Passion for Precision

**GF Machining Solutions: all about you**
When all you need is everything, it’s good to know that there is one company that you can count on to deliver complete solutions and services. From world-class electrical discharge machines (EDM), Laser texturing and Additive Manufacturing through to first-class Milling and Spindles, Tooling, Automation and software systems — all backed by unrivalled customer service and support — we, through our AgieCharmilles, Microlution, Mikron Mill, Liechti, Step-Tec and System 3R technologies, help you raise your game and increase your competitive edge.

We are Mikron Mill.
We are GF Machining Solutions.
The Mikron MILL S 200 U has been designed for the highest precision and surface quality. These vertical high-speed machining centers are therefore offered for both tool and mold-making and the production of high-quality parts. They incorporate the full technical competence of the Swiss machine manufacturer.

GF Machining Solutions
Applications

Complex parts
Various materials
Watch-making industry / micro mechanics
+ Form and position accuracy
+ Extremely small geometries
+ Part-specific handling systems

Electrodes
Tungsten-copper / graphite
Tool and mold-making
+ Surface quality
+ Dimensional accuracy
+ Very small geometric features

Prostheses and implants
Titanium / CoCr
Medical technology
+ Powerful torque
+ 5-axis simultaneous machining
+ Perfect surfaces and working accuracy

Fluidics
Aluminum
Automobile industry
+ 5-axis simultaneous machining
+ Shortest machining time
+ Excellent surface quality

Reflectors
Powder-metallurgical tool steel
Tool and mold-making
+ 5-axis machining
+ Specular surface quality
Highlights

Precision and quality for tool-and mold-making, as well as exact parts production

Mikron MILL S 200 U

- Table design as 5 axes
- Robust tool spindle with 50,000 rpm
- Minimal distance from laser to workpiece
- Machine hood for thermal and acoustic insulation
- Tool magazine with 30/60/140 tools
- Suction
- High-performance machine control
- Automatic table clamping chuck with optional media feedthrough
- Chip tray
- Machine base made of polymer concrete with 3-point assembly

+ APS (Advanced Process System)
+ PFP (Power Fail Protection)
+ ITC (Intelligent Thermal Control)
+ OSS (Operator Support System)
+ RNS (Remote Notification System)
For uncompromising demands. Dynamics and precision brought together in one unit.

Short power flow, short tolerance chain
With high-speed milling machines, most important pre-requisites for very high precision and surface quality are damping and the stability of the machine structure. The revolutionary axis concept of the Mikron MILL S 200 U therefore consists of the following:

- Polymer concrete machine base with strong damping properties and heavy static weight
- Optimized force application and transmission within a slide construction
- Linear axes with recirculating roller guides 35 mm wide (X, Y, and Z axes)
- High dynamic rigidity of the linear direct drives

- Water-cooled direct drives in all axes: X, Y, Z, B, C
- Highly compact and extremely rigid axis assembly made of steel with thermal conductivity and expansion behavior
- All guides above the machining area
- Suction openings for graphite
- Chip drawer

Ergonomics
The spacious work area door enables the quick changing of externally equipped workpieces.

Chip management
Machining chips fall into the central chip shaft below the machining table. With low chip volumes, chips are caught in a chip drawer. With high chip volumes, the chips are discharged via an external system together with the cooling lubricant.

Dust management
Machining dust is sucked away centrally below the machining point. Two suction shafts integrated into the machine bed enable a generously proportioned suction cross section.
Heidenhain TNC 640 control

Optimal machining efficiency is at your fingertip

The Heidenhain TNC 640 control provides flexibility and efficiency from job preparation until part is milled. Mounted on a pivot arm to give more operator’s accessibility, the touchable screen allows the operator to quickly navigate through the control. Thanks to an user-friendly and practical interface in combination with several functionalities, the Heidenhain TNC 640 support operators in their daily job giving to them more availability for other tasks.

AMC (Automated Machine Calibration)

Higher precision from the beginning

AMC

Every MILL S 5 axis machine is featuring the new Automated Machine Calibration (AMC). This new calibration tool comes with the complete Calibration Hardware on a pallet and allows calibrating at any time the kinematic of the machine. Program it or release it manually simply by pressing the start button. Beside the machine kinematic, it will also automatically calibrate touch probe and tool measuring system when needed.
smart machine

Enhance your process beyond program and machine setup

The smart machine functionalities gathers a range of modules that offers various features in order to make the Milling process “intelligent.”

