
BIODOT

BIODOT . . .

is the leading supplier of systems for the research, development and manufacture of diagnostic tests. Its Mission is to enable, inspire and educate scientists to commercialize their R&D ideas through to manufactured product. Using its core competencies in low volume non-contact and contact dispensing, and technology transfer services, BioDot has developed a range of equipment for the research and development, and manufacture of biochips.

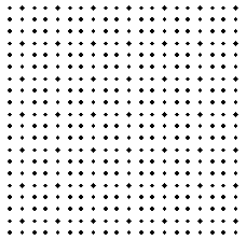
With a commitment to fully understanding our customer requirements, BioDot's personnel have a genuine wish to help you develop your research ideas. Our sales teams are highly trained in providing expert advice in both process and material handling needs. They are backed by strong support from teams of applications scientists and service engineers.

CONTENTS

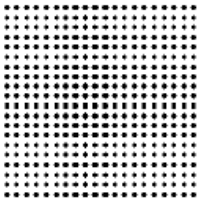
Bringing Manufacturing Strength to the Laboratory

BIOCHIPS

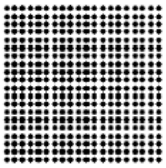
A common operation in genomics research is gridding of genetic material onto a substrate in an ordered array. Once arrayed, the substrate is probed with a fluorescently labeled DNA probe of interest, and is then analyzed to detect the locations where the probe bound to the substrate. An alternative to pin gridding, the most common means of achieving high-density arrays, is to use BioJet Plus for a non-contact dispense. Shown below are array examples achievable using BioJet Plus technology, each with decreasing center-to-center spacing from left to right.



1 mm spacing
(100 drops/cm²)

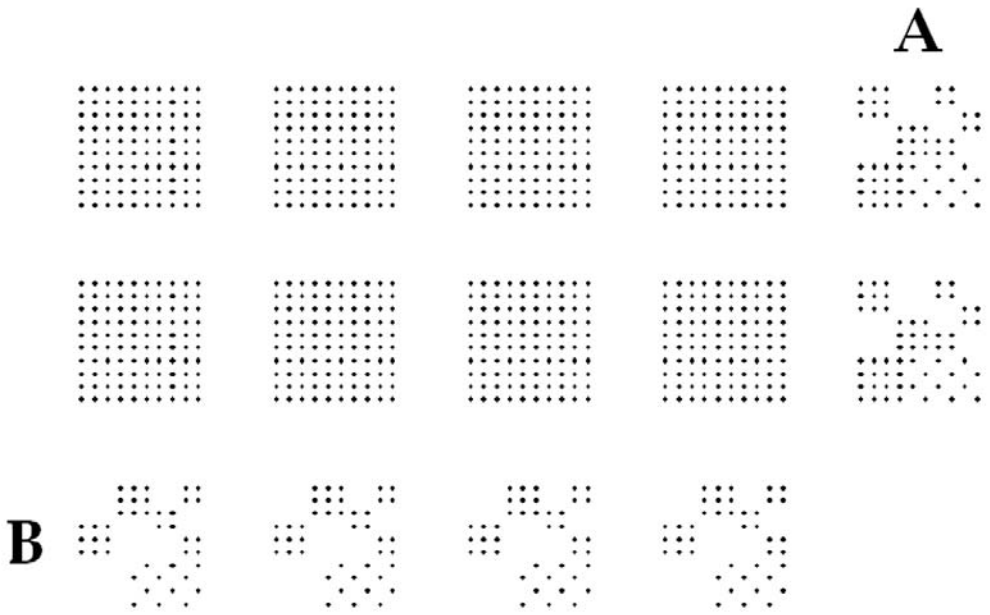


0.7 mm spacing
(196 drops/cm²)



0.5 mm spacing
(400 drops/ cm²)

Shown below are arrays of 10 x 10 drops, and a 1.0 mm center-to-center spacing (array density is 100 drops/cm2). The pattern was created in a two step process. The first step was dispensing sub-pattern A to each location, followed by dispensing the complementary sub-pattern B to each location.



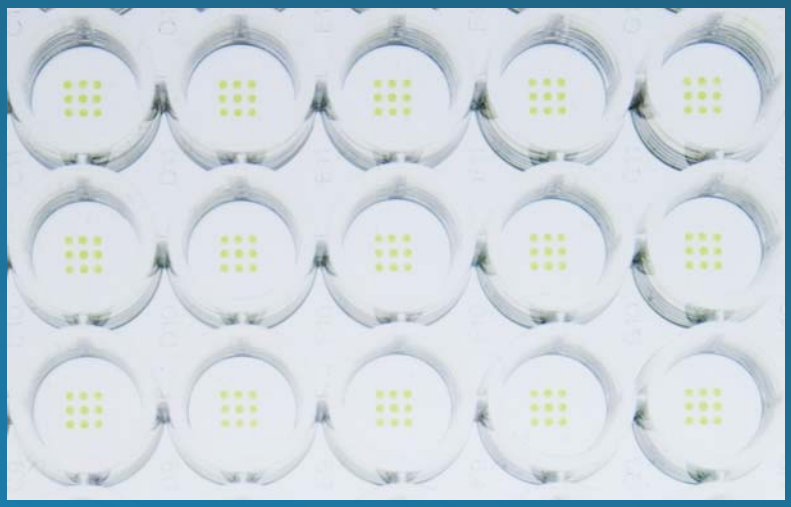
Using BioJet Plus, non-contact arraying can be completed on glass slides, membranes, or in microtiter plates.

