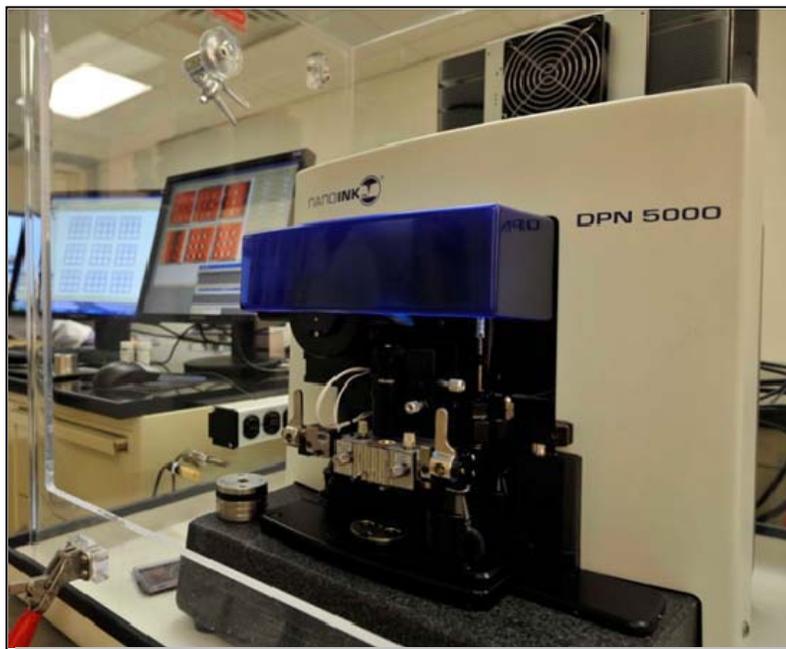


DPN 5000 System

Desktop NanoFabrication System

NanoInk has developed the DPN 5000 System to have the standard controls and tools for all tip-based nanofabrication applications, while maintaining compatibility with a wide range of applications.



Standard features include:

- Custom DPN® Scanner
- InkCAD™ Version 4.0 Software
- Ultra-Low Noise LFM & AFM Imaging
- New DPN Stage & Optics
- Linux® DPN Controller
- E-Chamber Controller

The DPN 5000 System supports all of the following options:

- Customized Ink Library Option
- 2D nano PrintArray™ Kit
- Active Pen™ Array Kit
- AFM Imaging Modes
- Applications Support Package
- Extended Service Package

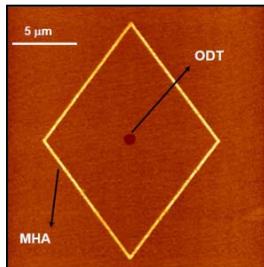
Custom DPN Scanner

NanoInk designed a custom scanner for DPN which allows for compatibility with a wide range of cantilever geometries, reflectivities, and ink coatings. Relevant features include:

- Compatible with NanoInk 1D & 2D pen arrays and ink protocols
- Sum signal switch for photo-detector adjustment, allowing maximum ink versatility and patterning control
- Extended laser and photo-detector working range to accommodate multiple cantilever array geometries
- Adjustable laser focus up to 2 mm for precise focal placement (advanced user)



A new, closed loop flexure scanner with ultra-low noise inductive sensors allows for positional precision and accuracy.

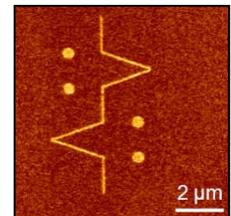


- 90 µm XY scan range with better than 0.5% linearity
- XYZ inductive calibration sensors resolution ~ 1 nm
- XY, XZ, YZ crosstalk < 1%
- 8 µm Z range
- Z out of plane motion +/- 30 nm over 90 microns
- Z bit resolution < 0.001 nm
- Z-noise 0.06 nm (in optimal vibration conditions)

