

MULTI-AXIS MACHINING SYSTEM FOR Freeform Head-up Display (HUD) Mold Manufacturing

If you are looking to manufacture Head-up Display molds for automotive or aerospace applications, the Nanoform® 700 ultra or Nanoform® L 1000, are uniquely positioned to meet your needs.



When equipped with an HD-160 spindle with a C axis and Adaptive Control Technology (ACT) there is no better solution in the market today for this application.

The stiffness and dampening of the HD-160 results in improved surface finish and the capacity for large parts and fixtures. The HD-160 has an ultimate load capacity of 170 Kg (375 lbs.)

Precitech's C axis and high resolution encoder, with feedback resolution of 0.010 arc-sec, and servo tuning algorithms allow for tight control of the rotary position of the spindle. The result is the capability to manufacture high accuracy freeform shapes with superior surface finish using XZC machining.

Finally, Adaptive Control Technology (ACT), exclusively offered by Precitech, utilizes a unique learning algorithm to eliminate errors in X and Z that repeat with spindle position. This allows you to increase the spindle speed, reducing manufacturing time while improving form error.

Since 1962, Precitech has delivered complete ultra precision solutions and maintains an installed base of over 1,500 systems worldwide. We continue to define the state-of-the-art, enhancing accuracy, productivity, and ease of use.

Precitech is ultra precision machining solutions.



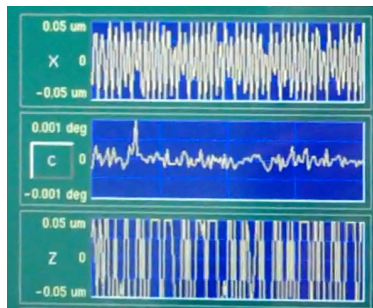
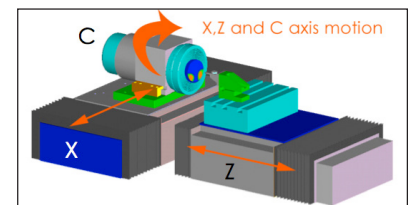
Nanoform® 700 ultra



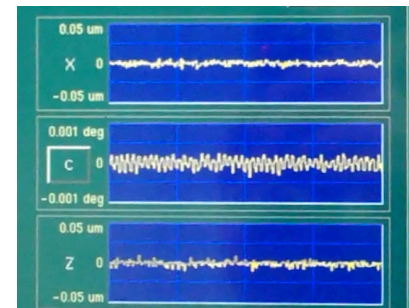
Nanoform® L 1000

- ▶ **Accommodate large and heavy parts**
HS 160 spindle
- ▶ **Manufacture non-rotationally symmetric freeform shapes**
Rotary C axis
- ▶ **Improve form and reduce machining time**
Adaptive Control Technology (ACT)

Key Machine Specifications	Nanoform 700 ultra	Nanoform L 1000
Swing capacity	700 mm (27.5 in.) dia.	Max swing 1 meter (39 in.) dia.
Surface finish	< 1.0 nm Ra	< 1.25 nm Ra
Form accuracy	< 0.125 micron P-V	< 0.125 micron P-V



