ONE Labs Inc.

1658 Milwaukee
Chicago, Illinois 60647
t: 312-436-1466

Date: July 12, 2015

Quotation

Quote Number:

Customer: Bryan Bishop

Delivery to: Bryan Bishop

Project Description:

This document sets forth the quotation an piezo inkjet deposition system. It contains a description of the product, scope of services to be included in the project, and pricing information.

Piezo Inkjet 3-Axis DNA Printer

Rev 0.3

3 -Axis Stage:

Specifications:

3-axis linear positioners

Closed Loop

Travel: X: 60cm, Y: 50cm, Z: 10cm

Repeatability: 10um

Printhead:

Epson Artisan 1430 Printhead mounted to X axis.

It contains six fluid channels that can hold the four standard monomers, the catalyst, and still accept a modified monomer, monomer mixture, or preformed linker. It contains 90 nozzles per fluid channel for a total of 540 nozzles. The droplet size quoted by the manufacturer is 1.5 pL. Droplet size varies with viscosity and surface tension, and temperature.

Printhead Controller:

Custom Digital and Analog IO board

Connects to Mesa 6i24 PCIe FPGA card using IO ports
DAC and amplifier for firing pulse generation
Buffering of the printheads control and data signals.
Analog sensor inputs

Analog Inputs

1	Hygrometer
1	O_2 sensor

CNC Motion Controller:

PC - 64bit x86 Processor

Mesa FPGA PCIe Card – 6i24

The MESA 6I24 is a low cost, general purpose, FPGA based programmable I/O card for the PCIe bus.

Firmware modules are provided for hardware step generation, quadrature encoder counting, PWM generation, digital I/O, Smart Serial remote I/O, BISS, SSI, SPI, UART interfaces and more. All motion control firmware is open source and easily modified to support new functions or different mixes of functions.

All I/O bits are 5V tolerant and can sink 24 mA. All I/O pins support 3.3V LVDS signaling. Pullup resistors are provided for all pins so that they may be connected directly to opto-isolators, contacts etc. The 6I24 has 72 I/O bits available on three 50 pin connectors.

Mesa Servo Board – 7i33

The 7I33 is a 4 axis analog servo interfaces intended for operation with MESA's Anything I/O cards when used for motion control applications. All 7I33 models take the PWM and direction signals from the Anything I/O card and converts them to +- 10V analog output voltages for direct connection to analog input servo amplifiers.

The 7I33 also conditions the encoder input signals with input filters for TTL inputs or a RS-422 receivers for differential encoder inputs.

The controller connection is a 50 pin header that matches the pinout of the Mesa 6i24. The 7I33 uses another 50 pin connector for servo amp/encoder connections.

Mesa Digital IO board – 7i37

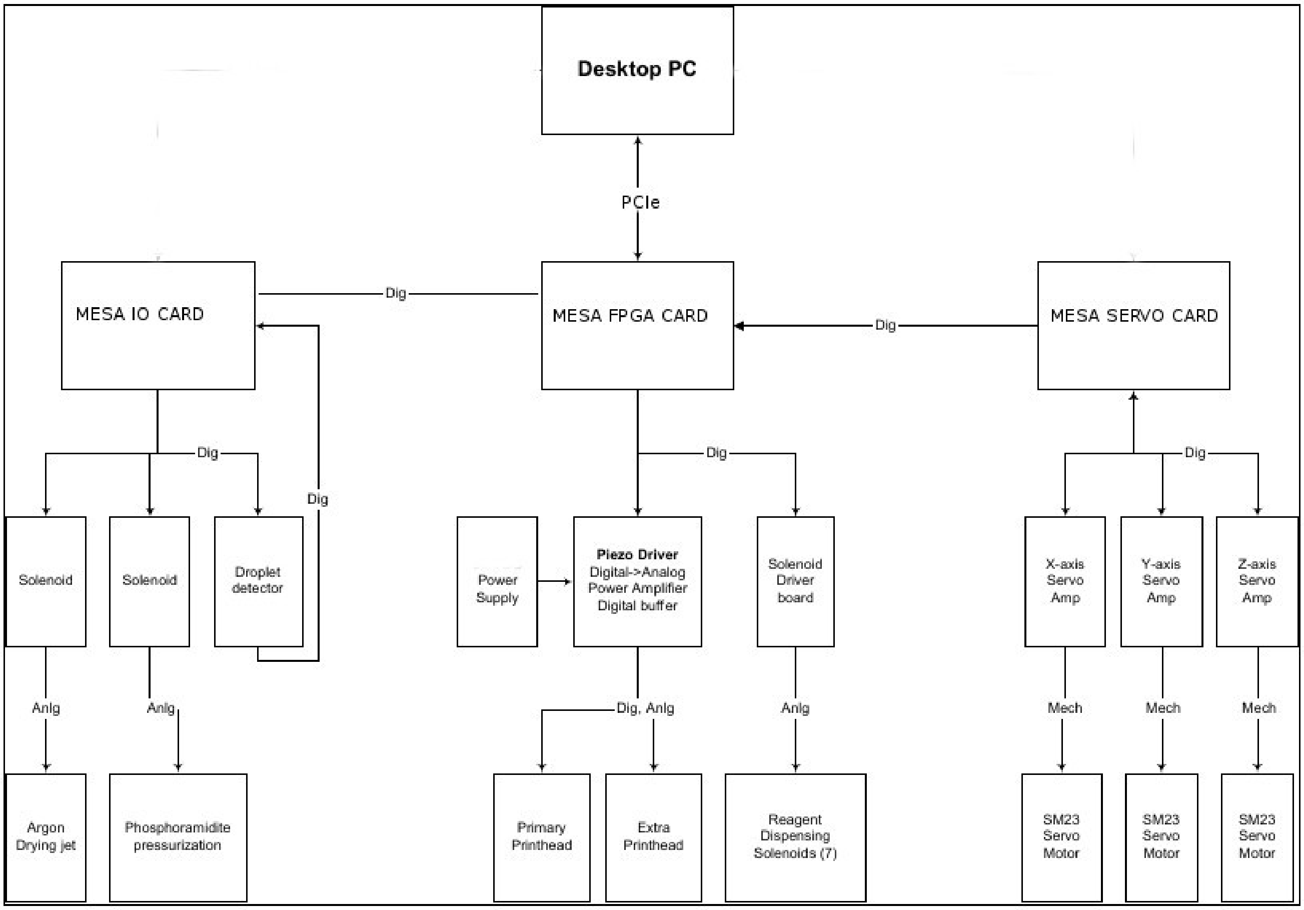
The 7I37 is an 8 output, 16 input isolated I/O interface card. The 7I37 provides 8 Isolated 48VDC 1A output drivers and 16 Opto-isolated inputs. All output drivers are low saturation voltage MOSFETS for low power dissipation. Each of the 8 output switches is isolated from the others, allowing high side, low side, push-pull and other output switch configurations. The 16 opto-isolated inputs will operate with input voltages from 4 to 24 V. Reverse protection diodes are provided to allow use with AC inputs. The 7I37 is compatible with the all Mesa 50 pin parallel I/O and FPGA cards.

