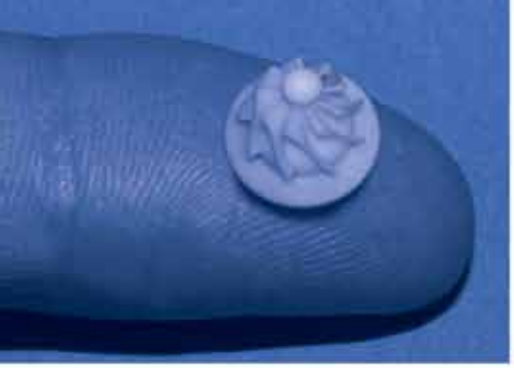


Microlution

High Performance Micro Manufacturing Equipment

MADE IN USA

Technology for a Smaller More Precise World

Microlution: A proven leader in micro manufacturing equipment

- Microlution designs and builds machining centers optimized for small part production. We build our equipment in Chicago, Illinois.
- Microlution delivers fully integrated turn-key solutions for R&D and production using our expertise in multi-scale, multi-process manufacturing, research and engineering.
- Microlution specializes in developing customized micro manufacturing platforms (micro milling machines, micro laser machining centers, fully integrated micro factories, etc.) for a broad range of small part applications.

A growing list of customers

- Microlution customers include leading companies, OEMs and contract manufacturers in the medical, defense, aerospace, automotive and semiconductor industries. Research and scientific development groups also use our equipment for their advanced work.

3M

BOEING® Forever New Frontiers

LOCKHEED MARTIN *We never forget who we're working for™*

DELPHI

Abbott Vascular

ILLINOIS UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Honeywell

accellent *Helping People Live Better Lives*

MERITMEDICAL

DRAPER

Microlution Core Products

363-S 3-Axis Horizontal Machining Center

The fastest 3-axis machine on the market with best-in-class accuracy

3-axis horizontal configuration

5100-S Vertical Machining Center

Superior performance and productivity designed into a small footprint

3, 4 or 5 axis configurations available

Specifications: 363-S and 5100-S

Linear motor driven, over 2g acceleration
High speed spindles: 50,000 RPM and greater, vector controlled options available
Positional accuracy +/- 1 micron (0.00004") with sub micron repeatability
Precision ground natural granite base
Standard G- code programming

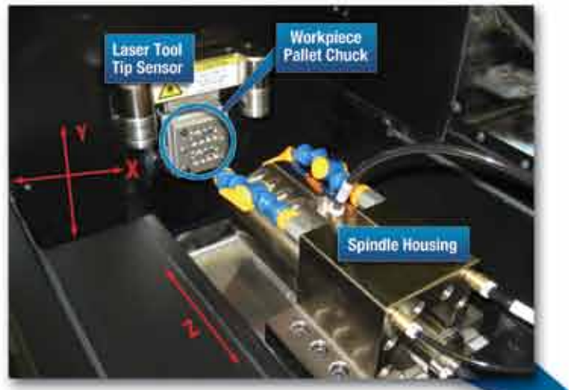
Microlution 363-S 3-Axis Micro Machining Center

363-S: The fastest 3-axis machine on the market with best-in-class accuracy

- ✧ High performance, horizontal style linear motor driven machining center
- ✧ Designed specifically for high precision small part applications

The dimensions shown to the left exclude coolant systems.

Machining Area



Tool Changer and Machine Vision Camera

Palletized Workholding (System 3R or Erowa)

BASE CONSTRUCTION	Precision ground natural granite base
ENCODER TYPE	Heidenhain Glass Scales
MOTOR TYPE	Ironless Linear Motors

FOOTPRINT (W x D x H)	25" x 28" x 53" (635mm x 711mm x 1346mm)
WEIGHT	700 lbs (320 kg) without accessories
UTILITY REQUIREMENT	Compressed Air - 100 PSI, 6CFM Electricity - 120VAC, 20A
COOLANT DELIVERY	Flood (water based and oil based) and Air Blast standard Mist option available

POSITIONAL ACCURACY	+/- 0.00004" (+/- 1 micron)
WORKING VOLUME	X: 2.48" (63mm) Y: 2.48" (63mm) Z: 2.48" (63mm)

