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NLP 2000 System

Introduction

NanoInk's NLP 2000 System is a user-friendly and easy to operate desktop nanolithography instrument capable of depositing a wide variety of materials with sub-micron accuracy and precision. Using NanoInk's proprietary MEMS devices and deposition protocols with the NLP 2000 System's printing and automation software, users can create custom patterned substrates in under an hour.

Applications

The NLP 2000 System is ideal for nanoengineering and biomaterials applications which require 1-10 micron printing and imaging capabilities, such as:

- Multiplexed protein printing
- Biosensor functionalization
- Cell micro and nanopatterning studies
- Polymer patterning, including ethylene glycol and acrylic

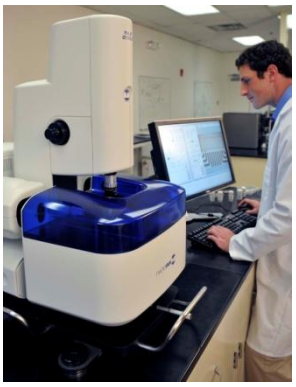

Figure 1: NLP 2000 System.

Standard Components

- NLP 2000 System stage, optics, and controller
- M-type Multipen Arrays, InkWells, and substrates
- On-site system installation
- Two days user training
- Getting Started Guide, User Manual & CD
- 1 year warranty, parts & labor

Optional Components

- Localized environmental chamber (EC-0110-00)
- Integrated vibration isolation feet (ATB-0100-00)
- 2D nano PrintArray™ upgrade (NLP-0100-01)
- 1D leveling & scripting (NLP-0400-01)
- 1D & 2D leveling & scripting (NLP-0500-01)
- Plasma cleaner (DPN-0312-01/02)
- Active Vibration Isolation Table (ATB-0200-00)
- Extended Limited Warranty, 1 year (NLP-0310-01)

Features and Benefits

Along with the ability to create patterns of nano- to micron-scale features from many materials, benefits of the NLP 2000 System include:

- Rapid fabrication of multi-component patterns with 1-10 micron feature sizes

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- Automated, precise, co-planar patterning of areas as large as 40 mm x 40 mm
- Functionalization of pre-existing microstructures
- Process monitoring & control using high resolution optical microscopy & environmental chamber

Rapid Fabrication of Multicomponent Patterns

Many researchers (including those studying cell-substrate interactions, developing sensors, and analyzing proteins) need to rapidly pattern materials with features in the 1-10 micron size range. The NLP 2000 System is the only commercially available platform capable of patterning 1-10 micron features of multiple materials with sub-micron registry. With the NLP 2000 System's user-friendly software and materials deposition protocols, it is simple to go from idea to final product in less than an hour.

Automated, Precise Patterning of Large Areas

In addition to a large 40 mm x 40 mm XY stage, The NLP 2000 System includes everything needed for users to begin to rapidly pattern large surface areas after only minimal training. The NLP 2000's three encoded piezo-driven linear stages (XYZ) and 2 encoded goniometer stages (T_x and T_y) make precise, rapid, large area patterning repeatable. Automated leveling controls, standard patterning routines, and software scripting capabilities simplify, control and automate long deposition runs.

Microstructure Functionalization

Using the NLP 2000 System's high resolution stages, sub-micron optical resolution and simple patterning interface, scientists can easily functionalize sensors, sensor arrays, microcontact printing stamps, microfluidic devices, or other pre-fabricated microstructures. The NLP 2000 System easily resolves features less than a micron in size, enabling system alignment to these pre-fabricated microstructures.

Controlled Patterning Environment

To fully monitor & control the patterning process, the NLP 2000 System features a high resolution optical microscope, and environmental chamber, and vibration isolation. Integrated environmental controls allow the user control and log temperature, humidity, and other unit parameters for immediate or subsequent analysis and correlation with printing. In addition, the NLP 2000 is compatible with commercial passive and active vibration isolation tables.