Solenoids

6	Reagent Dispense (Wash) Solenoid
1	Waste (Vacuum) Solenoid
1	Argon/Nitrogen Drying Jet Solenoid
1	Phosphoramidite Pressurization Solenoid

Inputs

1	Laser Droplet Detector
1	E-Stop
6	Limit Switch (2ea per Axis)


Desktop PC
PCIe
MESA IO CARD
Dig
MESA FPGA CARD
Dig
MESA SERVO CARD
Dig
Dig
Dig
Dig
Solenoid
Solenoid
Droplet detector
Power Supply
Piezo Driver
Digital->Analog
Power Amplifier
Digital buffer
Solenoid Driver board
X-axis Servo Amp
Y-axis Servo Amp
Z-axis Servo Amp
Anlg
Anlg
Dig, Anlg
Anlg
Mech
Mech
Mech
Argon Drying jet
Phosphoramidite pressurization
Primary Printhead
Extra Printhead
Reagent Dispensing Solenoids (7)
SM23 Servo Motor
SM23 Servo Motor
SM23 Servo Motor

Slide Holder

The Teflon slide holder is mounted to the Y-axis.
30cm x 30cm vacuum chuck
Vacuum to chuck is solenoid controlled

Drying Nozzles

6 Drying Nozzles

Microarray slides are blown dry during synthesis by a six-jet nitrogen manifold. Drying nozzles are attached to the X-axis next to the printhead.

Droplet Detection Laser and Photodiode

The droplet detection laser sends a beam from behind the print head to the photodiode detector in front of the print head. The beam is aligned so that all droplets fired downward from the 90 nozzles in any one bank will intersect the beam. Light from the beam is normally blocked from reaching the photodiode by a black tape blocking strip. Light refracted by the droplets passes around the strip and reaches the detector.

Software:

Linux OS

CNC Control – LinuxCNC

LinuxCNC provides:

- Several graphical user interfaces including one for touch screens
- Interpreter for "G-code" (the RS-274 machine tool programming language)
- Realtime motion planning system with look-ahead operation of low-level machine electronics such as sensors and motor drives
- Software PLC programmable with ladder diagrams
- Closed loop servo control
- LinuxCNC runs on Linux using real time extensions. Support for RT-Linux or RTAI patches.

User Interface:

Monitor

USB Keyboard and Mouse

Operation:

The motion of the multi-axis printer system is controlled by LinuxCNC.

G-code programmed

DNA printing GUI – TBD, not supplied by seller

The printhead operation and jetting is synchronized to the motion of the stage.

Power:

120-240 VAC 60Hz

Control Enclosure:

Of adequate size to allow for cooling, access for:

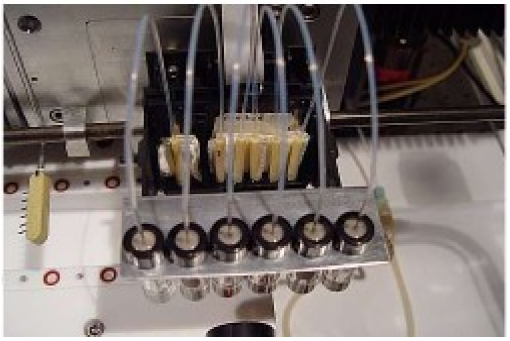
Servo Drives
Mesa IO Board
Mesa Servo Board
Power Supplies
Solenoid Drivers

Inkjet Enclosure

TBD

Phosphoramidite Vials

Vials to be held with a similar arrangement shown below.