MORE ON BIOCHIPS . . .

"A Single Nucleotide Polymorphism, or SNP is a single base, point, genetic change, or variation, that can occur within a person's DNA sequence. The genetic code is specified by the four nucleotide "letters" A (adenine), C (cytosine), T (thymine), and G (guanine). SNP variation occurs when a single nucleotide, such as an A, replaces one of the other three nucleotide letters - C, G, or T" [1]. Specifically, the apparent benign genetic change represents a deviation from the "normal" or known, common sequence for a particular gene.

SNPs that appear in the promoter region, coding region, or at exon/intron boundaries may result in altered transcriptional regulation, altered amino acid sequence in the gene product, and altered mRNA editing (splicing), respectively. Investigating the frequency and phenotypic correlates with known SNPs harbors the potential to

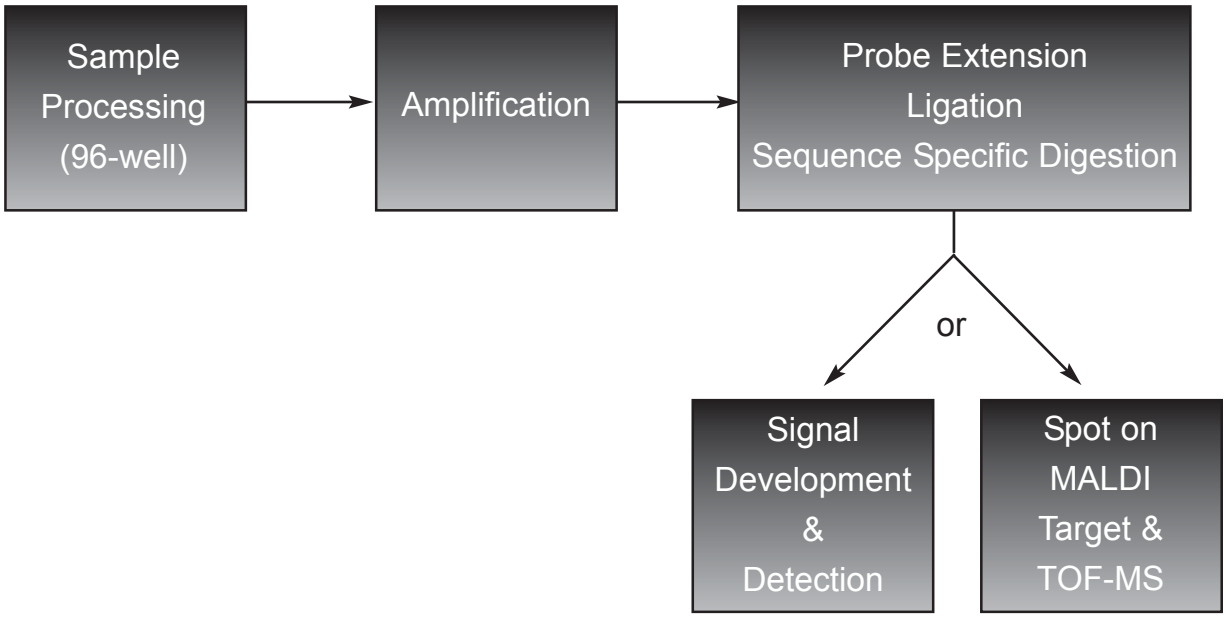
TURN THINKING INTO DOING . . .



discover specific genes that are responsible for predisposition for disease risk, as well as offers value in forensics research and population genetics. Many efforts to use SNP's for understanding genetic variability are now ongoing. High Throughput laboratories are undergoing research to map SNP's for disease diagnosis, pharmacogenomics , and agricultural genetics. Several institutions have exceeded runs of 100,000,000 wells per year. Given the increasing focus on SNP technology, there is an immediate need to increase throughput using robotic automation and to reduce reagent costs with nanoliter dispensing.

Although specific methods and analytical approaches vary, there are common processes for which BioJet Plus, an innovative low volume dispenser can be successfully integrated. “Essentially all assay platforms for known SNPs exploit nucleic acid mismatch hybridization chemistry and/or single-base extension chemistry to identify the SNP(s) under investigation”[2,3,4].

As described in the flowchart below, BioJet Plus can be used for non-contact dispensing into a microtiter plate and MALDI target spotting.