AUTOMATIC TOOL CHANGER	36 pocket Automatic Tool Changer (ATC) supporting tools up to 0.157" (4mm) in diameter Direct Shank Tool Clamping
AUTOMATIC TOOL SENSOR	Laser sensor to measure tool length and diameter

SPINDLE OPTIONS	• A variety of spindles can be integrated with this system • The most common spindles integrated fall into one of these three categories: • Electric Motor / Ceramic Bearing • Electric Motor / Air Bearing • Air Turbine / Air Bearing • 50,000 RPM and greater

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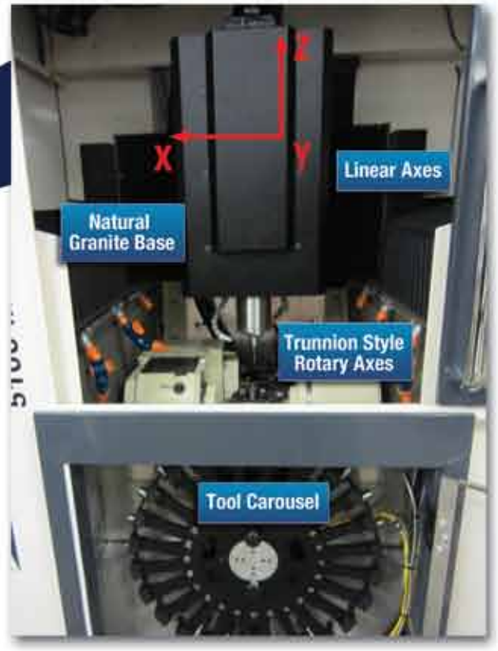
Microlution 5100-S 5-Axis Micro Machining Center

5100-S: Superior performance with 5-axis milling flexibility

- High performance, vertical style, linear motor machining center designed specifically for high precision small part applications.
- The 5100-S is available in a 3-axis configuration.
- A trunnion can be integrated to achieve full 5-axis capabilities.

The dimensions shown to the right exclude coolant systems and thermal management systems.



BASE CONSTRUCTION	Precision ground natural granite base (~4,000 lbs)
ENCODER TYPE	Heidenhain Glass Scales
MOTOR TYPE	Ironless Linear Motors

FOOTPRINT (W x D x H)	65" x 40" x 84" (1651mm x 1016mm x 2134mm)
WEIGHT	5,500 lbs (2,500 kg)
UTILITY REQUIREMENT	Compressed Air – 100PSI, 10CFM Electricity – 230VAC, Three Phase, 30A
COOLANT DELIVERY	Flood (water based and oil based) and Air Blast standard Mist option available

POSITIONAL ACCURACY	+/- 0.00004" (+/- 1 micron)
TOTAL TRAVEL (working volume of the 3-axis configuration)	X-Axis: 6.89" (179mm) Y-Axis: 6.89" (179mm) Z-Axis: 5.51" (140mm)
FULL 5-AXIS WORKING TRAVEL	X-Axis: 3.94" (100mm) Y-Axis: 3.94" (100mm) Z-Axis: 3.94" (100mm)
AUTOMATIC TOOL CHANGER	24 pocket Automatic Tool Changer (ATC) supporting tools up to 0.250" (6.35mm) in diameter HSK-E25, ISO-10 or Direct Shank Tool Clamping options available
AUTOMATIC TOOL SENSOR	Laser sensor to measure tool length and diameter

SPINDLE OPTIONS	• A variety of spindles can be integrated with this system
	• The most common spindles integrated fall into one of these three categories:
	  • Electric Motor / Ceramic Bearing
	  • Electric Motor / Air Bearing
	  • Air Turbine / Air Bearing
	• 50,000 RPM and greater
	• Vector controlled spindle options available