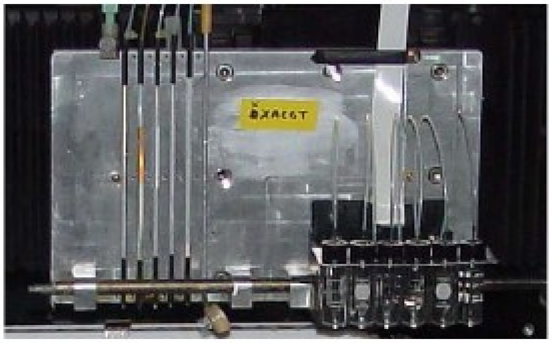
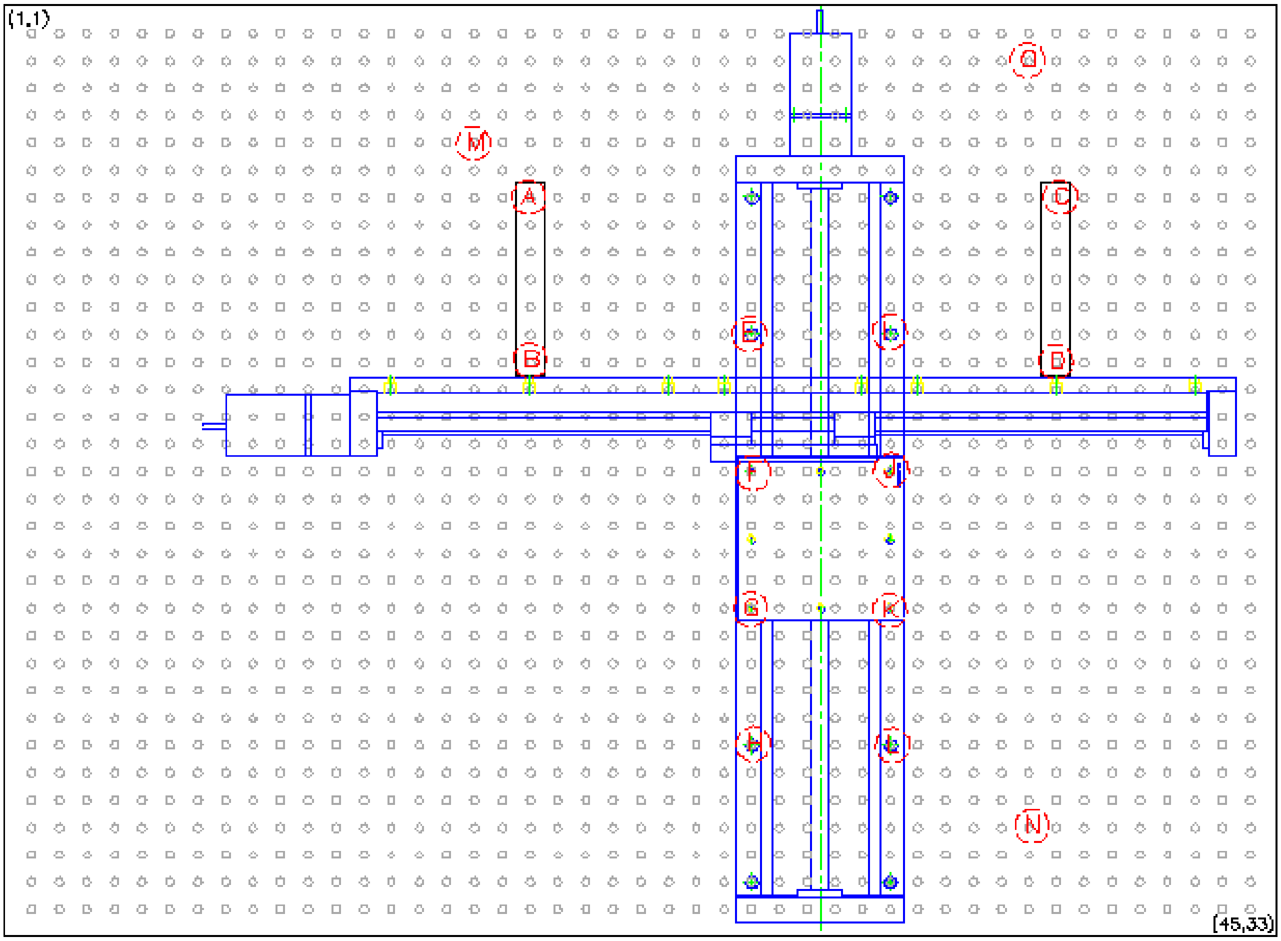
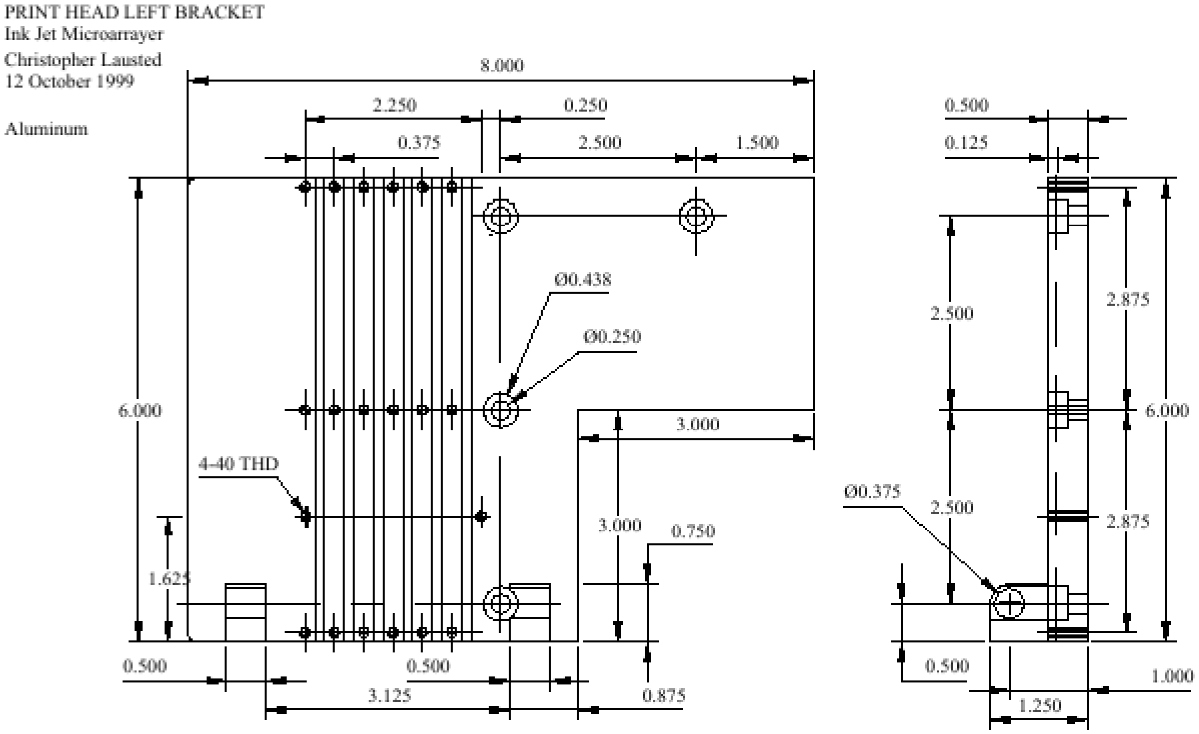


