System 3R – Tooling

Powder Compacting Technology
Becoming better every day – since 1802

GF Machining Solutions
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 unmatched Electrical Discharge Machining (EDM), Laser texturing, Laser micromachining, Additive Manufacturing and first-class Milling and Spindles to Tooling and Automation, all of our solutions are backed by unrivaled Customer Services and expert GF Machining Solutions training. Our AgieCharmilles, Microlution, Mikron Mill, Liechti, Step-Tec and System 3R technologies help you raise your game – and our digital business solutions for intelligent manufacturing, offering embedded expertise and optimized production processes across all industries, increase your competitive edge.
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8  Examples of configurations

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12 Tooling top down choice by size

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System 3R Tooling

Productivity in effect
+ Simple, quick set-up
+ High accuracy
+ Low scrap rate
+ Maximal machine utilization
+ Increased productivity
System 3R applied in PM

Upper punch
Repeatability <0.002 mm

Die
Repeatability <0.002 mm

Lower punch
Repeatability <0.002 mm
System 3R applied in the Toolshop

Use System 3R tooling when producing punches and dies
Gives an increased productivity in the Tool shop by a reduction of the set-up times, improved accuracy & quality and reduced number of rejections.

Use System 3R tooling also for Powder Compacting
Reduces the set-up times in the press and gives an improved accuracy & quality and less repairs.

Fitting the machines with the same reference system means that electrodes and workpieces can be moved between the machines without subsequent alignment and checking – One Minute Set-up.
A reference system minimises setup times
Every minute that can be converted from internal to external setting time increases the spindle time of the machine and with it the productivity of the business.

Big earnings are within your reach
The machine generates revenue when its spindle is turning – and only then. Work smarter, not harder.

Conventional setting-up

<table>
<thead>
<tr>
<th>Job 1</th>
<th>Job 2</th>
<th>Job 3</th>
<th>Job 4</th>
<th>Job 5</th>
<th>Job 6</th>
</tr>
</thead>
</table>

One manned shift – eight hours

Pallet system

<table>
<thead>
<tr>
<th>Job 1</th>
<th>Job 2</th>
<th>Job 3</th>
<th>Job 4</th>
<th>Job 5</th>
<th>Job 6</th>
</tr>
</thead>
</table>

One manned shift – eight hours

One Minute Set-up
Set-up time: change & alignment

Hours

<table>
<thead>
<tr>
<th>Multi-level</th>
<th>Single-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>with System 3R</td>
</tr>
</tbody>
</table>

Reduction 95%  
Reduction 98%  

=1-1.5 h  
=1-4 h  
=2-5 min  
=12-24 h
Examples of configurations

Single levels

Manual configuration
Mechanical operated

Automatic configuration
Pneumatic operated

Upper punch, Macro

Die, 3Refix

Lower punch and core pin, Macro

Upper punch, Macro

Die, Matrix

Lower punch and core pin, Macro
Single levels

**Manual configuration**
Mechanical operated

- Upper punch, Matrix
- Die, 3Refix
- Lower punch and core pin, Matrix

**Automatic configuration**
Pneumatic operated

- Upper punch, Matrix
- Die, Matrix
- Lower punch and core pin, Matrix
Examples of configurations

Multi level

Inner punch, Matrix

Outer punch, Matrix

Die, 3Refix

Outer punch, Matrix

Die, Matrix

Inner punch and core pin, Macro

System 3R Tooling for Powder Compacting Technology
Maintain flexibility in Press

Convert Multi to single level

1. Load chuck adapter for shorter core rod.

2. Load chuck adapter for single punch

Connectors for Pneumatic chuck, Matrix 142

Chuck adaptor connectors

Unclamp Turbo/Airblast cleaning
Tooling – Top down choice by size

### Chucks

**3Refix PM mandrels, 3R-901-10PM-TX, Ø10 mm**
- Recommended tightening torque: 4 Nm.
- Weight: 0.02 kg.

**3R-901-20PM-TX, Ø20 mm**
- Recommended tightening torque: 10 Nm.
- Weight: 0.1 kg.

**Pneumatic chuck, Matrix 220, 3R-690.1-220**
- Chuck for permanent mounting into a PM press.
- Built in height: 50 mm
- Max pressure: 200 ton.
- Required drawbar: 3R-695.2-220
- Weight: 11 kg.

