LASCON® pyrometer closed loop control and systems for

- laser soldering
- laser plastic welding
- laser hardening and cladding
About us
We are a leading provider of laser process control software and laser equipment. Our family-owned company was founded in 1991 and is headquartered in Bavaria, Germany.

Focus
Our main focus lies on laser solutions in which we have unique technological expertise. Our laser process control LASCON® for low and high power laser processes has a constantly increasing number of installations worldwide. This pyrometer-based closed-loop control enables our customers to realize challenging laser applications like laser soldering, laser plastic welding, laser hardening and cladding.

Additionally, we offer specialized laser equipment, such as laser heads, diode lasers, robotics and complete solutions for laser soldering and laser plastic welding.
Product overview

1. LASCON process control

   LASCON controller with high speed pyrometer
   LASCON software

   Closed loop control of temperature during laser processing, real time visualization, storage and archiving of laser process data.

2. Laser processing heads

   Low power laser head LH102
   Laser head LH501

   A range of compact laser processing heads especially designed for laser soldering, cladding and heating applications.

3. Diode lasers

   Fiber coupled diode laser
   LASCON® controlled laser

   Diode lasers with 25-300W power and special multi function lasers

4. Specialty equipment

   Blackbody calibrators
   Laser Workstations

   Workstation, desktop robots and other specialty equipment like blackbody calibrators integrate the entire range of technologies.
LASCON process control

More than 1,500 industrial laser machines worldwide run with a LASCON® process control

- LASCON is a **unique temperature measurement and closed loop control system**, which enables handling of complex laser processes in the industry and in scientific research.
- LASCON employs **high-speed pyrometers** to acquire temperature data and **tested algorithms** to process, visualize, and interpret this data.
- The resulting parameters provide **real-time feedback** and enable **automated process optimization**.
- The **5th generation system** relies on unique technological and process know-how that stems from **20+ years of experience**.

Industrial I/O terminal with 24V digital and analog 0-10V I/O for integration in automation lines and connection to PLC’s.

Compact, rugged controller with real-time operating system and 4 GB flash disk to store up to 500,000 processes at a rate of up to 10kHz.

Built in infrared or 2-color pyrometer with sampling rates down to 100μs.

Blocked against laser light, glass fiber coupling for high immunity against electromagnetic interference, visible laser beam for aiming.

Various optics with spots down to 200μm diameter and temperature ranges from 70°C to 2,200°C.

Ethernet connectivity and EtherCAT® machine bus.
Key applications of LASCON

LASCON is a key component of our laser solutions and can be easily integrated into third-party multi-kW laser systems.

- **Laser plastic welding**: LASCON supports contour and quasi simultaneous plastic welding. Typical speed: 50-100mm/s (contour), typical process temperature: 180-240°C.
  - **Examples**: Gas/watertight sealing of electronic housings, Membranes in MedTech, Filter housing in wastewater technologies, Lamp housing in the automotive industry.

- **Laser soldering**: Ideal use case for LASCON: selective laser soldering. Soldered parts are usually sensitive to temperature or need special temperature settings for precise soldering.
  - **Examples**: Soldering of SMDs and through-hole components on printed circuit boards, Solar cells.

- **Laser hardening**: In laser hardening processes, components are partially heated by high-power lasers in the multi-kW range. LASCON ensures the precise temperature control necessary to achieve optimal hardness.
  - **Examples**: Ferrous material surfaces, including steels and cast iron, Camshafts used in combustion engines.

- **Laser cladding**: Temperature of the heat affected zone is a key parameter for cladding, which usually requires the attention of a specialized technician. LASCON controls and optimizes temperatures during the process.
  - **Examples**: Repair and reinforcement of surface structures, Coating of shapes to increase lifetime of wearing parts.

LASCON integrated into MT’s complete laser solutions.

Controller delivered as a sub-system.
### Laser processing heads

We develop and manufacture a range of compact and technically advanced laser processing heads.

<table>
<thead>
<tr>
<th>Mini laser heads</th>
<th>Special laser heads</th>
<th>Intelligent laser head</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Low power laser head LH102" /></td>
<td><img src="image2" alt="Adaptive laser head LH200 ZooOM" /></td>
<td><img src="image3" alt="Intelligent laser processing head ILPH" /></td>
</tr>
<tr>
<td><img src="image4" alt="Low power laser head LH103" /></td>
<td><img src="image5" alt="Laser head LH501" /></td>
<td></td>
</tr>
</tbody>
</table>

The small size of these components enables easy integration into production machinery as well as into desktop robots and rotary axes. Examples of typical applications are: **laser soldering**, **laser plastic welding**, **laser heating** during thermal bonding, and **soldering on wafers**.

