

AgieCharmilles

# FORM X 400

# FORM X 600



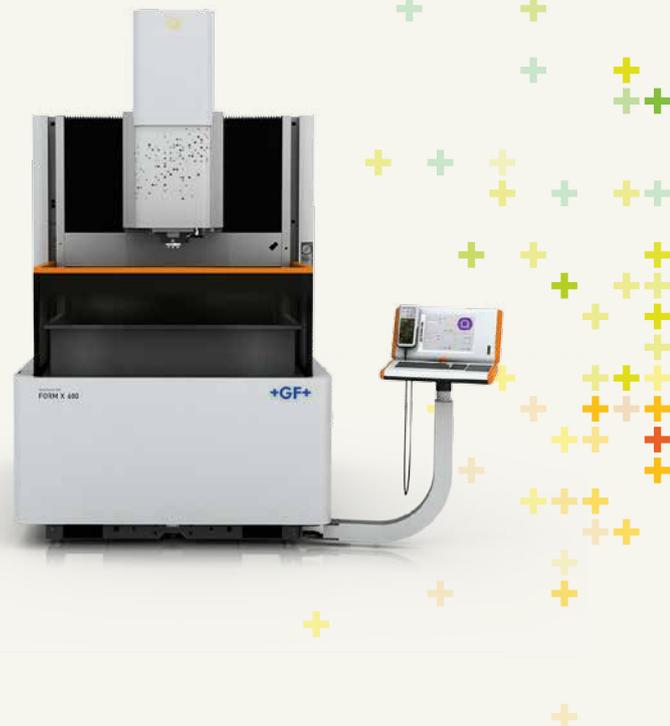
### **GF Machining Solutions: all about you**

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.

# Passion for Precision

# Contents

Highlights	4
The mechanics	6
AC FORM HMI	10
The generator	12
Autonomy and flexibility	14
GF Machining Solutions	22



## Fast, intelligent and accurate

Set new performance benchmarks with the intelligent and easy-to-integrate FORM X 400 and FORM X 600, delivering positioning accuracy within 1  $\mu\text{m}$ , and general machining accuracy on the workpiece down to 5  $\mu\text{m}$ .

## Highlights

# EDMASTER for highest accuracy, speed and automation



The FORM X 400 and FORM X 600 combine multiple elements dedicated to the most accurate product production. As a master of accuracy and speed, it is no surprise that GF Machining Solutions has mastered every detail in the FORM X 400 and FORM X 600, from the generator components and the human-machine Interface (HMI) to the numerical control, mechanical concept and Automation. The unparalleled performance of the FORM X 400 and FORM X 600 ensure a new degree in competitiveness due to their simplification and Automation of the highly technical processes around the production of molds and components.

With the FORM X 400 and FORM X 600, deep know-how is integrated and application success is programmable at the touch of a finger. This ease of use is especially important in microelectronics, telecommunications, medtech, connectors and optical systems.



### AC FORM HMI: perfect results at your fingertips

The ergonomics of GF Machining Solutions' new AC FORM HMI put customers in the driver's seat by making die-sinking EDM an intuitive, easy-to learn and easy-to-use process. That means greater autonomy over your processes, higher efficiency, improved process reliability and accelerated performance. The standardized working environment created by the AC FORM HMI makes it easy to achieve perfect machining results.

### Remote control menus adapted to operator tasks

To allow the operator to adapt the remote control to the manual task at hand, a menu is provided for configuring the icons displayed on the remote control display. In addition to standard icons, this menu allows the operator to define semi-automatic movements or specific measuring cycles during the manual process. This is one of many AC FORM HMI features that put greater flexibility and efficiency at the operator's fingertips.



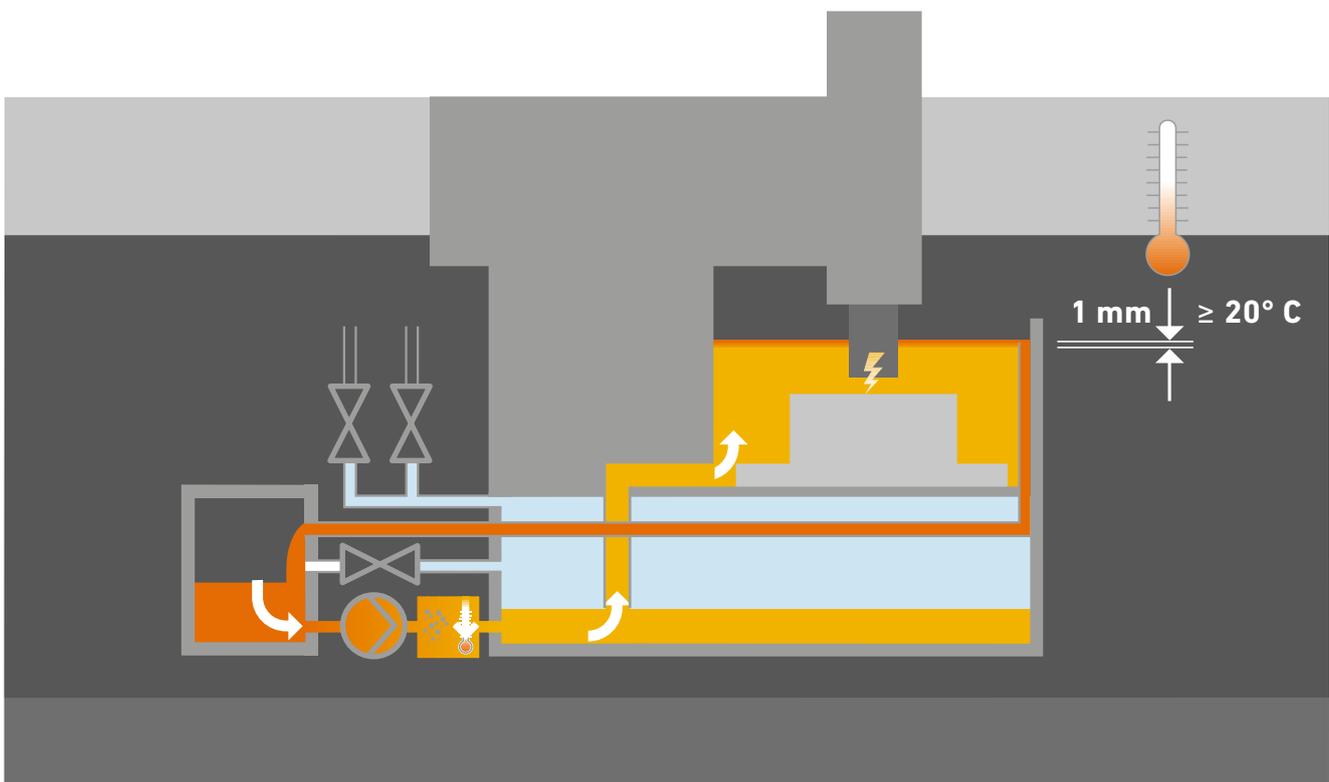
## The mechanics

# A reliable, long-lasting mechanical concept

The structure adopted includes a frame of polymeric material, with fixed worktable, ideal for loading heavy workpieces as well as for Automation of rapid workpiece/electrode change operations.