**Pneumatic chuck, built in, Matrix 220, 3R-SP28340**
- Chuck for permanent mounting into a PM press.
- Built in height: 25 mm
- Max pressure: 100 ton.
- Required drawbar: 3R-695.2-220
- Weight: X kg.

**Pneumatic chuck, Matrix 185, 3R-690.1-185**
- Chuck for permanent mounting into a PM press.
- Built in height: 50 mm
- Max pressure: 100 ton.
- Required drawbar: 3R-695.2-185
- Weight: 9 kg.

**Pneumatic chuck, built in, Matrix 185, 3R-SP28268**
- Chuck for permanent mounting into a PM press.
- Built in height: 25 mm
- Max pressure: 100 ton.
- Required drawbar: 3R-695.2-185
- Weight: X kg.

**Pneumatic chuck, Matrix 260, 3R-690.1-260**
- Chuck for permanent mounting into a PM press.
- Built in height: 50 mm
- Max pressure: 200 ton.
- Required drawbar: 3R-695.2-260
- Hardened references
- Weight: 13 kg.
Chucks

**Pneumatic chuck, Matrix 142, 3R-690.1-142**
Chuck for permanent mounting into a PM press.
+ Air sensor separated from Turbo.
+ Built in height 17.5 mm
+ Max pressure 50 ton
+ Required drawbar 3R-695.2-142
+ Weight 2.7 kg.

**Pneumatic chuck, Matrix 142, 3R-690.1-142HD**
Chuck for permanent mounting into a PM press.
+ Air sensor separated from Turbo.
+ Built in height 50 mm
+ Max pressure 50 ton.
+ Required drawbar 3R-695.2-142
+ Weight 7 kg.

**Pneumatic chuck, Built in, Matrix 142, 3R-SP28395**
Chuck for permanent mounting into a PM press.
+ Built in height 17.5 mm
+ Max pressure 50 ton.
+ Required drawbar 3R-695.2-142
+ Weight 2.7 kg.

**Pneumatic chuck, Built in, Matrix 142, 3R-690.1-142**
Chuck for permanent mounting into a PM press.
+ Built in height 50 mm
+ Max pressure 50 ton.
+ Required drawbar 3R-695.2-142
+ Weight 7 kg.

**Pneumatic chuck, Matrix 110, 3R-690.1-110**
Chuck for permanent mounting into a PM press.
+ Built in height 35 mm
+ Max pressure 25 ton.
+ Required drawbar 3R-695.2-110
+ Weight 2.5 kg.

**Pneumatic chuck, Matrix 110, 3R-690.1-110HD**
Chuck for permanent mounting into a PM press.
+ Air sensor separated from Turbo.
+ Built in height 35 mm
+ Max pressure 25 ton.
+ Required drawbar 3R-695.2-110
+ Weight 2.5 kg.

**Pneumatic chuck, Matrix 110, 3R-690.1-110**
Chuck for permanent mounting into a PM press.
+ Built in height 35 mm
+ Max pressure 25 ton.
+ Required drawbar 3R-695.2-110
+ Weight 2.5 kg.

**Pneumatic chuck, Built in, Matrix 110, 3R-SP28219**
Chuck for permanent mounting into a PM press.
+ Built in height 25 mm
+ Max pressure 25 ton.
+ Required drawbar 3R-695.2-110
+ Weight 2.5 kg.
Tooling – Top down choice by size

### Chucks

**Manual chuck, MacroMagnum, 3R-680.27-150**
- Built in height 28 mm
- Max pressure 150 ton.
- Required drawbar 3R-605.11
- Weight 4.7 kg.