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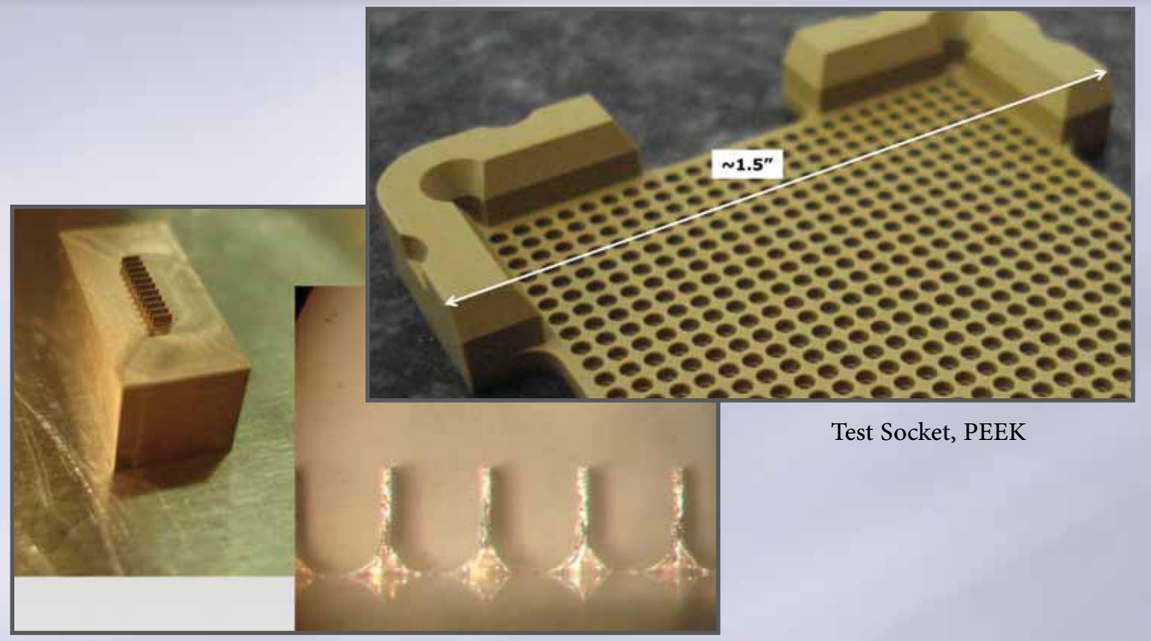
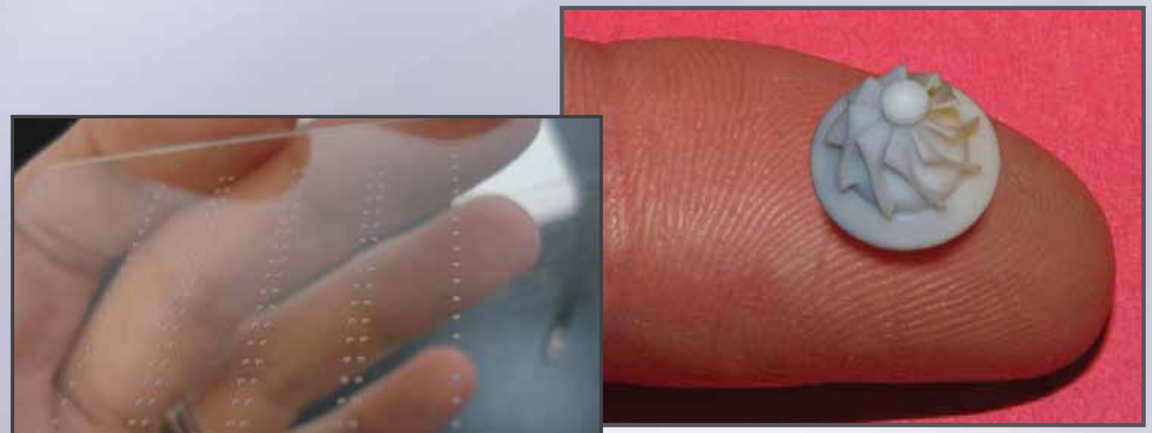
Application Examples

