Mikron Mill

High-speed Milling graphite solutions
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.
Based on Mikron MILL S and HSM machines, the GRAPHITE series is dedicated to the machining of glass molds and electrodes.

From information and communications technology (ICT) and automotive to electronic components, manufacturers must cope with a variety of graphite machining challenges. These range from material specifications to requirements for highest precision and surface quality.

Whatever your application, GF Machining Solutions has the right solution.
Market segments and applications

Glass molds

High quality graphite molds to shape the glass for ICT and automotive markets

The emergence of new end products, like high-end curved touch screens, requiring molded glass drives an increasing need for machining of graphite molds—an application that presents specific manufacturing challenges in terms of precision, surface finish, and long machining times.

Challenges

Molds for glass manufacturing are made of graphite and present their own distinct manufacturing challenges. They require up to ±5 μm precision, Ra 0.4 μm surface finish and as many as five hours of machining (depending on the application) in wet or dry conditions. These molds must have absolutely no milling marks.

Solution

GF Machining Solutions’ Milling machines ensure the process stability, parts quality and shop floor productivity to support machining of graphite molds for glass end products.

As ambient workshop temperatures fluctuate and machining speed changes, process stability is maintained, due to Mikron Mill machines’ intelligent thermal management system and thermostabilized machine body.

Step-Tec’s completely tight Spindle brings the precision and stability to the tool tip.

ICT

Automotive
Electrodes

Fast production of electrodes for subsequent EDM process

Graphite machining has never been so attractive—and challenging. Precise graphite electrodes boost die-sinking electrical discharge machining’s productivity and reduce costs.

Challenges
Manufacturers require speed in their mold manufacturing as lead times are becoming shorter; automated and reliable processes are requested to maintain precision, flexibility, higher productivity and reduce the cost per electrode.

Solution
GF Machining Solutions’ Milling machines are genuine high-speed Milling solutions due to both their high-speed Spindle and their unparalleled process dynamics. This is enhanced by integrated Automation from GF Machining Solutions, positioning mold makers for above-average agility, productivity and return on investment.

Furthermore, these solutions deliver more process capabilities, allowing mold makers to machine graphite and a wide variety of other materials.
Mikron MILL S 400 / 500 GRAPHITE

Fast track – no trace

Master precision over time and perfect surface finish on 3D graphite mold

Drive your graphite business to meet the challenging and booming demand of graphite molds for glass end products. Demand for high-end, glass touch screens is soaring due to the emergence of new information and communications technology (ICT) products such as smart phones featuring near field communication (NFC) and wireless battery loading.

\[ R_a 0.4 \mu m \] surface finish, no milling marks
\[ \pm 5 \mu m \] accuracy
25\% higher productivity vs. well-known competitors
24/7 reliable process with ±1 µm repeatability thanks to S3R reference systems
Dry and wet machining

Beyond the market requirements, operating a graphite machining shop presents specific challenges. Establishing a process, ensuring its stability, and sustaining productivity while reducing running cost are paramount. Furthermore, maintaining a clean environment is necessary for both process quality and employees’ health. GF Machining Solutions offers two different solutions to best suit your specific environment and process requirement.

**Dry**

- Well-established process
- Simple and compact solution
- Free of graphite slurry accumulation

**Wet**

- Increased tool lifetime, reduced cost
- Clean process
- Dust-free air
- Also capable of copper and hard milling

450-liter filter system
Graphite machining has never been so attractive—and challenging. While graphite electrodes boost die-sinking electrical discharge machining's (EDM's) productivity and reduces costs, the graphite-based glass mold market is quickly growing, with new requirements in terms of surface finish, precision and machining speed.

The HSM 500 Graphite provides the ideal answer to these challenges. It combines the well-established HSM 500 that set a benchmark in terms of speed and surface finish with a dedicated high-precision Step-Tec Spindle. Additional benefits are its improved dust exhaust unit in a black enclosure and integration of the System 3R WPT1+.

