MIKRON
HSM 400 LP
HSM 400U LP
HSM 500 LP
HSM 600 LP
HSM 600U LP
HSM 800 LP
MIKRON HSM 400 LP / 500 LP

MIKRON HSM 400U LP

High-speed milling - universal approach to mold-making and production
GF AgieCharmilles presents new reference machines in 3-axis and 5-axis versions for high-speed milling.

Based on the concept of the present HSM series, GF AgieCharmilles engineers have developed three new machine models which represent optimal answers to all aspects of 3-axis and 5-axis high-speed milling needs. The HSM LP series (LP = Linear Performance) were designed for ultimate precision and supreme surface quality. The necessary design measures focus on the machine bed, cooling, axis drives, motion control and tool measurement.

These vertical high-speed machining centers, developed for tool and mold manufacturing as well as medium- and small-series production of high-quality parts, combine the Swiss machine manufacturer’s entire technical expertise and extensive development experience. GF AgieCharmilles.
Applications
3-axis

MIKRON HSM 400 LP
MIKRON HSM 500 LP
MIKRON HSM 600 LP
MIKRON HSM 800 LP

Watch components
MIKRON HSM 400 LP
Different materials
Watch making industry/ micro-mechanics
- Shape accuracy
- Smallest geometries
- Parts-specific handling systems

Graphite electrode
MIKRON HSM 600 LP
Graphite
Mold making
- High contour accuracy
- Efficient graphite machining

Electrode
MIKRON HSM 400 LP
Tungsten-copper
Tool and mold manufacturing
- High surface quality
- Shape accuracy
- Very small geometry features

Die
MIKRON HSM 800 LP
Alloyed tool steel
Tool and mold making
- Surface quality
- Shape accuracy
- Positional accuracy

Ball screw drive
Linear direct drive

HSC milling of a prototype mold insert
Applications
5-axis

**Impeller**
MIKRON HSM 600U LP
Titanium
Automobile industry
- 5-axis simultaneous machining
- High vibration damping
- Strong cutting ability

**Tire mold**
MIKRON HSM 600U LP
Aluminium
Automobile industry
- 5-axis simultaneous machining
- High feed rates
- Thin-walled geometries

**Closed impeller**
MIKRON HSM 400U LP
Aluminium
Automobile industry
- 5-axis simultaneous machining
- Perfect kinematics insure machining of complicated geometries

**MedTech**
MIKRON HSM 400U LP
Titanium / CoCr
Medical technology
- Adequate spindle performance
- Process stability
- 5-axis simultaneous machining 24/7
- Greatly improved tool life

**Casting mold**
MIKRON HSM 400U LP
Alloyed tool steel
Tool and mold making
- High surface quality
- 5-axis simultaneous machining of thread with undercut section
**Highlights**

Precision and quality for tool- and mold-making as well as accurate part manufacturing

**MIKRON HSM 400U LP**

Crane loading  
Flexible workpiece automation  
Machine hood for thermal and acoustic insulation  
High-performance machine control  
Robust tool spindle with vector control and ceramic hybrid bearings  
Direct drives on all axes: X, Y, Z, B, C

**Stability and damping**
Primary prerequisites for maximum precision and best workpiece surface quality include damping and stability of the components:
- Monolithic design
- Highly stable portal construction
- Machine base of mineral cast with high damping characteristics
- Optimised force distribution within castings
The MIKRON HSM LP series impresses with the unrivalled accessibility, regardless of their particular configuration.

MIKRON HSM 600U LP

Crane loading
High-performance machine control
Robust tool spindle with vector control and ceramic hybrid bearings

Flexible workpiece automation

Direct drives on all axes: X, Y, Z, B, C

Ergonomics and process reliability
...are key features of this machine series:
• Equally accessible in all upgrade levels - thanks to workpiece automation via the portal
• Excellent view into the workspace
• Access to the workpiece from three sides
• Crane loading
• Side window to optimally monitor machining
### Table versions

