Closed-loop temperature control
High beam uniformity
Adjustable spotsize

MERGENTHALER
ultimate laser processing

Why laser assisted bonding (LAB)?

New packaging types has led to the development of 2 next generation packaing technologies, thermocompression bonding (TCB) and laser assisted bonding (LAB), to replace the established mass reflow (MR) process.

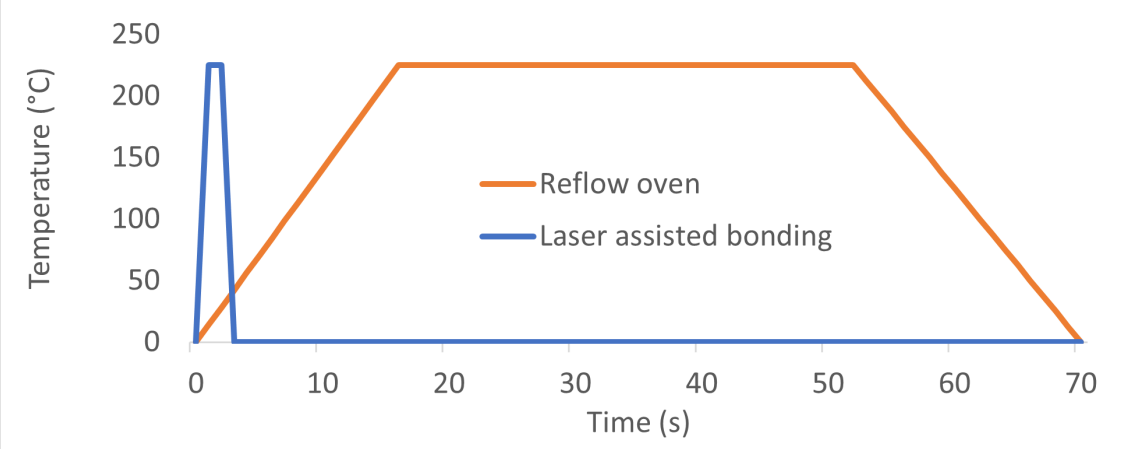
LAB offers several advantages compared to MR and TCB.

Firstly, higher productivity, due to its short and targeted heating process.

Secondly, lower energy costs, due to its more efficient heating process.

Thirdly, higher quality joints with less warpage and lower thermal stresses between die and substrate and no thermal stresses outside of the bonding interfaces. Its contactless temperature measurement and negligible thermal impact from bonding tool reduces risks of chip damage.

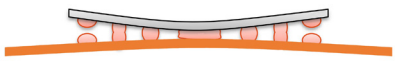
Lastly, it can use more substrate types allowing for finer pitch applications which is trend likely to continue as PCBs becomes increasingly dense.



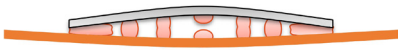
Scematic 1. Temperature profiles from reflow oven (MR) and laser assisted bonding (LAB) processes.

Exposing the whole wafer to a long heating process causes bending from high thermal stresses.

Mass reflow process (MR)



Schematic 2. Concave bending.



Schematic 3. Convex bending.

High thermal stresses results in bending which causes 3 types of poor quality solder joints.

Non-wet joints. Seen in schematic 2 edges and 3 middle.
Streched joints. Seen in schematic 2 and 3.
Bridge joints. Seen in schematic 2 middle and 3 edges.

Laser assisted bonding LAB)

Schematic 4. No bending.

Low thermal stresses results in healthy joints.

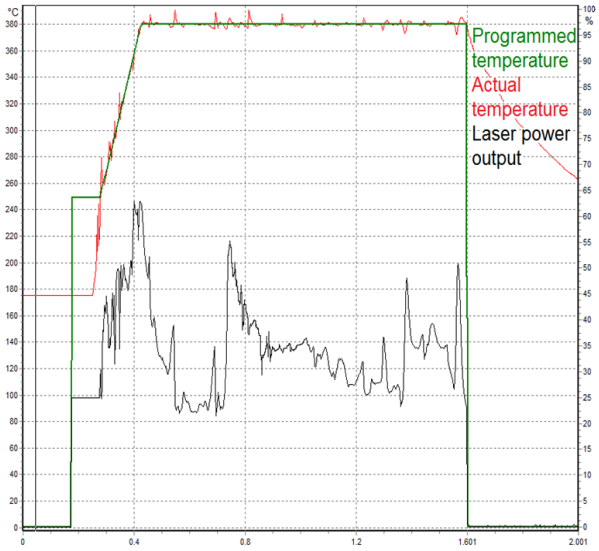
Why Mergenthaler laser bonding system?

Our laser bonding system offers 2 distinct advantages.

1. Temperature control

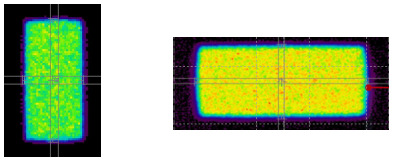
Lascon® controller is connected to the laser. It allows for fast, precise, and accurate material surface temperature control.

The image shows how our laser varies its power output in order to reach its pre-programmed temperature profile. In this case a stable 300 °C during 1.2s.