Advanced LFM Imaging

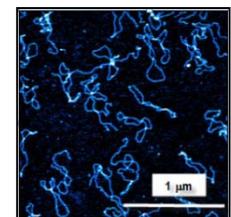
NanoInk has specifically designed the DPN 5000 scanner to assure high quality lateral force microscopy (LFM) imaging for immediate detection of DPN patterned substrates. Relevant features include:

- A low coherence laser with 7 x 20 micron laser spot size
- A flip down mirror to facilitate laser alignment on cantilever



AFM Imaging & Analysis

For those users that need AFM functionality and control, NanoInk provides a research AFM software package (SPM Cockpit) and a comprehensive collection of SPIP™ modules for sophisticated image processing and measurement **all as standard equipment** with the system.

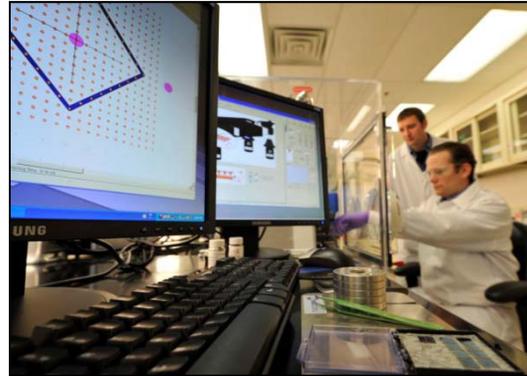


InkCAD™ 4.0 Software

NanoInk's InkCAD 4.0 software is the user interface for driving the DPN 5000 system, providing full-featured, industrial-strength functionality. Supporting a true CAD capability, it goes well beyond what commercial AFM lithography packages can offer in terms of tip control. In addition, InkCAD software provides a comprehensive set of tools for tackling all DPN research experiments.

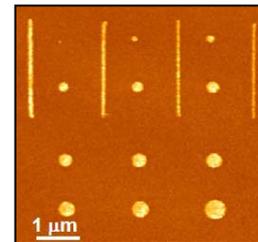
InkCAD 4.0 provides the following capabilities:

- Simple pattern creation routines for easy DPN experiments
- Layered structural hierarchy for sophisticated pattern design, with organizational tools for the individual design elements
- The ability to import and write complex CAD patterns from GDS II format files
- Automated alignment (NanoFind) and linearization routines for better DPN process control
- The ability to calibrate ink diffusion rates and by writing a prescribed pattern, and then use these diffusion rates to control patterned feature sizes



As well as the following **NEW** features:

- **Advanced tip control** allowing for shorter dwell times and faster lines speeds, precise layer to layer alignment allows for multi-ink deposition using NanoFind, MicroMap and NanoMap.
- **User Profiles**, allowing the user to define and save all DPN lithography and AFM settings, so multiple users on the same system can save and load their own settings.
- **Advanced CAD capabilities**, including order of lithography previews, easy arrayer, and multi-layer, multi-ink capability.

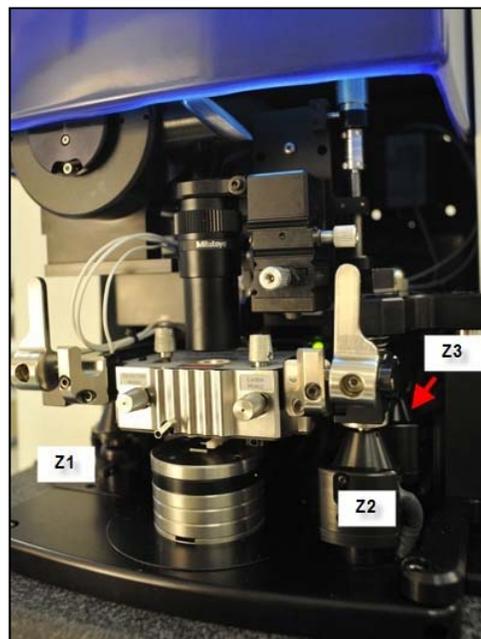


For a detailed description of InkCAD 4.0 software, please consult the InkCAD data sheet at www.nanoink.net.