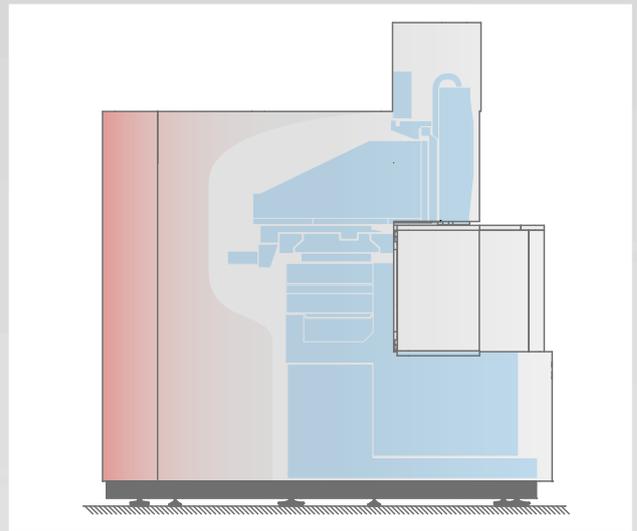
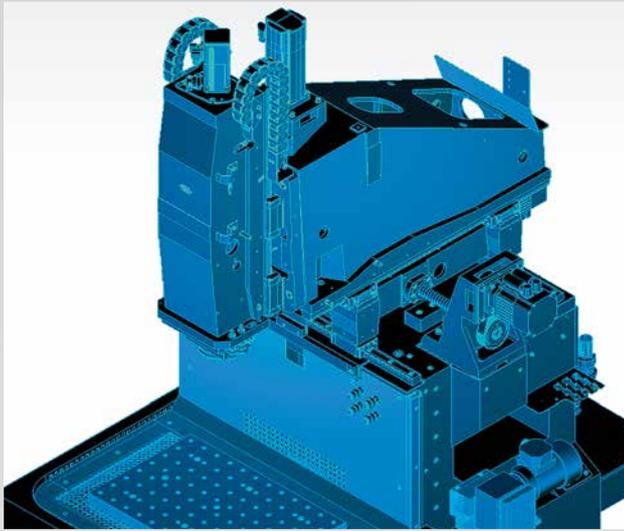
As work area ergonomics are an important factor in productivity, this structure has been specially designed to allow access on three sides even in the case of a high capacity electrode changer. The spheroidal cast iron XYZ axes located in the upper part of the machine are based on highly accurate calculations in order to reduce their mass and at the same time meet requirements in terms of rigidity, precision and dynamic conditions associated with the new performance levels of the FORM X 400 and FORM X 600.

These moving parts are fully disassociated from the loading and machining area in order to ensure that they are unaffected by variations in temperature in the erosion area, nor by the extreme range in weights of the workpieces that can be accommodated by the FORM X 400 and FORM X 600.





Variation in ambient temperature where the machine is installed and that of its various components can certainly physically affect its static and dynamic geometry and, consequently, the quality and accuracy of the parts produced. As the micron becomes the new measure of precision for this range of machines, such aspects received careful attention in all the various phases of development of the range, thus allowing incorporation of innovative control and isolation solutions to make the FORM X 400 and FORM X 600 machines very much less sensitive to these variations in temperature. As a result, the geometrical accuracy and positioning results are guaranteed to a high degree of certainty.



### Unique mechanical concept

The FORM X 400 and FORM X 600 die-sinking EDM machines have a unique mechanical structure. The modern solution consists of a machine column made of polymer, a fixed table with an automatically lowerable work tank, allowing easy loading of heavy workpieces, as well as a modular Automation system for loading and unloading workpieces and electrodes.

### Mastery of the working temperature

Temperature environment is often subjected to a fluctuation, some time related to the environment or related to the equipment itself. In the interests of maximum thermal stability GF Machining Solutions has been able to master these fluctuations to allow ultimate stability whatever the production rate.

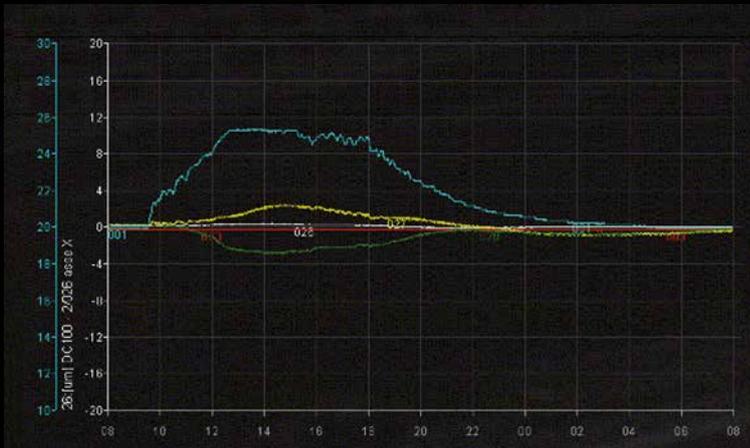


### Exceptional positioning accuracy

With accuracy in the  $\mu\text{m}$  range on the workpiece, the FORM X 400 and FORM X 600 meet the high demands of mold making. Typical applications are multi-functionally designed plastic parts. These include webs, jaws, apertures and cavities enabling the assembly and secure mounting of electronic components.