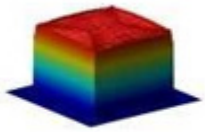


2. Uniform and shaped laser spot

We use a top hat beam profile with high beam uniformity. Sharp contours prevent damage to surrounding areas.



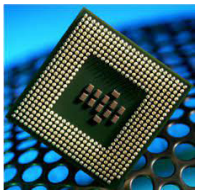
Rectangular beam profiles with highly uniform temperature

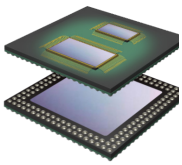


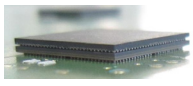
Top-hat beam profile

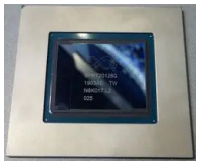
Common chips for LAB application

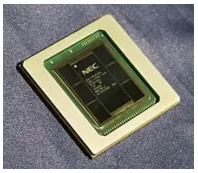
fcBGA | fcCSP | PoP | CoWoS | HBM | 2.5D

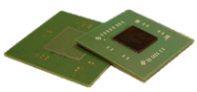




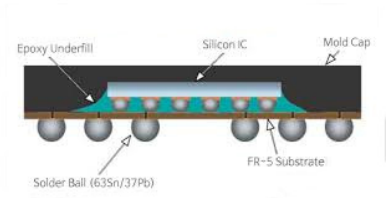


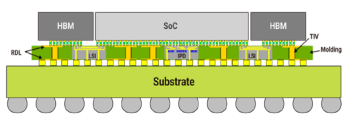


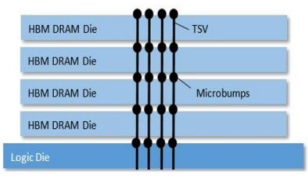


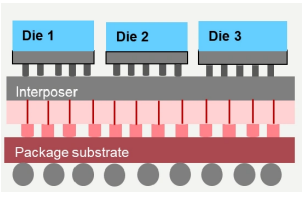


fcCSP | CoWoS | HBM | 2.5D



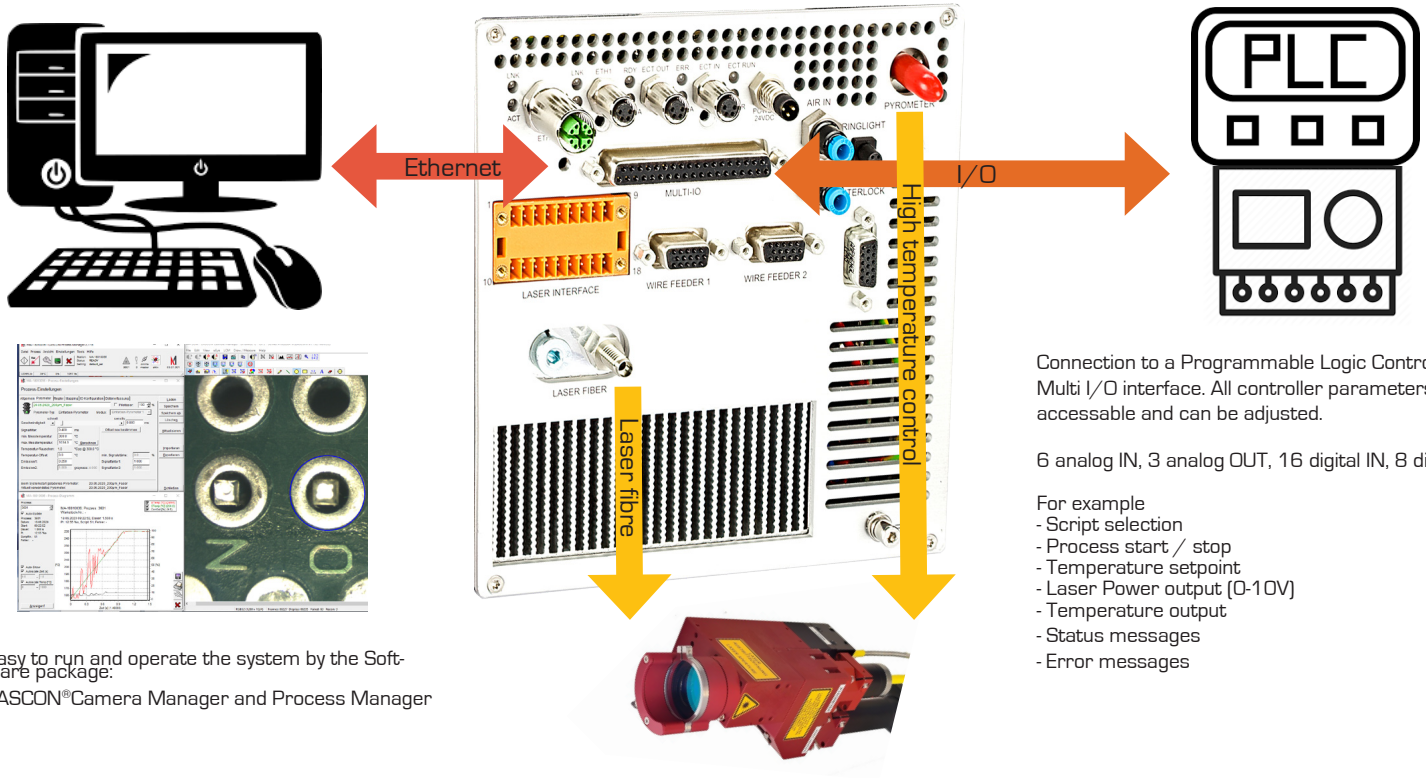






Setup schematic

Connections can be done alternatively or simultaniously



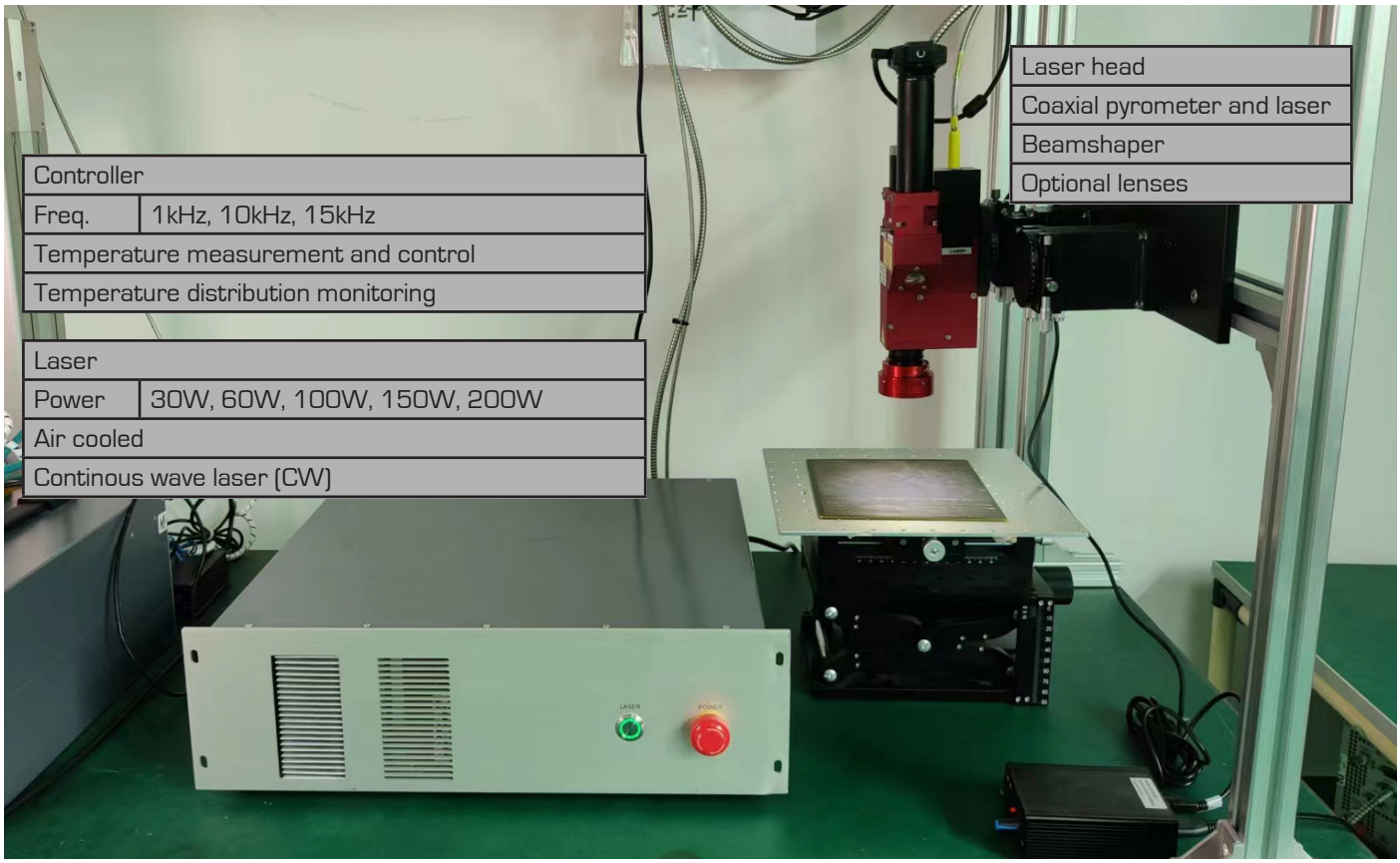
Easy to run and operate the system by the Soft-ware package:
LASCON®Camera Manager and Process Manager

Connection to a Programmable Logic Controller via Multi I/O interface. All controller parameters are accessable and can be adjusted.