**As flexible as needed**

<table>
<thead>
<tr>
<th>Machine tool size</th>
<th>Travel X, Y, Z: 500 x 450 x 360 mm</th>
<th>Machine tool size</th>
<th>Travel X, Y, Z: 600/800 x 600 x 500 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3 axis versions</strong></td>
<td></td>
<td><strong>5 axis versions</strong></td>
<td></td>
</tr>
<tr>
<td>MIKRON HSM 500 LP</td>
<td>200 kg</td>
<td>MIKRON HSM 400 U LP</td>
<td>25 kg</td>
</tr>
<tr>
<td>MIKRON HSM 400 LP</td>
<td>120 kg</td>
<td>MIKRON HSM 600 U LP</td>
<td>120 kg</td>
</tr>
<tr>
<td>MIKRON HSM 600 LP</td>
<td>500 kg</td>
<td>MIKRON HSM 800 LP</td>
<td>1000 kg</td>
</tr>
<tr>
<td>MIKRON HSM 800 LP</td>
<td>1000 kg</td>
<td>MIKRON HSM 600/800 LP</td>
<td>800 kg</td>
</tr>
</tbody>
</table>

**Greatly reduces unproductive times**

Fully integrated zero-point clamping systems from manufacturers System 3R and Erowa.

- Extremely dynamic and fast: Rotation and swivelling with direct drives in the B and C axis up to 250 min⁻¹
- Extremely accurate and precise: Liquid-cooled motors and absolute measuring systems
- Extremely stable and flexible: Hydraulic clamping in the rotation and swivel axis plus integrated zero-point clamping system with a B-axis swivel range up to 220°
Basic machine

For uncompromising demands

**Pyramidal construction**
The pyramidal structure ensures both optimal dynamic to static mass distribution and a perfect distribution of cutting forces.

**Closed structure**
The O-shaped portal is outstandingly suitable for automation solutions by GF AgieCharmilles or other manufacturers.

**Moving slides**
The weight and rigidity of the cross slide are optimised to stand up to the high dynamic requirements.

**Polymer concrete**
The polymer concrete features high thermal inertia and excellent damping properties.

*Graph showing amplitude against time for Grey cast iron and Polymer concrete.*
Dynamics and precision
Mechanical drive systems have a basic disadvantage: a loss of precision must be accepted to achieve a highly dynamic configuration. This effect is not relevant for customers in auxiliary motions such as tool changing or axial positioning. An HSC machine changes the situation: During cutting control, high dynamics must be combined with great precision. This is where the linear direct drive shows all its advantages.

- Short setting time
- No oversteering through drive play and elasticity
- High dynamic rigidity of the attitude control
- Independent of slide position

Advantages
- Outstandingly precise, accurate workpiece machining due to the extremely rigid drive and control concept.
- Excellent long-term precision due to the reduction of friction-induced wear by the direct drive and central oil lubrication
- Reduction of main operating times due to extremely high dynamic parameterisation (OSS)
- Reduction of auxiliary times by high rapid-traverse speeds
- Reduction of maintenance and servicing, since the lack of ball screw drives or transmissions reduces the number of wearing parts.
Dynamic precision

Path measurement systems
Direct path measurement systems in the linear and rotational axis are standard equipment on all MIKRON HSM LP machines.

- Tried and tested Heidenhain precision
- Resolution in the nanometer range
- Protected by sealing air

Static precision

Swiss thoroughness
Before delivery, every MIKRON HSM LP machine undergoes an extensive quality check in our air-conditioned assembly hall in accordance with GF AgieCharmilles acceptance guidelines. Quality-consciousness means added value.
Thermal precision

Cooling concept
The MIKRON HSM LP series ushers in a new era of precision cutting. Since high axis feeds over long periods always heat the drive assemblies, the MIKRON HSM LP series beats the problem with an ingenious cooling management system. Each of the linear axis as well as the circular swivel unit have their own cooling cycles. The heat is therefore systematically led out of the machine instead of being distributed inside it. This safeguards geometric stability, which in turn ensures extremely high motion control repeatability.

All electrical heat sources in the MIKRON HSM LP machines are water-cooled.

- X, Y, Z, B, C drives
- Tool spindle with Opticool technology
- Electrical cabinet

Tool spindle
Even greater precision with Step-Tec Opticool technology
- Cooling of the front roller bearings
- Low thermal flow in the tool interface
- Increases accuracy when working with the measuring probe on the machine

Measuring probe
Even greater precision with new Thermo-Lock measuring probe technology.
- Easy set-up
- Inhibits thermal flow between measuring probe and tool spindle
- Increases accuracy when working with the measuring probe on the machine
- Two strong partners: Thermo-Lock and Opticool
**ITM (Intelligent Tool Measurement)**

ITM tool measurement registers the entire tool tip up to Ø 12 mm on modern imaging sensors. Special software digitally cleans and measures the digitally captured tool geometry. An idea takes concrete shape: For the first time, ITM makes it possible to measure tools on a MIKRON machine with micrometer-range repeatability.