Sequenom, Third Wave, and Applied BioSystems are some of the companies offering a variety products and techniques to support SNP Analysis. Each technique requires different dispense patterns and protocols. BioJet Plus Technology has been used with these widely recognized protocols to increase throughput and reduce the costs of reagents per well. Dispensed patterns to plates can be in interwoven matrices or in four distinct quadrants. An interwoven matrix allows for the four common reagents to be dispensed into wells A1, A2, B1, B2, …. Using this pattern in a 384 well plate, and four BioJet Plus channels, the entire plate can be filled in less than 30 seconds. Likewise by dispensing reagents into four distinct quadrants allows for 12 x 8 block of wells to be dispensed in less than 30 seconds. To increase throughput, additional BioJet Plus channels can be added, as multiples of eight.

References:

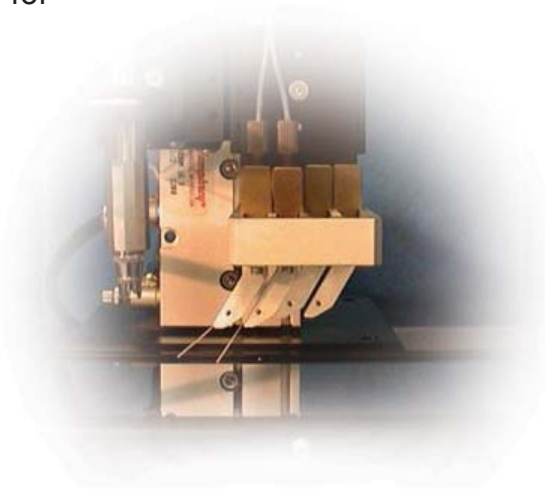
1. http://www.ncbi.nlm.nih.gov/About/primer/snps.html
2. Kwok, PY (2001) Methods for genotyping single nucleotide polymorphisms. Annu Rev Genomics Hum Genet 2:235-258.
3. Shi, MM (2001) Enabling large-scale pharmacogenetic studies by high-throughput mutation detection and genotyping technologies. Clin Chem 47:164-172.
4. Kwok, PY (2000) High-throughput genotyping assay approaches. Pharmacogenomics 1: 95-100.

DISPENSING TECHNOLOGIES

Contact Dispensing:

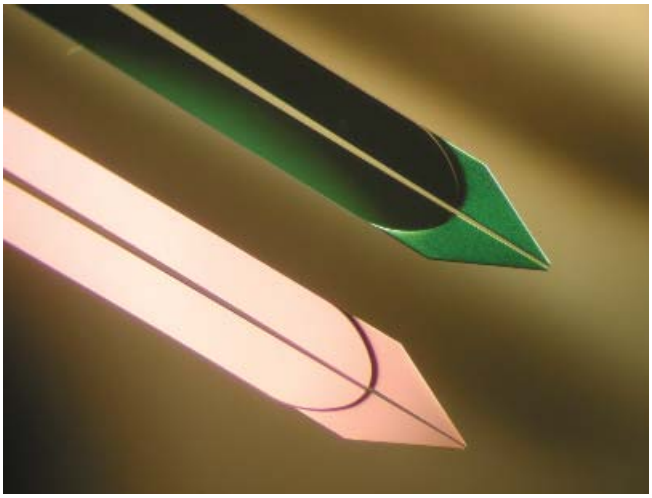
FrontLine:

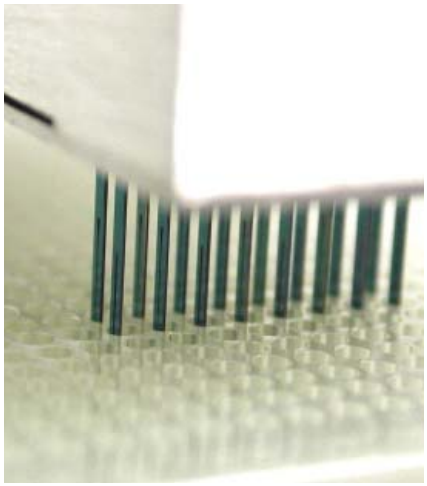
Frontline dispensing is ideal for printing lines on membranes and other substrates for BioChips. The technology couples a high resolution syringe pump with a micro-tube. During dispensing the micro-tube glides across the surface of the membrane or substrate to create a quantitative line. The width of the line can be adjusted by increasing or decreasing the programmed volume of the line.

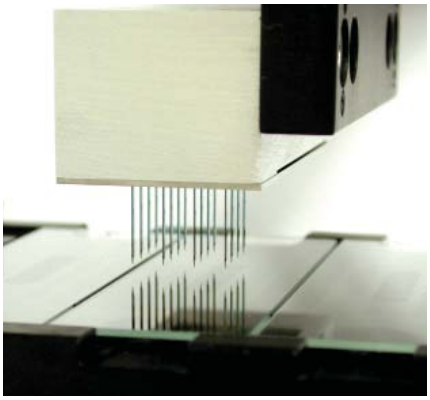


Silicon Pins:

The Silicon Microarray™ Printer fabricates highly precise microarrays at a fast rate and low cost. Ultra high precision micromachining capabilities and the unique physical properties of single crystal silicon have been combined to create a contact printing technology.