6 analog IN, 3 analog OUT, 16 digital IN, 8 digital OUT

For example
- Script selection
- Process start / stop
- Temperature setpoint
- Laser Power output (0-10V)
- Temperature output
- Status messages
- Error messages

Setup

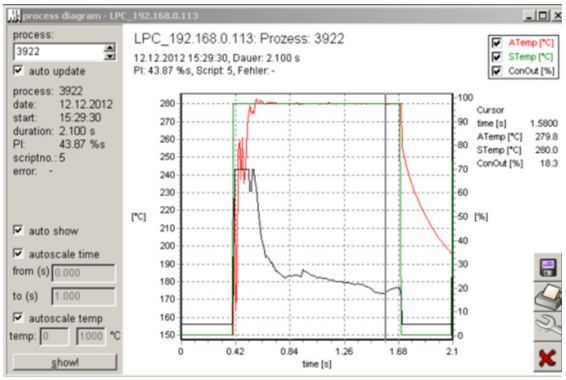


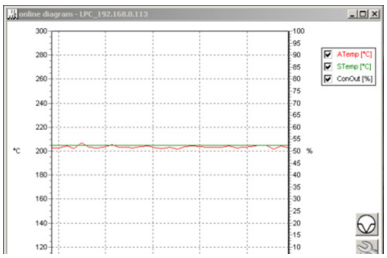
Controller	
Freq.	1kHz, 10kHz, 15kHz
Temperature measurement and control	
Temperature distribution monitoring	

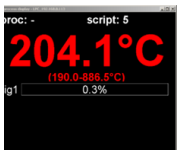
Laser	
Power	30W, 60W, 100W, 150W, 200W
Air cooled	
Continous wave laser (CW)	

Laser head
Coaxial pyrometer and laser
Beamshaper
Optional lenses

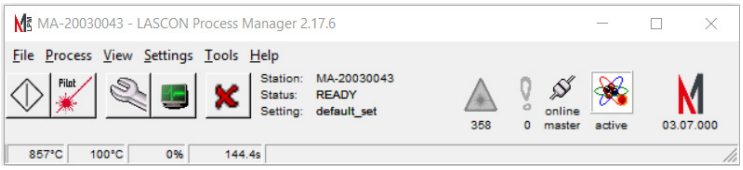
Software







Temperature Bandwidth Control



Process Manger Software (LPM)

Windows® operating system
Adjustment of all pyrometer and controller parameters
Providing variety of control commands and functions for script
Storage capacity up to 500.000 processes and 255 scripts
Process visualization, automatical data export in csv format
Free configuration of Multi I/O interface
Pyrometer calibration inside the application
Access rights management with password protection

Laser technical specifications

Laser power	W	30, 60, 100, 150, 200
Wavelength	nm	975
Pilot light		Yes
Numerical aperture		0.22
Fibre length	m	3, or 5 or customized
Connector		SMA905 or D80
Input voltage	V	200 - 240 (50 - 60 Hz)
Operating mode		Continuous wave (CW)
Dimensions (L×W×H)	mm	456 x 397 x 146
Weight	kg	10.5
Cooling method		air cooling
Working temperature	°C	15 - 30
Storage temperature	°C	5 - 50
Cooling requirements		10 cm open space around it
Laser safety class		DIN EN 60825-1, class 4

Lascon ® controller technical specifications

Temperature range	°C	100 - 2200
Spectral range	µm	1.65 - 2 / 1.65 - 2.5
Accuracy (e = 1, t90 = 1s, T=25 °C)		< 1500°C 0.3% ± 2K
Repeatability		0.1% ± 1K
Resolution	°C	0.1
Response time	ms	1
Emissivity		0.01 - 1
Analog output	V	0 - 10 (16Bit configurable using software)
Power supply		24V DC, max. 2A
Data storage		internal, 500.000 processes, 255 process control scripts
Optical fibre length	m	3, 5, or customized
Ambient temperature	°C	max 40
CE Label		According to EU directives for electromagnetic immunity
Conformity		RoHS Directive 2011/65/EU of 2011-06-08 with supplement from 2015-03-31 are fulfilled
Software		Includes LASCON® software
Position		Coaxial

Adaptive spot sizes

We offer three different laser head types based on your spotsize needs.

1. Fixed

This has a fixed spot size set during our internal calibration to match your needs. If you need to change the size it can be done by our team at our manufacturing site. Typical sizes are 1x1mm, 5x5mm, up to 30x30mm (maximum).

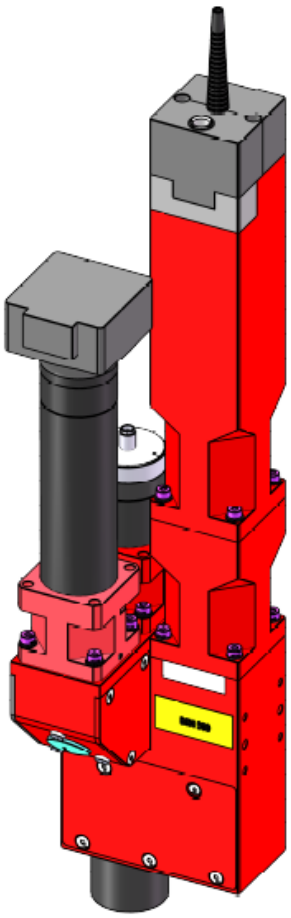
2. Zoom

This has an adjustable spot size allowing you to change both dimensions with the same ratio with up to 3x magnification. Typical sizes are 1x1mm to 3x3mm, 5x5mm to 15x15mm, 10x10mm to 30x30mm (maximum).