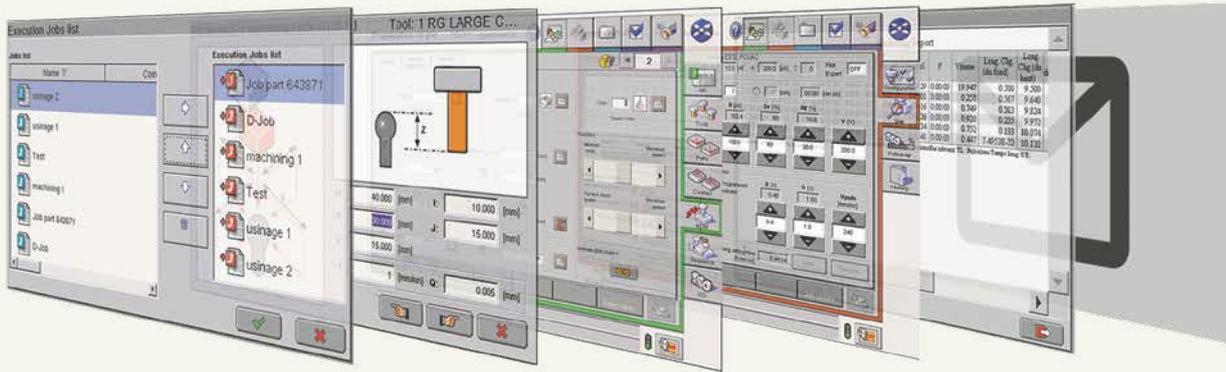
### Thermo Control: the system for unmatched precision under workshop conditions

The new, sophisticated and unique system compensates for temperature variations. Temperature stabilization is achieved by cooling the X, Y and Z glass scales and the Z axis ball screw with stable temperature dielectric. The thermal expansion of the cast iron X, Y, and Z axes is compensated and absolute precision is achieved.



#### Position accuracy: 24 hours test

- Room temperature
- X axis
- Y axis
- Z axis



**Flexible work organization**

Whether on a PC or on the FORM X 400 and FORM X 600 machines, AC FORM HMI offers you job organization according to your priorities.

**Measurement of essential offsets and positions during work preparation:**

the measurements made on a pre-measurement terminal can be used directly by AC FORM HMI.

**Electrodes designed under AC FORM HMI**

offer ideal undersize and streamline the number of electrodes necessary for machining.

**Machining under AC FORM HMI high surveillance,**

with Systems EXPERT automated protection, guarantees you results at the height of your requirements.

**Control of work executed under AC FORM HMI**

automatically creates a report after each machining session. The operator can access it via the network or directly on the machine.

**SMS notification**

All information related to machining can be transmitted directly to the operator via SMS.

AC FORM HMI

# Faster control, in complete security

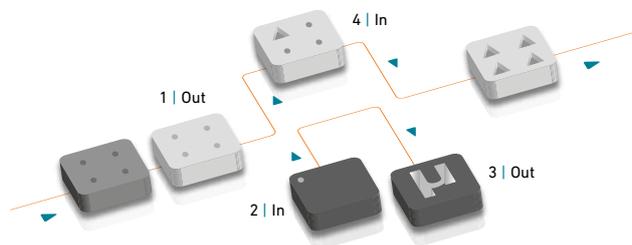
**Dynamic manufacturing process**

The development of AC FORM HMI is based on a study carried out with numerous mold makers in order to streamline the mold making technique. The organization and layout of screens are a direct development of the information taken from this study. This user friendliness that has made GF Machining Solutions interfaces so successful has been not only maintained but further developed benefit the mold maker's tasks.

**Maximize productive time**

Due to the necessity of maximizing productive time, the AC FORM HMI brings new solutions:

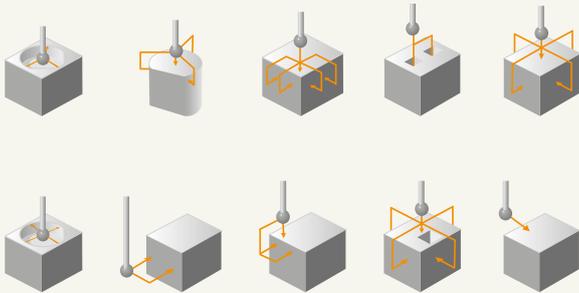
- Part Express allows interruption of an operation so that an urgent job can be inserted.
- Job List organizes the order of jobs according to manufacturing priorities.



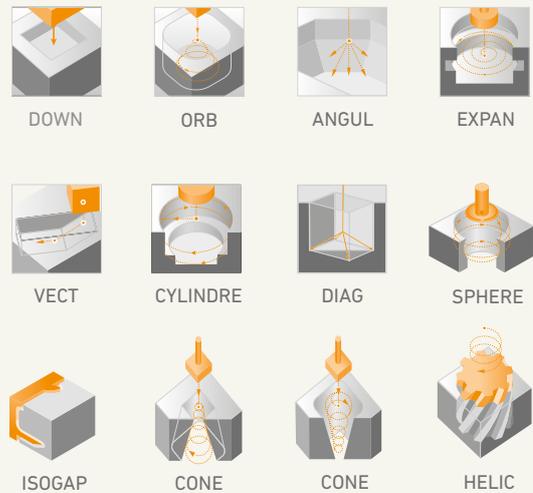
### Interactive graphical assistance

All operations, such as measurement, machining or cavity-positioning cycles, are illustrated by graphics/icons, allowing the operator to understand intuitively and spontaneously.

#### Measurement cycles



#### 2D/3D machining cycles



### e-Doc

The FORM X 400 and FORM X 600 range incorporate new online help to allow the operator to find relevant information as quickly as possible. This occurs via simplified access to help menus, by having a clearly organized navigation interface that is more user friendly and easy to grasp, and including search by key words or user index. Machining examples are produced as hard copy, presented in a succinct manner.

They are called up by using the online help system, so that implementation of a machining process can be followed stage by stage. More than additional descriptive documentation, e-Doc allows a genuine knowledge transfer for the benefit of the operator, enabling continuous knowledge improvement while reducing working days lost to training.

### Automatic CAD/CAM link

The different EDM machining sequences are automatically integrated into AC FORM HMI.