Bone Plate Example, Titanium



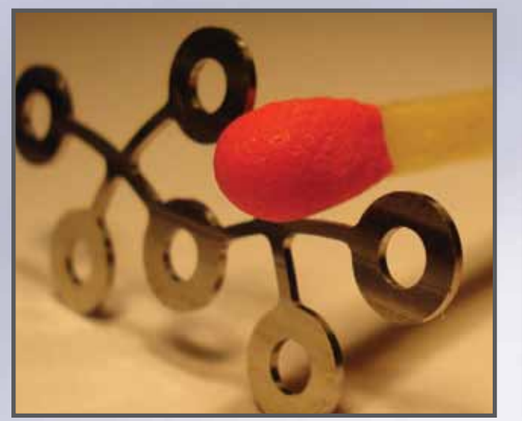
Test Socket, PEEK

Electrode, 40 Micron Wide, 440 Micron Tall
Contoured Fins, Tungsten Copper

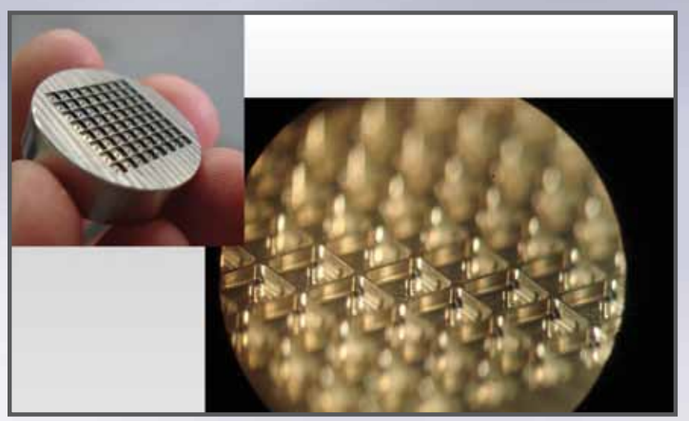


Micro Impeller

250 Micron Hemispherical Pocket Array, Glass

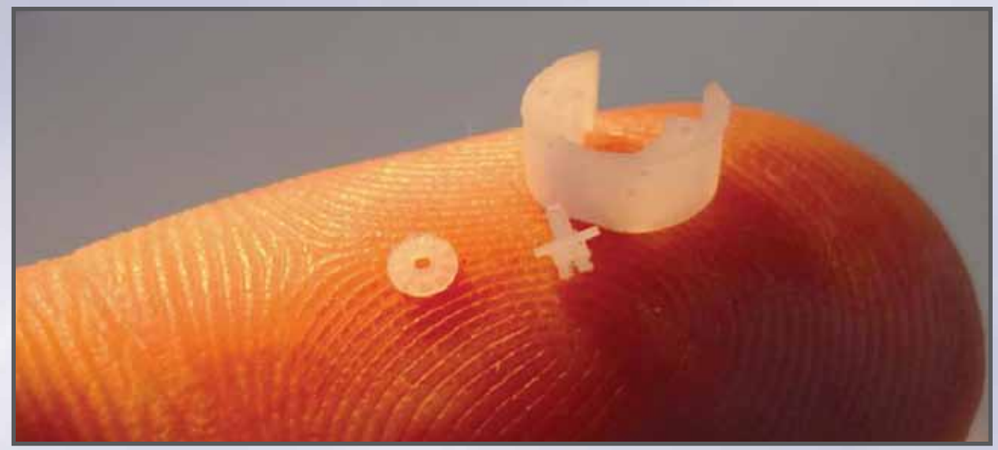


Bone Mesh Example, Titanium

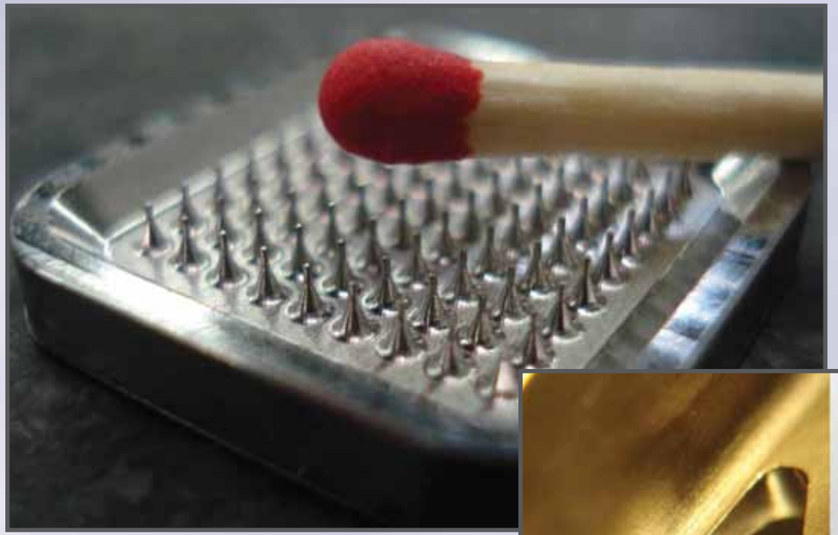


Inserts for Micro Molding, 100 Micron Diameter Posts
P20 Tool Steel

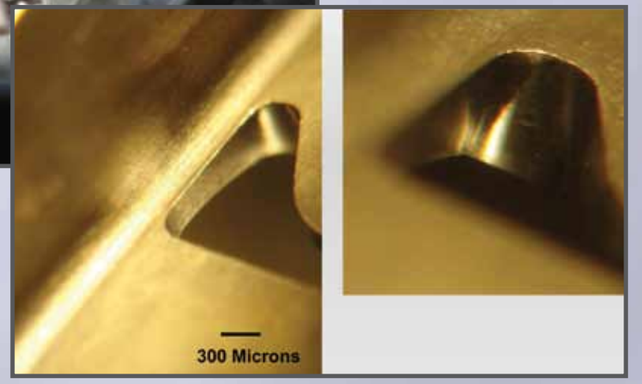
Application Examples



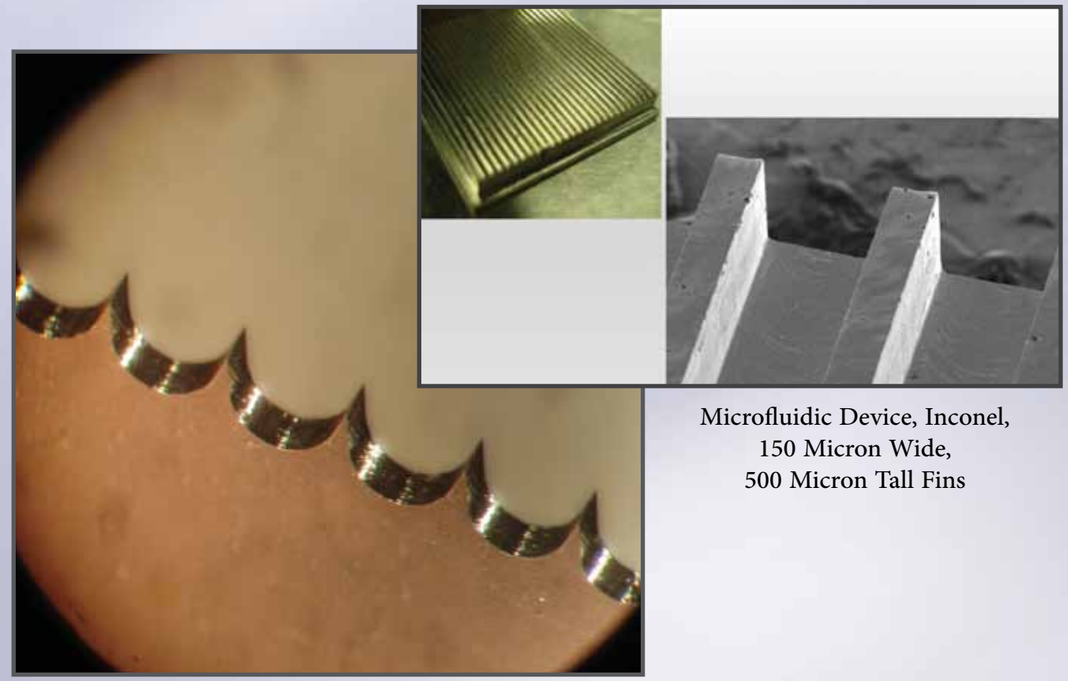
Hearing Aid Components, Delrin



3D Contoured Posts,
440C Stainless Steel

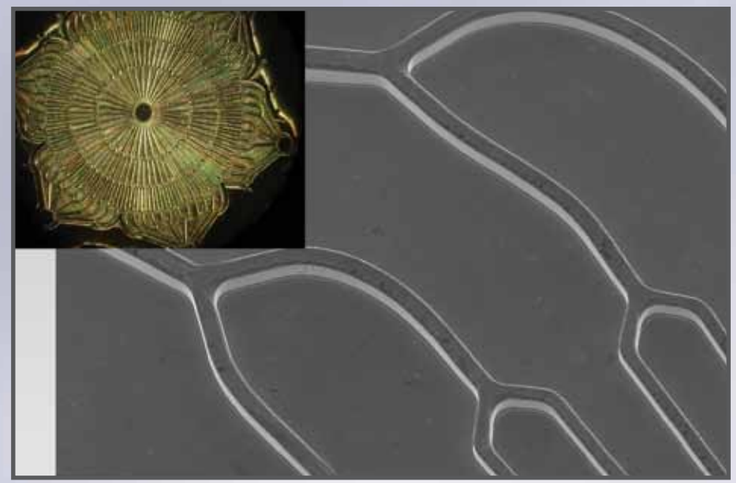


Fuel Component,
440C Stainless Steel, 58HRc

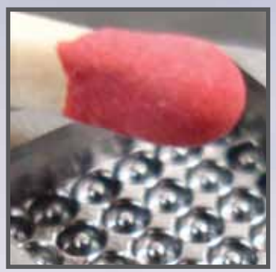