3. XY

This has an adjustable spot size allowing you to change both dimensions independently from one another. Either dimension can be increased by 3x. Typical sizes are 1x1mm to 1x3mm, 5x5mm to 5x15mm, 10x10mm to 10x30mm.

Fixed laser head



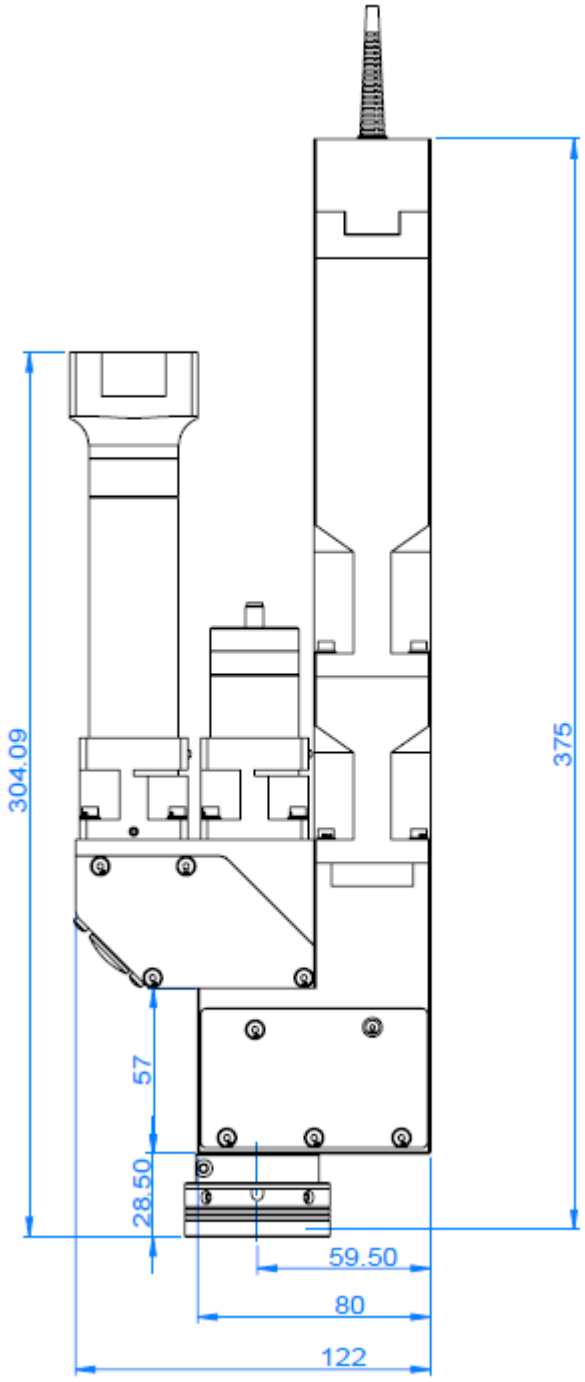
BSH500 fixed laserhead render

Fixed laser head technical specifications

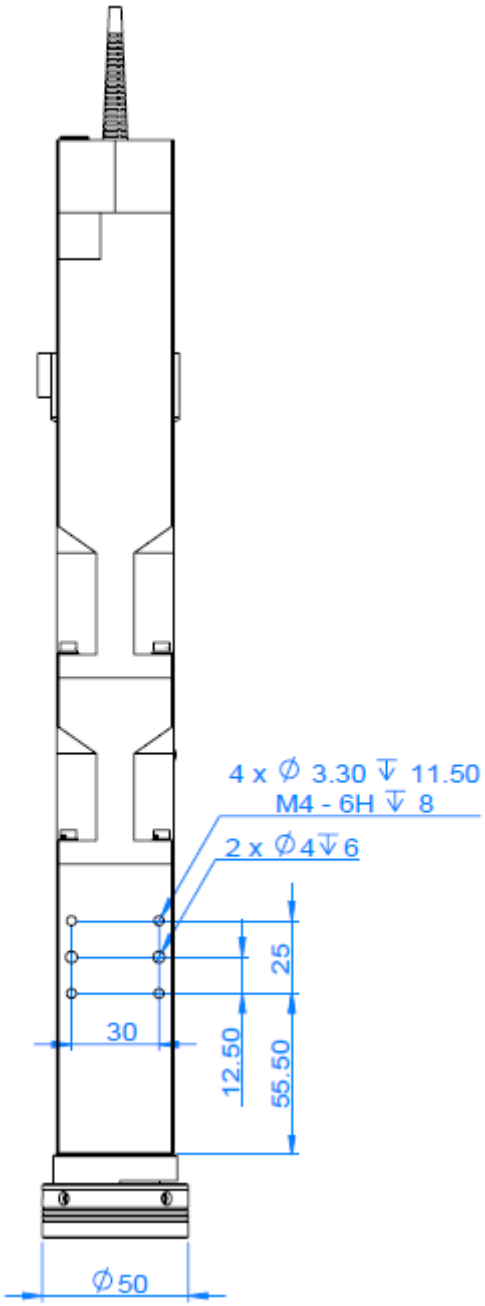
Power limit	W	500
Ambient temperature	°C	5-55 for operation, no condensation
Dimensions	mm	122 x 50 x 375
Weight	kg	5.5
Protection		IP50
CE Label		According to EU directives for electromagnetic immunity
Conformity		RoHS cirective 2011/65/EU of 2011-06-08 with supplement from 2015-03-31 are fulfilled.
Camera		USB2.0 1280x1024, coaxial with pyrometer and laser