All laser heads can be connected with a coaxial pyrometer, optional ccd camera and are compatible with the LASCON process management system.
# Laser processing heads - Details

<table>
<thead>
<tr>
<th></th>
<th>LH102</th>
<th>LH103</th>
<th>LH200 ZooOM</th>
<th>LH501</th>
<th>ILPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser power</td>
<td>External fiber coupled lasers max. 140 W</td>
<td>External fiber coupled lasers max. 140 W</td>
<td>External fiber coupled lasers max. 500 W</td>
<td>Integrated laser source up to 60 W</td>
<td></td>
</tr>
<tr>
<td>Wavelength</td>
<td>808-980 nm</td>
<td></td>
<td></td>
<td>978 nm</td>
<td></td>
</tr>
<tr>
<td>Optics</td>
<td>AR coated 1.0&quot;-optics, focal length on customer request</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported pyrometer</td>
<td>Infrared pyrometer, typical range 100-650 °C, optionally &lt; 70 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video camera</td>
<td>n/a</td>
<td>integrated (optional) USB color or mono camera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported LASCON software</td>
<td>LPM</td>
<td></td>
<td>LPM + Camera Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber connector</td>
<td>FSMA905</td>
<td>SMA905, D80, LLK-A</td>
<td>n/a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber diameters</td>
<td>Typically 100-600 μm</td>
<td>Pigtailed 100 μm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num. aperture</td>
<td>0.22; others on request</td>
<td>Approx. 2x fiber diameter</td>
<td>Approx. 2x fiber diameter</td>
<td>Typically 200 μm; Min. 100 μm</td>
<td></td>
</tr>
<tr>
<td>Laser spot at working distance 100 mm</td>
<td>Approx. 2x fiber diameter</td>
<td>Approx. 0.3-2.5 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimension (WxDxH)</td>
<td>52x40x100 mm; 0.2 kg</td>
<td>50x110x180 mm; 0.7 kg</td>
<td>50x110x240 mm; 2.0 kg incl. solder wire feeder</td>
<td>122x40x220 mm; 1.2 kg</td>
<td>450x160x160 mm; 5 kg</td>
</tr>
<tr>
<td>Protection</td>
<td>IP50</td>
<td></td>
<td></td>
<td>IP40</td>
<td></td>
</tr>
<tr>
<td>Pilot laser beam</td>
<td>Pilot laser, Laser Class 3R, Wavelength 635nm, adjustable</td>
<td></td>
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</tr>
</tbody>
</table>

**Beam shaping:**
Mergenthaler offers all kind of beam shaping, such as lines, squares, rings and also exotic shapes like rectangles and double lines.
3 Diode lasers

We offer a range of advanced diode laser modules to provide our customers with complete systems

Feature overview

The laser current can be regulated by an external 0-10V voltage and is shown on the frontside by a digital display. A second input can be used to blank the laser power (optional).

Complete laser systems for different power and wavelength requirements: fiber coupled diode lasers from 25W to 300W power with a 200µm to 600µm detachable fiber or pigtailed with 100µm.

Laser driver: very fast, low noise (0.1%, 50mA peak-to-peak) constant current source.

An integrated interlock (emergency stop: category 4, performance level E) switches the laser on and off. This device can control doors in laser safety environments or stop the system when the laser fiber is disconnected.

The laser has an on/off button, key lock, emergency stop and a start and stop button for regular operation. Two alarm lights are integrated for laser radiation warning.

Integrated air vent to avoid overheating. For power higher then 200W: water cooling.
LASCON controlled laser (LCL)

The LCL seamlessly integrates multiple functions in one system

Feature overview

Diode laser system with built-in LASCON process control for ultra fast, closed loop temperature control.
Enables high speed laser soldering and plastic welding of unmatched quality.

Various laser processing heads such as LH102 (ultra compact) and LH103 (with video camera and pyrometer port) can be directly connected to the LCL via glass fiber cables.

Optional integrated wire feeder / adaptive zoom controller.

Rugged controller housing with real-time operating system and 4 GB flash disk to store data at a rate up to 10kHz.

All features are supported by the LASCON process manager software. The software always runs on the controller and can additionally be installed on a Windows PC, connected to the controller via Ethernet.
Calibrators

Pyrometer calibrators have been developed to satisfy specific customer demands and are also used for service

Feature overview

The blackbody calibration source can be used to check unique temperature points or to set a new calibration of the pyrometer (100-400°C temperature range).

Very compact dimensions and light weight: the blackbody can easily be transported to the pyrometer that needs calibration (100-990°C temperature range).

Ideal for inline integration thanks to its compact design.

Extremely fast heating rate and unrivaled temperature settling time.

Pyrometer calibrator HS-25-400

Blackbody HS-25-1000
Growing demand for customized laser solutions has prompted the development of desktop robots and workstations for specific process needs.

(Selected examples)

**Desktop robot LWS090**
- Autonomous cell with linear and rotary axes.
- Customized axis modules in portal or H gantry design. Up to 4 NC axes with step motors and ball screws.

**Workstation LWS080-RT**
- Autonomous cell with rotary table, specifically designed for laser soldering (process times <1s) and plastic welding.
- Integrated diode laser up to 200W, laser head with camera, pyrometer, and LASCON software included.

**Integrated diode laser**

**Fiber coupled 60W or 140W diode laser**
- Rotary indexing unit with two segments, optionally with additional drives for tool handling.
- Laser heads with integrated camera and pyrometer.