Following error without ACT active



Following error with ACT active

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	TMC MaxDamp self leveling dual chamber pneumatic isolation system		
Control System	UPx™ Control System with optional Adaptive Control Technology		
Operating System	QNX real time operating system		
Programming Resolution	0.01nm linear / 0.0000001° rotary		
File Transfer	USB, CD-ROM, Ethernet		
Performance	Nanoform 700 ultra	Surface Finish < 1.0 nm Ra	Form Accuracy < 0.125 micron P-V
	Nanoform L 1000	Surface Finish < 1.25 nm Ra	Form Accuracy < 0.125 micron P-V
Linear Oil Hydrostatic Slideways		Description	
Type	Hydrostatic oil bearing slideways with symmetrical linear motor placement		
Travel	Nanoform 700 ultra = X axis: 350 mm (13.8 inch) Z axis: 300 mm (11.8 inch) Nanoform L 1000 = X axis: 500 mm (19.7 inch) Z axis: 300 mm (11.8 inch)		
Maximum Feedrate	Nanoform 700 ultra = 4000 mm/minute (157 inch/minute) Nanoform L 1000 = 3000 mm/minute (118 inch/minute)		
Drive System	AC Linear Motor		
Position Feedback Resolution	32 picometers (0.032 nanometers)		
X-axis Straightness	Nanoform 700 ultra = Horizontal: 0.30 micron (12 micro inch) full travel 0.05 micron/25 mm (2 micro inch)		
Z-axis Straightness	Horizontal: 0.40 micron (16 micro inch) full travel 0.05 micron/25 mm (2 micro inch)		
Vertical Straightness	X: 0.75 micron (30 micro inch) Z: 0.75 micron (30 micro inch)		
X-axis Straightness	Nanoform L 1000 = Horizontal: 0.50 micron (20 micro inch) full travel 0.05 micron/25 mm (2 micro inch)		
Z-axis Straightness	Horizontal: 0.50 micron (20 micro inch) full travel 0.05 micron/25 mm (2 micro inch)		
Vertical Straightness	X: 1.0 micron (40 micro inch) Z: 0.75 micron (30 micro inch)		
Workholding Air Bearing Spindle		High Performance HS150 Spindle	Heavy Duty HD-160 Spindle
Spindle Air Bearing Type	Slot type thrust bearing	Slot type thrust bearing	
Materials	Steel shaft / Bronze journal	Steel shaft / Bronze journal	
Standard Swing Capacity	700 mm (27.5 inch) diameter 350 mm (13.7 inch) over optional B Axis tabletop	700 mm (27.5 inch) diameter 350 mm (13.7 inch) over optional B Axis tabletop	
Motor	Integral brushless motor	Integral brushless motor	
Ultimate Load Capacity	136 Kg (300 pounds) @100 PSI	170 Kg (375 pounds) @100 PSI	
Axial Stiffness	230 N/micron (1,314,000 pounds/inch)	350 N/micron (2,000,000 pounds/inch)	
Radial Stiffness	130 N/micron (743,600 pounds/inch)	175 N/micron (1,000,000 pounds/inch)	
Motion Accuracy	Axial/Radial ≤ 15 nm (0.6 micro inch)	Axial/Radial ≤ 50 nm (2 micro inch)	
Thermal Control	Liquid cooled chiller +/- 0.1C Accuracy	Liquid cooled chiller +/- 0.1C Accuracy	
C-axis Feedback Resolution	0.010 arc-sec 16,200 line encoder	0.010 arc-sec	
C-axis Positioning Accuracy	+/- 1 arc-sec	+/- 1 arc-sec	
C-axis Max Speed	1,500 RPM	1,500 RPM	
Workholding Spindle Max Speed	10,000 RPM	5,000 RPM	
Rotary B-axis		HydroRound Rotary B-axis	
Type	Bi-conical, self compensated, patented oil hydrostatic bearing with integral motor and integral encoder		
Material	High-alloy steel		
Tabletop size	380 mm (15 inch)		
Maximum Speed	10 RPM		
Motor Torque	72 inch-pounds 8.1 N/micron		
Position Feedback Resolution	0.003 arc-sec		
Radial Error Motion	0.10 micron (4 micro inch) @ 1 inch above table and can be improved with optional error mapping		
Axial Error Motion	0.10 micron (4 micro inch)		
Coning Error	1.0 nm/mm (1.0 microns/inch)		
Radial Stiffness	525 N/micron (3,000,000 pounds/inch)		
Axial Stiffness	875 N/micron (5,000,000 pounds/inch)		
Moment Stiffness	17 N-m/μrad (150 inch-pounds/μrad)		
Positioning Accuracy	+/- 1 arc-sec		
High Speed Milling / Grinding Spindles		SP75FF Spindle	Levicron High Speed Milling Spindle
Air Supply Pressure	690 KPA (100 PSI)	610 KPA (88 PSI)	
Air Consumption	50 lpm (1.7 SCFM)	70 lpm (2.5 SCFM)	
Radial Load Capacity	32 kg (70 pounds) Ultimate Load Capacity	29 Kg (65 pounds) ultimate	
Axial Stiffness	70 N/micron (400,000 pounds/inch)	50 N/micron (285,000 pounds/inch)	
Radial Stiffness	22 N/micron (125,000 pounds/inch)	35 N/micron (200,000 pounds/inch)	
Axial Error Motion	< 50 nm (2 micro inch)	< 30 nm (1.2 micro inch)	
Radial Error Motion	< 50 nm (2 micro inch)	< 30 nm (1.2 micro inch)	
Maximum Speed	15,000 RPM	80,000 RPM (stiffness increases 50% with 60 k RPM model)	
Facility Requirements		Nanoform® 700 ultra and Nanoform® L 1000	
Power	208 +/-10% or 230 +/-10% VAC - 3.0 KVA 1 phase - 50/60Hz		
Compressed Air Supply	Typical: 12 SCFM @ 100 PSIG		
Machine Size and Weight	Nanoform 700 ultra = 1437 mm x 1930 mm x 2043 mm (57 inch x 76 inch x 80 inch) Nanoform L 1000 = 1745 mm x 2162 mm x 2226 mm (69 inch x 85 inch x 88 inch)		