Smallest dimension (X)	(Y)	Spot size
1	1	1 x 1mm
3	3	3 x 3mm
5	5	5 x 5mm
10	10	10 x 10mm
15	15	15 x 15mm
30	30	30 x 30mm

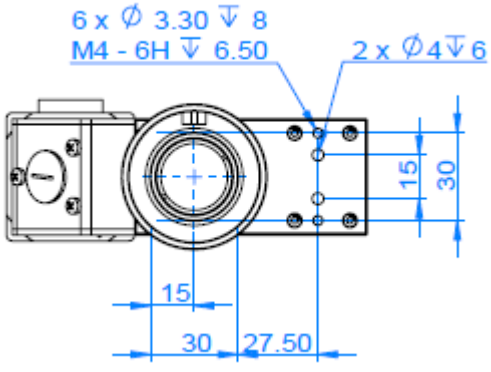
Fixed laser head dimensions



Fixed laserhead unit side view

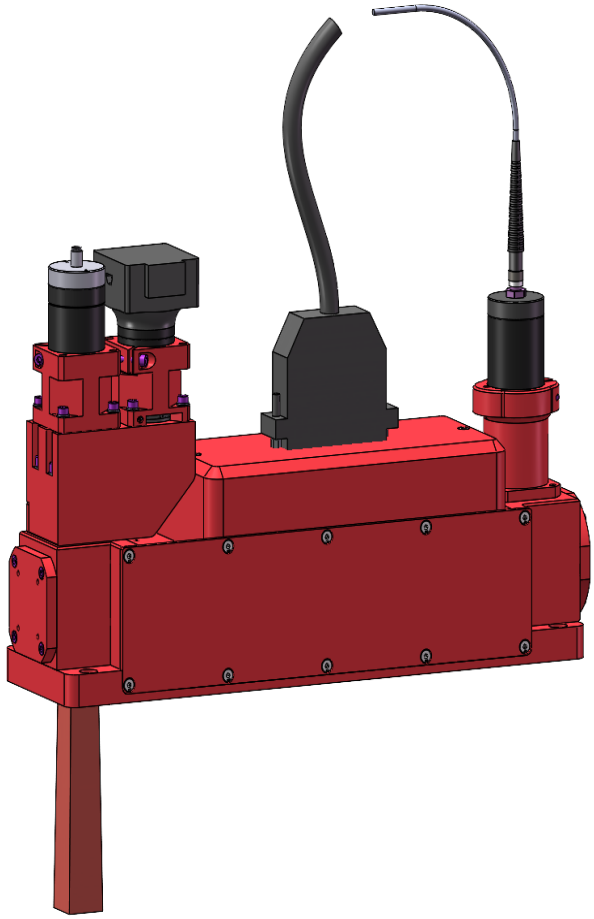


Fixed laserhead unit front view



Fixed laserhead unit top view

Zoom laser head



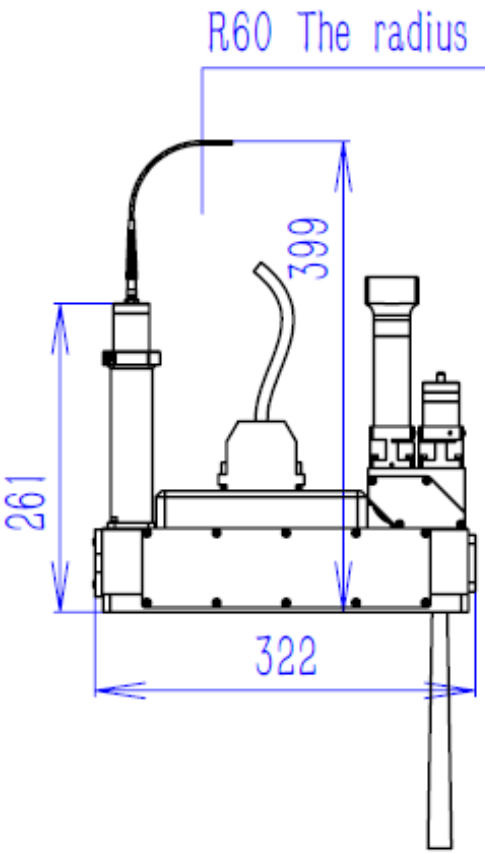
BSH500 Zoom laserhead render

Zoom laser head technical specifications

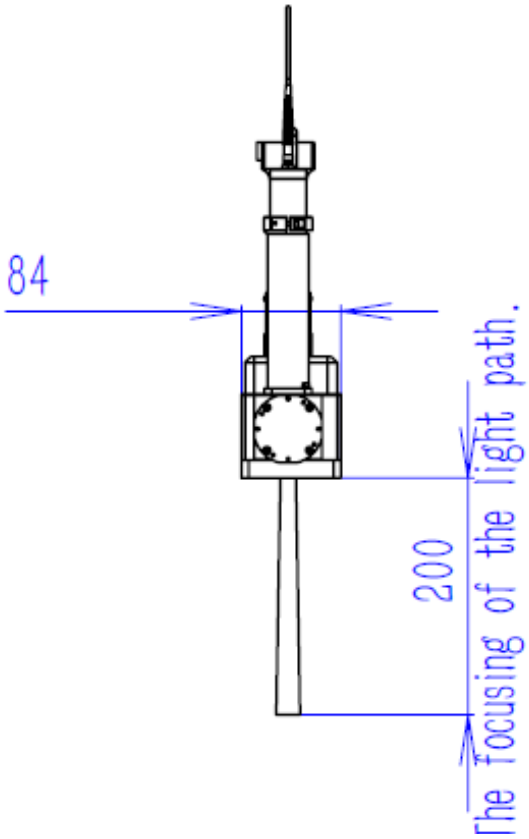
Power limit	W	500
Ambient temperature	°C	5-55 for operation, no condensation
Dimensions	mm	261 x 84 x 322
Weight	kg	5.5
Protection		IP50
CE Label		According to EU directives for electromagnetic immunity
Conformity		RoHS cirective 2011/65/EU of 2011-06-08 with supplement from 2015-03-31 are fulfilled.
Camera		USB2.0 1280x1024, coaxial with pyrometer and laser

Smallest dimension (X)	(Y min)	Spot size (min)	Y (max)	Spot size (max)
1	1	1 x 1mm	1 x 3 = 3	3 x 3mm
3	3	3 x 3mm	3 x 3 = 9	9 x 9mm
5	5	5 x 5mm	5 x 3 = 15	15 x 15mm
10	10	10 x 10mm	10 x 3 = 30	30 x 30mm

