Mikron

MILL E

500 U
700 U
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 E 500/700 U high-efficiency series comprises five-axis machines in a stiff, stable, cast iron C-frame construction. With large-sized guideways and double supported rotary table, this range delivers parts quality and optimum chip removal rate—ideal for job shops and parts producers in automotive, energy and power generation, and general machinery.
Market segments and applications

Typical applications

**Aerospace**

PART EXAMPLE
- Secure process stability – Milling with no chatter marks
- Achieve high accuracy and surface quality
- Get ready for production ramp-up with no worries

**Medical**

PART EXAMPLE
- Get a turnkey solution
- Reduce cost of operations
- Achieve high surface quality

**Medical**

PART EXAMPLE
- Speed-up operations and reduce cost: one clamping
- Efficient process – from roughing to finishing
- Productive and flexible serial production

**Part Example**
- Plate cover
  - Material: AL 7575
  - Wall thickness: 0.5 mm
  - Surface finish: Ra 0.5 μm
  - Accuracy: ±0.05 mm
  - Repeatability: 24/7 parts production

**Part Example**
- Surgical support device
  - Material: AL 6061
  - Surface finish: Ra 0.3 μm
  - Production cost reduced by 30%
  - Process time: 6.5h

**Part Example**
- Hook bone plate
  - Material: SS 17-4
  - Surface finish: Ra 0.5 μm
  - Process time: 80min
  - Swivel range of +120° to -65°
**PART EXAMPLE**

- **Lever flexibility:** many different milling processes
- **Reduce cost:** Mill efficiently with 5-Axis
- **Secure process stability over long milling periods**

**Tools from**

- Ø4mm to Ø40mm

**Removed material**

- 0.021m³/min

**Process time**

- 23h

**Accuracy**

- ±0.03mm

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**PART EXAMPLE**

- **Deep cavity Milling**
- **High surface finish**
- **Continuous cutting speed thanks 5-Axis simultaneous Milling**

**Cookie blister**

- Material: AL 6082

**Tool diameter**

- 1.5mm

**Surface finish**

- Ra 0.5μm

**Accuracy**

- ±0.05mm

**Removed rate**

- +210cm³/min

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**PART EXAMPLE**

- **Achieve high positioning accuracy in 5-Axes**
- **High material removal rate**
- **Variable operations on all five sides**
- **Multiple machining operation**
- **Deformation-free machining**

**Cover plate**

- Material: AL 6082

**Wall thickness**

- < 1mm

**Accuracy**

- ±0.05mm

**Removed rate**

- +210cm³/min

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**Automotive**

**Mold and die**

**Machinery and general mechanics**
Technology

High-efficiency Milling

The Mikron MILL E U series is a dynamic, high-efficiency machine center for entry-level five-axis machining.

It provides highly efficient and productive processing for all kinds of materials, including aluminum alloys and stainless steel. This solution’s economical design saves spaces and its ergonomics make it easy for your operator to use.

+ 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.

Efficiency and productivity for 5-Axis machining
Solutions

The right solution—for you

+ Benefit from the dynamic behavior essential to perfect part production.
+ Machine under maximum load generates minimal noise and achieves top quality on your parts.
+ Get the performance and Spindle power to execute all kinds of applications.
+ Enjoy unmanned production—nights or weekends—with your favorite Automation system.

Customer benefits

Stiff machine construction
Double-supported rotary torque table
Step-Tec Spindle: 120 Nm, 20,000 rpm
Choice of HEIDENHAIN or FANUC control
Integrated Automation or third-party automation
Integrated palletization

Customer benefits

Stiff machine construction
Double-supported rotary torque table
Step-Tec Spindle: 120 Nm, 20,000 rpm
Choice of HEIDENHAIN or FANUC control
Integrated Automation or third-party automation
Integrated palletization
Robust and precise

Mikron MILL E 500 U / 700 U
core components

+ **Up to 60 tools integrated. 215 tools on a tool tower**
  Easy loading during operation

+ **Torque or gear drives for rotary table**
  High positioning accuracy and repeatability thanks to direct drive technology

+ **Large swivel range from -65° to +120°**
  Allows perfect access with the optimal tool length to the part

+ **20,000 rpm motor spindle with 120 Nm**
  Best surface finish for both roughing and finishing

+ **Compact footprint and ergonomic access**
  Highest efficiency and ergonomics on smallest space