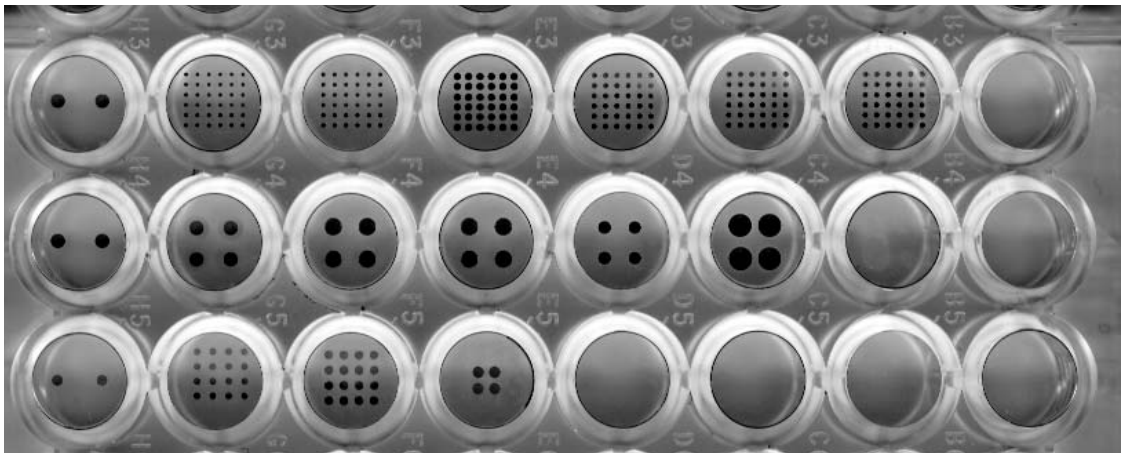


Using the Parallel Synthesis Silicon Pins allows for a very dense array with reduced carryover. The Silicon Pins are also capable to aspirate from a 1536 well source plate and have no pre-spotting requirements.

Non-Contact Dispensing:

sciFLEXARRAYER™:

The Scienion sciFLEXARRAYER piezo system is a non contact liquid handling and spotting system. The technology dispenses with a high dynamic volume range (picoliter to microliter) and can accurately aspirate and dispense aqueous and organic solutions as well as living cells. Using piezo, spot volume can be changed as well as dispensing reagents on top of each other without contamination. Results can be analyzed with standard technology and give immediate results for optimal reaction parameters.

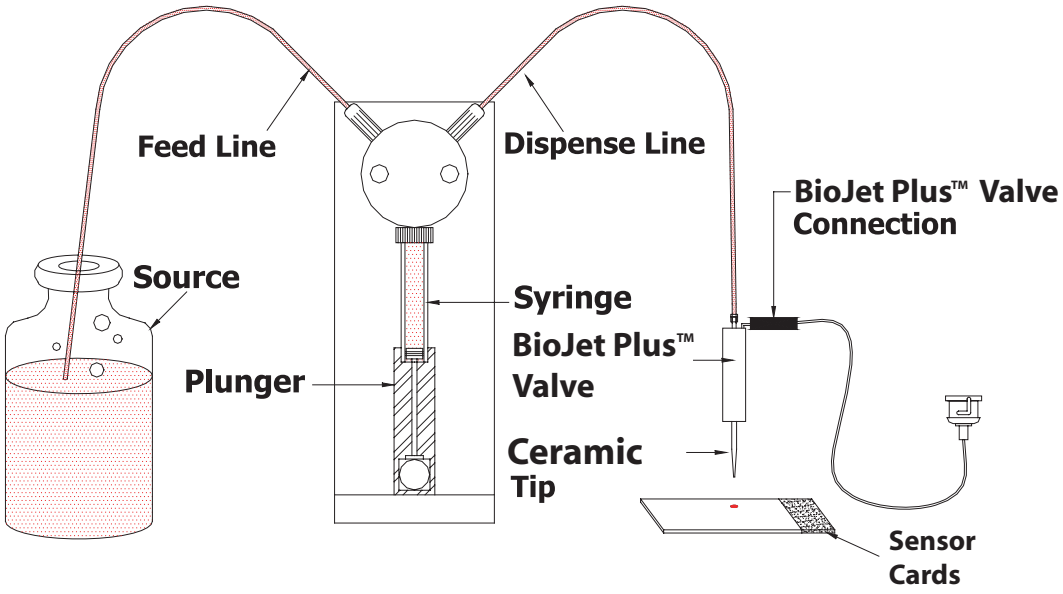


BioJet Plus™:

The proprietary BioJet Plus technology was developed for high speed dispensing. The technology involves (1) the coupling of a high speed micro solenoid valve with a high resolution syringe pump and (2) synchronization of the dispense system with the movements of the stage. The result is an extremely fast dispensing system which can deliver volumes from 20 nL to 4 µL in a single drop. BioJet Plus can work in either an Aspirate/Dispense or Bulk Dispense modes.