Table and Stage Layout



Point	*What*	*Coordinates*
A	*Screw point for XZ axis support bracket*	*(19,7)*
B	*Screw point for XZ axis support bracket*	*(19,13)*
C	*Screw point for XZ axis support bracket*	*(38,7)*
D	*Screw point for XZ axis support bracket*	*(38,13)*
E	*Screw point for Y axis*	*(27,12)*
F	*Screw point for Y axis*	*(27,17)*
G	*Screw point for Y axis*	*(27,22)*
H	*Screw point for Y axis*	*(27,27)*
I	*Screw point for Y axis*	*(32,12)*
J	*Screw point for Y axis*	*(32,17)*
K	*Screw point for Y axis*	*(32,22)*
K	*Screw point for Y axis*	*(32,27)*
M	*Soleonid tower*	*(17,5)*
N	*Photodiode post*	*(37,28)*
O	*Laser post*	*(37,2)*

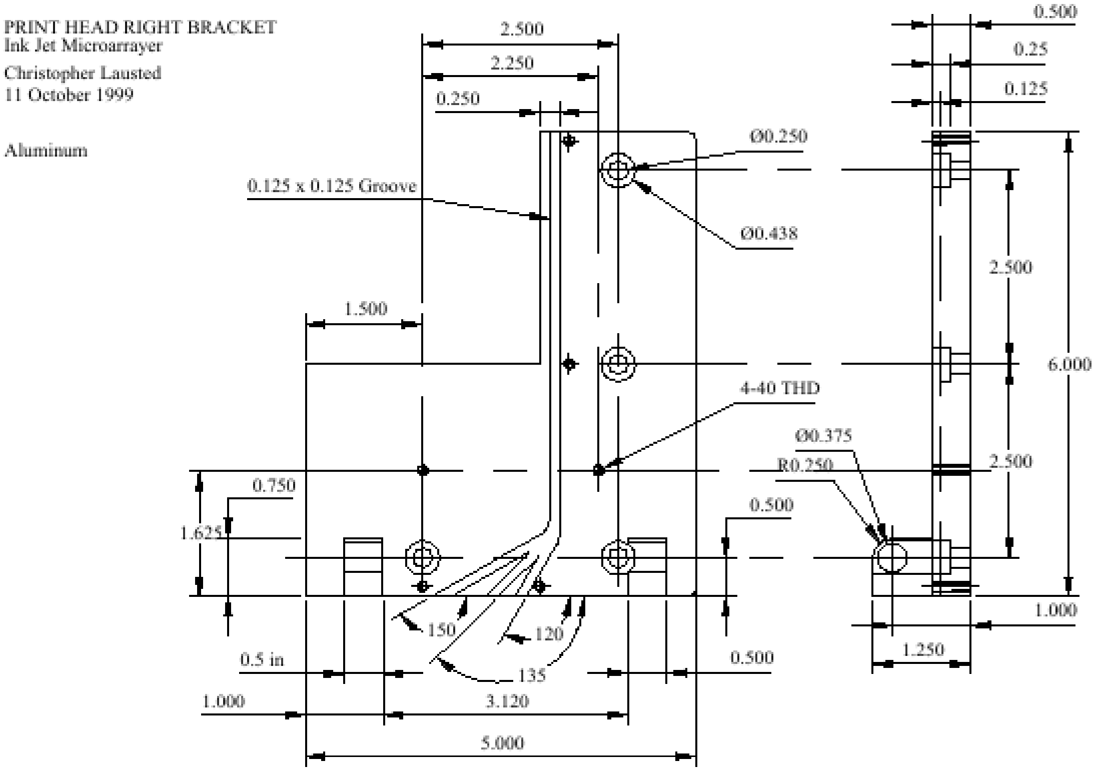
Printhead Mounting Bracket



PRINT HEAD LEFT BRACKET
Ink Jet Microarrayer
Christopher Lausted
12 October 1999

Aluminum

8.000
2.250
0.250
0.375
2.500
1.500
0.500
0.125
Ø0.438
Ø0.250
2.500
2.875
6.000
3.000
4-40 THD
Ø0.375
2.500
2.875
6.000
3.000
0.750
1.625
0.500
0.500
3.125
0.875
0.500
1.250
1.000