The fast-track machine has been transformed into the perfect graphite solution that leaves no trace on your parts or in your workshop.

40% cost reduction per part vs. well-known competitors
± 7 µm accuracy
24/7 reliable process with ±1 µm repeatability thanks to S3R reference systems
Automated processes

**Highest productivity and flexibility per m$^2$**

- **24/7**
  - reliable automated process
  - WPT1+ with up to 70 pallets
  - 1x HSM 500 GRAPHITE
  - $= 10.4 \text{m}^2$

- **2x**
  - more production capacity
  - WPT1+ with up to 70 pallets
  - 2x HSM 500 GRAPHITE
  - $= 18.5 \text{m}^2$

- **+100%**
  - more flexibility
  - WPT1+ with up to 70 pallets
  - 1x HSM 500 GRAPHITE
  - 1x FORM P 350
  - $= 19.5 \text{m}^2$
Dust extraction

Up to 2940 Pa suction
3600m$^3$/h

+ Clean processing
+ Clean environment
+ Reliable Machining

Mikron
MILL S 400 GRAPHITE
MILL S 500 GRAPHITE

Mikron
HSM 500 GRAPHITE
High-speed Step-Tec Spindle

42,000 / 30,000 min⁻¹
High speed, precision

Benefits

+ Best thermal stability and polar temperature behavior with less than 1.7 K around the Spindle mantle thanks to sophisticated design and OptiCool principle (OCS)
+ Dust dry Spindle nose
+ Consistently high surface quality thanks to Intelligent Spindle Monitoring (ISM). It constantly monitors vibrations along each axis as well as temperatures of hot spots (bearings, motor) and ambient air.

Spindle nose
Twin-air sealing system

- Protecting air
- Dirt
- Oil

Dimensions
Ø 140 mm x 492 mm

Tool Interface
HSK-E40 DIN69063-1

Power (S6)
13.5 kW

Torque (S6)
8.8 Nm

Speed max.
42,000 min⁻¹ / 30,000 min⁻¹

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High-speed Milling graphite solutions

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11 High-speed Milling graphite solutions
Our Solutions – for you

Increase your productivity and optimize your costs and time.

Graphite’s extraordinary characteristics make it the perfect material for electrodes and glass molds. Graphite is largely used for electrical discharge machining (EDM) in production and other applications fields like mold making, general engineering and micromachining. It offers many advantages, including low wear, easy machining and thermostability to provide very high cost-effectiveness.

GF Machining Solutions offers various grades of graphite with a wide range of performance characteristics. Each grade can be dedicated to a specific range of applications.

Achieve high performance, extend the scope of your parts production operations, take on new applications, and enjoy vast Automation capability with the AgieCharmilles FORM P 350.

GF Machining Solutions’ die-sinking EDM know-how is fully embedded in the FORM P series through its EDM process management.

The die-sinking iGAP feature varies spark power between the fronts and sides of electrodes to enable outstanding material removal and push your productivity ahead.
For a single machine with integrated Automation

**Job Tool Manager (JTM) - bring agility back to the shop floor**

User friendly software for one machine with integrated pallet changer. Assign NC programs to pallet position by drag and drop on a touch screen, close to the pallet changer.

**Advantages**

+ Easy to change priorities when the machine is working
+ Add or remove jobs while machining
+ Jobs where cutters are missing will not be started
+ Estimated and present machining time for the magazine content are calculated.

Assign NC file, check tool capacity, schedule

By selecting the NC program, JobToolManager registers the tools used in the program. Time is stored if the NC program defines the time for the entire machining or if each tool has its use time.

If the program has been used earlier, it automatically displays the last recorded time.

