

The Nanoform L1000 *ultra grind* is designed for the ultimate productivity and flexibility in diamond turning and deterministic microgrinding of optical lenses, mold inserts, mirrors, and precision mechanical components. It can be configured with up to 5 axes (X, Z, C, B, and W(Fast Tool Servo)).

Common applications include aspheric and freeform shaped glasses, ceramics, and steels. It's also very beneficial for turning infrared materials that require water-based coolant, such as silicon.

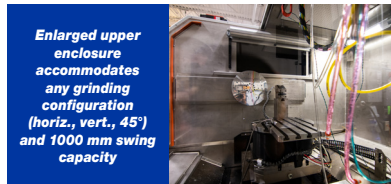
Nanoform L 1000 machines have the largest swing capacity of any standard production ultra precision machining systems available on the market.



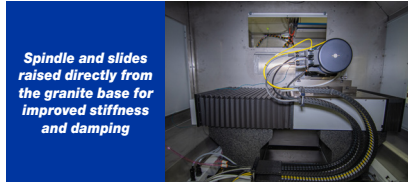
### Key Features



Fully sealed stainless steel enclosure protecting the machine from flood coolants



Enlarged upper enclosure accommodates any grinding configuration (horiz., vert., 45°) and 1000 mm swing capacity



Spindle and slides raised directly from the granite base for improved stiffness and damping



Air Filtration System



Direct access between spindle and work envelope for optical tool setter



Accessible front and side of enclosure

- ▶ **Expand your capabilities with full flood coolant compatibility in a large frame machine**
- ▶ **Maximize flexibility with diamond turning and ultra precision grinding capabilities in a single machining system**
- ▶ **Assure your part quality with performance rivaling that of small frame machines**

### Capabilities:

- Single point diamond turning (2 or 3 axes) including non-axi-symmetrical designs of optics and optical molds
- Tool normal diamond turning (3 or 4 axes) utilizing a contouring B axis for freeform shapes in hard-to-machine materials, such as silicon
- Precision grinding and milling (2 or 3 axes) utilizing a 15,000 RPM spindle in a 45° or 90° orientation for cross-axis grinding of precision glass optics
- Freeform grinding and milling (3 or 4 axes) utilizing a 80,000 RPM spindle and a rotary B axis for parallel grinding or 45° grinding of optical mold inserts such as tungsten carbide for glass pressing applications

### Key Specifications

Turning performance	Surface roughness ≤ 1.25 nm Sa Form accuracy ≤ 0.125 μm P-V
Swing capacity	1000 mm over Z axis 450 mm over B axis
Load capacity	HS-150 spindle: 136 kg (300 lbs) HD-160 spindle: 170 kg (375 lbs)
Position feedback resolution	8 μm (0.008 nm)
Programming resolution	0.01 nm

Machine Base and Control	Description
Machine Base	Sealed natural granite base provides exceptional long term machine tool stability
Machine Type	Ultra precision, two, three, or four axes CNC contouring machine
Vibration Isolation	Self leveling dual chamber pneumatic isolation system (Optional PEPS® II-VX active vibration cancellation available)
Control System	UPx™ Control System with optional Adaptive Control Technology
Operating System	QNX real time operating system
Programming Resolution	0.01 nm linear / 0.0000001° Rotary
File Transfer	USB, CD-ROM, Ethernet
Performance	Turning: Surface Finish < 1.25 nm Sa, Form Accuracy < 0.125 µm P-V

Linear Hydrostatic Slideways	Description
Type	Hydrostatic bearing slideways with symmetrical linear motor placement and liquid cooling
Travel	X axis: 500 mm (19.7 in.) Z axis: 300 mm (11.8 in.)
Maximum Feedrate	3,000 mm/min. (118 in./min.)
Drive System	Linear motors used on all linear axes
Position Feedback Resolution	8 µm (0.008 nm)
X-axis Straightness	Horizontal (critical direction): 0.50 µm (20 µin.) full travel 0.05 µm/25 mm (2 µin.)
Z-axis Straightness	Horizontal (critical direction): 0.50 µm (20 µin.) full travel 0.05 µm/25 mm (2 µin.)
Vertical Straightness	X axis: 1.0 µm (40 µin.) Z axis: 0.75 µm (30 µin.)
Hydrostatic oil supply system	Hydro-7 Smart Servo Control, low pulsation pump, optional thermal control

