

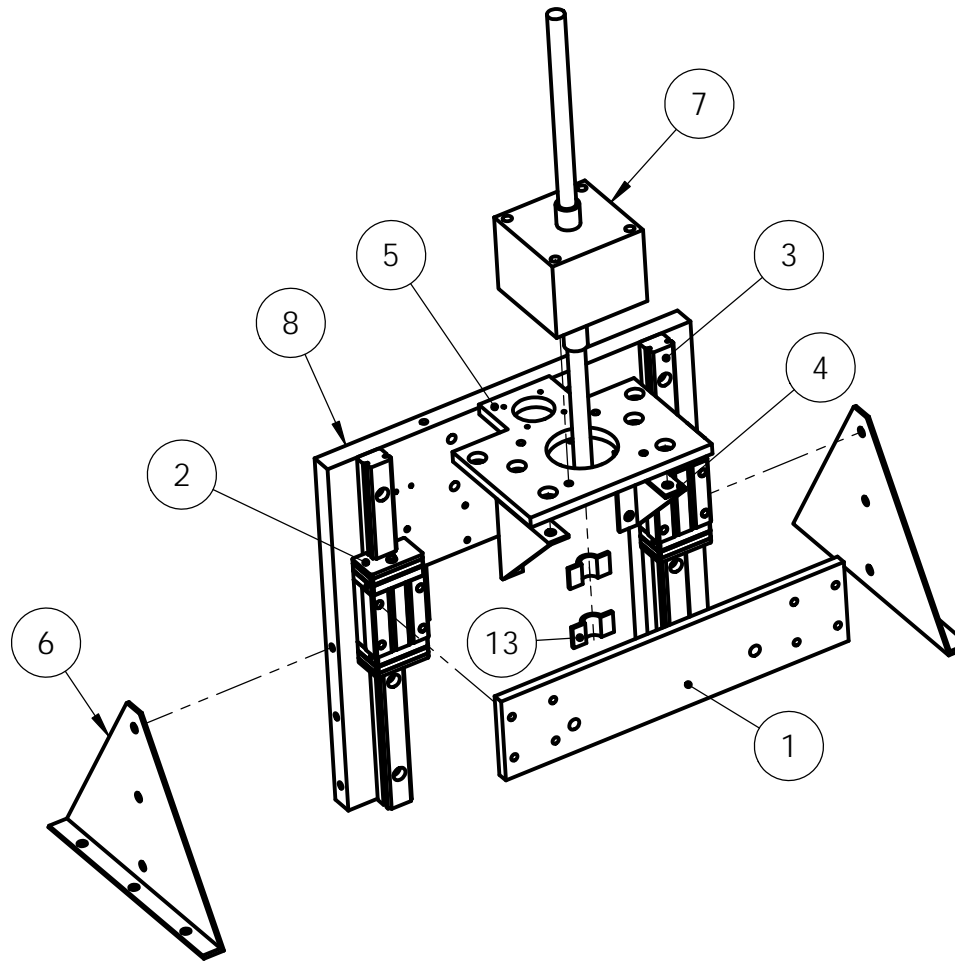
# Appendix B: Drawings

Bill of Materials	B1
Assembly Drawings	B3
Part Drawings	B7
Wiring Diagram	B20
Pit Detection Algorithm	B21
Software Class Diagram	B22
Example Sequence Diagram	B23

