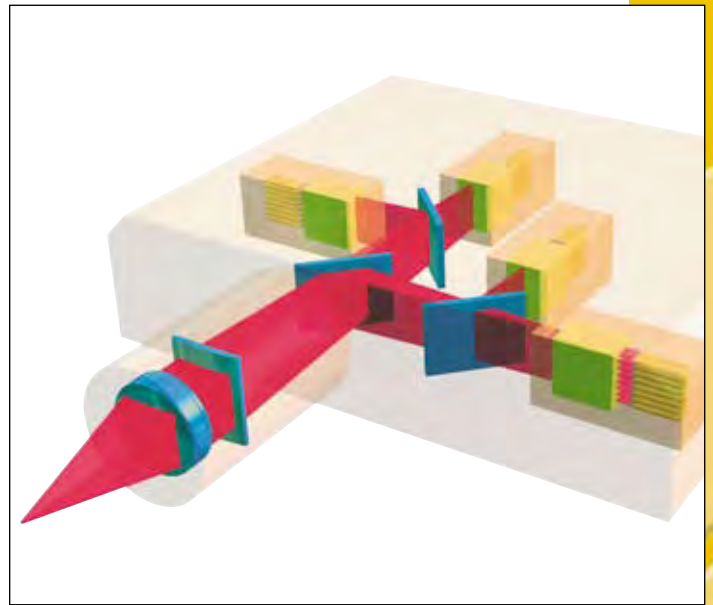
A comprehensive system management based on monitoring more than 70 operating parameters ensures

technology and further control elements.

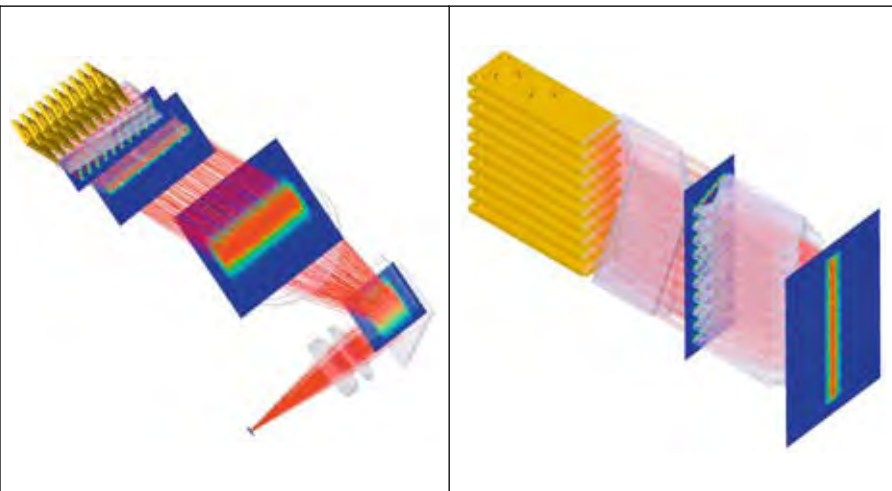
STACK MANAGEMENT

Laserline aims for maximum reliability, particularly for the core of each diode laser system, the individual laser diode.

Very stringent criteria and special test procedures, by far exceeding standard requirements, guarantee that only qualified laser diodes are



Polarization and wavelength coupling in a diode laser head



maximum availability, everywhere ranging from R&D to multi-shift production. All operating components, from the laser head to the cooling system, are monitored continuously. A two-stage fault management system, providing warning and error messages, enables the operator to react quickly in the case of a fault.

COMMUNICATION INTERFACES

Standard bus communication (Profibus, Interbus, Device Net, Ethernet) as well as analog and digital interfaces enable the diode laser to be integrated easily into external control systems. The control unit of the LDL, LDF and multi-laser series consists of an LCD display with touchscreen

used. Diode laser systems from Laserline operate for more than 30,000 hours, which is equivalent to 5 – 7 years of production, before diode laser elements may need replacing.

Should, despite all precautions, a spontaneous failure of a diode laser occur, Laserline's pioneering electronic stack management system steps into action. Based on the redundancy concept and automatic system adjustment, faults can be compensated within a few minutes, and an interruption of the production avoided.