**Pneumatic chuck, Macro PM, 90803.60**
- Built in height 70 mm
- Max pressure 100 ton.
- Required drawbar 90840.55
  (core rods up to Ø16 mm can be used)
- Weight 7 kg.

**Pneumatic chuck, Macro PM, 3R-600.17-60**
- Air sensor separated from Turbo.
- Built in height 70 mm
- Max pressure 64 ton
- Required drawbar 3R-605.11
- Weight 3.5 kg,

**Manual chuck, Macro PM, 3R-600.27-60**
- Built in height 22 mm
- Max pressure 64 ton
- Required drawbar 3R-605.11
- Torque 6 Nm
- Weight 1 kg

**Pneumatic chuck, Macro PM, 3R-600.17-30**
- Air sensor separated from Turbo.
- Built in height 70 mm
- Max pressure 32 ton
- Required drawbar 3R-605.11
- Weight 3.5 kg

**Pneumatic chuck, Macro PM, 90803.50**
- Built in height 70 mm
- Max pressure 40 ton.
- Required drawbar 90840.55 (core rods up to Ø16 mm can be used)

**Built in chuck, Pneumatic, Macro PM, 3R-600.17-32**
- Built in height 30 mm
- Max pressure 32 ton.
- Required drawbar 3R-605.11
- Weight 2 kg.
Chucks

Built in chuck, Pneumatic, Macro PM, 3R-600.17-34
- Built in height 30 mm
- Max pressure 32 ton.
- Required drawbar 3R-605.11
- Weight 2.9 kg.

Manual chuck (built-in) Ø80, Macro PM, 3R-600.27-30
- Built in height 22 mm
- Maximal pressure 32 ton.
- Required drawbar 3R-605.11
- Torque 6 Nm.
- Weight 1 kg.

Pneumatic chuck, Macro PM, 3R-600.17-16
- Built in height 63 mm
- Max pressure 16 ton
- Required drawbar 3R-605.11
- Weight 1.6 kg.

Manual chuck, Macro, D-20173
- Built in height 27 mm
- Max pressure 16 ton.
- Required drawbar 90958
- Weight 1 kg.

Distance block, Macro PM, 3R-A34249
For manual Macro chuck, i.e. 3R-600.27-XX.
- Built in height 47 mm.
- Weight 2.8 kg.
Tooling

Pallets and accessories

**Pneumatic Core rod chuck, D-20175**
For holder D-20175.10
+ Built in height 37 mm

**Holder, D-20175.10**
Pallet for core rods (Ø10 mm)

**Drawbar, Macro, 90840.55**
Requires chuck 90803.50.
+ Through hole Ø16 mm
+ Weight 0.2 kg.

**Drawbar, Macro, 3R-605.11**
+ Through hole Ø10.2 mm
+ Weight 0.2 kg.

**Drawbar, Macro, 90958**
+ Through hole Ø10.2 mm
+ Weight 0.1 kg.

**Drawbar, Macro, 90803.50**
Through hole Ø16 mm

**Note:** With automation, the gripper has to grip on the pallet or change drawbar with gripper interface (i.e. 3R-605.1).

**Locking ring key, 3R-605-GE**
To lift the locking ring of the drawbars.
+ Supplied in sets of 2

**Pallet 54 mm, Macro, 3R-651.7E-P**
+ Max press force: 16 ton.
+ Supplied in set of 8 pcs
+ Rust resistant material
+ Size 54 x 54 x 12.5 mm
+ Weight 0.2 kg/pc.
Pallets

**Pallet Ø75 mm, Macro, 3R-651.75E-P**
- Max press force: 32 ton.
- Supplied in set of 10 pcs
- Rust resistant material
- Size Ø75 x 12.5 mm
- Weight 0.3 kg/pc.

**Pallet Ø75 mm, Macro, 3R-651.75-50E**
- Max press force: 64 ton.
- Supplied in sets of 10 pcs.
- Rust resistant material
- Size Ø75 x 12.5 mm
- Weight 0.3 kg/pc.