Manage tools upon jobs to be done

Each time a new job is started, JobToolManager checks the machine tool table to see the availability of tools. If a tool is broken and no sister tool is available, will the job be blocked.
Intelligent Manufacturing Solutions from CAD to part

T.R.U.E. PRECISION

Just as GF Machining Solutions’ rConnect platform leverages connectivity-enabled machine communication to deliver machine data to your mobile device to ensure access to our remote service centers, our innovative, Intelligent T.R.U.E. (True Response to User Expectation) PRECISION fully digital manufacturing solution accelerates your Industry 4.0 readiness—today. With our proprietary Multi-Process Preparation (MPP) software component at its heart, T.R.U.E. PRECISION optimizes your die-sinking electrical discharge machining (EDM) process based on the real 3D shape of the electrode. Experience a highly accurate, fully predictable machining process that yields greater accuracy with T.R.U.E. PRECISION.
**T.R.U.E. PRECISION**

**True Response to User Expectation**
T.R.U.E. PRECISION is an innovative manufacturing solution for optimizing the die-sinking EDM process based on true geometry of the electrode. T.R.U.E. PRECISION ensures perfectly secure digital data utilization through an uninterrupted workflow for highest accuracy and consistency, from CAD and computer-aided manufacturing (CAM) to execution of the final part.

**MPP**

**Multi-Process Preparation**
MPP solves the significant manufacturing challenge of complete process chain optimization and gives you full control of your DSEDM process. In just six steps, MPP outlines the full DSEDM tool or part production process and, based on the 3D geometry of the truly active portion of the electrode, enhances your die-sinking EDM process to advance your efficiency, productivity and quality.

**Your benefits**
- High accuracy due to true digital geometry of electrode
- Predictable machining time
- Simulation and time/cost overview
- Optimized and increased the electrode usage
- Optimized machining sequence for each electrode
- Improve quality with the digital process with an accurate offset measurement within 2 μm
- Optimization of the die-sinking EDM process based on the true geometry of the electrode
- Best use of the Milling/die-sinking EDM ratio
rConnect comprises GF Machining Solutions modular digital services. You stay connected with your machine park, at any time and wherever you are. Select the digital service that best fits your individual needs. Our Live Remote Assistance (LRA) supports you in keeping your commitments.

Maximize your uptime
Live Remote Assistance provides you direct access to our expert service engineers with the latest technology. The LRA features audio, video, chat, whiteboard, file transfer, system access and screen sharing by using a Windows tablet or your standard PC.

Increase your flexibility
Know the status of your machines in real time at any location. The rConnect Cockpit is the user interface for your machine operator, maintenance technician or operations manager. It provides the operator with support for daily machine-related activities.

Secure connection based on the latest technology
To ensure your security, an encrypted point-to-point connection is established between your machine and GF Machining Solutions only at your request. Our remote service product is certified with the TÜViT Trusted Product Certificate.
## Technical data

<table>
<thead>
<tr>
<th>Machine</th>
<th>Mikron MILL S 400 GRAPHITE</th>
<th>Mikron MILL S 500 GRAPHITE</th>
<th>Mikron HSM 500 GRAPHITE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic machine</strong></td>
<td>Linear drives, Ambient robust</td>
<td>Linear drives, Ambient robust</td>
<td>Ball screw</td>
</tr>
<tr>
<td><strong>Work area</strong></td>
<td></td>
<td></td>
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<tr>
<td>Longitudinal X mm</td>
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<tr>
<td>Lateral Y mm</td>
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<tr>
<td>Vertical Z mm</td>
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<tr>
<td><strong>Feed rate</strong></td>
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<tr>
<td>Rapid traverse X, Y, Z m / min</td>
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<td>61</td>
<td>42</td>
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<tr>
<td><strong>Working spindle (40% ED, S6)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42,000 min⁻¹, HSK-E40 kW / Nm</td>
<td>13.5 / 8.8</td>
<td>13.5 / 8.8</td>
<td>13.5 / 8.8</td>
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<td>30,000 min⁻¹, HSK-E40 kW / Nm</td>
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<td>13.5 / 8.8</td>
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<tr>
<td><strong>Work table</strong></td>
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<tr>
<td>Table mm</td>
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<td>590 x 450</td>
<td>550 x 450</td>
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<tr>
<td>Pallet/clamping surface mm</td>
<td>Dynafix 280x280/350x350</td>
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<td>-</td>
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<td>Pallet/clamping surface mm</td>
<td>GPS 240x240</td>
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<td>Pallet/clamping surface mm</td>
<td>UPC 320x320</td>
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<tr>
<td>Max table load kg</td>
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<td><strong>Tool magazine</strong></td>
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<td>HSK-E40 piece</td>
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<td>18 / 36 / 68</td>
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<td><strong>Weight</strong></td>
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<td>Machine kg</td>
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<td>5'500</td>
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<td><strong>Control unit</strong></td>
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<td>iTNC 530 HSCI</td>
<td>iTNC 530 HSCI</td>
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<td><strong>Dust extraction (Amano)</strong></td>
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<td>980 – 2940</td>
<td>980 – 2940</td>
<td>980 – 2940</td>
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<tr>
<td>Largest gas receive amount m³/h</td>
<td>3600</td>
<td>3600</td>
<td>3600</td>
</tr>
</tbody>
</table>
GF Machining Solutions