Diode laser control components



SERVICE –



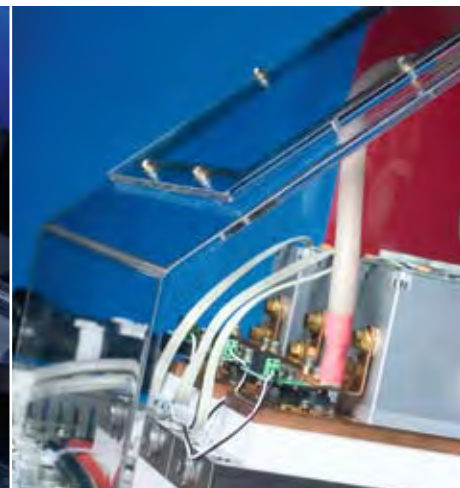
Final inspection
of a multi-diode laser

From competent advice in the selection of the appropriate beam source to service contracts for diode lasers in three shift production,

everything at Laserline centers on fulfilling the high expectations of our customers.

In addition, Laserline has built a worldwide network of university research facilities and system integrators, who can be called upon to help with the development of processes and the design of systems.

Right from the start of the project, the future service strategy is taken



Teleservice with modem access
for diode laser diagnosis

Our team of dedicated and competent application engineers creates optimum solutions for the customer's specific applications. Our German, US and Japanese Labs will determine laser and process parameters for particular tasks.

into account, which creates the foundation for a successful partnership and efficient production with Laserline diode lasers. Seminars on applications and equipment, either at our plant in Mülheim-Kärlich or at the customer's premises, ensure that the production process is efficient right from the start.



Customized

Our service team is ready to provide solutions to your questions once the laser runs in production. With Laserline's global experience with lasers in production, the 24/7 hotline and teleservice are a standard part of the service we offer our customers.

With the help of our teleservice,

swiftly to anywhere in the world. The simple, modular construction of most parts means they can be installed by the customer's own service personnel. This assures performance, limits downtime and once again places the focus on efficiency.



Working at the laser head of a fiber-coupled diode laser



faults are diagnosed and, in most cases, remedied immediately. Our customers benefit from fast response times and competent service.

CUSTOMIZED SERVICE

Almost all replacement parts are kept in stock and can be dispatched

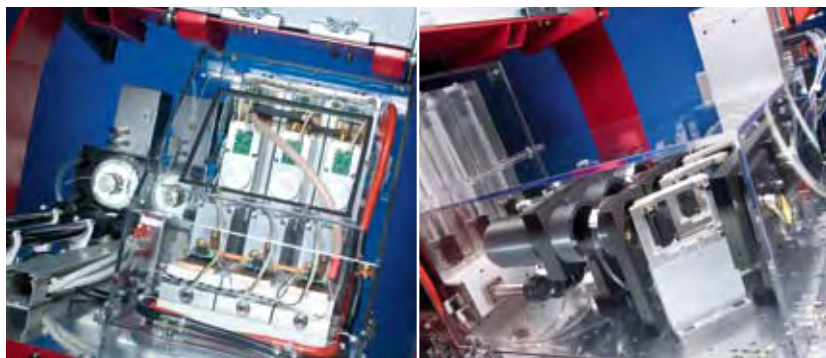
Laserline also offers tailor-made service and maintenance agreements for its customers. This allows maintenance requirements and production downtime to be kept to a minimum, so diode lasers achieve way over 99.5 percent reliability.

Burn-In: Long-term testing of diode laser elements



MAIN APPLICATIONS

- Welding of metals
- Brazing
- Cladding and coating
- Cutting
- Pump sources



Fiber-coupled diode lasers of the LDF series offering 100 to 10,000 W output power deliver the laser beam to the workpiece through an optical fiber.

Depending on the laser power, optical fibers of 200, 300, 400, 600, 1,000 and 1,500 μm diameter are used. The optical fibers are equipped with sensors to monitor temperature and breakage and can be simply plugged in and exchanged.

In most cases, fiber-coupled diode laser heads are integrated into the compact and mobile supply unit in

an all-in-one concept. In conjunction with stack and fault management, the supply unit guarantees maximum reliability in serial production. The laser system can be upgraded and adapted to different applications, for example, by adding diode laser stacks.