Each of the modules fulfills a specific task. Just like in a construction kit, the user can select the modules that seem to him to be the best option for improving his process.

+ Produce your workpieces in a process-secure and precise manner
+ Increase reliability in unmanned operation
+ Boost the service life of the machine
+ Significantly reduce production costs

Saving energy
smart machine modules like Econowatt, saving up to 50% energy, are ecological necessities with attractive economic advantages.

Time
smart machine modules like OSS and software tools such as rConnect boost your productivity. OSS extreme yields up to 24 % more speed with improved surface finish and accuracy.

Precision
smart machine modules like ITC and OSS support the precise base of your machining center to achieve an even more precise final part.

Protection
smart machine modules like PFP protect and extend the lifetime of your machine and tools.

With the new smart machine package for 5 axis machines GF Machining Solutions combines some of the most powerful smart machine modules for your targeted applications and market needs. This tuning package will support you to get the best out of your machines according to your customer base.

For the 5 axis machines the included AMC extended corrects beside any position errors of the 4th and 5th axis also the angle errors of the swivel and rotary axis.

smart machine classic package

Find your market and tune your machine accordingly
**Table variants**

**As flexible as required**

**Fully automatic production of small batches**
Avoid unproductive periods during the production of small batches through:
- Automated changing of pallets or pallet-bound, part-specific zero point clamping systems
- Automated changing of customer-specific individual parts through the employment of part-specific, zero point clamping systems

**A solution for all automation projects**
Wide selection of simple or complex pallet designs:
- System 3R GPS 120
- System 3R GPS 120 with up to 4 additional media on the pallet surface (can be activated via the M function and the pressure adjusted variably via the cycle, e.g. for System 3R TwistLock)

**Automatic zero-point clamping system for pallets**

GPS 120

**Options for automatic zero-point clamping systems for customized parts**

GPS 120 with 4× media  
System 3R TwistLock  
Watch plates

Automatically changeable collets  
Automatically changeable expanding mandrel
Precision

Core components: Static and dynamic precision

Static precision

Swiss thoroughness
Prior to delivery, each Mikron MILL S machine undergoes a comprehensive quality inspection in our air-conditioned assembly hall according to GF Machining Solutions acceptance guidelines.

Dynamic precision

Position sensor systems
All Mikron MILL S 200 U machines are equipped with direct position sensor systems in the linear and rotary axes as standard.

+ Resolution in the nanometer range
+ Protected by sealing air
Precision

Core components: Thermal precision and component precision

**Thermal precision**

**Cooling concept and reserve capacity**

The Mikron MILL S 200 U leads precision machining into a new era. Sophisticated cooling management for heat discharge of the electrical drive groups.

All linear axes and the circular-swivel unit feature a separate cooling circuit.

![Five separate cooling circuits for the motors of the drives in the X, Y, Z, B/C axes, and the spindle motor.](image1)

**Component precision**

**Micro machining made easy**

The workpiece and tool measuring systems are especially suited for micro machining.

- Low tactile forces allow for damagefree and highly precise measurement of geometric features
- Precision laser optics for highly precise measurement of very small tool diameters

![Low tactile forces and high temperature stability – 0.8 N of tactile force in the Z direction on thermo lock interface (hexagon / m&h)](image2)

![Precise measurement of very small tool diameters from 25 μm to 20 mm](image3)

Primary and secondary part mounted on a large cooling plate.
With the Mikron MILL S 200 U, automatic production is ensured by the low-cost integration of the pallet magazine.

+ Repetitive machining is executed without interruption in multi-shift operation
+ The machine’s efficiency is increased with an accordingly higher profit
+ System 3R GPS 120 14 pallets
+ System 3R MacroMagnum 12 pallets
+ System 3R Macro 70 20 pallets
+ System 3R Macro 54 20 pallets
+ Erowa ITS 148 12 pallets
+ Erowa ITS 115 14 pallets
Increased profitability is indispensable today
High-tech HSC spindle

Core components of Step-Tec

**Tool spindles for demanding machining**
With a Mikron MILL S 200 U machine you get the latest tool spindle technology.

+ 50,000 rpm HSK E-32
+ High torque up to 20,000 rpm
+ Low spindle heating increases working accuracy
+ Highly stable double-ceramic hybrid bearings in an “O” configuration for very high radial capacity and rigidity during machining
+ Contact-free 3-chamber labyrinth seal for optimum sealing of the spindle nose
+ Vector control for full torque in the lower speed range
+ Oil/air lubrication system with extraction of the consumed oil
+ Very short acceleration time – 2 seconds from 0 to 50,000 rpm
+ Thread cutting without compensating chuck in steel up to M6 (CK45)

**Smart machine**
Supplied in the package is the APS (Advanced Processing System) smart machine module for the reliable recording and display of vibrations during the milling process.