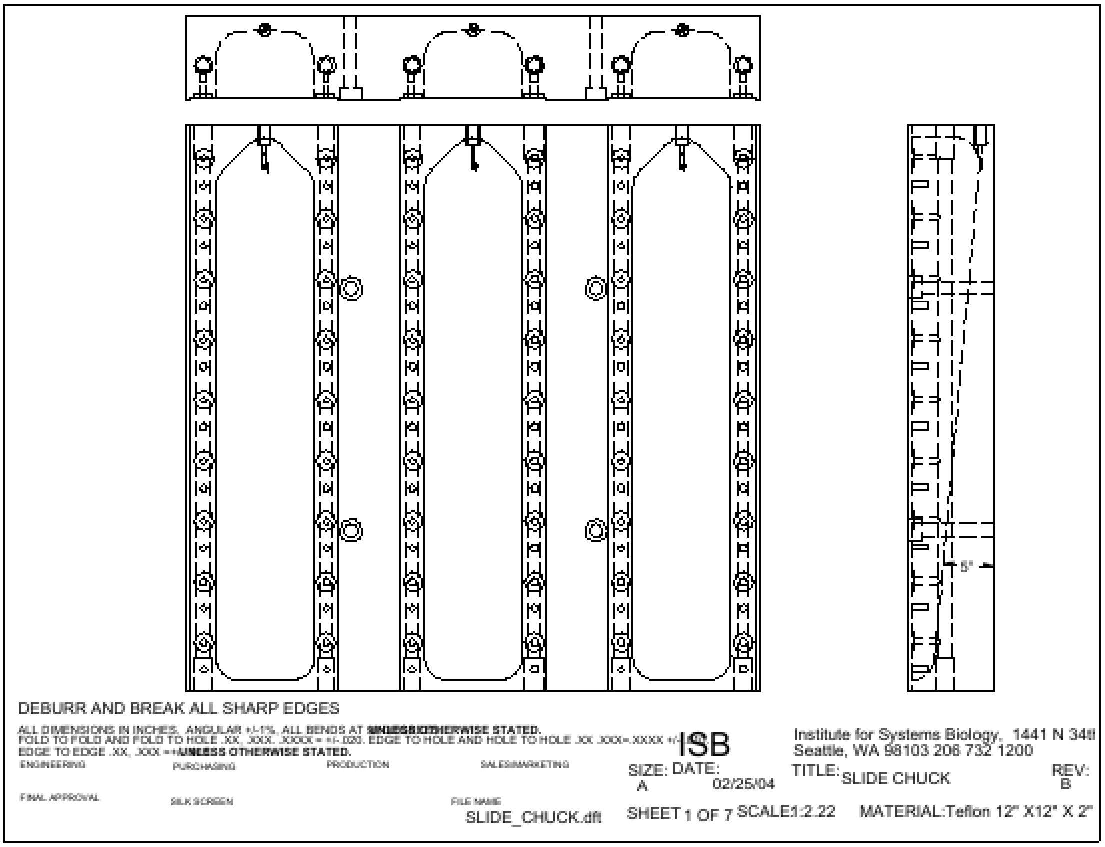


PRINT HEAD RIGHT BRACKET
Ink Jet Microarrayer
Christopher Lausted
11 October 1999

Aluminum

2.500
2.250
0.250
0.500
0.25
0.125
Ø0.250
0.125 x 0.125 Groove
Ø0.438
2.500
1.500
6.000
4-40 THD
Ø0.375
R0.250
2.500
0.750
0.500
1.625
150
120
135
0.5 in
0.500
1.000
3.120
5.000
1.000
1.250