**Detection of foreign particles**

**Measurement of smallest tool diameters**

**Test-piece with continuously increasing Z-level.**

Step to step: 2 µm

Orthogonal cutting to zero point Z-level with intermittent measuring cycle of employed spherical cutting tool.
Achieve more...
MIKRON HSM
400 LP, 400U LP, 500 LP
600 LP, 600U LP, 800 LP
### Automation

Disc type or linear type magazines - more parts in shorter time at lower cost

<table>
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<tr>
<th>Machine tool size</th>
<th>Travel X, Y, Z: 500 x 450 x 360 mm</th>
<th>Machine tool size</th>
<th>Travel X, Y, Z: 600/800 x 600 x 500 mm</th>
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</thead>
<tbody>
<tr>
<td><strong>3 axis versions</strong></td>
<td>MIKRON HSM 400 LP</td>
<td>90 kg</td>
<td>MIKRON HSM 600 LP</td>
</tr>
<tr>
<td></td>
<td>System 3R GPS</td>
<td>240 x 240 mm</td>
<td>10x</td>
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<tr>
<td></td>
<td>System 3R Dynafix</td>
<td>280 x 280 mm</td>
<td>7x</td>
</tr>
<tr>
<td></td>
<td>System 3R Dynafix</td>
<td>350 x 350 mm</td>
<td>7x</td>
</tr>
<tr>
<td></td>
<td>Erowa UCP</td>
<td>320 x 320 mm</td>
<td>7x</td>
</tr>
<tr>
<td><strong>5 axis versions</strong></td>
<td>MIKRON HSM 400U LP</td>
<td>25 kg</td>
<td>MIKRON HSM 600U LP</td>
</tr>
<tr>
<td></td>
<td>System 3R Macro Magnum</td>
<td>Ø 156 mm</td>
<td>18x</td>
</tr>
<tr>
<td></td>
<td>Erowa ITS</td>
<td>Ø 148 mm</td>
<td>20x</td>
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</tbody>
</table>

**Pallet magazine is a major plus**

GF AgieCharmilles has developed its own compact pallet magazines with customer requirements in mind. The disc and linear magazines can be loaded during operation and the CNC control is very easy to operate.
Ergonomic loading of the disc and linear type magazine during work preparation
A standardised robot interface allows the MIKRON HSM LP series to be operated with robot systems from reputable providers.

Regardless of the handling system used, the accessibility of the machine remains outstanding even when networking with other machines.
High-tech motor spindle

Tool spindles for challenging machining tasks
Whatever machine configuration you choose, a MIKRON HSM LP machine gives you state-of-the-art tool spindle technology.

The facts
• Vector control for full torque in the lowest range
• Ultra-stable ceramic hybrid spindle bearings
• Spindle mantle cooling by means of a controlled coolant cycle for constant temperatures throughout working times
• Oil-air lubrication system with suction disposal of used oil
• Integrated “smart machine” sensorics
• Cooling between tool interface and frontal spindle bearings in the Opticool spindles

You benefit from
• Precise high-performance
• Shorter acceleration phases
• High torque
• Thread cutting without compensation chuck

The delivered package includes the smart-machine module APS (Advanced Processing System) for reliable detection and display of vibrations during the milling process.
Individual solutions tailored to your production needs

Tool magazine

Tool automation in every configuration level
- Simple or double-row disc magazine
- Reliable “pick-up” changing system
- Feed control via light beam
- Capacity of up to 68 tools with magazines internal to the machines standard footprint
- Orientation of the touch probe

Optionally available in a variety of capacities:
- MIKRON HSM 400 LP
- MIKRON HSM 400U LP
- MIKRON HSM 500 LP
- HSK-E40 : 18; 36; 68 tools
- HSK-E32 : 20; 40 tools
- MIKRON HSM 600 LP
- MIKRON HSM 600U LP
- MIKRON HSM 800 LP
- HSK-E50 : 15, 30, 60 tools
- HSK-E40 : 18; 36; 68 tools

User-friendly tool feeding
Productivity and process reliability are ensured by lateral tool feeding
- Simultaneous machining and feeding
- Simple feed monitoring through large glass panel
- Ergonomic access
Equipment versions
Chip forms and volumes are determined by the work material and the machining strategy. The options offered range from an emulsion coolant tank with chip flushing to versions with cutting oil and coolant temperature stabilisation. Or with a lift-up chip conveyor with chip auger.