### Platform: Windows

- Integral PC
- Touch screen
- CD-ROM drive
- USB port
- Network connection



## The generator

# A highly flexible numeric generator

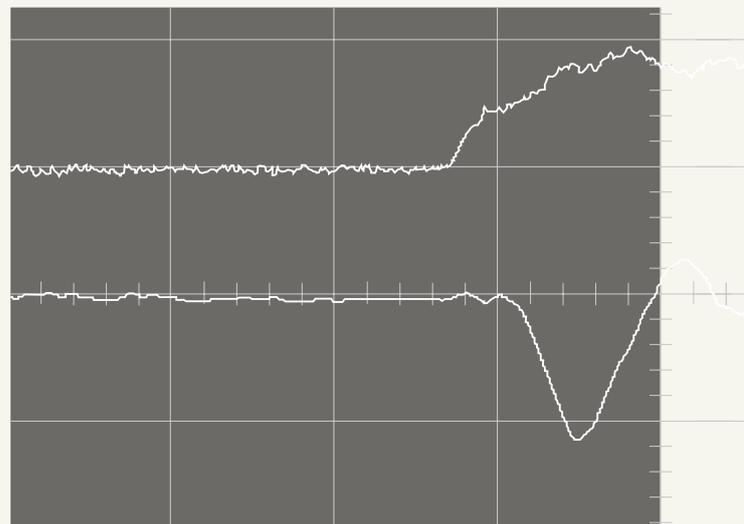
The ISPG generator, with fully digital data input, ensures a very high degree of predictability and repeatability of the machining results, even when executing the most complex shapes. The new generator incorporates a new technology, developed in our laboratories, that transports the lowest current levels of the generator to the erosion area, allowing a considerable increase in performance in the finishing phases with decidedly higher machining speeds and higher standards in surface finish, appreciable decreases in the residual altered layer and previously unimaginable rates of wear. Companies working in the world of miniaturization will find a great ally in the FORM X 400 and FORM X 600 and their modern generator.

The new type of digitally shaped pulses (DSP) and the highly automated machining strategies can easily carry out the various machining operations with no trouble using electrodes just a few tenths of a millimeter in size, regardless of their material. In this type of application, the tiniest of geometries must be reproduced with absolute perfection to guarantee the quality of the end products. The FORM X 400 and FORM X 600 yield impressive results on the most challenging micro applications, including very small inner radii.

### Lowest-wear EDM

These new possibilities offered by generator represent significant progress in die-sinking EDM and pave the way for completely new and attractive potential for customers manufacturing dies and components for a whole range of industrial sectors: They tower above their competitors because they can do more and better.

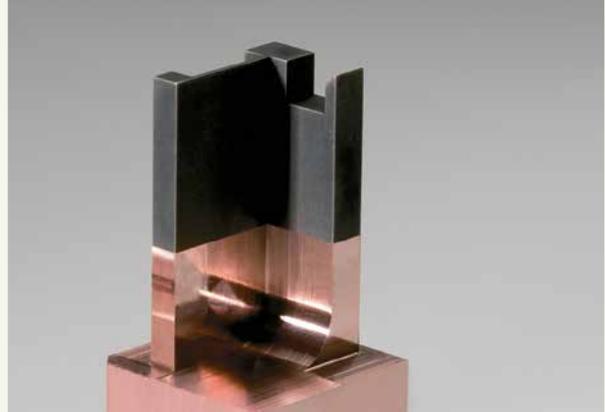
**High resolution parameters for current and voltage, and a high precision servo system with response times in the range of milliseconds enable machining with smallest internal radii.**



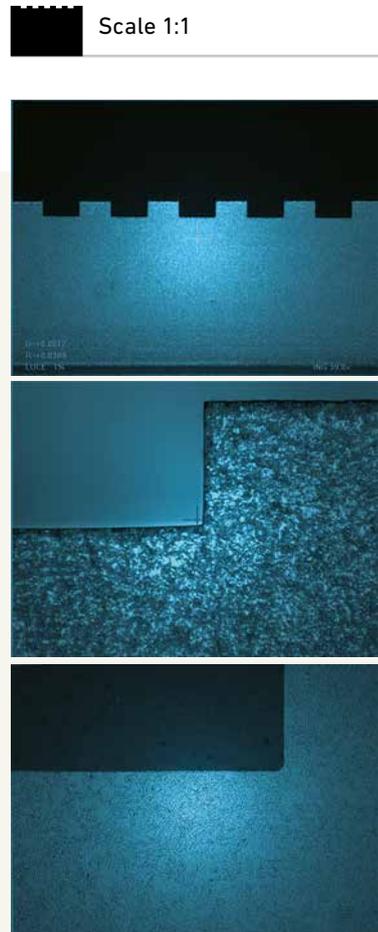
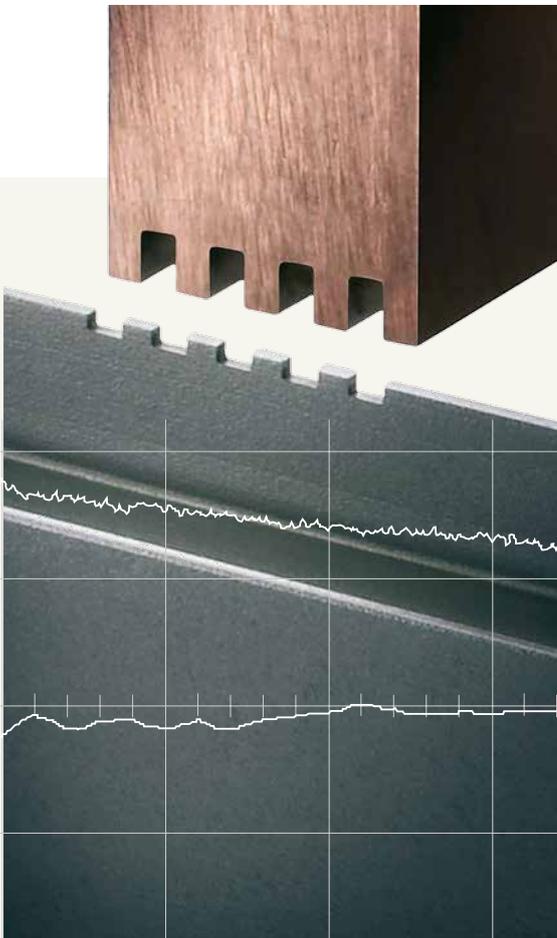
The iQ (innovative Quality) technology developed by GF Machining Solutions is available for the FORM X 400 and FORM X 600. Our iQ technology allows low-wear EDM with graphite and copper electrodes, reducing electrode consumption and related costs while guaranteeing the highest accuracy of form.



