



Inventor of Water Jet Laser

Industrial  
Applications



[www.synova.ch](http://www.synova.ch)

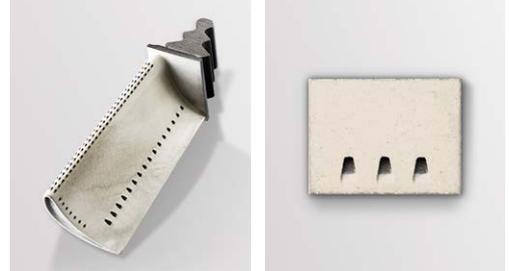


# Industries & Applications

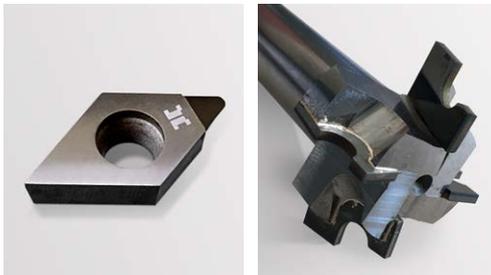


## Energy & Aerospace

Synova's Laser MicroJet (LMJ) systems offer hole-drilling and diffuser-machining solutions for the aerospace and power generation industries. Our 5-axis LCS 305 laser machining center and MCS machines are specifically designed for drilling precise cooling holes in hot section components of jet engines and gas turbines, e.g. blades and vanes with and without pre-coated thermal barrier film (TBC). They also cut ceramic-matrix composites (CMCs) smoothly and without thermal damage, micro-cracks and taper.



## Tool manufacturing



LMJ systems are able to cut any type of conductive and non-conductive hard material used for cutting tools ranging from tungsten carbides and ceramics to lab-grown diamond materials. The laser cutting systems with 3 axes are ideal for 2D cutting, drilling, grooving or slicing of PCD, SCD, PcBN or CVD diamond tool inserts, leaving smooth cutting surfaces and sharp edges. The 5-axis machines enable high-precision 3D ablation (shaping) for cutting multiple clearance angles and chamfering K-land edges.

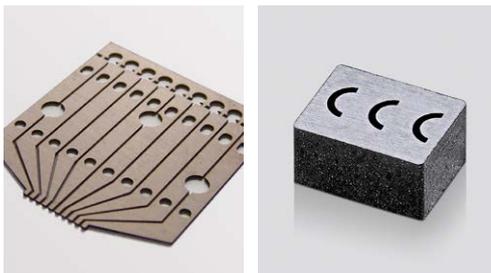


## Watchmaking

The cool and clean water jet guided LMJ technology is ideally suited for cutting thin metals such as brass or Durnico that are extremely susceptible to thermal effects but also new and challenging materials such as Phynox, silicon carbide (SiC) or Alumina. Synova's LCS machines with 3 or 5 axes cut watch movement components and decorative parts with the accuracy and quality required for the watch industry: free of mechanical stress, heat damage and with low roughness.



## Micro-machining



LMJ machines are flexible cutting systems that can process small and complex structures where conventional methods reach their limits. They can cut a wide range of materials, including titanium, ceramics and superalloys for various industries (medical, automotive, textile, electronics, consumer goods).