**Pallet Ø110 mm, Macro, 90506.06**
Hardened pallet with clearance holes for fixing screws.
- Max press force: 100 ton.
- Rust resistant material
- Size Ø110 x 12.5 mm
- Weight 0.7 kg.

**Pallet Ø142 mm, MacroMagnum, 3R-681.71**
Hardened pallet with clearance holes for fixing screws.
- Max press force: 150 ton.
- Rust resistant material
- Size Ø142 x 12.5 mm
- Weight 1 kg.

Choice of chuck, sets permissible max press load for punches

**Example: MacroPM chuck, 3R-600.17-60**
Max. Press force: 64 ton.
Alternate between pallets for 64 ton or less.

Price on consumables pallets

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Pallets and accessories

Pallets, Matrix
+ Rust resistant material.
+ Adapted for automatic changing.
Note: Not self carrying, requires extra support.

<table>
<thead>
<tr>
<th>Art. No</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>Press load (ton)</th>
<th>Drawbar</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3R-691.1-110</td>
<td>110</td>
<td>20</td>
<td>25</td>
<td>3R-695.2-110</td>
<td>0.5</td>
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<tr>
<td>3R-691.1-142</td>
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<td>50</td>
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<td>1.2</td>
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<tr>
<td>3R-691.1-185</td>
<td>185</td>
<td>20</td>
<td>100</td>
<td>3R-695.2-185</td>
<td>1.7</td>
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<tr>
<td>3R-691.1-220</td>
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<td>25</td>
<td>150</td>
<td>3R-695.2-220</td>
<td>2.6</td>
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<tr>
<td>3R-691.1-260</td>
<td>260</td>
<td>25</td>
<td>200</td>
<td>3R-695.2-260</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Drawbars, Matrix
Note: In automation the gripper has to grip on the pallet and not on the drawbar.

<table>
<thead>
<tr>
<th>Art. No</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3R-695.2-110</td>
<td>57</td>
<td>60</td>
<td>38</td>
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<td>76</td>
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<tr>
<td>3R-695.2-185</td>
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<td>119</td>
<td>45.5</td>
<td>0.8</td>
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<tr>
<td>3R-695.2-220</td>
<td>147</td>
<td>149</td>
<td>45.5</td>
<td>1.3</td>
</tr>
<tr>
<td>3R-695.2-260</td>
<td>187</td>
<td>189</td>
<td>45.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Torque wrench, 4 Nm, 3R-614-04
Intended for Ø10 mm 3Refix mandrels.
+ 4 Nm.

Torque wrench, 6 Nm, 3R-614-06
Intended for Macro manual chucks.
+ 6 Nm.

Torque wrench, 10 Nm, 3R-914-10
Intended for Ø20 mm 3Refix mandrels.
+ 10 Nm.

Air unit, 90125.25-05
Includes status indicators.
+ Weight 1 kg.
**Pallets and accessories**

**Adapterpalett Matrix 142-3Refix Ø10, 3R-SP29388**
Adapterpalett Matrix 142 to 3Refix (44/46) for dies.
+ Required drawbar 3R-SP29403
+ Weight 1.6 kg.

**Matrix 142-3Refix Drawbar, 3R-SP29403**
Special Matrix 142 drawbar for adapterpallet 3R-SP29388.

![Adapterpalett Matrix 142-3Refix Ø10, 3R-SP29388](image)

**Chuck adapter, Matrix 142-Macro, 3R-SP33230**
From Matrix 142 into Macro system. Chuck adapter with built-in Macro chuck.
+ Built in height 90 mm
+ Hardened references
+ Maximal pressure 50 ton.
+ Required drawbar 3R-605.11
+ Weight 7 kg.