Use BioJet Plus to dispense buffers, antibodies, enzymes or cells. BioJet Plus dispensing is independent of the substrate allowing flexible dispensing to microtiter plates, glass slides or membranes. BioJet Plus systems are available from compact R&D systems to complete integrated manufacturing modules.

BioJet Plus™



“HANDS ON” WORKSHOPS

BioDot conducts worldwide workshops and seminars on the technology of manufacturing of Rapid Tests. In these workshops, BioDot and its strategic partners bring together experts in the various disciplines of rapid assay technologies to provide the most up to date information possible.

The workshops are a mixture of lecture and laboratory to present both a “Classroom” and “Hands On” style.

Classroom Sessions

- Emerging Rapid Assays & Challenges to Development
- Classical Approach to Microarrays & Application Challenges
- Antibodies: The Basis of a Good Rapid Assay
- Development, Validation, and Application of Antibody Arrays
- Polymer Based Visible Microarrays
- Next Generation Substrates
- Scaleable Dispensing Technologies for Biochip Manufacturing
- High Throughput Laser Scanning Platforms for Arrays in Multiwell Plates
- EpiTags: The Scaelable Approach to Quantitative Multiplex Immunoassays
- Adhesives used with Biochips

“Hands On” Sessions

- Protein Arraying with BioJet Plus
- Protein Arraying with sciFLEXARRAYER piezo
- Slide Processing and Development
- Adhesives Property and Evaluation
- Fluorescent Detection of Antibody and Spot Array
- Data Analysis

Practical Considerations of Development of Biochips

Location	Date
Oklahoma, OK	May 2006
Oklahoma, OK	Aug. 2006
Fairfax, VA	Sep. 2006

Emerging Rapid Assays Technologies

Location	Date
San Diego	Oct. 2005
Taipei, TW	Nov. 2005
Tokyo, JP	Nov. 2005
Salt Lake City, UT	Mar. 2006
Beijing, CN	Apr. 2006
Shanghai, CN	Apr. 2006
Dublin, IE	Apr. 2006
Chicago, IL	Jul. 2006
Taipei, TW	Nov. 2006
Seoul, KR	Nov. 2006

PRODUCTS & OPTIONS

Dispensing Systems

AD1500

Research & Development System

PRODUCT DESCRIPTION

The AD1500 is a tabletop workstation designed for high speed aspirating and dispensing applications to glass slides, microtiter plates or membranes. Its compact footprint and up to four BioJet Plus Pumps make it ideal for a research laboratory to investigate new applications.

Both chemical and biological reagents can be dispensed using the proprietary BioJet technology. BioJet Plus couples the X-Y-Z motion control system with the high precision displacement capabilities of a syringe pump and the high-speed actuation of a micro-solenoid valve. The three components synchronized together result in a precise, non-contact liquid handling system.

FEATURES AND BENEFITS

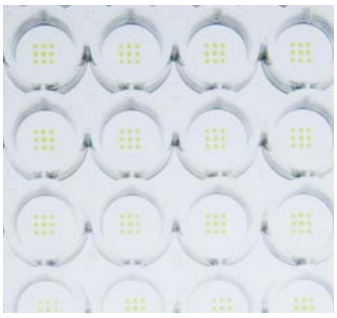
SPEED
- -"On the Fly" dispensing
- -Non-Contact mode reduces wash time

FOOTPRINT
- - Small design to accommodate research environment

MULTI-MODE DISPENSING
- - Contact and Non-Contact dispensing capabilities
- - Dispense to slides, microtiter plates, or membranes
- - Aspirate and Dispense or Continuous Dispense operations

PERFORMANCE

X-Y Table Speed
175 mm/second
Minimum Aspirate Volume
1 µL
Minimum Dispense Volume
20 nL
Dynamic Dispense Range
20 nL - 250 µL
Positioning Performance
Stepper Motor Resolution = 1.3 µm
Repeatability < ± 10 µm
(95% Confidence)



A 3 x 3 array dispensed into a 96 well microtiter plate

Close Up photo of an AD1500 configured with a 14 glass slide nest

SPECIFICATIONS

DIMENSIONS (L x W x H)
- 32" x 24" x 24"

WEIGHT
- 85 lbs

POWER REQUIREMENT
- 110/220 VAC; 50/60 Hz

VACUUM REQUIREMENT
- Vacuum Wash Station: 2.1 CFM (~60 CL)

DISPENSING SPECIFICATIONS

DISPENSE MODES
- Aspirate/Dispense (source to destination)
- Continuous (bulk reservoir to destination)

DISPENSE TO DISPENSE PRECISION
- <10% CV at 50 nL, <7% CV at 100 nL; <4% CV at 500 nL