# Machine Solutions

## LCS Series

2-, 3- or 4-axis



General Specifications*	LCS 150	LCS 303	LCS 800
<b>Axes</b>			
Working volume (W x D x H) (with vision control)	125 x 200 x 100 mm	300 x 300 x 100 mm	690 x 630 x 100 mm
Linear axis XY	Linear motor	Linear motor	Linear motor
Maximum stroke (X, Y, Z)	200 x 200 x 100 mm	560 x 400 x 100 mm	820 x 630 x 100 mm
Accuracy (X,Y) (after compensation)	+/- 3 µm	+/- 5 µm	+/- 8 µm
Repeatability (X,Y)	+/- 2 µm	+/- 3 µm	+/- 5 µm
Maximum XY speed	1000 mm/s	1000 mm/s	1000 mm/s
Acceleration (X,Y)	1 G	1 G	1 G
CNC control (Bosch-Rexroth)	2-, 3- or 4-axis	3- or 4-axis	3-axis
<b>Laser</b>			
Laser type	DPSS Nd: YAG, pulsed	DPSS Nd: YAG, pulsed	DPSS Nd: YAG, pulsed
Wavelength	532 nm	532 nm	532 nm
Power	20-200 W	50-400 W	50-400 W
<b>Water Jet</b>			
Nozzle diameter	25-80 µm	25-80 µm	30-100 µm
<b>Dimensions/Weight</b>			
Dimensions (machine) (W x D x H)	1050 x 1350 x 1880 mm	1500 x 1100 x 2430 mm	1960 x 1650 x 2000 mm
Dimensions (utilities cabinet) (W x D x H)	700 x 2300 x 1600 mm	700 x 2300 x 1600 mm	700 x 2300 x 1600 mm
Weight (machine)	1400 kg	2000 kg	3500 kg
Weight (utilities cabinet)	700-750 kg	700-750 kg	700-750 kg
<b>Options/Functions</b>			
	<ul style="list-style-type: none"> <li>• Rotary axis</li> <li>• Z-axis with automatic jet angle correction</li> <li>• High-transmission head for high power applications</li> <li>• Vision + Pattern recognition software</li> <li>• CAD CAM software</li> <li>• Breakthrough detection</li> <li>• Jet protection system</li> <li>• Chiller for laser</li> <li>• Chuck with vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Rotary axis</li> <li>• Automatic laser-nozzle alignment</li> <li>• Automatic jet angle correction</li> <li>• Vision + Pattern recognition software</li> <li>• CAD CAM software</li> <li>• Breakthrough detection</li> <li>• Positioning sensor</li> <li>• Jet protection system</li> <li>• Jet stability sensor</li> <li>• Integrated power meter</li> <li>• Chiller for laser</li> <li>• Chuck with vacuum</li> </ul>	<ul style="list-style-type: none"> <li>• Automatic laser-nozzle alignment</li> <li>• Automatic jet angle correction</li> <li>• Vision + Pattern recognition software</li> <li>• CAD CAM software</li> <li>• Breakthrough detection</li> <li>• Positioning sensor</li> <li>• Jet protection system</li> <li>• Jet stability sensor</li> <li>• Integrated power meter</li> <li>• Chiller for laser</li> <li>• Chuck with vacuum</li> </ul>

\* The specifications are subject to change without notice due to technical changes.

# LCS Series

5-axis



General Specifications*	LCS 50	LCS 305
<b>Axes</b>		
Working volume (with vision control)	50 x 50 x 50 (W x D x H)	 260 x 130 mm (H x Ø)
Linear axis XY	Linear motor	Linear motor
Linear axis Z	Ball screw + AC motor	Linear motor
Rotary axis B	-12° to 102°, Torque motor	-
Rotary axis A	-	-20° to 135°, Torque motor
Rotary axis C	N x 360°, Torque motor	N x 360°, Torque motor
Maximum stroke (X,Y,Z)	250 x 60 x 100 mm	500 x 380 x 380 mm
Accuracy (X,Y) (after compensation)	+/- 3 µm	+/- 5 µm
Repeatability (X,Y)	+/- 1 µm	+/- 2 µm
Maximum XY speed	1000 (X) / 300 (Y) mm/s	1000 mm/s
Maximum Z speed	300 mm/s	300 mm/s
Maximum B/A speed	200 RPM	200 RPM
Maximum C speed	1200 RPM	500 RPM
Acceleration (X,Y)	1 G	1 G
CNC control (Bosch-Rexroth)	5-axis	5-axis
<b>Laser</b>		
Laser type	DPSS Nd: YAG, pulsed	DPSS Nd: YAG, pulsed
Wavelength	532 nm	532 nm
Average power	20-200 W	50-400 W
<b>Water Jet</b>		
Nozzle diameter	25-60 µm	30-100 µm
<b>Dimensions/Weight</b>		
Dimensions (machine) (W x D x H)	800 x 1200 x 1650 mm	1800 x 1950 x 2610 mm
Dimensions (utilities cabinet) (W x D x H)	700 x 2300 x 1600 mm	700 x 2300 x 1600 mm
Weight (machine)	750 kg	5500 kg
Weight (utilities cabinet)	700-750 kg	700-750 kg
<b>Options/Functions</b>		
	<ul style="list-style-type: none"> <li>• Automatic jet angle correction</li> <li>• CAD CAM software</li> <li>• Breakthrough detection</li> <li>• Positioning sensor</li> <li>• Jet protection system</li> <li>• Touchprobe</li> </ul>	<ul style="list-style-type: none"> <li>• Automatic laser-nozzle alignment</li> <li>• Automatic jet angle correction</li> <li>• Vision + Pattern recognition software</li> <li>• CAD CAM software</li> <li>• Breakthrough detection</li> <li>• Positioning sensor</li> <li>• Jet protection system</li> <li>• Jet stability sensor</li> <li>• Integrated power meter</li> <li>• Chiller for laser</li> </ul>
	<b>LCS 50 also available as 3-axis machine</b>	