MULTIPLE STATION OPERATION

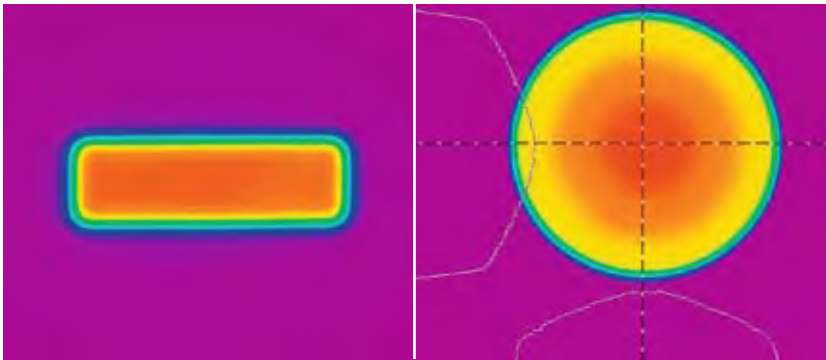
The diode lasers of the LDF series are particularly well suited to multiple station operation with beam switches and fibers of up to 100 m in length. The beam switch is integrated in the laser head and may also be added



Mobile power

ADVANTAGES

- Compact, cost-effective system for serial production
- Mobile, fiber-coupled diode lasers of up to 10,000 W power
- Extremely reliable
- Flexible, modular laser
- Optional beam switch



later, as customer requirements in production increase. It is equipped with an integrated function monitor and beam absorber. The mobility and compactness of the diode lasers allow for completely new redundancy strategies in multiple station operation.

The spot dimensions of the fiber-coupled lasers can be adjusted within a wide range to suit the particular application and can also be widened using special homogenization optics to form a uniform rectangle, line or square.

PROCESSING OPTICS

There are currently two diameters of processing optics available for fiber-coupled diode lasers: 25 mm or 50 mm. Both can be easily complemented with sensors for process monitoring and control, for example, for weld seam monitoring.

SPECIAL PROCESSES

Thanks to standardized fiber connectors, other manufacturer's processing head for special production processes such as welding optics, cutting heads or nozzles for cladding, can easily be used together with diode lasers from Laserline.

LDF – FIBER-COUPLED DIODE LASER

max. output power	1,000 W	2,000 W	3,000 W	4,000 W	5,000 W	6,000 W	8,000 W	10,000 W
beam quality	20 mm·mrad		30 mm·mrad		40 mm·mrad	60 mm·mrad		100 mm·mrad
laser light cable	400 µm, NA 0.1		300 µm, NA 0.2 or 600 µm, NA 0.1		400 µm, NA 0.2	600 µm, NA 0.2		1,000 µm, NA 0.2
spot at f= 100 mm	0.2 mm		0.3 mm		0.4 mm	0.6 mm		1.0 mm

LDL – Direct power

MAIN APPLICATIONS

- Hardening
- Welding of metals
- Pump sources

ADVANTAGES

- Optimum spot adjustment
- Mobile, compact system
- Flexible laser type, easy to upgrade
- Highest efficiency of all diode lasers
- Very cost-effective system



The direct diode laser series, LDL, is available from Laserline in several ranges offering different beam qualities and laser output powers of 150 W to 10,000 W.

Despite its high power, the diode laser head is no larger than a shoebox and weighs only 18 kg. The laser head is equipped with optics, such as those required for hardening and welding applications, and is positioned directly in the processing area in production. The spot can be adjusted to suit different applications by simply changing the

processing optics. In all cases, maximum homogeneity is achieved. The laser head can often be equipped with a removable fiber connector and, consequently, can be used with or without laser light cable.

MOBILE SUPPLY UNIT

The corresponding mobile supply unit holds, as for the LDF laser series, all components for diode laser operation and has a graphical user interface with programmable power selection and interaction with external control signals.

LDL 80



LDL 160



LDL – DIRECT DIODE LASER

min. spot at f = 100 mm	LDL 80, weight 9 kg max. output power	LDL 160, weight 18 kg max. output power
0.4 x 0.4 mm ²	150 W – 1,200 W	300 W – 2,400 W
0.4 x 0.6 mm ²	150 W – 1,700 W	300 W – 3,400 W
0.6 x 1.0 mm ²	150 W – 2,200 W	300 W – 4,400 W
0.6 x 3.0 mm ²	150 W – 5,000 W	300 W – 10,000 W

LDM – Compact power

MAIN APPLICATIONS

- Welding of plastics
- Welding of metals
- Soldering
- Pump sources

ADVANTAGES

- Cost-effective
- Robust and reliable
- Very compact
- Virtually maintenance-free
- Easy to integrate

The fiber-coupled OEM modules of the LDM series meet the highest expectations in terms of compactness and reliability.