More than 50 years legacy of machine design expertise
Axis travel
Vertical Z
MILL E 500 U: 400 mm
MILL E 700 U: 500 mm

Axis travel
Crosswise Y
MILL E 500 U: 450 mm
MILL E 700 U: 600 mm

Axis travel
Lengthwise X
MILL E 500 U: 500 mm
MILL E 700 U: 700 mm

Rotation axis
n x 360°

Swivel axis
MILL E 500 U: -65 / +120°
MILL E 700 U: -65 / +120°
Benefit from an automated process

Ramp up your productivity and flexibility

Execute small, express jobs with the same efficiency and profitability as mid-size series or repeat orders.

Your progress to higher productivity:

**Step 1**
Move from three-axis, multi-clamping Milling to five-axis, one-clamping Milling.

**Step 2**
Upgrade the machine: clamping with System 3R

**Step 3**
Extend your system: pallet magazine and clamping with System 3R

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**+46% productivity**

**+20% productivity**

**+16h additional capacity daily**

You’ll run additional shifts 24/7 at lowest cost.
Generate a fast return on invest with a Mikron MILL E 500 U with 20,000 rpm Spindle, simultaneous torque table and our own pallet Mikron Mill pallet Automation with up to seven pallets.
Take your productivity to new levels while reducing your costs with our superior Automation solution. The pallet magazine’s generously dimensioned door allows optimum pallet access for loading light parts by hand and heavy parts by crane. Larger windows allow a good view into the pallet area, and pallets are managed by using the machine control.

Ergonomic door design for easy loading of parts up to 200 kg
Five-sided processing in one clamping

5-Axis processing offers significant advantages for large and small components. Using 5-Axis technology, it is possible to process different shapes and surfaces with one clamping device.

+ Rotary swiveling table available as a pallet version: System 3R (Dynafix/Delphin)
+ Rotary swiveling table available as a generously dimensioned tabletop version (Ø 500 / 630 mm with parallel T-grooves)
+ Cartesian (right-angled) arrangement of the axes results in easily understood tool/workpiece movements during the Milling process
+ Direct measurement on the B and C axes
+ Machine available as 5-Ax or 5-Axis simultaneous versions
Tool magazines

We have the solution for your needs

+ Ergonomic and user friendly
+ Ensures productivity and process reliability
+ Parallel machining and tool loading
+ Easy tool loading possibilities thanks to an ergonomic tool loading door
120, 170 or 215 tools
Circular magazine design with handling system
High-performance Spindles

High-efficiency Milling and effective processing

The high-performance Spindles on the Mikron MILL E 500 U / 700 U series are designed to do heavy roughing and Milling to best surface finish all at once. With a bearing design with three preloaded hybrid ball bearings in the front and a thermally robust hybrid cylindrical roller bearing on the back, you are guaranteed a super-rigid rotating system that enables Milling with extra-long tools reaching into deep cavities. Ramp up your chip removal, thanks the feed rates made possible by this solution’s absorption of high Milling forces at the tool tip.

The 20,000 min\(^{-1}\) Spindle features the well-proven OptiCool principle that keeps the front bearing area cool while the extra heat barrier cooling loop keeps the motor heat away from the Spindle nose. That results in a thermally balanced Spindle thus assuring a high level of precision, repeatability and surface finish.

| Spindle 20,000 min\(^{-1}\) | • Direct Lubricating System (DLS) oil-air bearing lubrication through outer race  
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Power (S6)</td>
<td>36 kW</td>
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<tr>
<td>Torque (S6)</td>
<td>120 Nm</td>
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<tr>
<td>Speed max.</td>
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<tr>
<td>Acceleration</td>
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<tr>
<td>Lubrication</td>
<td>Oil-air</td>
</tr>
<tr>
<td>Tool interface</td>
<td>HSK-A63 DIN69863-1</td>
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</table>

The 20,000 min\(^{-1}\) Spindle delivers sufficient performance and power for all kinds of applications. The ball bearings, which are lubricated for life, are effectively protected against incoming dirt with an air purge system. The tool is held by a spring and is released through hydraulic cylinder.

| Spindle 12,000 min\(^{-1}\) | • Good thermal stability through OCS  
<table>
<thead>
<tr>
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<tr>
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<td>Torque (S6)</td>
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<tr>
<td>Speed max.</td>
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<tr>
<td>Acceleration</td>
<td>2.5 s</td>
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<tr>
<td>Lubrication</td>
<td>Oil-air</td>
</tr>
<tr>
<td>Tool interface</td>
<td>ISO 40 / BT 40 / CAT 40</td>
</tr>
</tbody>
</table>

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Spindle challenge

Slotting operation

**Description**
- Slotting with a depth of 1.5xD is a challenging task for the machine.
- The feed rate was set to a spindle load of 85%.
- Tests with more speed brought the machine to soar up.