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# MCS & XLS Series

3- or 5-axis



General Specifications*	MCS 300	MCS 500	XLS 1005
<b>Axes</b>			
Working volume (with vision control)	400 x 300 x 200 mm (W x D x H)	500 x 400 x 500 mm (W x D x H)	 700 x 800 mm (H x Ø)
Linear axis (X,Y)	Linear motor	Linear motor	Ball screw + AC motor (Optional: Linear motor)
Linear axis (Z)	Servo motor	Servo motor	Ball screw + AC motor
B axis	360° (Rotation, optional)	-100° to 50° (Tilt)	-110° to 110° (Tilt)
C axis	-	360° (Rotation)	-225° to 225° (Tilt)
Maximum stroke (X, Y, Z)	480 x 310 x 210 mm	760 x 400 x 500 mm	1000 x 1200 x 750 mm
Accuracy (positioning) (X, Y)	+/- 1 µm	+/- 1.5 µm	+/- 10 µm
Repeatability (X, Y)	+/- 1 µm	+/- 1 µm	n/a
Maximum XY speed	1000 mm/s	1000 mm/s	750 mm/s
Acceleration (linear)	1 G	0.4 G	0.5 G
CNC control (MCS: Mitsubishi, XLS: Siemens)	3-axis or 3+1-axis	3+2-axis/5-axis	5-axis
<b>Laser</b>			
Laser type	DPSS Nd:YAG, pulsed	DPSS Nd:YAG, pulsed	DPSS Nd:YAG, pulsed
Wavelength	532 nm	532 nm	532 nm
Maximum power	100 W	200 W	200/400 W
<b>Water Jet</b>			
Nozzle diameter	30-100 µm	50-100 µm	60-100 µm
<b>Dimensions/Weight (incl. peripheral equipments for MCS)</b>			
Dimensions machine (W x D x H)	2140 x 4300 x 2000 mm	2340 x 3440 x 2750 mm	2450 x 3450 x 3500 mm
Dimensions utilities cabinet (W x D x H)			700 x 2300 x 1600 mm
Weight (machine)	4100 kg	4400 kg	8000-9000 kg
Weight (utilities cabinet)			700-750 kg
<b>Options</b>	<ul style="list-style-type: none"> <li>Air dryer</li> <li>Air booster</li> <li>Mist collector</li> <li>Power meter</li> <li>Pulse monitoring</li> <li>Jet angle correction</li> <li>Transformer 400 V</li> </ul>	<ul style="list-style-type: none"> <li>Automatic calibration and alignment</li> <li>Air dryer</li> <li>Air booster</li> <li>Mist collector</li> <li>Power meter</li> <li>Touch probe</li> <li>Pulse monitoring</li> <li>Breakthrough detection</li> <li>Back-strike control</li> <li>Transformer 400V</li> <li>Chiller for laser</li> </ul>	<ul style="list-style-type: none"> <li>Automatic calibration and alignment</li> <li>Mist collector</li> <li>Power meter</li> <li>Touch probe</li> <li>Pulse monitoring</li> <li>Chiller for laser</li> <li>C2 axis (6th axis), rotating the work piece (N x 360°)</li> <li>CAD CAM software</li> <li>Hand control device</li> </ul>