Microfluidic Device, Inconel,
150 Micron Wide,
500 Micron Tall Fins

Surgical Device, Stainless Steel



Microfluidics, Brass Mold for PDMS



Mold Insert,
Tool Steel, 55 HRc

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Frequently Asked Questions

What type of controller do you use / How do I program the Microlution machines?

- ✧ Microlution uses high performance Delta-Tau controllers.
- ✧ Microlution machines all interpret standard G- and M- codes.
- ✧ Microlution has worked with all of the major CAM (Computer Aided Manufacturing) packages.

What materials can I work with on the Microlution machines?

Microlution machines are utilized on a wide range of materials.
Some common materials include:

- ✧ Plastics
  - ❍ Delrin, Torlon, PEEK, Vespel, Polycarbonate, etc.
- ✧ Metals
  - ❍ Hardened tool steels, Stainless Steels, Titanium, Inconel, Aluminum, Brass, etc.
- ✧ Ceramics
  - ❍ Macor, Photoveel, glass, etc.

What is the range of tool sizes I can work with?

- ✧ Typically, the largest tool utilized on Microlution systems is 0.250" (6.35mm) in diameter.
- ✧ Microlution systems have run tools as small as 0.0004" (~10 microns) in diameter.

What type of coolant system do you offer?

Microlution systems are all available with fully integrated coolant systems.
These systems support:

- ✧ Flood (oil based or water based)
- ✧ Mist (oil based or water based)
- ✧ Air Blast

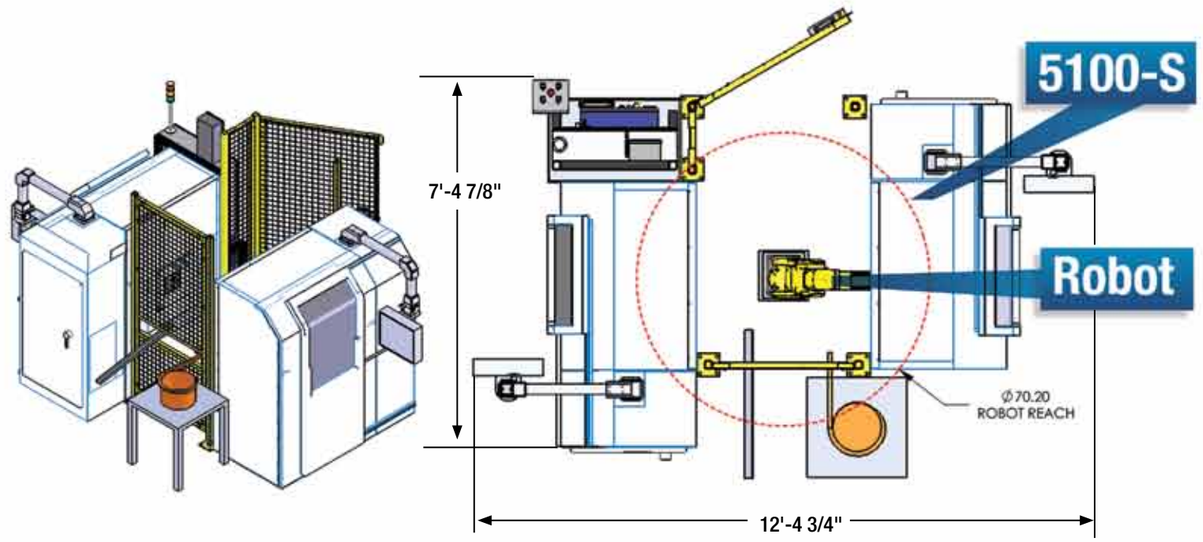
How do we fixture parts and raw materials?