Integrated into a 19-inch rack mount the size of a PC are the laser head with fiber-coupling unit, the power supply and microprocessors, used to monitor and control the laser.

COMPACT AND COST-EFFECTIVE

By cutting back to basic functions and forgoing a graphical user inter-

face, the fiber-coupled diode lasers of the LDM series are very compact and cost-efficient. Laserline also offers PC software to control the laser via Ethernet.

STANDARD INTERFACES

The diode laser modules use standard interfaces for controlling, monitoring and for laser safety circuits. Bus interfaces and teleservice functionality are also available. This makes them extremely easy to integrate into production lines and quick to replace, if necessary.

LDM – FIBER-COUPLED DIODE LASER MODULE				
max. output power	750 W	1,200 W	2,000 W	2,500 W
beam quality	30 mm·mrad	40 mm·mrad	60 mm·mrad	100 mm·mrad
laser light cable, NA 0.2	300 µm	400 µm	600 µm	1.000 µm
spot at f= 100 mm	0.3 mm	0.4 mm	0.6 mm	1.0 mm



CUSTOMIZED BEAM SOURCES –



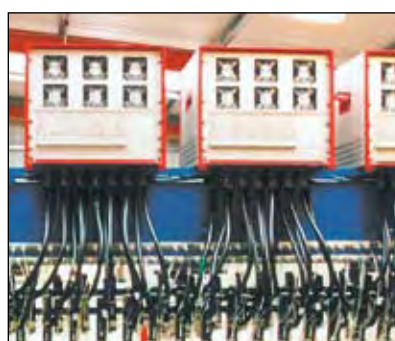
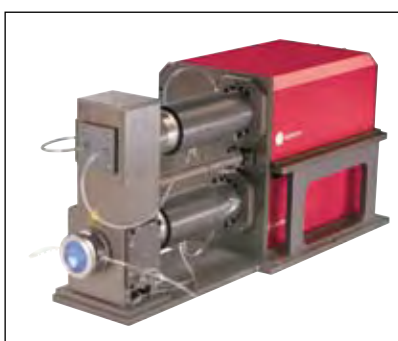
The modular concept of the diode laser allows customized diode lasers to be developed and produced that meet special application requirements. The laser systems are based on standard core components, such as Laserline diode laser stacks.

Around the core element, mechanical, electrical and optical interfaces are designed to order. Integrated sensor technology may also be adapted. This concept allows mechanical housings to be changed very efficiently, even for smaller series.

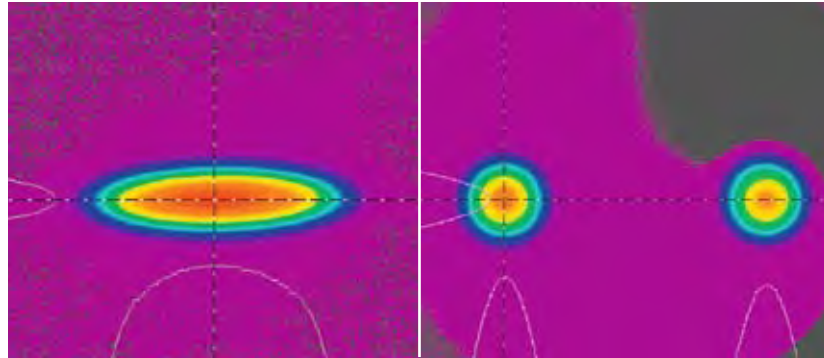
Diode lasers are well suited for multi-laser applications. Peripheral equipment, such as the control or cooling unit is used collectively by all beam sources. This reduces costs in comparison to using several diode lasers separately.

CONTROL CONCEPTS

A master-slave control architecture allows systems to be upgraded at any time. These control concepts can be implemented in systems with two to over a hundred beam sources.



A wealth of possibilities



Laserline offers a large selection of additional components for its diode lasers, which optimize the beam source or supply unit for a range of special applications.

They include various exchangeable standard and special optics, scanner systems for plastics welding and beam switches for multi-station operation.