DPN Stage

The DPN stage has all the features needed for tip sample leveling and easy tip exchange for rapid ink development experiments.

- Easy tip exchange (1 minute) independent of the sample stage, allowing for rapid ink development and more accurate lithography
- 3 independently adjustable Z motors serve to level the plane of the pen and scanner assembly with the substrate tip 3.5° (Z1 wrt Z2, Z3) and 7° tilt (Z2 wrt Z3, Z1 fixed)
- XY sample stage translator motors: min. 3 micron step size, 1" x 1" travel, max. 2.5 mm/sec slew rate XY stage stationary during tip exchange, allowing for more accurate substrate alignments with different tips
- Solid granite support base, size: 16" x 16" x 14", weight: 122 lbs (loaded)
- Sample holder is grounded, made of stainless steel disks with a central magnetic post
- Maximum sample size: 2" in diameter, < 1.5" thick, and can be attached to a magnetic central post
- Vacuum stage (optional) for holding 2" wafers for large area patterning.



Optics

- Optical Stage registered to and overlaid with AFM images through InkCAD software (MicroMap) for easy relocation of any feature.
- Color CCD video camera with motorized zoom (4X) and focus capability.
- High-quality 10X long working distance (WD = 44 mm) Mitutoyo lens mounted on an adjustable collar that allows panning the field of view over 4 mm of viewable travel.
- Computer controlled focus and zoom.

Video magnification:

	Magnification	FOV
Min Zoom	365X	1050 μm x 820 μm
Max Zoom	1140X	340 μm x 260 μm

NanoInk 's MEMs, Accessories & Deposition Protocols

The DPN 5000 System comes complete with all of the tools you need to create nanostructures using DPN, from the simple to the complex. After careful study, NanoInk has developed the DPN 5000 System to have the standard controls and parts common to all tip based nanofabrication applications, while maintaining compatibility with a wide range of applications. As such, NanoInk provides a "Getting Started" kit—everything needed for additional DPN experimentation.

DPN® Getting Started Kit:

- MHA (Mercaptohexadecanoic acid) Pen Kit: Qty. 5 pens and 1 ink vial
- ODT (Octadecane Thiol) Pen Kit: Qty 6 pens and 1 ink vial
- DPN Single Pens: Qty. 20, 10 each of Type A & B
- DPN Passive, Multi-Pen Arrays: Qty. 20, 10 each of Types E & F
- AC Mode Pens: Qty. 10
- Probe Clip & Clip Mounting Block
- Universal Inkwell Array Chips: 1 tray of 10 inkwell chips
- DPN Patterned Sample Substrates: Qty. 16, 8 gold coated and 8 silicon oxide substrates



DPN Passive Pens: Single & Multi-Pen Arrays (standard)

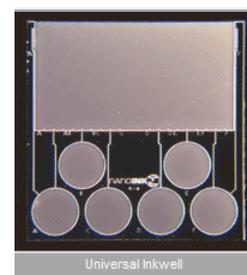
NanoInk's passive single and multi-pen arrays allow for deposition of are produced at NanoInk's own MEMs facility in California. Features include:

- Silicon nitride pens
- Passive multi-pen arrays
- Large-area coverage and/or multi-ink patterning
- Arrays with both writing and reading pens
- A-frame or diving board shaped cantilevers

Ink wells (standard)

The Universal Inkwell solution was specifically designed to overcome the problem of delivering a solvent-based ink to one (or several) tips among a pen array without cross contamination.

- With Universal Inkwells, an ink/solvent solution is delivered to one of six inkwell reservoirs via a micropipette.
- Six unique molecular inks are possible on each inkwell chip.
- The ink is then guided through microchannels to the microwell, where the tip will dip and be coated with ink.