Part material: Steel 1.2343  
 Electrode material: Graphite R8710  
 Number of electrodes: 2  
 Number of simple forms: 7  
 Machining depth: 9 mm  
 Roughness: VDI 19, Ra 0.9 µm  
 Electric discharge machining time: 88 minutes  
 Average linear wear: 7 µm



Part material: Steel 1.2343  
 Electrode material: Copper  
 Under measure: 0.56 mm  
 Machining depth: 20 mm  
 Roughness: VDI 26, Ra 1.8 µm  
 Result with iQ technology (total time): 5 h 21 min.  
 Reduction in wear: from 20 % to 90 %



Autonomy and flexibility

# Configurable performance potential



### **Increased autonomy without manual intervention**

Manufacturing a mold often requires a large number of electrodes and pallets with sparking times varying noticeably from one cavity to another.

GF Machining Solutions offers a large variety of automation solutions allowing large storage capacity, positioning your business for unlimited machining potential.

### Tool changer

The electrode changer comes in three versions, for quantities ranging from 20 to 140 electrodes. Maximum flexibility is to be found in the "Capacity 3" version, allowing adaptation of the quantity of electrodes at any time in relation to customers' needs. Thus it is possible to start off with an electrode changer having three 20-electrode discs for a total of 60 electrodes, and then increase to seven 20-electrode discs to get a maximum total of 140 electrode positions.

### Capacity 1

One rotary disc for 20 electrodes with standard chuck or 30 electrodes with Combi chucks

### Capacity 2

Two rotary discs for 40 electrodes with standard chuck or 60 electrodes with Combi chuck

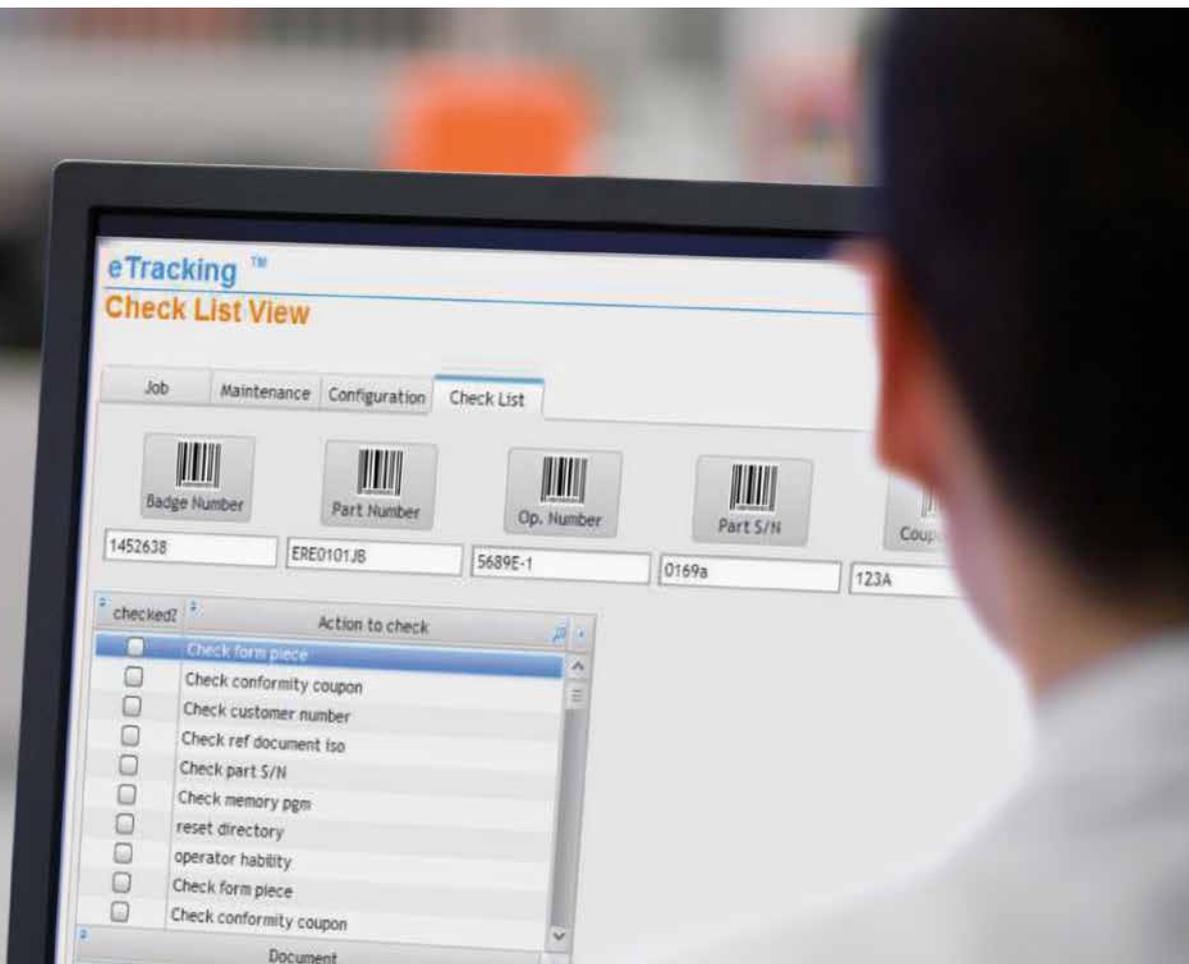
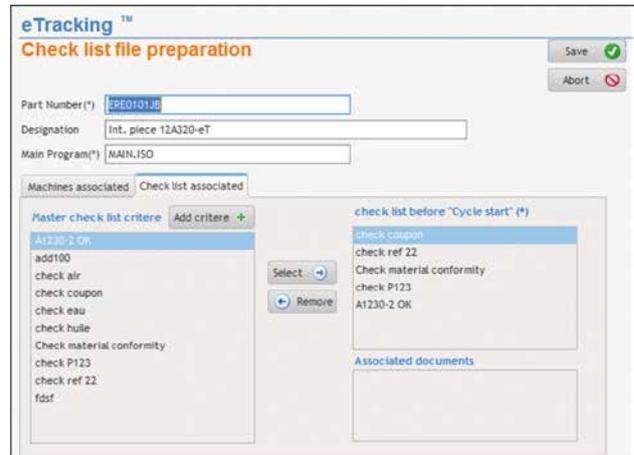
### Capacity 3

Three to seven rotary discs for 60 to 140 electrodes with standard chuck or 90 to 210 electrodes with Combi chuck



**Get on the fast track to superior quality**

GF Machining Solutions eTracking software platform, linked with the computer numerical control (CNC) of EDM machines, help trim costs by reducing the number of rejected parts and focusing on post-machining control of suspect parts. Our eTracking software helps you establish standard machining methodology from the start, lays a foundation for machining quality, and creates a data record for certification of quality production.