- ✧ Raw materials and parts are fixtured using the same principles and techniques as in traditional macro-scale milling, scaled down to size.
- ✧ Screws, clamps & vices, locating dowel pins, vacuum chucks, etc. are specific techniques that can be used.

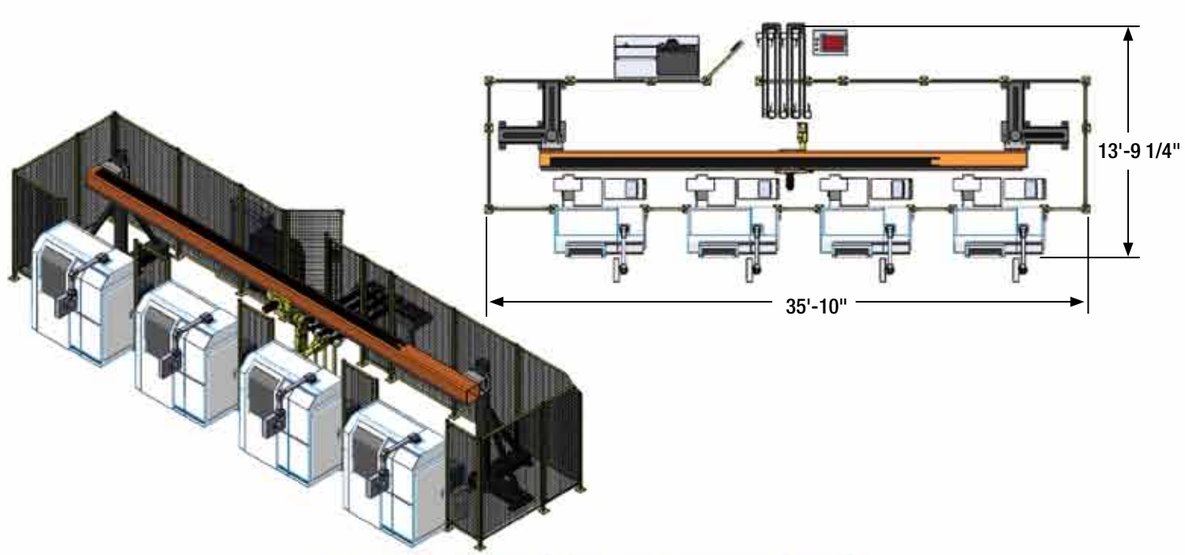
Where can I get micro end mills / drills?

- ✧ Micro cutting tools are available from a number of suppliers including:
  - ❍ Harvey Tool (www.harveytool.com)
  - ❍ Kyocera (www.kyoceramicrotools.com)
  - ❍ Mitsubishi (www.mitsubishicarbide.com)
  - ❍ Performance Micro Tool (www.pmtnow.com)
  - ❍ Robbjack (www.robbjack.com)
- ✧ The suppliers listed, as well as many others, have a variety of standard, in-stock catalog tools. Standard tools include flat, ball, corner radius, dovetail and other end mills as well as chamfer cutters, drills, counterbores, reamers and other types of tools.
- ✧ Many suppliers also provide tools with custom geometry (i.e. wheel cutters, extended reach tools, thread mills, etc.)
- ✧ The most common tool material is micro-grain carbide. PCD, CBN and natural diamond inserted tools are also available.
- ✧ Many tool coatings are available including TiAIN, diamond, PCD and other materials.