**Fixture for punch on Macro, 90238**
Fixture for punch on Macro, in order to wire-cut a through hole within Ø20 mm.

![Chuck adapter, Matrix 142-Macro, 3R-SP33230](image)

**Fixture for punch on Macro, 90238**

![Fixture for punch on Macro, 90238](image)
## Accessories

**Force gauge press Ø72 mm, 3R-SSP122**
Intended for checking clamping force of Matrix chucks and for those Macro chucks found in compacting machines [due to cramped and limited space inside machine]. In order to check Matrix chucks, see additional converter kits 3R-SSP115-Matrix XXX enabling checking.

![Force gauge press Ø72 mm, 3R-SSP122](image)

**Force gauge regular, 3R-SSP115-BASE**
Intended for checking clamping force of Matrix chucks and for those Macro chucks found in non-compacting machines. In order to check Matrix chucks, see additional converter kits 3R-SSP115 Matrix xxx enabling checking.

**Converter kit, 3R-SSP115 Matrix 110**
Added kit to enable checking Matrix 110 chucks.

**Converter kit, 3R-SSP115 Matrix 142**
Added kit to enable checking Matrix142 chucks.

**Converter kit, 3R-SSP115 Matrix 185**
Added kit to enable checking Matrix185 chucks.

![Converter kit, 3R-SSP115 Matrix 142](image)

**Index blocker-pin, 3R-SP29196**
To disable indexing feature on Matrix 110 chucks.
+ Delivered 1 pc.

![Index blocker-pin, 3R-SP29196](image)

**Index blocker-pin, 3R-SP29533E**
To disable indexing feature on Matrix 142 and 185 chucks.
+ Delivered 2 pcs.

![Index blocker-pin, 3R-SP29533E](image)
## Accessories

### Index blocker-pin, 3R-SP29559E
To disable indexing feature on Matrix 220 and 260 chucks.
+ Delivered 4 pcs.

### Handle, Matrix 110, 3R-692.7-110
Handle to circumvent pallet for easier lift off chuck.
Comes by different sizes.

### Handle Matrix 142, 3R-692.7-142
Handle to circumvent pallet for easier lift off chuck.
Comes by different sizes.

### Handle, Matrix 185, 3R-692.7-185
Handle to circumvent pallet for easier lift off chuck.
Comes by different sizes.

### Handle Matrix 220, 3R-692.7-220
Handle to circumvent pallet for easier lift off chuck.
Comes by different sizes.

### Lifting device, 3R-692.8-142
In combination with 3R-692.7-110 and 3R-692.7-142 to enable lift by crane.

### Lifting device, 3R-692.8-220
In combination with 3R-692.7-185 and 3R-692.7-220 to enable lift by crane.
How to make a configuration

Chuck

Punch

Die

Chuck

Core rod

<table>
<thead>
<tr>
<th>Punch</th>
<th>Force (Ton)</th>
<th>Core rod (Ø mm)</th>
<th>Manual or Pneumatic</th>
<th>Build On or Build In</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-20173</td>
<td>16</td>
<td>10</td>
<td>M</td>
<td>O</td>
</tr>
<tr>
<td>3R-600.17-16</td>
<td>16</td>
<td>10</td>
<td>P</td>
<td>O</td>
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<tr>
<td>3R-690.1-110HD</td>
<td>25</td>
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<td>P</td>
<td>I</td>
</tr>
<tr>
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<td>P</td>
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<td>10</td>
<td>P</td>
<td>I</td>
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<td>10</td>
<td>P</td>
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<td>10</td>
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<td>O</td>
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<td>90803.60</td>
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<td>16</td>
<td>P</td>
<td>O</td>
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<td>O</td>
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<tr>
<td>3R-680.27.150</td>
<td>150</td>
<td>10</td>
<td>M</td>
<td>I</td>
</tr>
</tbody>
</table>
Accessories

**Punch alignment system, D-20158-BASE**
This fixture enables adjustment of punches within metal powder compacting by Macro system. The fixture is a stand-alone unit. It is possible to replace the indicators with electrical sensors. Free access from underneath, to access fixation-screws for the pallets.

