

# Nanotech 350FG Specification Overview

April 1<sup>st</sup>, 2011

General	Description
System Configuration	Ultra-Precision three, four, or five axis CNC machining system for on-axis turning of aspheric and toroidal surfaces; slow-slide-servo machining (rotary ruling) of freeform surfaces; and raster flycutting of freeforms, linear diffractives, and prismatic optical structures
Workpiece Capacity	500mm diameter x 300mm long
Base Structure	Monolithic cast epoxy-granite, with integral coolant troughs
Vibration Isolation	Optimally located three point passive air isolation system. Optional Self-Leveling Shear Damped Air Isolation System.
Control System	Delta Tau PC based CNC motion controller with 160Mhz DSP, operating in a Windows environment, with 19" color flat panel touch screen display. 1 GB memory, AGP video, 10/100 Base T Ethernet, CD-RW / DVD Drive, and 80GB hard drive. Total system mounted in NEMA 12 cabinet.
Programming Resolution	0.01 nanometer linear / 0.0000001° rotary
Functional Performance (As measured with laser interferometer & white light interferometer on <u>same</u> part)	Material – High purity aluminum alloy. Both accuracies measured on the <u>same</u> part. Form Accuracy (P-V): ≤ 0.15µm / 75mm dia, 250mm convex sphere. Surface Finish (Ra): ≤ 3.0 nanometers (Test Parts cut in both the X-Z and Y-Z planes)

Workholding Spindle	Heavy Duty (Standard)
Type	Fully constrained Professional Instruments groove compensated air bearing
Liquid Cooling (optional)	To maintain thermal stability and tool center repeatability, a closed loop chiller provides recirculating temperature controlled water to cooling channels located around the motor and bearing journals of the air bearing spindle. The chiller has an integral PID controller which maintains temperature control to ± 0.5°F. Flow is controlled by a solenoid integrated with the machine's CNC control.
Mounting	Integrally mounted within the Y-axis carriage to increase loop stiffness and minimize thermal growth. Spindle cartridge resides in an athermalized housing to further enhance thermal stability
Speed Range	50 to 10,000 rpm, bi-directional
Radial Load Capacity (@ spindle nose)	70Kg (154 lbs.) @ 100 psi. / 85Kg (187 lbs.) @ 145 psi.
Axial Stiffness	228 N/µm (1,300,000 lbs/in) @ 100 psi / 260 N/µm (1,500,000 lbs/in) @ 145 psi
Radial Stiffness (@ spindle nose)	98 N/µm (560,000 lbs/in) @ 100 psi / 140 N/µm (800,000 lbs/in) @ 145 psi
Drive System	Frameless, Brushless DC motor
Motion Accuracy	Axial: ≤ 12.5 nanometers (0.5µ") Radial: ≤ 12.5 nanometers (0.5µ")

Linear Axes	X	Z	Y (Vertical)
Type	Fully constrained oil hydrostatic, box way slide	Fully constrained oil hydrostatic, box way slide	Fully constrained oil hydrostatic box way slide with adaptively controlled air bearing counterbalance to negate gravitational forces & varying workpiece loads.
Travel	350mm (14")	300mm (12")	150mm (6")
Drive System	Brushless DC Linear Motor	Brushless DC Linear Motor	Dual Brushless DC Linear Motor
Feedback Type	Laser holographic linear scale (athermally mounted)	Laser holographic linear scale (athermally mounted)	Laser holographic linear scale (athermally mounted)
Feedback Resolution	0.034 nanometer	0.034 nanometer	0.034 nanometer
Feed Rate (maximum)	2000mm/min	2000mm/min	2000mm/min
Straightness in critical direction	0.3µm (12µ") over full travel	0.3µm (12µ") over full travel	0.5µm (20µ") over full travel / 0.3µm (central 100mm)
Hydrostatic Oil Supply	Compact, low flow, low pressure system with closed loop servo control and pressure accumulator to minimize pump pulsation.		

Optional Rotational Axes	B	C
Type	Oil Hydrostatic (fully constrained)	Groove Compensated Air Bearing (liquid cooled)
Travel	360° (Bi-directional)	360° (Bi-directional)
Drive System	Brushless DC motor	Brushless DC motor
Axial Stiffness	875 N/µm (5,000,000 lbs./in.)	See <b>Workholding Spindle</b> Specifications Listed Above
Radial Stiffness (at nose)	260 N/µm (1,500,000 lbs./in.)	See <b>Workholding Spindle</b> Specifications Listed Above
Positioning Accuracy	± 1.0 arc seconds (compensated)	± 1.0 arc seconds (compensated) static
Feedback Resolution	0.02 arc seconds	0.07 arc seconds
Maximum Speed (Positioning Mode)	50 rpm	3,000 rpm
Motion Accuracy	Axial: ≤ 0.1µm (4µ") Radial: ≤ 0.1µm (4µ")	Axial: ≤ 12.5 nm (0.5µ") Radial: ≤ 12.5 nm (0.5µ")

Utility Requirements	Air	Electrical	Floor Space
For optimal cutting results, facility thermal stability should be held within ±0.5°C (±1.0°F)	7 to 10 bar (100-145psi) 280 liters/min (10 scfm) Dry to 10°C pressure dew point and pre-filtered to 10µm	11kVA at the customer specified voltage from 208 - 480 VAC; 50 / 60hz; 3 Phase (26kVA with optional oil hydrostatic grinder)	1.72m wide x 1.73m deep x 1.84m high Approx. 3,180 Kg (Includes enclosure but not including peripheral equipment and control pendant)

Warranty	1 year full parts and labor warranty
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Note: In an effort to continually improve our product performance, specifications are subject to change without notice.