**Tool**
- Type: Ø16 end mill
- Manufacturer: FRANKEN (2615AZ.016)

**Processing parameters**
- Spindle speed: 2,586 min⁻¹
- Feed rate: 1.034 mm/min
- Cutting depth: 24 mm
- Step over: 16 mm
- Material removal rate: 397 cm³/min

**Machinery and general mechanics**

**PART EXAMPLE**
- Faster processing
- Higher chip removal rate
- Less vibration and longer machine live time

**Challenge part**
Böhler K110 1.2379
(X153CrMoV12)

**Removed material**
- +160 cm³/min
- 397 cm³/min

**Spindle load**
- −76%
The standard version of the swivelling table is ideally suited to the machining of workpieces in multiple clamping devices.

- No wear
- High dynamics
- High accuracy
- No backlash
Direct torque drive technology allows excellent precision and surface finish on the workpiece. The fact that there are no mechanical transmission elements involved in the force transmission means that friction and wear as well as reduction in dynamic and rigidity are things of the past.

All rotary tables are designed and manufactured in-house by GF Machining Solutions.

**Torque drive**

Experience high dynamics due to no mechanical transmission elements.

- Water cooling ensures optimum heat transfer.
- Fixation damping absorbs stress and vibration.
- Contactless motor system eliminates wear and ensures a long lifetime.

**PART EXAMPLE**

Ensure positioning accuracy on five-sided parts.

Secure repeatability over series production.

Get ready to rapidly achieve stable quality.

**Automotive**

- Warm-up cycle: 30 min
- Thermal stability: 24/7
- Repeatability within 10 µm
- Concentricity challenge of two holes < 10 µm
- Bore length: 2x 150 mm
Chip management

Clean machining, wet or dry

Adapted chip management
- Solution for high-volume small and light chips with lift-up scraper chip conveyor and coolant unit with fine filtration
- Solution for high-volume steel Milling chips with lift-up scraper chip conveyor and coolant filtration unit

Options
- Through-Spindle coolant
- Wash-down system
- Coolant thermal control
- Oil skimmer

+ Optimum chip flow to steep and smooth cabin walls
+ Wash-down nozzles for all corners to prevent chip accumulation
+ Professional lift-up scraper to transport 43 l/h chips out of the working area
Efficient processing with fast return on investment
Heidenhain TNC 640 and smart machine

Optimal machining to enhance your process beyond program and machine setup

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

1st is establishing comprehensive communication between man and machine, which makes available precise information that the operator requires to assess the Milling process.

2nd is supporting the operator in the optimization of the process, which considerably improves the performance.

3rd is the machine optimizing the Milling process, which improves process safety and workpiece quality—especially important in unmanned operation.

+ 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.

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 TNC 640 support operators in their daily job giving to them more availability for other tasks.

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

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

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

**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.
New digital service possibilities

GF Machining Solutions Customer Services continues to push technological boundaries to deliver the future of services to you—today.

rConnect is the digital services platform available for all GF Machining Solutions technologies. Following a modular approach, rConnect comprises a range of services that empower you to increase your manufacturing productivity. Certified with the TÜVIT Trusted Product Certificate.

rConnect Messenger, we deliver machine data to your mobile device to keep you constantly informed about your production. You can supervise your workshop from your smartphone.

rConnect Live Remote Assistance (LRA), our expert engineers rapidly respond to your service requests. LRA allows effective face-to-face assistance using audio, video, chat and many more functionalities.
Options

Multiple options to drive your success

- Pallets
- Laser tool measuring system
- Infrared measuring probe
- Mist extraction
- Air through Spindle/coolant through Spindle
- Wash down system
- TSC belt filter system (20 bar)
- Rotating inspection window
- Operation mode 3
- Signal light
- Additional options
- Extended warranty
- Linear glass scales
- Minimal quantity lubrication
- Scratched proofed window
- Oil skimmer
- Robot interface

Fanuc control system
Reliable and cost-performance CNC with high-end features like NANO interpolation and AI contour control

Performance and reliability
The Fanuc 0i-MD features an ultra-compact design using limited cabling to ensure highest reliability and provide easy maintenance.
Coupled with the latest Fanuc drive technology, the Fanuc 0i-MD ensures smooth machined surfaces by using a much finer resolution for position commands.