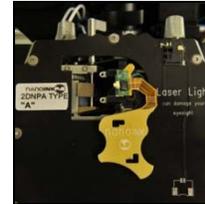


For more detailed information on these and other options, please visit www.nanoink.net for a corresponding datasheet.

Every customer has different DPN applications needs. Therefore, the system base price includes 2 of the following customer specified options.

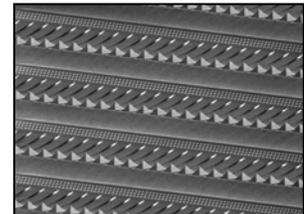
Active Pen™ Array Kit

Using thermal bimorph technology, individual cantilevers can be actuated to enable multi-ink writing without any cross-contamination or unintended surface patterning. Additionally, reader tips can be left clean to image surface patterns, or address specific surface structures without unintentional inking.



2D nano PrintArray™ Kit

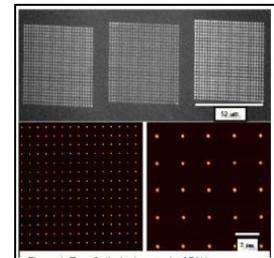
The 2D nano PrintArray Chip provides a high-throughput solution to flexibly pattern nanoscale features. The 2D nano PrintArray retains the direct write, high resolution, ambient deposition, and chemical and material flexible attributes of DPN, while multiplying the desired pattern 55,000 times across a 1 cm² area.



Customized Ink Library Option

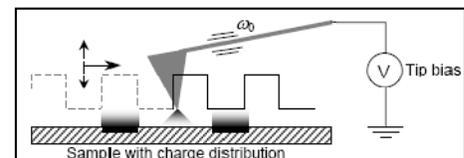
This option allows NanoInk's customers access to our library of ink types and protocols. Examples include:

- Just Add DNA™
- Protein Inks
- Polyethylene Glycol Universal Carrier
- Thiols (MHA,ODT, etc.)
- Nanoparticle Inks



Advanced AFM Modes

An easy plug on bottom board, with fully integrated electronics, makes the DPN 5000 System capable of magnetic force microscopy, electric force microscopy, F-d curves, fluid imaging, and conductive mapping. Imaging and control are fully integrated in the software.

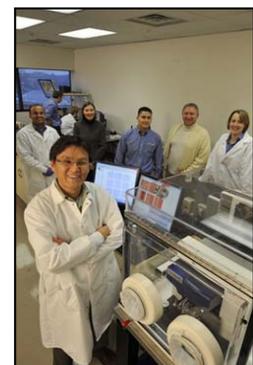


Extended Applications Support Package

NanoInk provides support to its customers with every sale, providing 5 standard training days with each system. Our applications and service team consists PhDs with extensive experience in nanotechnology, surface science, chemistry, and instrumentation. For those needing additional support, NanoInk offers an extended customer support package, up to 3 weeks a year. This is especially useful for large user facilities where there are multiple users with multiple applications.

Extended Service Package

Receive an additional 6 months service and warranty, beyond the standard 1 year warranty.



DPN Controller

The controller includes all of the circuits required for controlling seven stepper motors as well as the piezoelectric flexure scanner.

- Pentium® IV microprocessor, controller software is written in C++ on a Linux® platform
- TCP/IP communications between controller and workstation
- Reliability is assured with the 16 bit input output cards from National Instruments



XYZ Board Scanner

- Digital zoom/offset
- Analog zoom
- Z high voltage
- Z sample/hold
- GPID control
- Phase/amplitude
- XY high voltage
- XY sensor
- Phase/amplitude

Access to all internal controller signals is available through the Signal Access Console, which comes standard with the DPN 5000 System.



Workstation PC Configuration

- Pentium IV or latest equivalent architecture with minimum 3.0 GHz CPU with hyper threading technology for faster processing
- Minimum 1.0 GB RAM, 533 MHz DDR2 2x512
- 16X DVD+/- RW drive 48X/32X/48X
- 80 GB hard drive 8MB with data burst cache
- Dual video display card for dual LCD flat panel display configuration (19" and 19" display).