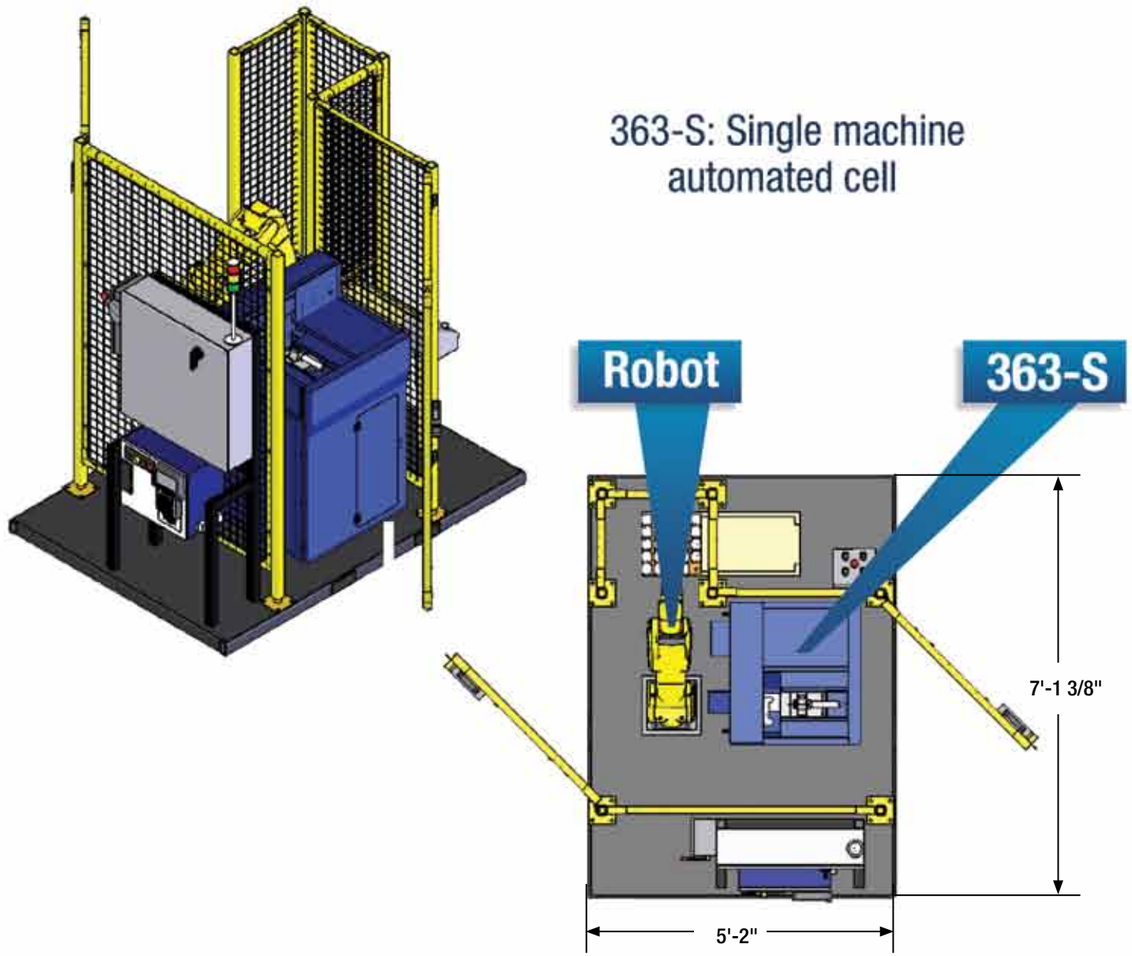
Fully Automated Cells with Microlution Equipment



5100-S: 2 machine automated cell



5100-S: 4 machine automated cell



363-S: Single machine automated cell

For more information or to schedule a demonstration, contact Microlution, Inc.

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