Slide Holder


5°
DEBURR AND BREAK ALL SHARP EDGES
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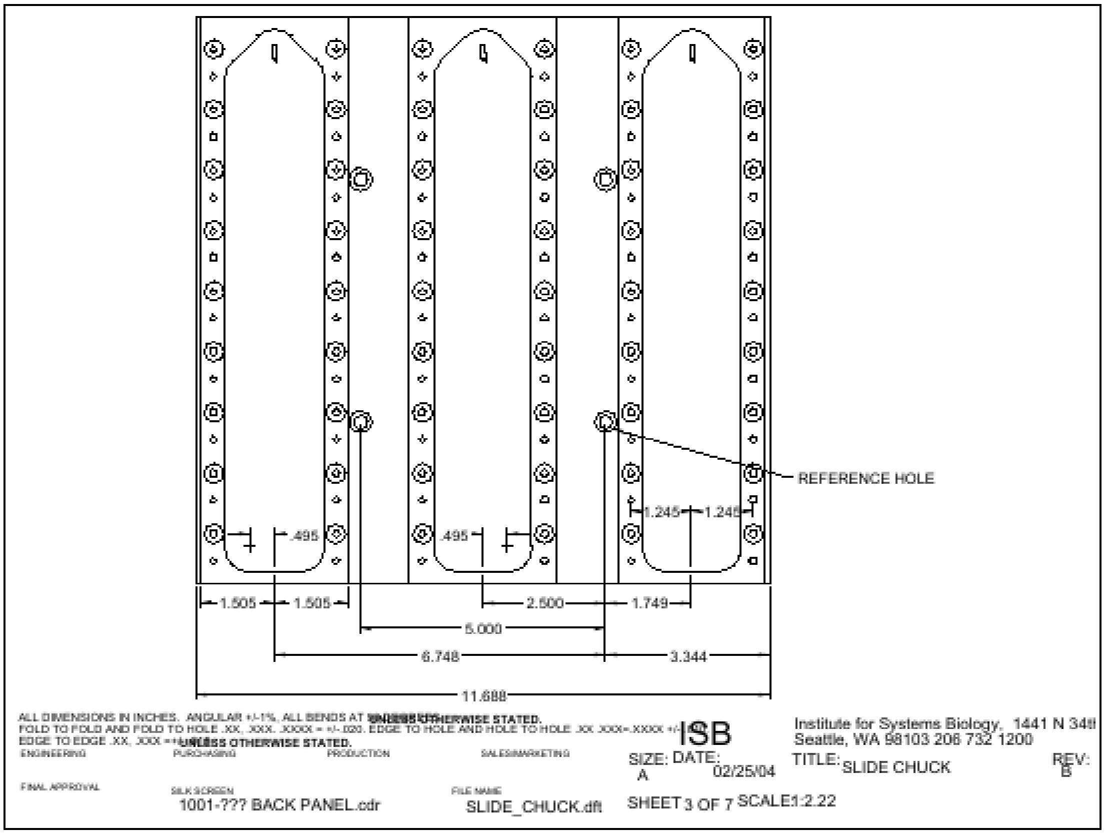
FOLD TO FOLD AND FOLD TO HOLE .XX, .XXX, .XXXX = +/-.020. EDGE TO HOLE AND HOLE TO HOLE .XX .XXX=.XXXX +/-
EDGE TO EDGE .XX, .XXX =+ UNLESS OTHERWISE STATED.
ENGINEERING
PURCHASING
PRODUCTION
SALES/MARKETING
FINAL APPROVAL
SILK SCREEN
FILE NAME
SLIDE_CHUCK.dft
ISB
Institute for Systems Biology, 1441 N 34t
Seattle, WA 98103 206 732 1200
SIZE: A
DATE: 02/25/04
TITLE: SLIDE CHUCK
REV: B
SHEET 1 OF 7
SCALE1:2.22
MATERIAL:Teflon 12" X12" X 2"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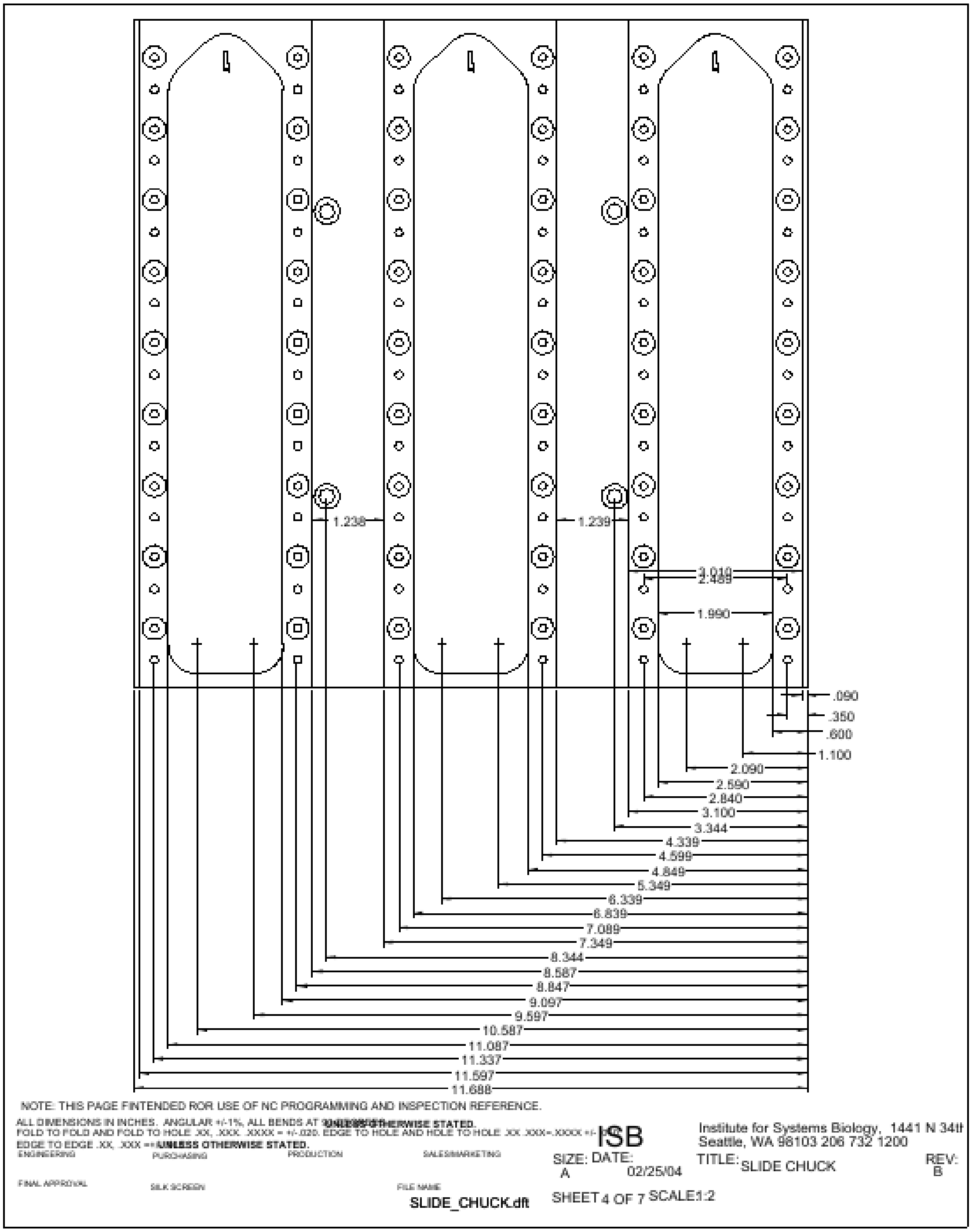
REV: B
SHEET 3 OF 7
SCALE1:2.22