To increase the tank capacity an external filter system of 650 l is also available.
**Built to withstand tough production conditions**
Thanks to its flexibility and reliability the MIKRON HSM ProdMod product series is a benchmark for automated production of high quality parts.

- Efficient management of chips
- A flushing system reliably keeps the workspace doors free of chips.
- Feed of coolant through the center of the spindle
- Extended tool-storage capacities
  - E40 (168x or 308x)
  - E50 (120x, 170x, 220x)
- Integrated laser tool measuring system

**Air blast through the spindle center and/or**
**Through spindle coolant (TSC)**
With TSC up to 70 bar you can bring the cooling lubricant with high pressure and process reliability to the cutting edges of the tool. Differing tool diameters do not require new alignment of the coolant hoses. The purity of the lubricant effects the life time of the spindle. A filter system is therefore essential.

**Extended tool magazine**
The tool storage device external to the machines standard foot-print is built as a circular hanger with up to 308 tool positions. Time for changing tools: < 2 sec. Time for preparing tools: < 10 sec.
Options

Tailor-made equipment

Chip flushing

Cooling lubricant container

Spiral chip conveyor

Lift-up chip conveyor

High performance band filter unit

Cutting oil package with temperature stabilisation

Minimum quantity lubrication

Mist extraction system

Mist extraction system

Automation interface (closed)

Automation interface (open)

Touch probe TI

Further options:
- Rotating window
- Dust extraction system
- Beacon
- Laser tool measurement
- ITM [Intelligent Tool Measurement]
- ...

smart machine (www.gfac.com)
Bringing intelligence into the milling process is the intended aim of "smart machine".

This includes a range of modules that are collectively referred to under the generic term “smart machine” and that fulfil various functions. In order to make the milling process “intelligent”, various requirements have to be implemented.

First of all, establishing comprehensive communication between man and machine, which makes precise information that the operator requires to assess the milling process available to him. Secondly, supporting the operator in the optimisation of the process, which considerably improves the performance. Thirdly, the machine optimises the milling process, which improves the process safety and the quality of the workpiece - above all in unmanned operation.

The facts
- Greater accuracy in shorter machining times
- Increase in the workpiece surface quality as well as the surface and shape accuracy
- Recognition of critical machining strategies
- Improvement in the process safety
- Reduction of the machine set due to longer service life
- Higher availability
- Better operating comfort
- Considerable increase in reliability in unmanned operation

smart machine construction kit system
Each of the modules fulfils 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.

Your benefit
Producing the workpieces in a process-secure and precise manner, increasing the reliability in unmanned operation, increasing the service life of the machine and significantly reducing production costs.

The smart machine is constantly being further developed.

The currently available modules can be found at [www.gfac.com](http://www.gfac.com)
Milling  
High-Speed and High-Performance Milling Centers  
In terms of cutting speed, HSM centers are 10 times faster than conventional milling machines. Greater accuracy and a better surface finish are also achieved. This means that even tempered materials can be machined to a condition where they are largely ready to use. One essential advantage of HSM is that with systematic integration, the process chain can be significantly shortened. HSM has developed alongside EDM into one of the key technologies in mold and tool making.

EDM  
Electric Discharge Machines  
EDM can be used to machine conductive materials of any hardness (for example steel or titanium) to an accuracy of up to one-thousandth of a millimeter with no mechanical action. By virtue of these properties, EDM is one of the key technologies in mold and tool making. There are two distinct processes – wire-cutting EDM and die-sinking EDM.

Laser  
Laser ablation  
Laser ablation supplements and extends the technologies offered by GF AgieCharmilles. With our laser technology we enable you to produce texturizing, engraving, microstructuring, marking and labeling of 2D geometries right through to complex 3D geometries. Laser ablation, compared to conventional surface treatment using manual etching processes, offers economic, ecological and design advantages.

Customer Services  
Operations, Machine and Business Support  
Customer Services provides with three levels of support all kind of services for GF AgieCharmilles machines. Operations Support offers the complete range of original wear parts and certified consumables including wires, filters, electrodes, resin and many other materials. Machine Support contains all services connected with spare parts, technical support and preventive services. Business Support offers business solutions tailored to the customer’s specific needs.

Automation  
Tooling, Automation, Software  
Tooling for fixing workpieces and tools; automation systems and system software for configuring machine tools and recording and exchanging data with the various system components.