APS
APS extended
ITC
ITC 5X
RNS
PFP
DNC
KinematicsOpt
smart machine
## Technical data

<table>
<thead>
<tr>
<th>Machine</th>
<th>Mikron MILL E 500 U</th>
<th>Mikron MILL E 500 U</th>
<th>Mikron MILL E 700 U</th>
<th>Mikron MILL E 700 U</th>
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<tr>
<td><strong>Axis travel</strong></td>
<td>RTT 5-Axis</td>
<td>RTT 5-Axis simultaneous</td>
<td>RTT 5-Axis</td>
<td>RTT 5-Axis simultaneous</td>
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<td>Vertical Z mm</td>
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<tr>
<td>Swivel axis °</td>
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<td>-65 / +120</td>
<td>-65 / +120</td>
<td>-65 / +120</td>
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<td>n x 360</td>
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<td>3+2</td>
<td>3+2</td>
<td>3+2</td>
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</table>

| **Spindle**      |                     |                     |                     |                     |
| Spindle type     | In-line Motor       | In-line Motor       | In-line Motor       | In-line Motor       |
| Max. rotations min⁻¹ | 12,000              | 12,000              | 12,000              | 12,000              |
| Max. torque kW/Nm | 20/88               | 20/88               | 20/88               | 20/88               |
| Tool interface   | ISO 40 HSK-A63      | ISO 40 HSK-A63      | ISO 40 HSK-A63      | ISO 40 HSK-A63      |
|                  | BT 40 CAT 40        | BT 40 CAT 40        | BT 40 CAT 40        | BT 40 CAT 40        |

| **Travel speed** |                     |                     |                     |                     |
| Rapid traverse X, Y, Z m/min | 30 / 30 / 30 | 30 / 30 / 30 | 30 / 30 / 30 | 30 / 30 / 30 |
| Rapid traverse B, C min⁻¹ | 17 / 28 | 32 / 112 | 17 / 28 | 32 / 112 |

| **Automation**   |                     |                     |                     |                     |
| Integrated tool magazine unit | DT 30 / CT 60 | DT 30 / CT 60 | DT 30 / CT 60 | DT 30 / CT 60 |
| Tool tower unit  | 120 / 170 / 215    | 120 / 170 / 215    | 120 / 170 / 215    | 120 / 170 / 215    |
| Pallet magazine unit | 5 Delphin 400/400 or 5 MTS 400/400 or 7 Dynafix 350/350 or 7 UPC 320/320 | 5 Delphin 400/400 or 5 MTS 400/400 or 7 Dynafix 350/350 or 7 UPC 320/320 | 5 Delphin 400/400 or 5 MTS 400/400 or 7 Dynafix 350/350 or 7 UPC 320/320 | 5 Delphin 400/400 or 5 MTS 400/400 or 7 Dynafix 350/350 or 7 UPC 320/320 |
| Pallet changing time sec. | 30 | 30 | 30 | 30 |
| Robot interface  | Available           | Available           | Available           | Available           |

| **Rotary swivel table** |                     |                     |                     |                     |
| T-groove table mm      | 500                  | 500                  | 630                 | 630                 |
| Workpiece weight (3/5) kg | 300                  | 300 / 200            | 450                 | 450 / 450           |

| **Weight**             |                     |                     |                     |                     |
| Machine weight kg      | 6,030               | 6,030               | 8,060               | 8,060               |

| **Control**            |                     |                     |                     |                     |
| Heidenhain             | TNC 640             | TNC 640             | TNC 640             | TNC 640             |
| Fanuc (12,000 min⁻¹)   | 0i-MD               | -                   | 0i-MD               | -                   |
Mikron MILL E 700 U with pallet magazine
Mikron MILL E 500 U with pallet magazine and tool magazine 120, 170 or 215 tools

Mikron MILL E 700 U with pallet magazine and tool magazine 120, 170 or 215 tools
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.
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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