DioSCAN

- Beam scanner for quasi-simultaneous welding of plastics
- Control via a separate PC or programmable memory card
- Designed for laser power of up to 6,000 W

BEAM SWITCH

- Up to six exits (time-sharing)
- Efficient multi-station operation
- Flexibility and safety
- Integrated beam absorber
- Internal function monitoring
- Fast switching times
- Bus communication

DioSCAN

focal length	f = 80 mm	f = 160 mm	f = 217 mm	f = 434 mm
min. spot-Ø	0.25 mm	0.5 mm	0.7 mm	1.3 mm
scan area [mm ²]	30 x 40	100 x 100	130 x 130	260 x 260

Values are based on: 200 µm fiber; further focal lengths available on request



ACCESSORIES –



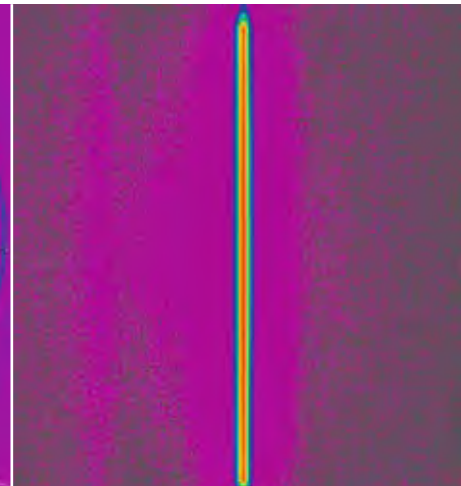
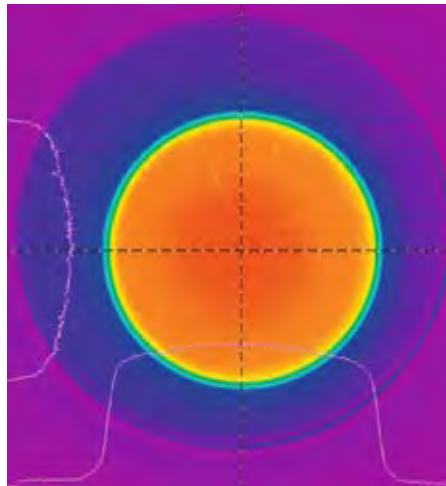
Homogenizing optics with connection for pyrometer

WELDING OF METALS

- Integrated weld monitor
- CCD camera
- Cover slide monitor
- Cross jet
- Shield gas nozzle
- Pressure finger or pressure roller

HARDENING

- Optimized beam geometry for every application, e.g. 40 x 8 mm², 30 x 10 mm², 15 x 15 mm²
- Integrated pyrometer for temperature measurement and control at the surface
- Zoom optics with motorised spot dimensions, e.g. 3 x 6 mm² to 3 x 18 mm²



Coating head for diode laser with connection for pyrometer



CUTTING

- Laser cutting head
- Exchangeable cutting nozzle
- Cover slide
- Tactile or capacitive distance regulation
- Spot sizes of 0.15 – 0.5 mm
- Integrated gas feed
- Crash sensor