**Laser heads with integrated camera and pyrometer.**
Application example (1/5) – Laser soldering of ceramic PCBs

The LASCON controlled system prevents overheating and makes the process fully traceable

Customer problem and requirements
A tier-1 automotive supplier needs a laser soldering system for a critical ceramic PCB application:
- Prevention of cracks in the ceramic PCB
- Maximum reliability and full process traceability for all soldering joints
- Support for installation in all plants worldwide

Solution by Mergenthaler
- LASCON controlled laser system with 60W power; integrated pyrometer for closed loop temperature control; integrated precision wire feeder controller
- LH103 processing head with laser, pyrometer and video port
- Accurate temperature control and optimized soldering script ensure process stability and crack prevention
- Testing and optimization were conducted in our own laser soldering laboratory
- Installation on site was carried out by Mergenthaler

Status quo
- The system has been running for 20,000 hours; no downtime and no need for repairs
- We have become a partner of choice for laser applications worldwide
Application example (2/5) – Soldering on sensor PCBs

The combination of LASCON and machine vision technologies generates a flexible and reliable soldering system

Soldering of connector pins on PCBs for different sensor types

Customer problem and requirements
A tier-1 sensor manufacturer wants to produce approx. 200 different sensor types in small lots upon customer request:

- System needs to support the production of a wide variety of PCBs
- Connector pins have to be soldered on the PCB

Solution by Mergenthaler
- LCL laser system with integrated LASCON controller; LH103 laser head
- Integrated machine vision system to correct the position of the laser head according to the PCB soldering pads
- The sensor type is detected by the PLC, which sends the corresponding laser soldering script to the LASCON controller via the Ethernet bus
- The scripts are executed and processed by the laser system
- Soldering is performed according to IPC 610 A and shows excellent penetration in the through-hole solder joint
- Testing and optimization were conducted in our own laser soldering laboratory
- Installation and integration with existing equipment carried out on site

Status quo
- The system has been running for 18 months
- No downtime and no need for repairs
Application example (3/5) – Rotary laser plastic welding

The newly developed rotary unit overcomes limitations of other laser systems

Radial laser plastic welding with a rotary laser head

Customer problem and requirements
A manufacturer needs to weld a plastic structure to an outer transparent surface:
- The existing laser plastic welding solution had to be replaced with an innovative rotary welding head
- Closed loop temperature control is required to optimize the process

Solution by Mergenthaler
- Standard 140W Mergenthaler diode laser LM140; standard laser head LH103; newly developed rotary unit
- Design, construction and manufacturing of the innovative rotary welding head was completed within 10 weeks
- The laser beam is guided by a rotary arm around the cylinder wall, hence avoiding having to move the workpiece
- Closed loop control is performed by the LPC04 LASCON controller
- Rotation speed and number of rotations required are defined by the controller software

Status quo
- The first units are currently being installed in the production facility
- The system will replace an existing ultrasonic welding system
Application example (4/5) – Laser plastic welding

The LASCON controller ensures optimal process speed and quality in laser plastic welding

Welding of connectors to fiber optical cables

Customer problem and requirements

Tier-1 automotive supplier needs plastic welding equipment to weld Polymer Optical Fibers cables (POF) to plastic connectors. POFs are used in automotive applications for media oriented system transport networks (MOST).

- Manufacturer needs **small sized system** for integration into assembly machine
- **Full process control** for shortest process time and best welding quality

Solution by Mergenthaler

- We delivered various laser components including:
  - Laser **processing heads**
  - Laser **systems**
  - LASCON closed loop controllers

Status quo

- Hundred of millions of connectors have been welded with the Mergenthaler equipment
- Worldwide installations in factories around the globe. In operation for almost 20 years at different customer sites
Application example (5/5) – Laser hardening

LASCON controls high power laser processes in job shops and industrial manufacturing around the world

Integration of LASCON into high-power robotic laser tools

Customer problem and requirements
Laser hardening and cladding are high-power laser processes for **large steel parts**, such as big tooth wheels or drill heads in the oil industry.

**Precise temperature control** is needed to achieve maximum hardness. Accuracy of the hardening process is especially important as **processed parts are very expensive** and cannot be easily replaced or repaired in case they fail.

Solution by Mergenthaler
- We are the **market leader in industrial temperature control** for these high power laser processes
- Special **two-color pyrometers** together with the unique **LASCON controller** enable optimal laser material processing

Status quo
- Global base of installations in production plants and scientific centers for almost 20 years
Services and after sales

Mergenthaler is your experienced advisor across all project phases

Development of manufacturing processes
We develop the complete laser production process in its own application labs.
As a customer, your receive explanatory videos and protocols and an estimate of the expected process capability.
We also offer inhouse presentations, tailored training, and test days.

Equipment setup on site
We support customers worldwide with the installation of the equipment and first ramp up of the process.

Calibration and maintenance
We offer periodical checks and maintenance of the equipment in production.
We verify and adjust calibration of pyrometers for our customers and issue the certification needed for ISO9000 compliance.

Training and process expertise
Mergenthaler’s customers benefit from comprehensive software and hardware training at their own facility.
We are also happy to provide our expertise on how to best integrate the company’s products into third-party machinery.