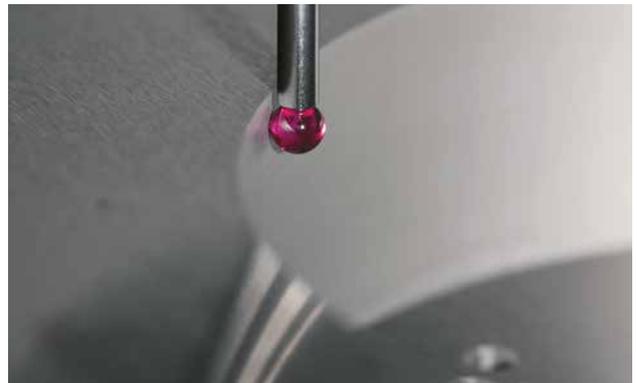


### **Accura-C, the best high-performance axis on the market**

It is not unusual to be confronted by machining situations where the electrodes are incorrectly located, even by such a distance that maintaining their position or stability during machining becomes problematic. Pulsation-induced movements in a liquid (dielectric) medium generate lateral forces (flexural or rotational) on the electrode, which must be resisted by the C axis. Thanks to its very robust design, the Accura-C allows very high moments of inertia to be absorbed, up to 5,000 kgcm<sup>2</sup>.

### **Renishaw probe**

To ensure positioning precision, an optical transmission probe can be managed by the FORM X 400 and FORM X 600. Measurement allows dimensional inspection of machined cavities as well as the taking of references of the part, without having to remove it, for considerable time savings. Furthermore, a measurement report is automatically generated by AC FORM HMI enabling rigorous checking and monitoring.



## Technical data



**FORM X 400**



**FORM X 600**

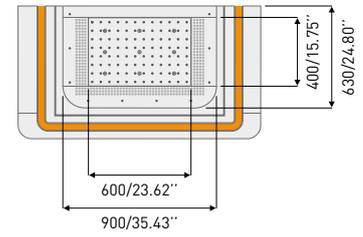
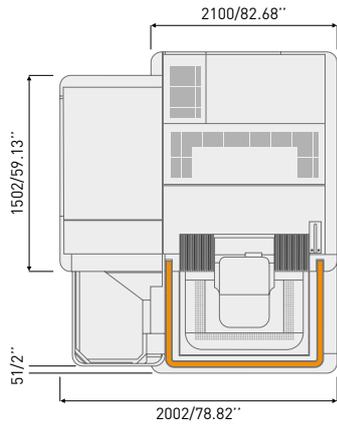
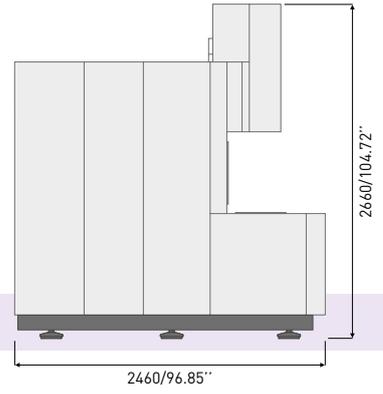
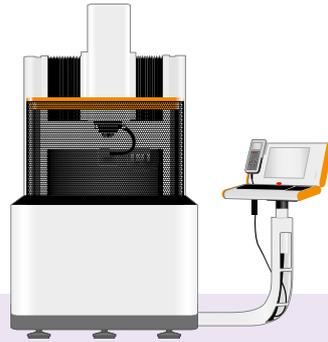
		<b>FORM X 400</b>	<b>FORM X 600</b>
<b>Machine</b>			
Architecture		C-frame/Fixed table/Drop tank	C-frame/Fixed table/Drop tank
Machine dimensions *	mm (in)	1410 x 2460 x 2660 (55.5 x 96.8 x 104.7)	1790 x 2860 x 3110 (70.5 x 112.6 x 122.4)
Weight total without dielectric	kg (lbs)	3830 (8444)	5900 (13007)
Floor space **	mm (in)	3400 x 4400 (133.86 x 173.23)	3800 x 4800 (149.61 x 188.98)
<b>X, Y, Z axes</b>			
X, Y, Z travel	mm (in)	400 x 300 x 350 (15.7 x 11.8 x 13.8)	600 x 400 x 500 (23.6 x 15.7 x 19.7)
X, Y, axes speed	m/min (ft/min)	6 (19.68)	6 (19.68)
Z axis speed	m/min (ft/min)	15 (49.21)	15 (49.21)
Positioning resolution X, Y, Z	µm (µin)	0.1 (3.94)	0.1 (3.94)
<b>Work area</b>			
Worktank size *	mm (in)	900 x 630 x 350 (35.43 x 24.80 x 13.78)	1280 x 1040 x 450 (50.39 x 40.94 x 17.72)
Worktable size **	mm (in)	600 x 400 (23.62 x 15.75)	850 x 600 (33.46 x 23.62)
Distance floor to clamping level	mm (in)	1000 (39.37)	1000 (39.37)
Min./Max. distance between table and chuck	mm (in)	170/520 (6.69/20.47)	200/700 (7.87/27.56)
<b>Workpiece and electrode</b>			
Max. electrode weight	kg (lbs)	50 (110.23)	50 (110.23)
Max. workpiece weight	kg (lbs)	800 (1763.70)	2000 (4409.24)
Max. workpiece dimensions	mm (in)	820 x 580 x 250 (32.28 x 22.83 x 9.84)	1200 x 800 x 350 (47.24 x 31.50 x 13.78)
Bath level	mm (in)	0-290 (0-11.42)	0-390 (0-15.35)
<b>Dielectric unit</b>			
Capacity	l (gal)	500 (132.08)	900 (237.75)
Number of filter elements and type		4 Paper filter cartridges	8 Paper filter cartridges