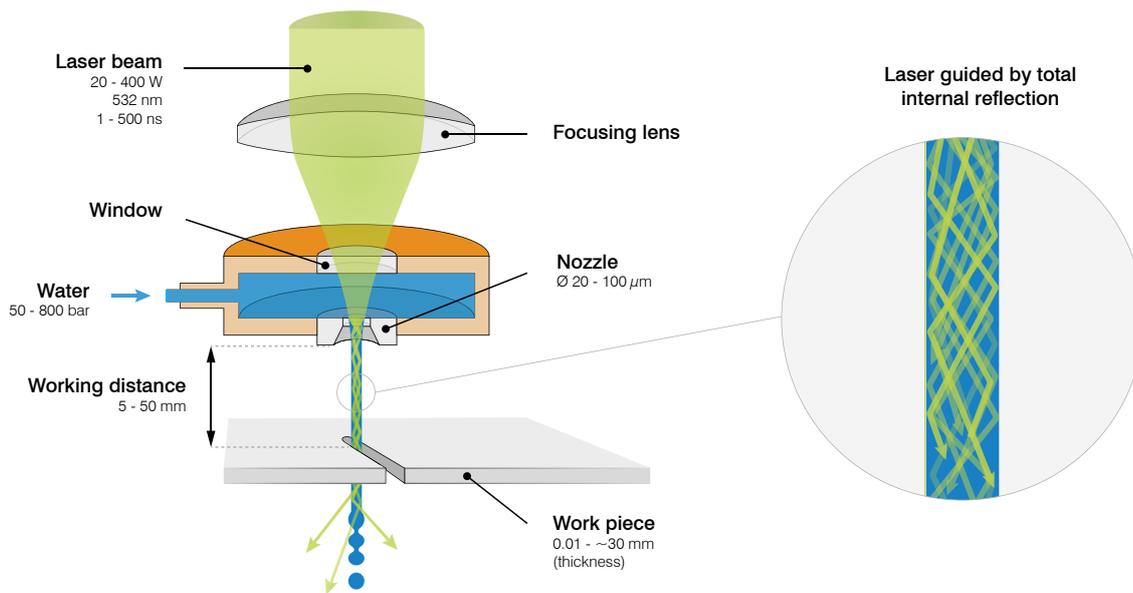
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# Laser MicroJet® Technology

The water jet guided laser is an advanced cutting technology, which combines the cooling and large working distance advantages of the water jet with the precision and speed of conventional dry laser cutting.

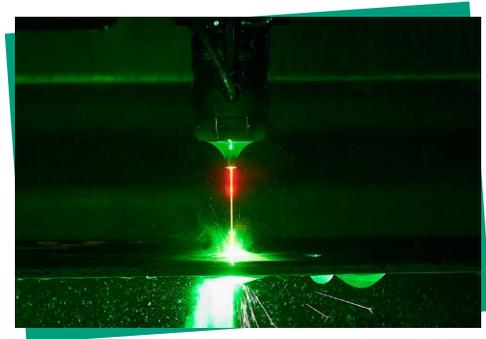
## How does the LMJ work?

The Laser MicroJet (LMJ) combines a laser with a “hair-thin” water jet that precisely guides the laser beam by means of total internal reflection in a manner similar to conventional optical fibers. The water jet continually cools the work piece during laser ablation and efficiently removes debris, leaving a clean cutting surface.



## What are the advantages?

As a “cold, clean and controlled laser”, Synova’s LMJ technology resolves the significant problems associated with dry lasers such as thermal damage, oxidation, micro-cracks, burrs, particle deposition and taper.



## Materials that can be machined:

**Metals:** Superalloys, stainless steel, aluminium, copper, brass, gold, Durnico, Phynox, CuBe, shape-memory alloys, titanium, nickel etc.

**Superhard materials:** Polycrystalline CBN (PcBN), polycrystalline diamond (PCD), single crystalline diamond (SCD), CVD diamond, natural diamond, tungsten carbide (WC)

**Ceramics:** Ceramic-matrix composites (CMCs), silicon carbide (SiC), silicon nitride (SiN), zirconia (ZrO<sub>2</sub>), HTCC/LTCC, aluminium nitride (AlN), aluminium oxide (Al<sub>2</sub>O<sub>3</sub>)

**Composites:** Carbon fiber reinforced polymer (CFRP)

# Custom Automation

Synova's Laser MicroJet machines can be equipped with several different automation types in order to enable work in automatic mode.



## Automatic feed

The collaborative robot is used for automatic loading and unloading of small parts such as rough diamonds for the jewelry industry and components in the watchmaking, micromachining or tooling industries. The robot grips the workpiece and moves it inside the machine for laser processing. The workpiece is then automatically removed again, put back and a new part is taken.

## Bowl feeder

System that presents parts one-by-one, oriented in a particular direction to machine for further processing. Vibratory bowl feeders are often found in the automotive or electronics industries.



## Robot/Automated line

Our machines also interface with robots on rails. A robotic arm runs on a linear motion track tending multiple machines. It performs several tasks such as transporting and positioning work pieces. These automated lines are employed in various industries to run 24/7 and increase productivity, as for example, in the aviation industry.

# Water Jet Guided Laser Systems With Micron Precision

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