Slide Holder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3.344
4.339
4.599
4.849
5.349
6.339
6.839
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9.097
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Institute for Systems Biology, 1441 N 34th
Seattle, WA 98103 206 732 1200
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DATE: 02/25/04
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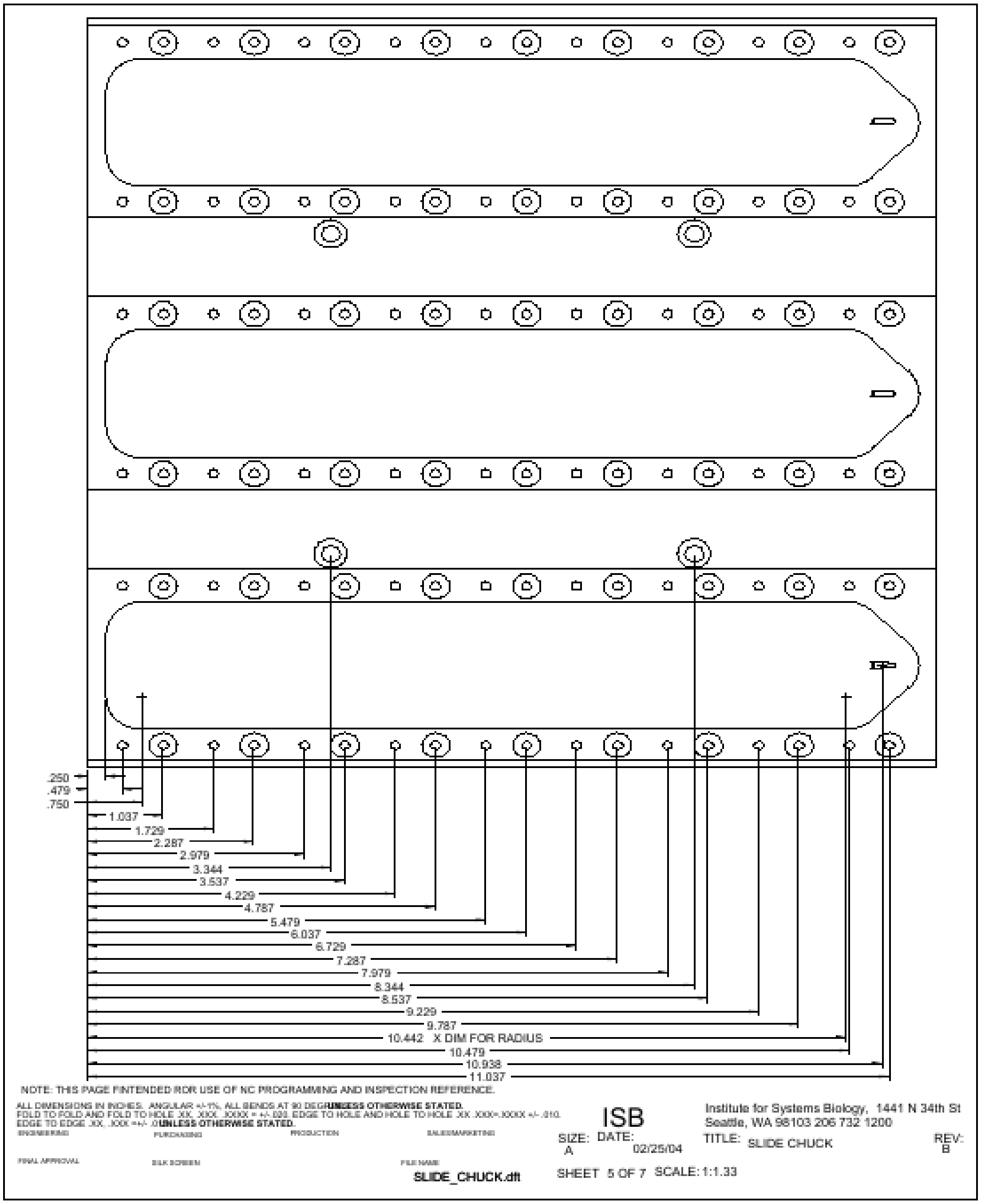
REV: B
SHEET 4 OF 7
SCALE1:2