\* Width x depth x height \*\* Width x depth

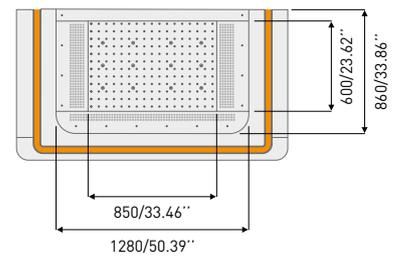
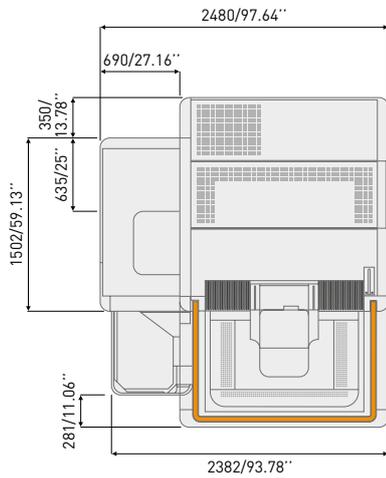
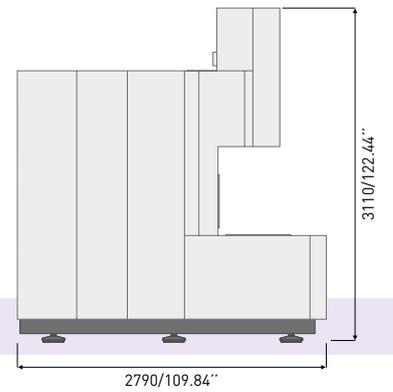
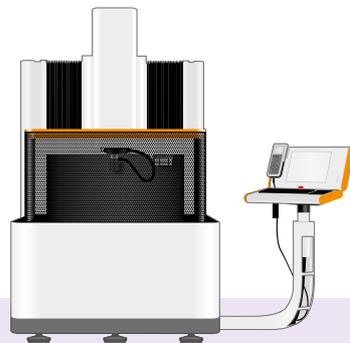
		FORM X 400	FORM X 600
<b>Generator</b>			
Generator type		ISPG	ISPG
Max. machining current	A	80 (140 ***)	80 (140 ***)
Best surface finish Ra	µm (µin)	0.08 (2)	0.08 (2)
<b>Electrical supply standard</b>			
Standard voltage		3 x 380 V/400 V ± 10% 50/60 Hz (50 Hz is standard)	3 x 380 V/400 V ± 10% 50/60 Hz (50 Hz is standard)
<b>Cooling</b>			
Heat exchanger air/water for the cabinet		Integrated	Integrated
Heat exchanger dielectricum/water for the dielectricum		Integrated	Integrated
<b>Control Unit</b>			
Operating system		Windows	Windows
Data input		15" LCD screen, mouse or touch screen, keyboard and remote control	15" LCD screen, mouse or touch screen, keyboard and remote control
User interface		AC FORM HMI	AC FORM HMI
Expert systems		TECFORM	TECFORM
Console support		Fixed or movable	Fixed or movable
<b>Modules</b>			
Z axis (15 m/min)		Standard	Standard
Multicavity flushing 6 outputs		Option	Option
3D probe measuring system for Erowa or System 3R		Option	Option
iQ graphite and copper module for reduction of electrodes' wear		Standard	Standard
Tool Changer Capacity 1		20 (Standard)/30 (Combi)	20 (Standard)/30 (Combi)
Tool Changer Capacity 2		40 (Standard)/60 (Combi)	40 (Standard)/60 (Combi)
Tool Changer Capacity 3		Up to 140 (Standard) and 210 (Combi)	Up to 140 (Standard) and 210 (Combi)
<b>Standard C-axis</b>			
Max. electrode weight on automatic chuck	kg (lbs)	25 (55.12)	25 (55.12)
Rotation speed	rpm	0-100	0-100
Max. inertia	kgcm <sup>2</sup> (lbsin <sup>2</sup> )	1500 (512)	1500 (512)
<b>Accura-C Axis (***)</b>			
Max. electrode weight on automatic chuck	kg (lbs)	25 (55.12)	25 (55.12)
Rotation speed	rpm	0-100	0-100
Max. inertia	kgcm <sup>2</sup> (lbsin <sup>2</sup> )	5000 (1700)	5000 (1700)