**Step-Tec**
Since 1995, Step-Tec has been developing, producing, selling, and repairing precise, high-performance spindles for leading manufacturers of machining centers for milling and drilling applications.
Tool magazine

Tailored to your needs

Tool storage in many configurations
- Disk magazine with 30, 60 or 150 tool positions
- Reliable and extremely quick double-gripper change system
- Chip-to-chip in 4.4 seconds
- Secure orientation of the measuring sensor through a firmly assigned magazine space

Productivity and process safety
- User-friendly tool feeding
- Simple feed monitoring through a large glass panel
- Secure access even during full automation
- Feeding during machining possible

Double-gripper change system
# Chip and dust management

## Clean work area

<table>
<thead>
<tr>
<th>Customer requirements</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cutting lubricant (Combination)</strong></td>
<td><strong>Autonomous chip volume</strong></td>
</tr>
<tr>
<td>Minimal quantity lubrication (MQL)</td>
<td>Small</td>
</tr>
<tr>
<td>Air blow off external / dry</td>
<td></td>
</tr>
<tr>
<td>Emulsion</td>
<td>Small</td>
</tr>
<tr>
<td>Dust extraction</td>
<td>Large</td>
</tr>
<tr>
<td>Emulsion</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal quantity lubrication (MQL)</td>
<td>Small</td>
</tr>
<tr>
<td>Air blow off external / dry</td>
<td></td>
</tr>
</tbody>
</table>

Supply air: Chips with emulsion: Chips: Air with dust: Emulsion
Chips, graphite, emulsion. Always a solution!

Suction openings for dust

Supply air for dust extraction

Drawer with opened bottom part for emulsion operation with large chip volume

Chip drawer with water-permeable bottom part and integrated fine filter
## Technical data

### Mikron MILL S 200 U

### Workarea
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal X</td>
<td>mm 160</td>
</tr>
<tr>
<td>Cross Y</td>
<td>mm 160</td>
</tr>
<tr>
<td>Vertical Z</td>
<td>mm 200</td>
</tr>
<tr>
<td>B-axis</td>
<td>° +30/-120</td>
</tr>
<tr>
<td>C-axis</td>
<td>° n x 360</td>
</tr>
<tr>
<td>Number of simultaneous axis</td>
<td>5</td>
</tr>
</tbody>
</table>

### Feed drive
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed rate X, Y, Z</td>
<td>m / min 42</td>
</tr>
<tr>
<td>B, C</td>
<td>min⁻¹ 150 / 250</td>
</tr>
<tr>
<td>Acceleration X, Y, Z</td>
<td>m/sec² up to 14</td>
</tr>
<tr>
<td>B, C</td>
<td>rad/sec² up to 165 / 418</td>
</tr>
</tbody>
</table>

### Accuracy (Standart)
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy A</td>
<td>µ 4</td>
</tr>
<tr>
<td>Repeatability B</td>
<td>µ 2</td>
</tr>
</tbody>
</table>

### Work table
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamping surface</td>
<td>mm according Pal.</td>
</tr>
<tr>
<td>Max. table load</td>
<td>kg 8</td>
</tr>
</tbody>
</table>

### Tool magazine
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Positions 30, 60, 150</td>
</tr>
</tbody>
</table>

### Weight
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Including Pallet magazine</td>
<td>approx. kg 3600</td>
</tr>
</tbody>
</table>

### Options
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Tool Measuring</td>
<td>+</td>
</tr>
<tr>
<td>Coolant tank 80l / 400l</td>
<td>+</td>
</tr>
<tr>
<td>Mist extraction</td>
<td>+</td>
</tr>
<tr>
<td>Dust extraction</td>
<td>+</td>
</tr>
</tbody>
</table>

### Spindle
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>50'000 rpm</td>
<td>Power 40% ED kW 8.5</td>
</tr>
<tr>
<td>HSK E32</td>
<td>Torque 40% ED Nm 3.4</td>
</tr>
</tbody>
</table>

### Pallet magazine
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS 120</td>
<td>Pallet 14</td>
</tr>
<tr>
<td>MacroMagnum, Macro 70, 54</td>
<td>Pallet 14, 20, 20</td>
</tr>
<tr>
<td>ITS 148, 115</td>
<td>Pallet 12, 14</td>
</tr>
</tbody>
</table>
Options