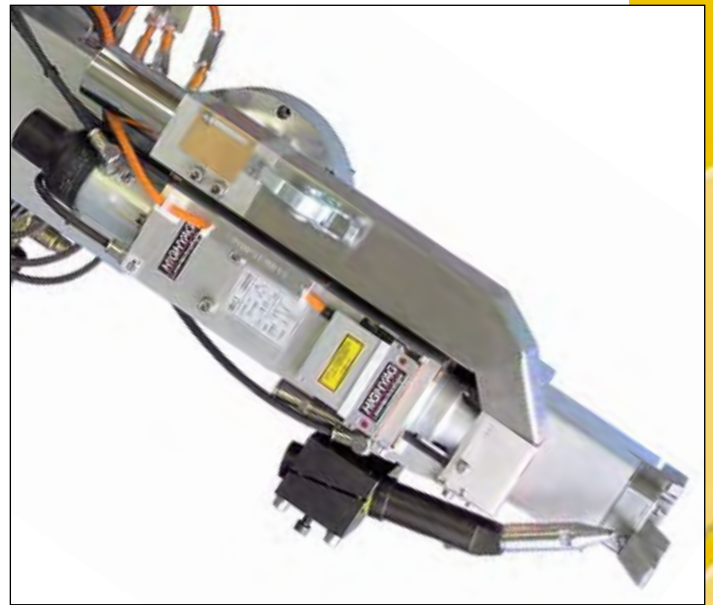
Application and solution

WELDING OF PLASTICS

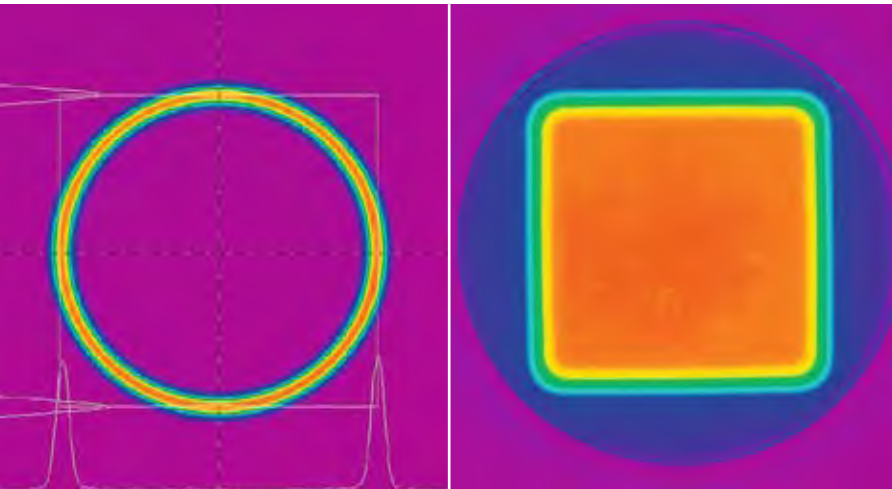
- Beam scanner: DioScan
- Ring focus optics for simultaneous welding of circular seams
- Pyrometer and CCD camera for process monitoring

BRAZING

- Controlled wire feeding with integrated gas feed
- Weld seam tracking
- Cross jet
- Cover slide monitor
- CCD camera
- Tactile or camera-guided seam tracking
- Crash sensor



Welding head with double pressure finger



CLADDING AND COATING

- Powder or wire cladding
- Coaxial powder feed
- Integrated shield gas feed and cooling
- Integrated sensors for process monitoring
- Dust protection

Cutting head for fiber-coupled diode lasers



ACCESSORIES



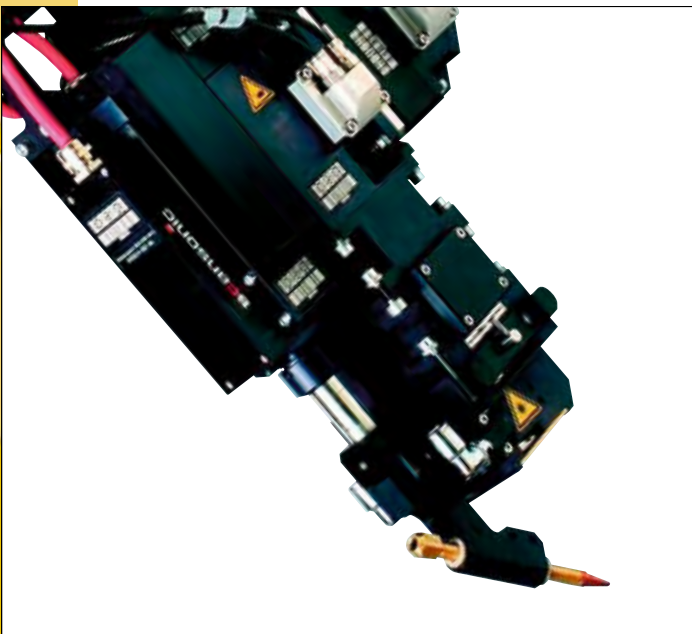
Processing head with monitoring camera, cross jet and quick change cover slide

CONTROL SYSTEM UPGRADE

- Profibus, Interbus, Device Net, Profi Net, Ethernet connection
- PC control: LL Control Software
- Separate control panel
- Wavelength selection
- Wavelength stabilization for pump applications
- Extended programming and interaction functionality



Brazing optics for fiber-coupled diode laser with seam tracking by filler wire



FURTHER OPTIONS

- Visible pilot laser
- 90° beam deflection
- Cover slide cassette
- Fiber length up to 100 m
- Twin spot optics
- 1-inch and 2-inch optics
- Additional protective elements for special environmental conditions (extreme dust, high humidity)
- Teleservice via safe VPN connection
- separate user panel
- water chiller with compressor
- optics chiller

Further options are available to tailor our diode lasers to your applications.



For details of further sales partners, please refer to our website.





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