DISPENSE ACCURACY
- ±7% at 50 nL, ±5% at 100 nL

DISPENSE SPEED
- Using 8 BioJet Plus channels, a 3 x 3 microtiter plate array completes in approximately 4 minutes

OPTIONS

UP TO 4 BIOJET PLUS DISPENSERS

SILICON MICROARRAY PINS, PRINTHEAD, AND WASH STATION

HUMIDITY CONTROL

SUBSTRATE NEST
- Glass Slide, Microtiter Plate, or Membrane Hold Down

VACUUM PUMP

HELIUM DEGASSER

AD3200

Development to Pilot Production System

PRODUCT DESCRIPTION

The AD3200 is a workstation designed for development and pilot scale production of biochips. Its standard 8 BioJet Plus and plate or slide nest configuration makes it ideal for a biochip development.

The proprietary BioJet Plus technology was developed for high speed dispensing. The technology involves (1) the coupling of a high speed micro solenoid valve with a high resolution syringe pump and (2) synchronization of the dispense system with the movements of the stage. The result is an extremely fast dispensing system which can deliver volumes non contact from 20 nL to 4 µL in a single dispensed drop.

BioJet Plus allows for flexible biochip development by dispensing to a glass slide, microtiter plate or membrane material.

FEATURES AND BENEFITS

ACCURACY
- High resolution X-Y-Z positioning

MULTI-MODE DISPENSING
- Contact and Non-Contact dispensing capabilities
- Dispense to slides, microtiter plates, or membranes
- Aspirate and Dispense or Continuous Dispense operations

FLEXIBLE
- Suitable for Biochip Development
- Configured with 9 Position Microtiter Nest, or 50 Glass Slides, or Membrane Hold down.

PERFORMANCE

X-Y Table Speed
175 mm/second
Minimum Aspirate Volume
1 µL
Minimum Dispense Volume
20 nL
Dynamic Dispense Range
20 nL - 250 µL
Positioning Performance
Stepper Motor Resolution = 1.3 µm
Repeatability < ± 10 µm
(95% Confidence)

SPECIFICATIONS

DIMENSIONS (L x W x H)
- 40" x 30" x 13" (each for 2 modules)

WEIGHT
- 160 lbs (total)

POWER REQUIREMENT
- 110/220 VAC; 50/60 Hz

VACUUM REQUIREMENT
- Vacuum Wash Station: 2.1 CFM (~60 CL)

DISPENSING SPECIFICATIONS

DISPENSE MODES
- Aspirate/Dispense (source to destination)
- Continuous (bulk reservoir to destination)

DISPENSE TO DISPENSE PRECISION
- <10% CV at 50 nL, <7% CV at 100 nL; <4% CV at 500 nL

VALVE TO VALVE PRECISION
- <10% average CV at 100 nL (8 valves)

DISPENSE ACCURACY
- ±7% at 50 nL, ±5% at 100 nL

DISPENSE SPEED
- 20 seconds to fill a 1536 well plate with 500 nL/well (8 channels)

Note: All specifications are based on total experiment cv's, which include drop to drop plate filling (where applicable) and plate reader cv's.

OPTIONS

UP TO 16 BIOJET PLUS DISPENSERS

SILICON MICROARRAY PINS, PRINTHEAD, AND WASH STATION

HUMIDITY CONTROL

SUBSTRATE NEST
- Glass Slide, Microtiter Plate, or Membrane

HELIUM DEGASSER

AD5000

Production Biochip System

PRODUCT DESCRIPTION

The AD5000 is a workstation designed for high throughput biochip manufacturing. Vision inspection (CCD camera), and barcode reading, can be configured on the AD5000 for verification of substrate positioning and reagent spot dispensing.

BioJet Plus proprietary non contact dispensing technology, links high resolution syringe pump liquid displacement with micro-solenoid actuated valve, controlling drop ejections. BioJet Plus synchronizes all parameters to achieve “on the fly” dispensing at very high speeds without compromising drop positional accuracy.

FEATURES AND BENEFITS

ACCURACY
- High resolution X-Y-Z overhead gantry for precise motion control
- Programmed parameters guarantee repeatability

MULTI-MODE DISPENSING
- Contact and Non-Contact dispensing capabilities
- Dispense to slides, microtiter plates, or membranes
- Aspirate and Dispense or Continuous Dispense operations

FLEXIBLE
- Suitable for Slide, Plate, or Membrane Materials

PERFORMANCE

X-Y Table Speed
250 mm/second
Minimum Aspirate Volume
1 µL
Minimum Dispense Volume
20 nL
Dynamic Dispense Range
20 nL - 250 µL
Positioning Performance
Stepper Motor Resolution = 1.3 µm
Repeatability < ± 10 µm
(95% Confidence)

SPECIFICATIONS

DIMENSIONS (L x W x H)
- 40” x 42” x 68”