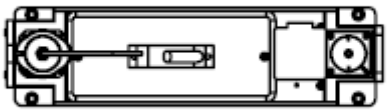
Zoom laser head dimensions



Zoom laserhead unit side view

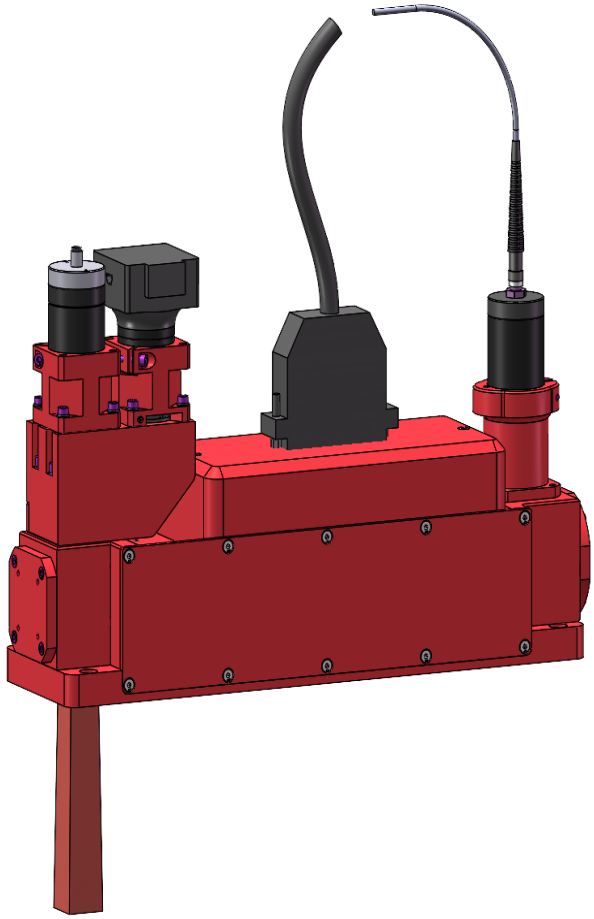


Zoom laserhead unit front view



Zoom laserhead unit top view

XY laser head

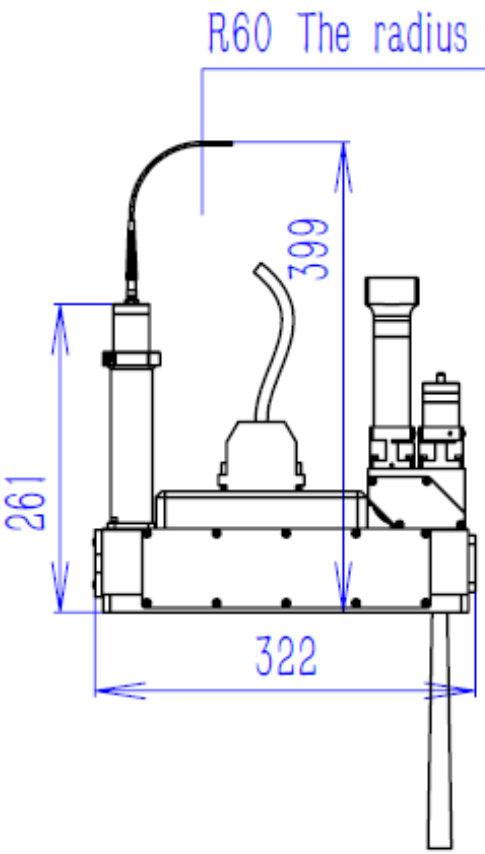


BSH500 XY laserhead render

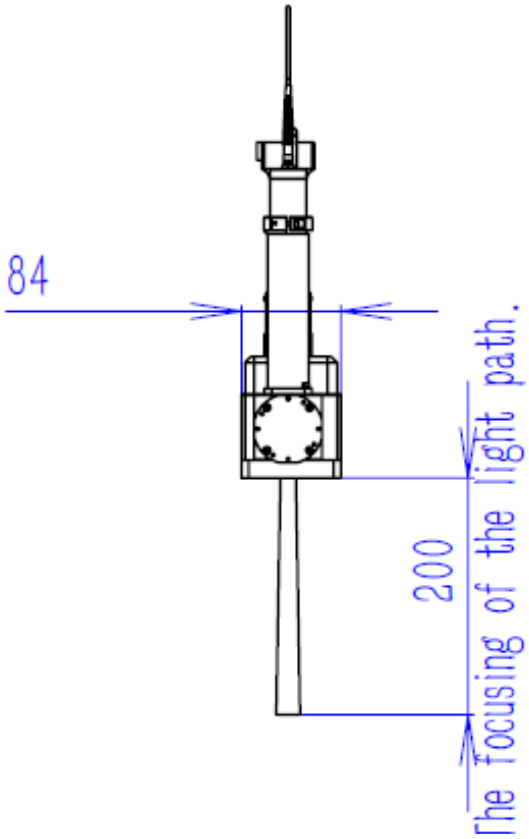
Zoom laser head technical specifications

Power limit	W	500
Ambient temperature	°C	5-55 for operation, no condensation
Dimensions	mm	261 x 84 x 322
Weight	kg	5.5
Protection		IP50
CE Label		According to EU directives for electromagnetic immunity
Conformity		RoHS cirective 2011/65/EU of 2011-06-08 with supplement from 2015-03-31 are fulfilled.