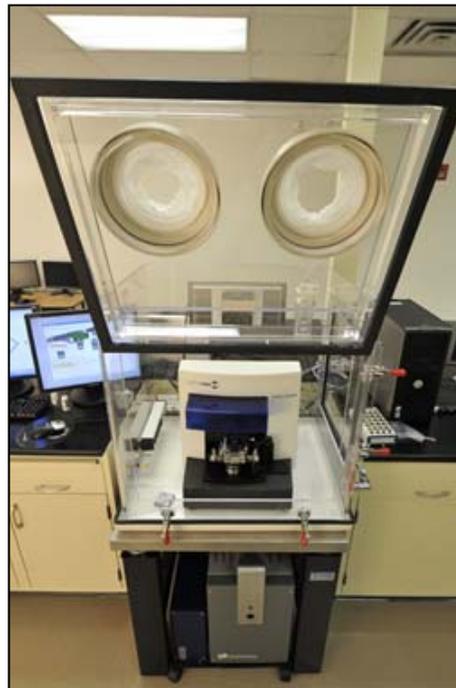
E-Chamber

NanoInk has integrated an environmental chamber as part of the DPN 5000 System, which controls the environmental conditions during DPN experiments. The chamber houses the entire DPN stage. Temperature and humidity sensors monitor the enclosed environment in real time, and both parameters are controlled by PID feedback loops. The system chamber is driven by a control module that is connected to the user PC. A PC-based software interface runs the E-Chamber from the PC.

- Box material: PolyCast™ cast acrylic with anti-static coating
- Weight: 180 lbs
- Inside dimensions: 28" x 23" x 29"
- Outside dimensions: 34" x 30" x 36"
- Hospital-grade multiple electric outlet strip (mounted on the interior left side)
- 2 gas valves for purging
- Latched front access door and side access door
 - 1 pair of bare-hand entry port conversions on front
 - Continuous stainless steel hinges (mounted on the top)
 - 2 stainless steel fastening clamps on each door access door opening on front is 24" wide x 20" high
 - Access door opening on side is 15" wide x 18" high
 - Specially mounted pressure relief valve (upper left hand side)
- Rear connector panel for easy feed-through of cables to the stage

External humidity and temperature control console, with dual digital PID feedback.

- PC-based software panel drives the power control console, connected via USB
- Inert gas hook-up and nebulizer (required for using the humidity control functions)
- Temperature control uses a 121-watt thermoelectric fan system for convective heating
- Sensor array components:
 - Humidity sensor (with 8' cable)
 - Temperature sensor (with 8' cable)
 - Pressure relief valve
 - Nebulizer on/off switch



Humidity control performance specifications:

- Humidity range: Min. = 5% Rh, max. = 75% Rh (below dew point)
- Set point stability: ± 0.5 % Rh
- Sensor resolution: ± 2.0 % Rh
- Overshoot amplitude: 0.1 % Rh @ 60 % Rh from a 15% up-ramp
- Humidification ramp rate: 3% Rh/minute
- (> 15 % Rh range using a range > 15% Rh)
- Dehumidification ramp rate: -1% Rh/minute (over 20 % Rh) using an air compressor.

Temperature control performance specifications:

- Temperature range: Min. = 2°C less than room temperature max. = up to 10°C greater than room temperature
- Set point stability: ± 0.2 °C (given a stable room temperature)
- Detection resolution: 0.1 °C for full scale
- Overshoot amplitude: 0.5°C
- Heating ramp rate: 0.26°C/minute without DPN stage
- Equilibrated heating ramp rate: 0.07°C/minute with DPN stage in chamber
- Programmability: Software stabilizes temperature to a desired set point

Learn more about NanoInk products and services at www.nanoink.net. Or call us at 847-679-NANO (6266).

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