Slide Holder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6.729
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10.442 X DIM FOR RADIUS
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10.938
11.037
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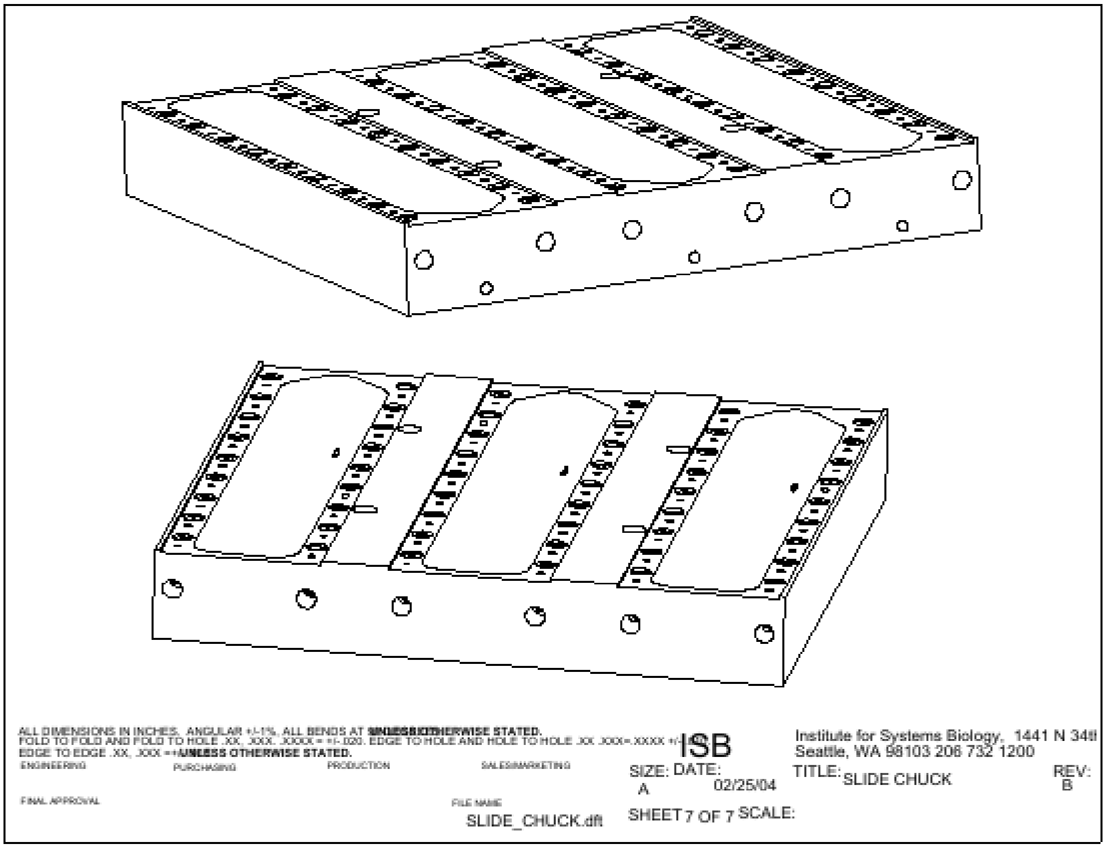
SHEET 5 OF 7
SCALE: 1:1.33

Slide Holder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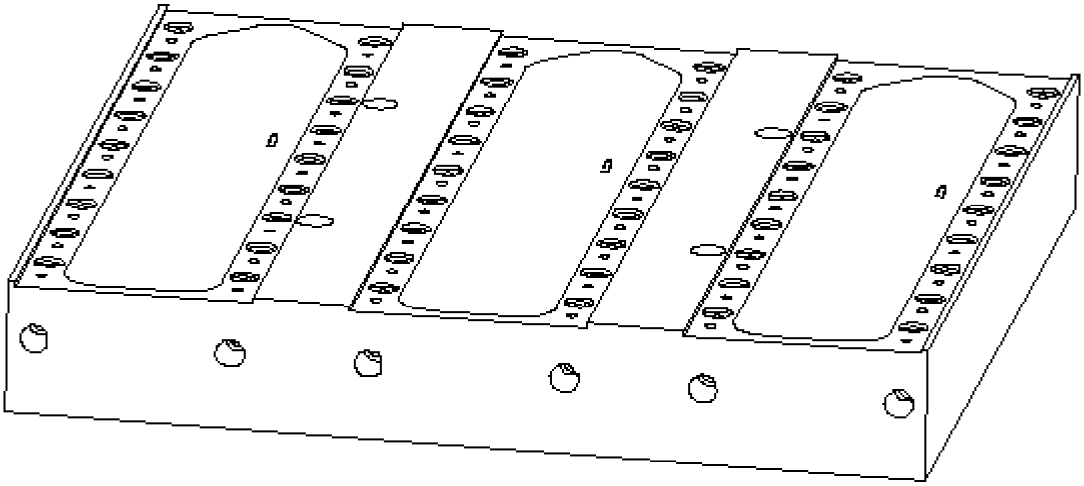
SHEET 7 OF 7
SCALE:



Deliverables:

3-axis stage and base
Printhead and mounting bracket with drying nozzles
Laser droplet detector
CNC control cabinet with power supplies, servo driver and IO boards
Slide holder
Custom printhead analog board

Bill of Materials

Design files for:
    Printhead mounting bracket and drying nozzles
    CNC control cabinet
    Slide holder
    Custom printhead analog board

Wiring diagrams for power supplies, cnc controls, printhead, solenoids, GPIO

Pricing:

$13K-16K

Payment Terms:

Additional Items

None included.

Freight

All Shipments are EXW Chicago, IL. Shipments are the responsibility of the customer. The customer bears all shipping charges.

Delivery

8-12 weeks ARO

Delivery dates are approximate only and Seller shall have no liability for any delays in delivery.

Validity

This quote expires 30 days after quotation date.

Alterations

Price and delivery are subject to change based upon alterations or additions presented in the customers final specifications or requested during design or fabrication phases. ONE Labs reserves the right to alter any design based upon its knowledge and experience in order to improve the printers performance.

Pre-Shipment Acceptance Testing

Prior to shipment of the equipment, ONE Labs will setup and test the equipment with material supplied by the Customer, in order to ensure its performance meets or exceeds the specifications described in this proposal. The Customer is invited to send their personnel, at Customer's expense, to our facility to witness these tests. At conclusion of this visit, having been satisfied that the equipment operates as described, the visiting personnel will release the equipment for shipment. If the Customer is unable to witness this pre-shipment checkout, Customer is to advise ONE Labs that he waives this opportunity and thus releases the equipment for shipment. In this instance it shall be understood that ONE Labs has verified that the equipment does perform in accordance with the criteria stated above, before shipment is made.

Conclusion

We thank you for the opportunity to discuss this project with you.
We look forward to working with you further.

Bari Ari
ONE Labs

Signature ____________________ Date ____________

Accepted By:

Signature ____________________ Date ____________

Name ____________________

Customer Purchase Order Number ____________________