System Specifications

High Resolution Stage Specifications

	X-Axis	Y-Axis	Z -Axis	Tx	Ty
Range	40 mm	40 mm	10 mm	± 5°	± 5°
Encoder resolution	5 nm	5 nm	5 nm	0.15 mDeg	0.15 mDeg
Stage repeatability (High Res. Mode)	± 25 nm	± 25 nm	± 75 nm	± 0.25 mDeg	± 0.25 mDeg
Stage repeatability (Low Res. Mode)	± 150 nm	± 150 nm	± 75 nm	± 0.25 mDeg	± 0.25 mDeg

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Patterning Specifications

Throughput	System throughput is application-dependant; typical examples for printing an array of 2 micron protein spots spaced 10 microns apart with various multi-"pen" tip arrays, assuming re-inking every 10 spots: *"Pen" Type* / *"Pen" Tips/ Array* / *Time (min)* / *Patterned Area (mm^2)* / *Number of Spots* *12 pen M-type array* / 12 / 30 / 0.1 / 1,000 *48 pen M-type array* / 48 / 30 / 0.4 / 4,000 Automated re-inking of multiple pen arrays
Feature size	250 nm - 10 microns
Coefficient of variation	5-20% consistency (depends on printing material & protocol optimization)
Leveling	Stage leveling wizard (standard); automated leveling (1D & 2D) optional
Optical pattern registration to substrate	1 micron

Imaging & Environmental Control Specifications

Optical imaging specifications	10x objective M plan APO Optical resolution: < 1 µm Motorized digitally controlled zoom and focus Digitally controlled halogen illumination system 0% zoom: 844 µm x 629 µm 100% zoom: 143 µm x 110 µm Video magnification: (280x -1700x)
Localized environmental control (optional)	Software controlled temperature & humidity Heating temperature range: (ambient + 20°C) Cooling temperature range: (ambient – 2°C) Temperature stability: +/- 0.5 °C Humidity range: (10-90% RH) Humidity stability: +/- 5% RH

Software Specifications

Pattern Design	Patterning of orthogonal dots and lines Arrays of dots and lines InkMap import of Bitmaps User controlled pattern sequencing Pattern preview window InkMap for import of bitmap patterns
Feature Size Control	User defined dot dwell time; user defined line patterning speed
Stage Movement	XYZ increments preset or user-defined Tip & Tilt increments preset or user defined Ability to capture and store X, Y, Z, Tx and Ty stage positions Tip approach
Pen Array/Sample Leveling Routines	Leveling uses 3 point capture to optically define the substrate surface plane

Consumables, Printing Materials and Substrates

Multi-pen Arrays & Inkwells

Arrays of "pen" tips are optimized for DPN deposition of one or more printing materials in large-area patterns. "Pen" tip arrays are made of silicon nitride and contain A-frame and diving board shaped cantilevers. "Pen" tips are loaded using NanoInk Inkwell reservoirs.

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Pen Type	Pen Tips/Array	Compatible Inkwells
C	10	Universal
D	24	Universal
F	50	Universal
E	18	Universal
M	12	M12
48 Bio M	48	48 Bio M
2DnPA	55,000	--
High Density Tip Arrays	10^6	--

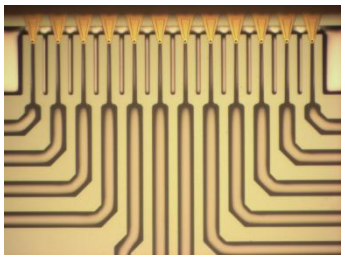

Figure 2: Type M 12-pen array dipping into matching inkwell array.

Printing Materials & Substrates

The NLP 2000 System is capable of depositing and imaging molecular materials and liquids with viscosities ranging from 1-20,000 cP on NanoInk substrates.

Supported printing materials:

- Proteins
- Nucleic acids
- Lipids
- Nanoparticles
- Polyethelyne glycol
- UV-curable polymers
- Heat-curable polymers
- Glycerol
- Silanes
- Thiols
- Catalysts

Compatible substrates:

- Silicon
- Silicon dioxide
- Silanized surfaces
- Amine functionalized slides
- Metals
- PDMS
- Hydrogels
- Polystyrene

Proven Protocols and Support

Leveraging years of experience and expertise in nanolithographic techniques and applications, NanoInk is committed to developing and thoroughly testing deposition protocols for a multitude of scientifically important materials (including DNA, hydrogels, polymers, silanes, thiols, and nanoparticles). These protocols, and accompanying inks, substrates and pens, are made available to NLP 2000 customers, and are accompanied by a variety of levels of customer support including e-mail, phone, remote desktop, on-site, and forums.

Ordering Information

Item Name: System, NLP 2000
Part #: DPN-1502-01

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