Workholding Air Bearing Spindle	High Performance HS150 Spindle (3 Year Warranty)	Heavy Duty HD-160 Spindle (3 Year Warranty)
Spindle Air Bearing Type	Slot type thrust bearing	Slot type thrust bearing
Materials	Steel shaft / Bronze journal	Steel shaft / Bronze journal
Standard Swing Capacity	1000 mm (27.5 in.) diameter 450 mm (13.7 in.) over optional B-axis tabletop	1000 mm (27.5 in.) diameter 450 mm (13.7 in.) over optional B Axis tabletop
Motor	Integral brushless DC motor	Integral brushless DC motor
Ultimate Load Capacity (@ spindle nose)	136 kg (300 lbs) @ 100 PSI 204 kg (450 lbs) @ 150 PSI	170 kg (375 lbs) @ 100 PSI 256 kg (564 lbs) @ 150 PSI
Axial Stiffness	230 N/µm (1,314,000 lbs/in.)	350 N/µm (2,000,000 lbs/in.)
Radial Stiffness	130 N/µm (743,600 lbs/in.)	175 N/µm (1,000,000 lbs/in.)
Motion Accuracy	Axial/Radial ≤ 15 nm (0.6 µin.)	Axial/Radial ≤ 25 nm (1.0 µin.), standard motor
Thermal Control	Liquid cooled chiller +/- 0.1°C Accuracy	Liquid cooled chiller +/- 0.1°C Accuracy
C-axis Feedback Resolution	0.010 arc-sec 16,200 line encoder (0.018 arc-sec 9,000 line encoder available on request)	0.010 arc-sec 16,200 line encoder (0.018 arc-sec 9,000 line encoder available on request)
C-axis Positioning Accuracy	+/- 1.0 arc-sec	+/- 1.0 arc-sec
C-axis Max Speed	2,000 RPM (4,000 RPM with 9,000 line encoder)	2,000 RPM (4,000 RPM with 9,000 line encoder)
Workholding Spindle Max Speed	10,000 RPM	5,000 RPM

Rotary B-axis	HydroRound II Rotary B-axis with Hydrolock
Type	Patented self compensated oil hydrostatic bearing, Bi-conic, integral brushless DC motor
Material	High-alloy steel
Tabletop Size	380 mm (15 in.)
Maximum Speed	10 RPM
Hydrolock Holding Torque	> 108 N-m / 80 ft-lbs
Positioning Feedback Resolution	.003 arc-sec
Radial Error Motion	0.10 µm (4 µin.) @ 1 in. above table and can be improved with optional error mapping
Axial Error Motion	0.10 µm (4 µin.)
Coning Error	1.0 µm/mm (1.0 µin.)
Radial Stiffness	525 N/µm (3,000,000 lbs/in.)
Axial Stiffness	875 N/µm (5,000,000 lbs/in.)
Moment Stiffness	17 N-m/µrad (150 in. lbs/µrad)
Positioning Accuracy	+/- 0.1 arc-sec

High Speed Milling/Grinding Spindle	SP75FF Spindle	Levicron High Speed Milling Spindle
Air Supply Pressure	690 KPA (100 PSI)	610 KPA (88 PSI)
Air Consumption	50 l/m (1.7 SCFM)	1.1 l/s (2.4 SCFM)
Radial Load Capacity	32 kg (70 lbs.) ultimate load capacity	29 kg (65 lbs.) ultimate load capacity
Axial Stiffness	70 N/µm (400,000 lbs/in.)	50 N/µm (285,000 lbs/in.)
Radial Stiffness	22 N/µm (125,000 lbs/in.)	35 N/µm (200,000 lbs/in.)
Axial Error Motion	< 0.05 µm (2 µin.)	< 30 nm asynchronous
Radial Error Motion	< 0.05 µm (2 µin.)	< 30 nm asynchronous
Maximum Speed	15,000 RPM	80,000 RPM (stiffness increases 50% with 60k RPM model)

Facility Requirements	
Power	208 +/-10% or 230 +/-10% VAC - 3.0 KVA 1 phase - 50/60Hz
Air Supply	Typical: 12 SCFM @ 100 PSIG
Floor Space (machine body only)	183 cm x 216 cm x 229 cm (72 in. x 85 in. x 90 in.)