Tailor-made equipment

External coolant supply via two nozzles

Spray ring with up to nine individually adjustable nozzles

Coolant tank 80 l

Rotating window

Mist extraction

Dust extraction

Air blow on C-axis positioned over laser system

Air through spindle/spindle slots

Automation interface

Touch probe m&h 40.40 LF/TI

Touch probe Renishaw OMP400

150 tool magazine

Signal lamp

Heidenhain TNC640
About GF Machining Solutions

Multi–technology solutions provider

Our commitment to you and your specific applications is proven by the value-adding intelligence, productivity and quality delivered by our multi-technology solutions. Your success is our chief motivator. That’s why we are continuously advancing our legendary technical expertise. Wherever you are, whatever your market segment and whatever the size of your operation, we have the complete solutions and the customer-centric commitment to accelerate your success—today.

Wire-cutting EDM
GF Machining Solutions’ wire-cutting EDM is fast, precise and increasingly energy efficient. From ultraprecise machining of miniaturized components down to 0.02 mm to powerful solutions for demanding high-speed machining with respect to surface accuracy, our wire EDM solutions position you for success.

Die-sinking EDM
GF Machining Solutions is revolutionizing die-sinking EDM with features like iGAP technology to dramatically boost machining speed and reduce electrode wear. All of our die-sinking systems offer fast removal and deliver mirror finishes of Ra 0.1 μm (4 μin).

Hole-drilling EDM
GF Machining Solutions’ robust hole-drilling EDM solutions enable you to drill holes in electrically conductive materials at a very high speed—and, with a five-axis configuration, at any angle on a workpiece with an inclined surface.

Milling
Precision tool and mold manufacturers enjoy a competitive edge with our Mikron MILL S solutions’ fast and precise machining. The Mikron MILL P machines achieve above-average productivity thanks to their high performance and Automation. Customers seeking fastest return on investment benefit from the affordable efficiency of our MILL E solutions.

High Performance Airfoil Machining
Our Liechti turnkey solutions enable the highly dynamic manufacturing of precision airfoils. Thanks to their unique performance and our expertise in airfoil machining, you increase productivity by producing at the lowest cost per part.

Spindles
As part of GF Machining Solutions, Step-Tec is engaged in the very first stage of each machining center development project. Compact design combined with excellent thermal and geometric repeatability ensure the perfect integration of this core component into the machine tool.

Laser texturing
Aesthetic and functional texturing is easy and infinitely repeatable with our digitized Laser technology. Even complex 3D geometries, including precision parts, are textured, engraved, microstructured, marked and labeled.

Laser micromachining
GF Machining Solutions offers the industry’s most complete line of Laser micromachining platforms optimized for small, high-precision features to meet the increasing need for smaller, smarter parts to support today’s leading-edge products.

Laser Additive Manufacturing (AM)
GF Machining Solutions and 3D Systems, a leading global provider of additive manufacturing solutions and the pioneer of 3D printing, have partnered to introduce new metal 3D printing solutions that enable manufacturers to produce complex metal parts more efficiently.

Tooling
Our customers experience complete autonomy while maintaining extreme accuracy, thanks to our highly accurate System 3R reference systems for holding and positioning electrodes and work pieces. All types of machines can easily be linked, which reduces set-up times and enables a seamless transfer of workpieces between different operations.

Automation
Together with System 3R, we also provide scalable and cost-effective Automation solutions for simple, single machine cells or complex, multi-process cells, tailored to your needs.

Digitalization solutions
To drive its digital transformation, GF Machining Solutions acquired symmedia GmbH, a company specialized in software for machine connectivity. Together, we offer a complete range of Industry 4.0 solutions across all industries. The future requires the agility to adapt quickly to continual digital processes. Our intelligent manufacturing offers embedded expertise, optimized production processes, and workshop Automation: solutions for smart and connected machines.

Worldwide for you
Ensuring the best performance throughout the lifetime of our customers’ equipment is the goal of our three levels of support. Operations Support offers the complete range of original wear parts and certified consumables. Machine Support includes spare parts, technical support, and a range of preventive services to maximize machine uptime. Business Support offers customer-specific business solutions.
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We enable our customers to run their businesses efficiently and effectively by offering innovative Milling, EDM, Laser, Additive Manufacturing, Spindle, Tooling and Automation solutions. A comprehensive package of Customer Services completes our proposition.

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