WEIGHT
- 1000 lbs

POWER REQUIREMENT
- 110/220 VAC; 50/60 Hz

VACUUM REQUIREMENT
- Vacuum Wash Station: 2.1 CFM (~60 CL)

DISPENSING SPECIFICATIONS

DISPENSE MODES
- Aspirate/Dispense (source to destination)
- Continuous (bulk reservoir to destination)

DISPENSE TO DISPENSE PRECISION
- <10% CV at 50 nL, <7% CV at 100 nL; <4% CV at 500 nL

VALVE TO VALVE PRECISION
- <10% average CV at 100 nL (8 valves)

DISPENSE ACCURACY
- ±7% at 50 nL, ±5% at 100 nL

DISPENSE SPEED
- 20 seconds to fill a 1536 well plate with 500 nL/well (8 channels)

NOTE: ALL SPECIFICATIONS ARE BASED ON TOTAL EXPERIMENT CV.S, WHICH INCLUDE DROP TO DROP PLATE FILLING (where applicable) AND PLATE READER CV.s.

OPTIONS

UP TO 48 BIOJET PLUS DISPENSERS

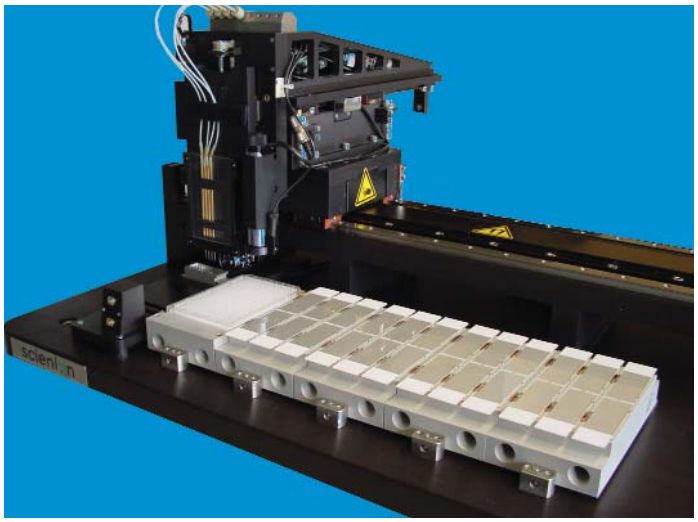
SILICON MICROARRAY PINS, PRINTHEAD, AND WASH STATION

HUMIDITY CONTROL

SUBSTRATE NEST
- Glass Slide, Microtiter Plate, or Membrane

HELIUM DEGASSER

Scienion sciFLEXARRAYER™



FEATURES AND BENEFITS

NON CONTACT DISPENSING
- -Transfer Volume is not Affected by the Substrate
- -Highly Reproducible
- -"Free-Fly" of droplets allows dispensing liquids into small cavities

FAST
- -> 1000 drops/s
- -Efficient Mixing of Reagents

SOFTWARE
- -Flexible and Easy Design of Chip Layout
- -Set up of Individual User Profiles

PRODUCT DESCRIPTION

The sciFLEXARRAYER Piezo dispenser is a non contact system that dispenses with a high dynamic volume range. The sciFLEXARRAYER is available in two formats (the s5 or s11) and comes with up to eight chemically inert dispense nozzles. The s5 and s11 can accurately aspirate and dispense aqueous and organic solutions as well as living cells.

The sciFLEXARRAYER dispenser includes a low volume wash station and an ultrasonic cleaning function for the glass nozzles. A high resolution optical drop control system can be configured onto either the s5 or the s11 sciFLEXARRAYER platforms.

Either the s5 or the s11 can be configured for a broad range of substrates from glass slides, microtiter plates, MALDI-MS sample plates, chambered glass slides, membranes and HTA™ Formats.

PERFORMANCE

Piezo Dispensing
- Non Contact
- Drop on Demand

Dispense Frequency
- 1-2000 Hz

Minimal Dispense Volume
- 150 pL (PDC 50)
- 300 pL (PDC 70)
- 500 pL (PDC 90)

Minimal Sample Update
- 0.5 0 1 µL

X-Y Motion
- < 5 µm

Z Motion
- < 10 µm

SPECIFICATIONS

DIMENSIONS (L x W x H)

s5: 83 cm x 58 cm x 60 cm

s11: 135 cm x 58 cm x 60 cm

CAPACITY

S5: 5 Microtiter Plates or 30 slides
(standard 1 MTP + 24 slides)

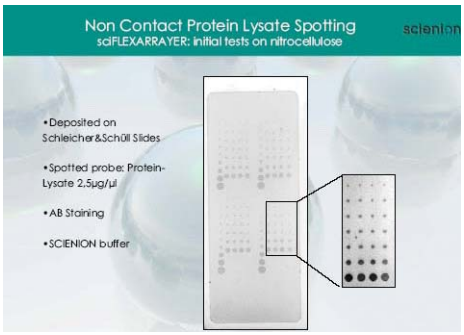
S11: 11 Microtiter Plates or 66 slides
(standard 1 MTP + 60 slides)