+ Linear probes, 3 pcs
+ Measuring accuracy for the probes
  - deviation: 0.2 µm
  - repetition error: 0.05 µm
  - applied pneumatic pressure: 1.1-1.5 bar

Accessory kits for (supplied separately):
Macro 54
Macro 75
Matrix 110
Matrix 142

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**Alignment tool & control Z-distance, Macro PM, 90909**
Alignment and control tool for the Macro + 3Refix system in PM. Alignment is rough but helps reduce assembly time before final verification and alignment with verification tools. Also to be used to check parallelism between punch levels versus die-platen-level.

+ Dimensions: Ø115x75 mm
+ cc. 3Refix Ø10 mm: 46+44 mm
+ Weight: 2.1 kg.

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**Die unit for Z-distance, Matrix 142, D-20198-DZxx**
Requires computer etc by D-20189-BASE.
To be used in combination with punch unit D-20198-Zxx.

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**Tool for Z-distance, Macro, D-20198-ZXX**
Tool to establish Z-distance in combination with either 3Refix or Matrix 142 pallet. This unit requires additional tool.
It is possible to apply electrical or mechanical indicators while measuring top surface.
Note: Linear probe is not included.

+ Built in height 50 mm
+ Requires drawbar 3R-605.11 or similar.
Software makes it easy to read and follow the steps.
Formal document is possible to print and/or store after alignment.

**Verification set – High Performance**
A set of probes with limited pressure point to measure location thus establish deviation by less than 0.1 µm within a second. Handheld computer allows operator to bring it inside the machine for better monitoring of exact location while checking alignment. After each chuck for punch has been aligned, values may be printed or stored. Sets for punches and die to be applied, are sold separately and made available by various tooling interfaces.

**Contents:**
Computer set for PM alignment, D-20189-BASE
+ Lap-top
+ Software
+ Signal converter
+ Pneumatic control unit
+ Pneumatically operated probes (3x)
Custom made and suitable tools are ordered separately. This goes for the die and punch(es) and includes required accessories.
Other Tooling – MacroNano and MatrixNano*

- Extremely high accuracy.
- High-precision machines are linked together in the production chain, without detracting from the extreme accuracy.
- Feedback to the machine for supplementary machining after inspection is possible. This feedback is only meaningful if the pallet system is at least as accurate as the measuring machine.

Workholding for Nano Precision

Nano-precision machining requires nano-precision referencing of workpieces and tools— a real challenge even with state of the art solutions available in the market. This becomes even more challenging when the references need to be established in the shortest possible time.

Nano system is best described in two words as precise and quick! The Nano clamping system links the production chain through an ultra-precision coupling both for workpiece and tool holding.

- Repetition accuracy – within 0.001 mm
- Fixed index positions 4x90°
- Required air pressure, pneumatic chuck – 6±1 bar

* Matrix 110 and Matrix 142
**MacroNano**

**Application example: Microstructuring with Diamond Machining**

Micro features produced with nano precision

This micro structure is produced by Diamond Flycutting operations on two different machines, each equipped with a MacroNano chuck. The square in the middle of the workpiece (right picture) is produced by plane milling on 1st machine, making use of indexing feature of the MacroNano system. The pallet carrying the workpiece is then transferred to the chuck on 2nd machine to produce the micro-grooves, once again using the indexing feature. The zero reference was determined only once on the 1st machine and then carried through the whole process chain using both the indexing precision and the system precision of the MacroNano system; overall structure deviation is less than 0.5 micron.

