



## Desktop Nano Lithography Platform System (NLP 2000)



### User Friendly, Desktop Nanolithography Platform

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. With 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. It is designed to serve the increasing need for large area depositions of nanoarrays, this Dip Pen Nanolithography-based system is the first system capable of fabrication of sub-micron features over large substrates. With a dynamic range of deposited features sizes ranging from sub-100 nm to over 10  $\mu\text{m}$ , the NLP 2000 brings truly unique capabilities to the world of nanofabrication. It is an ideal instrument for nano-engineering 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

#### **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
- 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
- User-friendly software
- Materials deposition protocols

### **Standard Components**

- NLP 2000 System stage, optics, and controller
- M-type Multiprobe Arrays, Reservoirs, and substrates
- Getting Started Guide, User Manual & CD
- 1 year warranty, parts & labor
- Localized environmental chamber
- Integrated vibration isolation feet
- Extended Limited Warranty, 1 year

### **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 (Tx and Ty) 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**

<b>High Resolution Stage Specifications</b>					
<b>Description</b>	<b>X-axis</b>	<b>Y-axis</b>	<b>Z-axis</b>	<b>Tx</b>	<b>Ty</b>
Range	50 mm	50 mm	10 mm	$\pm 5^\circ$	$\pm 5^\circ$
Encoder Resolution	5 nm	5 nm	5 nm	0.15 mDeg	0.15 mDeg
Stage Repeatability(High Resolution Mode)	$\pm 25$ nm	$\pm 25$ nm	$\pm 75$ nm	$\pm 0.25$ mDeg	$\pm 0.25$ mDeg
Stage Repeatability (Low Resolution Mode)	$\pm 150$ nm	$\pm 150$ nm	$\pm 75$ nm	$\pm 0.25$ mDeg	$\pm 0.25$ mDeg

<b>Imaging Control Specifications</b>					
Optical Imaging Specifications	10X Objective M Plan APO	Optical resolution < 1 um	Motorized digitally controlled zoom and focus	Digitally controlled halogen illumination system	0% zoom: 844 x 629 $\mu\text{m}^2$ 100% zoom: 143 x 110 $\mu\text{m}^2$

Environmental Control Specifications					
Localized Environmental Control	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: +/- 0.5% RH

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:															
	<table border="1"> <thead> <tr> <th>“Pen” Type</th> <th>“Pen” Tips/ Array</th> <th>Time (min)</th> <th>Patterned Area (mm<sup>2</sup>)</th> <th>Number of Spots</th> </tr> </thead> <tbody> <tr> <td>12 pen M-type array</td> <td>12</td> <td>30</td> <td>0.1</td> <td>1,000</td> </tr> <tr> <td>48 pen M-type array</td> <td>48</td> <td>30</td> <td>0.4</td> <td>4,000</td> </tr> </tbody> </table>	“Pen” Type	“Pen” Tips/ Array	Time (min)	Patterned Area (mm <sup>2</sup> )	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
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Feature Size	100 nm – 10 microns															
Coefficient of Variation	5-20% consistency (depends on printing material & protocol optimization)															
Leveling	Stage leveling wizard															
Optical Pattern Registration to Substrate	1 micron															

Software Specifications					
Pattern Design	Patterning of orthogonal dots and lines	Arrays of dots and lines	Inkmap import of Bitmaps	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	Tip retract safe position
Pen Array/Sample Leveling Routines	Leveling using 3 point capture to optically define the substrate surface plane				

### Consumables, Printing Materials & Substrates

#### Multi-pen Arrays & Reservoirs

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 Inkwell reservoirs.

### **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 variety of substrates.

#### **Supported printing materials:**

- Proteins
- Nucleic acids
- Antigens
- Lipids
- Nanoparticles
- Polyethylene glycol
- UV-curable polymers
- Heat-curable polymers
- Glycerol
- Silanes

#### **Compatible substrates:**

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

### **Proven Protocols and Support**

Leveraging years of experience and expertise in nanolithographic techniques and applications, ACS Technology 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 #: E-A1004

Learn more about ACS Technology products and services at [www.acs-t.com](http://www.acs-t.com). Or call us at 847-813-5042.