Metal Cutting System
Powered by Synova Laser MicroJet® & Makino

Cool Laser Machining

www.synova.ch
Advanced Laser Cutting Systems

The MCS family of machines integrates Synova’s cutting edge Laser MicroJet® (LMJ) technology with a Makino-based platform. The 3-axis MCS 300 with optional rotary axis enables high-precision metal and hard material machining such as cutting, drilling or grooving.

The MCS 500 with five simultaneous axes is specifically designed for 3D machining needs and drilling of cooling holes in hot section components of industrial gas turbines and jet engines. A wide range of materials such as super-alloys with thermal-barrier coating can be processed in one simple step, without cracks or delamination in the ceramic coating and extremely low recast in the metal structure.

Thanks to built-in subsystems such as laser generation and water treatment, the overall LMJ system footprint is considerably reduced. The running costs of the LMJ systems are low since there is no tool wear, few consumables and low waste rates.

Synova Laser MicroJet® Technology

The Laser MicroJet® is a hybrid method of machining, which 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 cutting zone and efficiently removes debris.

As a “cold, clean and controlled laser”, Synova’s LMJ technology resolves the significant problems associated with dry lasers such as thermal damage, debris deposition, taper and lack of accuracy.

Materials & Operations

**Metals:** Super-alloys, stainless steel, aluminum, copper, nickel, titanium etc.

**Hard materials:** Ceramics, polycrystalline CBN (PcBN), polycrystalline diamonds (PCD), monocrystalline diamonds (MCD), CVD diamonds, tungsten carbide (WC)

**Ceramic-matrix composites (CMCs):** Carbon, alumina, silicon carbide

**Operations:**
- **MCS 300:** Cutting, drilling, grooving, shaping in 3 axes, trenching, milling, dicing, engraving, profiling
- **MCS 500:** Cutting, drilling, grooving, shaping in 3 and 5 axes, trenching, milling, dicing, engraving, profiling
Key Benefits

**Fast and Accurate**
- Hole-drilling in 8 mm thick super-alloy (0.76 mm Ø) in 70 sec.
- High mechanical precision with a tolerance of +/- 1.5 µm (very small kerf width down to 30 µm)
- High aspect ratio in hole-drilling (up to 1:20)

**Cool and Clean**
- Virtually no heat impact thanks to water jet cooling capability
- Clean surfaces, no depositions or burrs
- Cylindrical beam resulting in perfectly parallel kerfs and drilled holes

**User-friendly**
- No laser focusing or distance control required
- No need of resin or protective layers
- No or very little post treatment necessary

Main Industries and Applications

- **Energy**
  Hole-drilling of industrial gas turbines (Super-alloys)

- **Aerospace/ Aviation**
  Hole-drilling of jet engine components (Super-alloys)

- **Tool Making**
  2D & 3D machining of inserts (Hard materials)

- **Automotive**
  Machining of automotive parts (Metals)

- **Micro-Machining**
  Cutting of high-precision parts (Sensitive materials)
### General Specifications

<table>
<thead>
<tr>
<th>Axes</th>
<th>MCS 300</th>
<th>MCS 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working volume</td>
<td>400 x 300 x 200</td>
<td>500 x 400 x 500</td>
</tr>
<tr>
<td>B axis</td>
<td>360° (Rotation, optional)</td>
<td>-100° to 50° (Tilt)</td>
</tr>
<tr>
<td>C axis</td>
<td>360° (Rotation)</td>
<td>-</td>
</tr>
<tr>
<td>Drive</td>
<td>Linear/ Servo</td>
<td>Linear/ Servo</td>
</tr>
<tr>
<td>Maximum stroke</td>
<td>480 x 310 x 210</td>
<td>760 x 400 x 500</td>
</tr>
<tr>
<td>Accuracy (positioning)</td>
<td>+/- 1</td>
<td>+/- 1.5</td>
</tr>
<tr>
<td>Repeatability</td>
<td>+/- 1</td>
<td>+/- 1</td>
</tr>
<tr>
<td>Maximum XY speed</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Acceleration (linear)</td>
<td>G</td>
<td>0.4</td>
</tr>
<tr>
<td>CNC control (Mitsubishi)</td>
<td>3-axis or 3+1-axis</td>
<td>3+2-axis/ 5-axis</td>
</tr>
</tbody>
</table>

### Laser

<table>
<thead>
<tr>
<th>Laser type</th>
<th>Diode pumped solid state Nd:YAG, pulsed</th>
<th>Diode pumped solid state Nd:YAG, pulsed</th>
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<tbody>
<tr>
<td>Wavelength</td>
<td>532 (1064)</td>
<td>532</td>
</tr>
<tr>
<td>Maximum power</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Beam transmission (optical fibre)</td>
<td>150/ 200</td>
<td>200</td>
</tr>
</tbody>
</table>

### Water Pump

| Water consumption | l/ h (average) | 10 | 10 |
| Water pressure | bar (max.) | 500 | 500 |
| Jet nozzle diameter | µm | 30-120 | 50-100 |

### Utilities

| Electrical power | V | AC 200 | AC 200 |
| Power consumption | kVA (max.) | 12 | 12 |
| Compressed air, oil free | bar | 7-8 | 7-8 |

### Dimensions/ Weight (incl. peripheral equipments)

| Dimensions | mm (W x D x H) | 2140 x 4300 x 2000 | 2340 x 3440 x 2750 |
| Weight | kg | 4100 | 4400 |

### Options

- Air dryer, air booster, mist collector, signal tower, compensator, power meter, oscilloscope, vision measurement system, manual jet angle correction
- Chiller for laser, transformer, mist collector, air dryer, air booster, power meter, vision measurement system, touch probe, oscilloscope, breakthrough detection, backstrike protection, manual jet angle correction, signal tower

The specifications are subject to change without notice due to technical changes. The MCS machines incorporate the worldwide patented technology of water jet guided laser, invented at the Swiss Federal Institute of Technology in Lausanne, Switzerland. These machines conform to CE regulations.

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