<table>
<thead>
<tr>
<th>Width (mm)</th>
<th>Length (mm)</th>
<th>Vertical dist. (mm)</th>
<th>Horizontal dist. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W₁ 0.9996</td>
<td>l₁ 0.9999</td>
<td>dᵥ₁ 0.4988</td>
<td>dₕ₁ 0.5013</td>
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<td>W₂ 0.9996</td>
<td>l₂ 0.9999</td>
<td>dᵥ₂ 0.4993</td>
<td>dₕ₂ 0.4995</td>
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<td>l₃ 0.9999</td>
<td>dᵥ₃ 0.4996</td>
<td>dₕ₃ 0.5001</td>
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<td>l₄ 0.9999</td>
<td>dᵥ₄ 0.4991</td>
<td>dₕ₄ 0.4995</td>
</tr>
<tr>
<td>W₅ 0.9996</td>
<td>l₅ 0.9998</td>
<td>dᵥ₅ 0.5010</td>
<td>dₕ₅ 0.5001</td>
</tr>
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<td>l₆ 0.9998</td>
<td>dᵥ₆ 0.5007</td>
<td>dₕ₆ 0.5002</td>
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<tr>
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<td>l₇ 0.9999</td>
<td>dᵥ₇ 0.4996</td>
<td>dₕ₇ 0.5012</td>
</tr>
<tr>
<td>W₈ 0.9996</td>
<td>l₈ 0.9999</td>
<td>dᵥ₈ 0.4992</td>
<td>dₕ₈ 0.5009</td>
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<tr>
<td>W₉ 0.9997</td>
<td>l₉ 0.9999</td>
<td>dᵥ₉ 0.4996</td>
<td>dₕ₉ 0.5009</td>
</tr>
<tr>
<td>W₁₀ 0.9996</td>
<td>l₁₀ 0.9998</td>
<td>dᵥ₁₀ 0.4998</td>
<td>dₕ₁₀ 0.5008</td>
</tr>
</tbody>
</table>

**Mean values**

| W 0.9996 | l 0.9999 | dᵥ 0.4997 | dₕ 0.5004 |

**Overall structure deviation < 0.5 µm**

Measurement of the cube dimensions

Measurement of groove positions
Tooling Technology
The Macro system for punches
Choice of reference element is determined by required pressing force.

Note: Recommended air pressure, pneumatic chuck 6±1 bar.

The Matrix system for dies and punches

Note: For the entire product range see www.system3r.com
3Refix for dies

3Refix is a cost effective solution. The 3Refix expanding mandrels (2 pcs) determines the position. First 3Refix mandrel is to determine X/Y-position and the second to determine the angle.

Description
1  Z-reference surface
2  3Refix mandrels
3  Customer made die
4  Die plate (table)
5  Die plate only requires two holes for 3Refix mandrels

Positioning accuracy
Improved positional accuracy.
Closer tolerances for finer grains.

Angular accuracy
Smaller angular deviations
Less wear and damage to punch and die.

Procedure (always)
A  Tighten R0 (primary)
B  Tighten R1 (secondary)
Tooling Technology

For Single-level press, 3Refix

1. Lower punch (Macro)
2. Die pallet to hold dial indicators
3. 3Refix Ø10 mm
4. Upper punch (Macro)
5. Pre-set tool
6. Drawbar (Macro)

Note: Dial indicators are optional.

For Single-level press, Matrix 142

1. Die pallet to hold dial indicators (Matrix 142)
2. Drawbar (Matrix 142)
3. Lower punch (Macro)
4. Upper punch (Macro)
5. Pre-set tool
6. Drawbar (Macro)

Note: Dial indicators are optional.

For Multi-level press, 3Refix

1. Drawbar (Matrix 142)
2. Outer punch (Matrix 142)
3. Inner punch (Macro)
4. Die pallet to hold dial indicators
5. 3Refix Ø10 mm
6. Pre-set tool
7. Drawbar (Macro)

Note: Dial indicators are optional.

For Multi-level press, Matrix 220

1. Drawbar (Matrix 220)
2. Outer punch (Matrix 142)
3. Inner punch (Macro)
4. Die pallet to hold dial indicators (Matrix 220)
5. Pre-set tool
6. Drawbar (Macro)
7. Drawbar (Matrix 142)

Note: Dial indicators are optional.
With conventional chucks, vibrations of the workpiece caused by the dynamic forces due to the action and rotation of the cutting tool. Restrictions therefore have to be imposed on the rotation speed and feed rate of the cutting tool, to prevent instability and to achieve the necessary surface quality.