EDM (electrical discharge machining)
AgieCharmilles wire-cutting, die-sinking and hole-drilling machines
For over 60 years we have been at the forefront of every EDM development: designing and refining the EDM process and building machine tools that deliver peerless part accuracies, surface finishes, cutting speeds and process reliability. Today, our AgieCharmilles wire-cutting, die-sinking and hole-drilling machines are recognized throughout the world as the best in the business. Our continuous research and development in digital generator technology, control systems and integrated Automation systems are evidence of our commitment to keeping your EDM operations on the leading edge of technology.

Milling
Mikron MILL S (high-speed Milling), Mikron MILL P (high-performance Milling) and Mikron MILL E (high-efficiency Milling)
Customers operating in the mold, tool and die and precision component manufacturing sectors stake their reputations on being able to quickly and cost-competitively meet their customers’ demands. That’s why they invest in GF Mikron machines. Incorporating the latest and most advanced technologies and premium-performance components, Mikron MILL S, Mikron MILL P and Mikron MILL E machines help you increase your production capabilities and improve your productivity. Designed and built for speed, accuracy and reliability, the machines, like you, are proven performers.

Laser
AgieCharmilles Laser texturing machines
Laser texturing is a fully-digitized surface engineering process that has huge potential. The technology enables precise 2D and 3D textures or engravings to be machined accurately and directly onto complex parts or molds to improve and alter their aesthetic appeal, functionality and performance. The process is infinitely repeatable and offers many distinct environmental and economic advantages over conventional texturing processes.

Laser Additive Manufacturing (AM)
GF Machining Solutions has partnered with EOS, the global leader for high-end AM solutions, to integrate this innovative technology and further develop it into its current solutions to fully benefit the mold industry, by focusing on injection efficiency: optimized cooling design to reduce cycle time, lower energy consumption, higher quality of plastic parts.

Tooling and Automation
System 3R Tooling, Automation and software
Productivity is the key to manufacturing success, and automating a manufacturing process is a proven method of increasing its efficiency, effectiveness, quality and reliability. System 3R’s integrated Tooling, Automation and software solutions ranging from simple workpiece pallet and electrode changers through to flexible manufacturing and robot handling systems are guaranteed to help you increase their competitive advantage.

Customer Services
Operations Support, Machine Support and Business Support
To help you get the most and the best from your machine tools and equipment, we offer three levels of support. Operations Support covers our range of original wear parts and certified consumables (EDM wires, filters, resins, electrodes etc.) to ensure that your machines are performing at the highest levels. Machine Support maximizes, through our best-in-class technical support, preventive services and quality spare parts, your machine tool uptime. Business Support is designed to help you make a real step-change in your productivity and performance with solutions tailored to your specific needs.
At a glance

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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