Camera		USB2.0 1280x1024, coaxial with pyrometer and laser

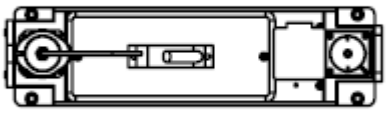
Smallest dimension (X)	(Y min)	Spot size (min)	(Y mid)	Spot size (mid)	Y (max)	Spot size (max)
1	1	1 x 1mm	1 x 2 = 2	1 x 2mm	1 x 3 = 3	1 x 3mm
3	3	3 x 3mm	3 x 2 = 6	3 x 6mm	3 x 3 = 9	3 x 9mm
5	5	5 x 5mm	5 x 2 = 10	5 x 10mm	5 x 3 = 15	5 x 15mm
10	10	10 x 10mm	10 x 2 = 20	10 x 20mm	10 x 3 = 30	10 x 30mm



Zoom laserhead unit side view

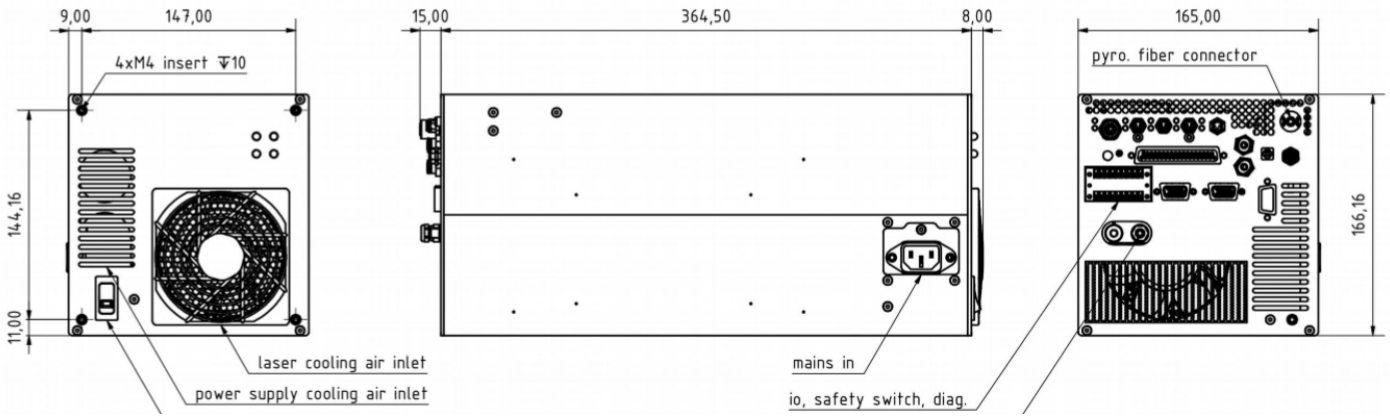


Zoom laserhead unit front view



Zoom laserhead unit top view

Dimensions



Laser unit front, side, back view drawings

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