**Advantages of a damped chuck**

After intensive research into the dynamics of chuck systems, machine tool maker System 3R has developed and patented a chuck with vibration-damped palletisation (VDP). By reducing the vibrations of the workpiece and a considerable proportion of the vibrations of the cutting tool, the VDP technology improves the dynamics of the entire metal cutting process. This means that machine tools can be operated at higher speeds with greater accuracy and at the same time with less wear. Workpieces can usually be produced in a single operation within strict dimensional tolerances and with a surface quality in the micrometer range – a millionth of a metre.

+ Better surface finish reduces the need for finishing.
+ Higher material removal rate improves productivity.
+ Less tool wear extends the life of the cutting tools.
+ Less vibration in the machine spindle.
+ Better dimensional accuracy gives fewer rejects.
+ Greater scope for machining difficult materials and complex shapes.
+ Shorter lead times thanks to a higher material removal rate.
+ Lower noise level during machining.

**Example Micro Milling:**

VDP advantages: The electrode Aspect Ratio (L/Ø) was doubled with VDP.
Dimensions: Ø 0.134 mm, length 4.8 mm
Increase your capacity with > +30%

WITH

WITHOUT

Less tool wear extends the life of the tools = increased revenue.

The diagram shows the effect on the oscillation amplitude when machining with the workpiece clamped conventionally and in a damped chuck.

### Process Stability Analysis (Swiss machine tool manufacturer)

<table>
<thead>
<tr>
<th>Cutting Speed (RPM)</th>
<th>Axial Depth of Cut (mm)</th>
<th>Increase in removal rate due to VDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Magnum Std</td>
<td>Magnum VDP</td>
</tr>
<tr>
<td>8500</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>9000</td>
<td>4.0</td>
<td>9.0*</td>
</tr>
<tr>
<td>10000</td>
<td>3.0</td>
<td>9.0*</td>
</tr>
</tbody>
</table>

Depth of cut is limited by the cutting tool used for the tests and not by the VDP.
Utilise every hour of the day and night!
An automatic production cell can generate revenue round the clock, seven days a week. Why be satisfied with 40 productive machine-hours a week when the same machine can achieve over 100 additional hours a week? Use every hour of the day and night for production!

WorkPal 1, WorkPartner 1+ and Transformer 6-axis robot - three “aces” which boost your productivity and sharpen your competitiveness.

And not least – they bring faster payback on the investments you made.

WSM – WorkShopManager

User-friendly Cell Management Software
Master workshop complexity and manage all control processes with our software. For manually controlled and automated processes.

+ Simplify the preparation of jobs
+ Easily execute the jobs in manual or automated machines
+ Monitor the process, change priorities and get utilization statistics
+ ID chip management to ensure highest process security.
Productivity in effect

+ Simple, quick set-up
+ High accuracy
+ Low scrap rate
+ Maximal machine utilization
+ Increased productivity

Punch Electrode
Materials: Tungsten copper carbide
Accuracy: ±2 µm
Surface quality: Ra 0.06 µm

Punch of carbide inserts
Materials: Cemented Carbide
Accuracy: ±2 µm
Surface quality: Ra 0.2 µm

Die of carbide inserts
Materials: Cemented Carbide
Accuracy: ±2 µm
Surface quality: Ra 0.1 µm

Powder Compacting Technology
– Produced details
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.

EDM (Electrical Discharge Machining)

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 the 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.

Advanced manufacturing

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.

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.

Tooling and Automation

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 single machine cells or complex, multi-process cells, tailored to your needs.

Software

Software

Customer Services

Software

Customer Services
Optimize the uptime of your equipment with our Customer Services

System 3R’s Customer Services is uniquely positioned to help you maximize the availability, value, precision and productivity of your System 3R equipment. Our cost-effective, customer-centric and expert services put your success at the center, ramp up your productivity and ensure predictable, uninterrupted uptime. System 3R’s service engineers are your expert partners for a wide range of success-triggering services.

For more info ask your local System 3R dealer.

www.system3r.com