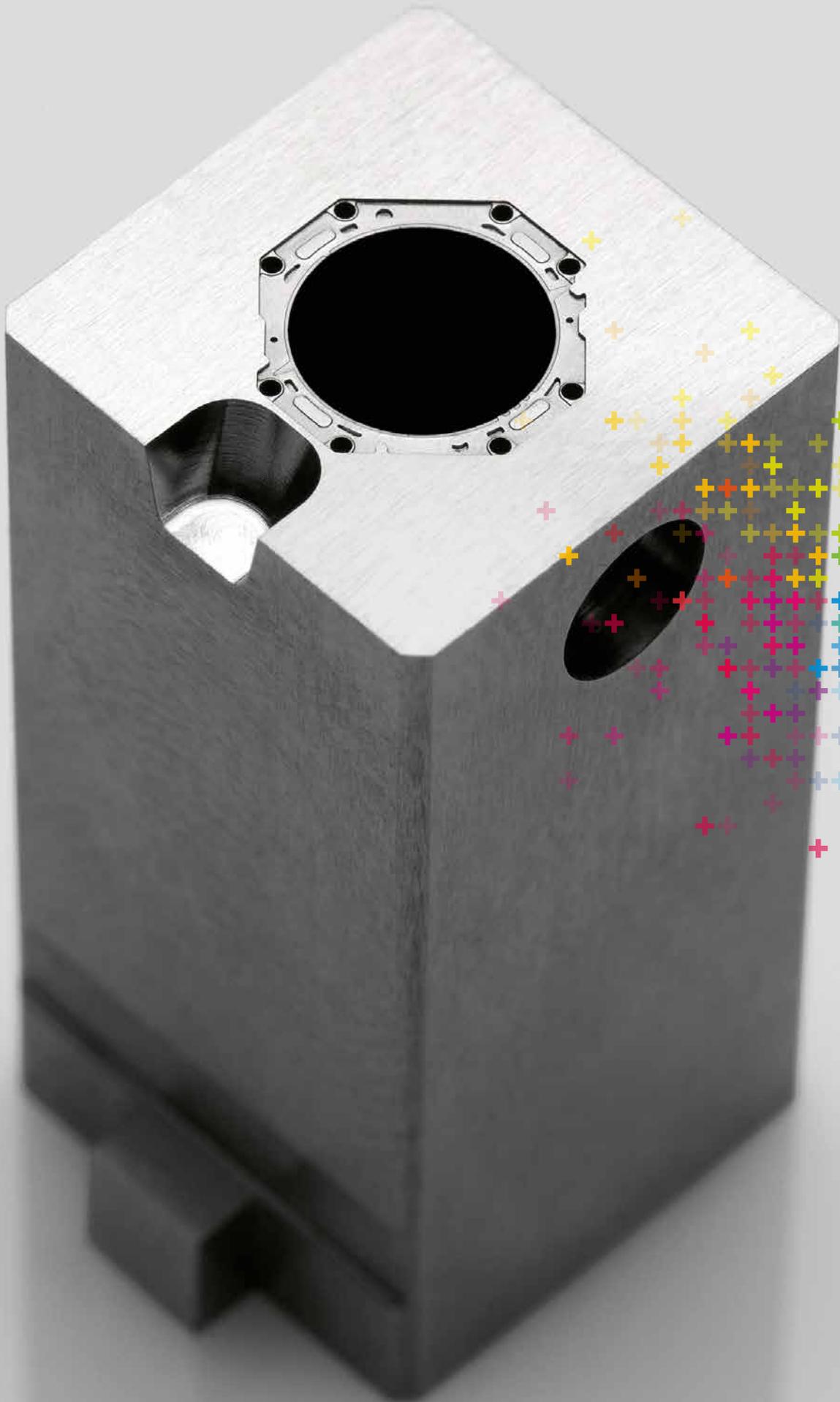
\*\*\* Option

**FORM X 400**



**FORM X 600**





# 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.



## 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.



## Milling

**Mikron high-speed (HSM), high-performance (HPM) and high-efficiency (HEM) Milling centers**

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 HSM, HPM and HEM 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.

**Liechti dedicated aerospace and energy machining centers**

Aerospace and power generation turbine manufacturers increasingly turn to Liechti dedicated five- and six-axis machining centers to machine complex, high-precision airfoils on blades, disks, blisks, blisks/IBRs and impellers. It's easy to see why because these machines, with their specific profile machining technology, specialized CAD/CAM software and engineering competence for ultra-dynamic machining in titanium, Inconel, nimonic, titanium-aluminide and high-alloy steels, yield productivity gains as much as 30 percent, thanks to reduced machining times. In the globally competitive aerospace and power generation manufacturing sector, that's definitely worth shouting about.

**Step-Tec Spindles**

At the heart of every GF Mikron machining center is high-performance Step-Tec Spindle. Step-Tec Spindles are essential core components of our machining centers. Highly accurate and thermally stable Step-Tec Spindles ensure that our machines can handle everything from heavy-duty roughing to fine-finishing operations.



## Customer Services

**Operations Support, Machine Support and Business Support**

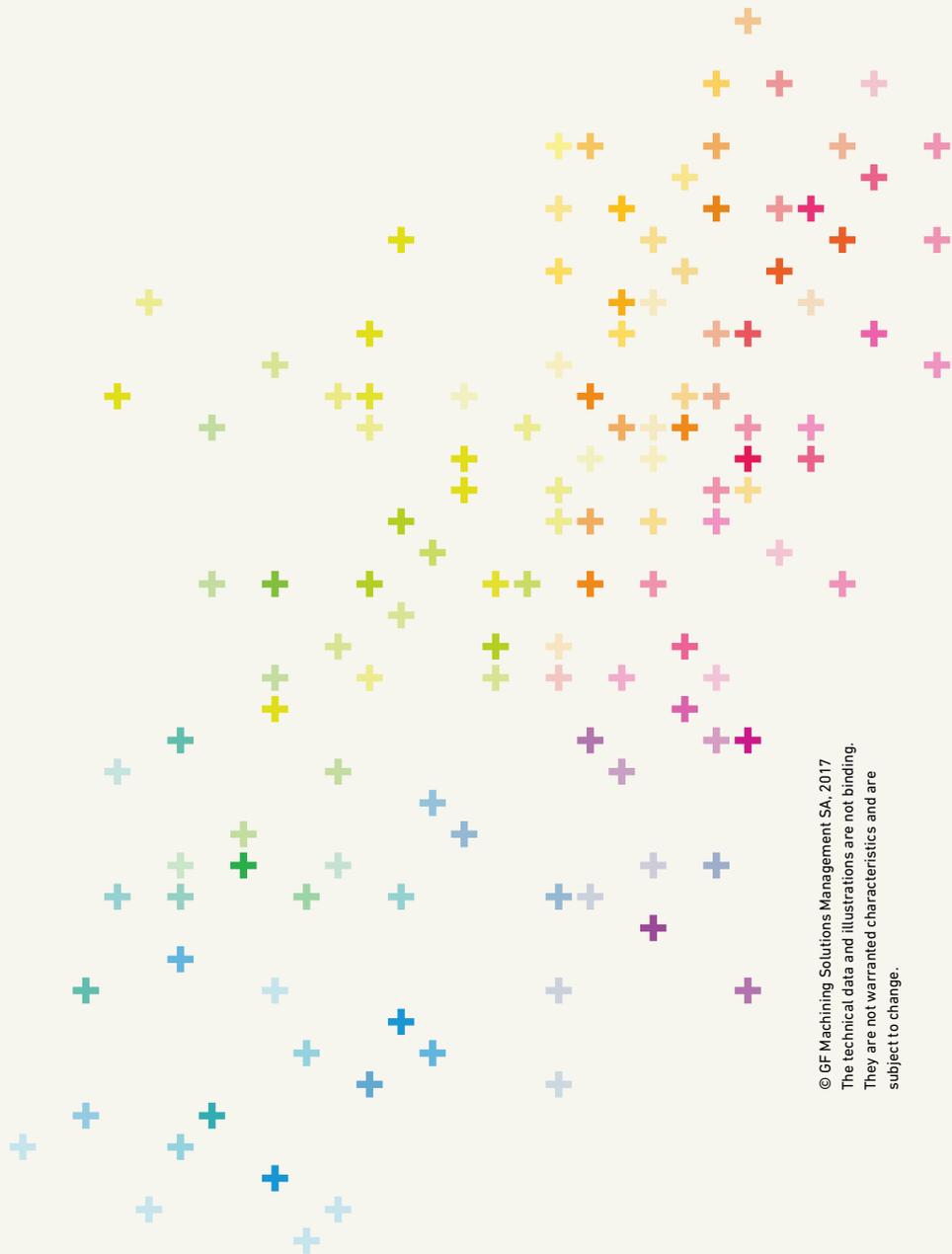
To help you get the most and the best from your machine tools and equipment, we offer three levels of support. Operations Support covers our range of original wear parts and certified consumables (EDM wires, filters, resins, electrodes etc.) to ensure that your machines are performing at the highest 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.

[www.gfms.com](http://www.gfms.com)



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