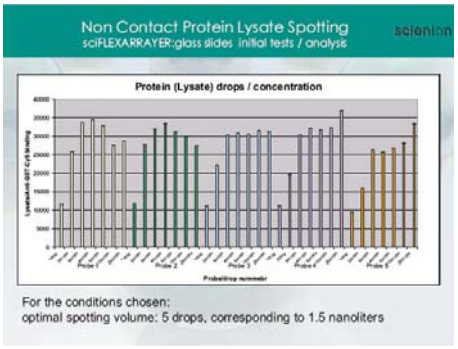
CAPILLARY ORIFACE

50 m (PDC 50)

70 m (PDC 70)

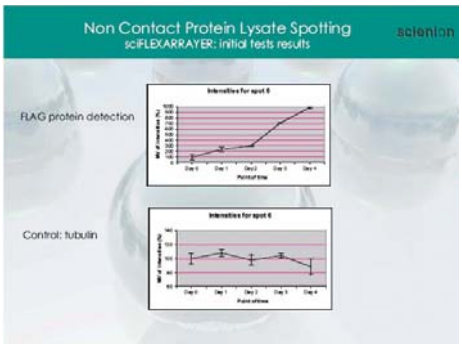
90 m (PDC 90)





OPTIONS

1-8 PIEZO DISPENSE CAPILLARIES
HIGH RESOLUTION OPTICAL DROP CONTROL SYSTEM
INDEPENDENT, SECOND WASH STATION
HUMIDITY CHAMBER
HEPA FILTER



Ordering Information

AD1500 up to 4 BioJet Plus Pumps 2 Microtiter Plate Positions **or** 7 Slide Nest **or** Vacuum Magnetic Hold-down Nest Integrated Wash/Vacuum Station Vacuum Pump Computer Controller	**Dispense Options:** BioJet Plus Pump: BJP3000 Silicon Print Assembly (Printhead, pin, and wash station): 6035-A048 **Nest Options:** Plate Nest: 6001-A105 Slide Nest: 6001-A107 Vacuum Nest: 6001-A106 **Humidity Control:** 115 V: 6001-A110-01 230 V: 6001-A110-02
AD3200 up to 16 BioJet Plus Pumps 9 Microtiter Plate Positions **or** 50 Slide Nest **or** Vacuum Magnetic Hold-down Nest Integrated Wash/Vacuum Station Vacuum Pump Computer Controller	**Dispense Options:** BioJet Plus Pump: BJP3000 Silicon Print Assembly (Printhead, pin, and wash station): 6035-A048 **Nest Options:** Plate Nest: 6022-A063 Slide Nest: 6022-A060 Vacuum Nest: 6022-A064 **Humidity Control:** 115 V: HC3200-01 230 V: HC3200-02
AD5000 up to 48 BioJet Plus Pumps 20 Microtiter Plate Positions **or** 100 Slide Nest **or** Vacuum Magnetic Hold-down Nest Integrated Wash/Vacuum Station Vacuum Pump(s) Computer Controller Humidity Chamber & Controller	**Dispense Options:** BioJet Plus Pump: BJP3000 Silicon Print Assembly (Printhead, pin, and wash station): 6035-A048 **Nest Options:** Plate Nest: 6021-A011 Slide Nest: 6021-A012 Vacuum Nest: 6021-A015
sciFLEXARRAYERs **s5** up to 8 Piezo Dispensers 5 Microtiter Plate Positions Chemical Inert Wash Chamber Instrument Enclosure Computer Controller **s11** up to 8 Piezo Dispensers 11 Microtiter Plate Positions Chemical Inert Wash Chamber Instrument Enclosure Computer Controller	**Dispense Options:** 50 µm Piezo Dispensers: 2100-0011-04 70 µm Piezo Dispensers: 2100-0011-01 80 µm Piezo Dispensers: 2100-0011-02 90 µm Piezo Dispensers: 2100-0011-03 **Nest Options:** Chilled Source Plate: 2100-0026 Microscope with Black & White CCD Camera: 2100-0006 Microscope with color CCD Camera: 2100-0008 **Humidity Control:** Humidity Chamber: 2100-0005 HEPA Filter: 6028-A046-01

PRODUCTS & OPTIONS

“Hands On” Workshops

Ordering Information

The “Hands On” workshops are offered throughout the years at various geographic locations. Due to the “Hands On” format, attendance is limited to a set number of delegates.

Location	Date
Salt Lake City, UT	Mar. 2006
Beijing, CN	Apr. 2006
Shanghai, CN	Apr. 2006
Dublin, IE	Apr. 2006
Oklahoma, OK	May 2006
Chicago, IL	Jul. 2006
Oklahoma, OK	Aug. 2006
Fairfax, VA	Sep. 2006
Taipei, TW	Nov. 2006
Seoul, KR	Nov. 2006

To register for the next workshop, log on to www.biodot.com and download the registration form.