## Bill of Materials

Part #	Description	Supplier	Mfg part #	Quantity	\$/item	Total Cost	Shipping
1	Carriage	McMasterCarr	9246K13	1	\$30.39	\$30.39	\$0.00
2	Carriage Linear Slides	McMasterCarr	5708K25	2	\$189.20	\$378.40	\$14.00
3	Carriage Linear Rails	McMasterCarr	5708K99	2	\$112.20	\$224.40	\$0.00
4	Support Bracket	Home Depot	15442	2	\$1.99	\$3.98	\$0.00
5	Actuator Mount (see part#1)	----	---	1	\$0.00	\$0.00	\$0.00
6	Stand	McMasterCarr	89015K37	2	\$16.85	\$33.70	\$0.00
7	Needle Stepper Actuator	Anaheim Automation	23AV104DX12-AB	1	\$195.00	\$195.00	\$10.30
8	Frame	McMasterCarr	9246K33	1	\$42.71	\$42.71	\$0.00
9	#10-24 X 3/8 SHCS	Fastenal	73436	4	\$0.16	\$0.64	\$0.00
10	#10-24 X 1/2 SHCS	Fastenal	73437	6	\$0.22	\$1.32	\$0.00
11	#10-24 X 2 SHCS	Fastenal	73444	4	\$0.56	\$2.24	\$0.00
12	#10-24 X 1 SHCS	Fastenal	73440	6	\$0.26	\$1.56	\$0.00
13	3/8 tube strap	Fastenal	450437	2	\$0.79	\$1.58	\$0.00
14	M4 X 12mm SHCS	Fastenal	MS2530012A4000	16	\$0.14	\$2.24	\$0.00
15	M4 X 25mm SHCS	Fastenal	MS2530025A4000	8	\$0.24	\$1.92	\$0.00
16	#10-24 nuts	Fastenal	1170707	10	\$0.06	\$0.58	\$0.00
17	Multiplexor Breakout	Sparkfun	BOB-09056	4	\$5.00	\$20.00	\$5.00
18	Shift Register Breakout	Sparkfun	BOB-10680	2	\$3.00	\$6.00	\$0.00
19	Analog to Digital Converters (ADC)	Digikey	AD7892ANZ-1-ND	2	\$30.00	\$60.00	\$7.63
20	Linear Comparator	Digikey	497-6993-5-ND	2	\$2.50	\$5.00	\$0.00
21	ZIF Connector (28 position)	Newark	17R8729	1	\$2.00	\$2.00	\$0.00
22	Power Supply	Jameco	2115240	1	\$95.00	\$95.00	\$0.00
23	Stepping Motor Driver	Gecko	G213V	2	\$170.00	\$340.00	\$13.75
24	Heatsink	Heatsink Factory	AK-210	2	\$10.00	\$20.00	\$7.25
25	Thermal Paste	Newegg	N82E16835186020	1	\$8.00	\$8.00	\$0.00
26	MicroController	Atmel	XMEGA-A1	1	\$30.00	\$30.00	\$0.00
27	Jumper Wires	Sparkfun	PRT-09140	2	\$4.00	\$8.00	\$0.00
28	Schmitt Trigger	Digikey	296-17840-ND	1	\$2.00	\$2.00	\$0.00
29	Limit Switch	Digikey	SW776-ND	2	\$1.00	\$2.00	\$0.00
30	Plastic Retaining Ring 1/4" thick	McMasterCarr	8560K359	1	\$11.00	\$11.00	\$0.00
31	Ring Linear Bearings	McMasterCarr	6255K32	4	\$42.00	\$168.00	\$0.00
32	Ring Linear Actuator	anaheimautomation	11AV102CX06-SB	1	\$148.00	\$148.00	\$0.00
33	Al. Shaft Diam3/8" L12"	McMasterCarr	5911K22	2	\$15.00	\$30.00	\$0.00
34	Sensor Mount Plate	McMasterCarr	9037K51	1	\$72.92	\$72.92	\$0.00
35	Sensor Cover Plate	McMasterCarr	9037K11	1	\$43.76	\$43.76	\$0.00

36	Sensor Protection Pad	Reynold's Adv. Materials	Custom	1	\$31.85	\$31.85	\$0.00	
37	1.5in Pins	Beverly's	N/A	350	\$0.01	\$3.99	\$0.00	
38	Aluminum Brackets	McMasterCarr	88805K56	1	\$26.82	\$26.82	\$0.00	
39	1/4-28x0.5 18-8 Stainless Steel Screw	Fastenal	70039	4	\$0.24	\$0.96	\$0.00	
40	1/4-28x0.625 18-8 Stainless Hex CS	Fastenal	70040	6	\$0.26	\$1.55	\$0.00	
41	1/4-28 NE 18-8 Stainless Hex Bolt	Fastenal	70880	10	\$0.20	\$2.01	\$0.00	
42	#8 X 3/8 SHCS Stainless	Fastenal	73421	2	\$0.19	\$0.38	\$0.00	
43	#4 X 1/4 SHCS Stainless	Fastenal	73410	1	\$0.07	\$0.07	\$0.00	
44	#2 X 1.5 SHCS Stainless	Fastenal	171030	4	\$5.70	\$22.80	\$0.00	
45	Pressure Sensor	Sensing Tex	N/A	1	\$77.38	\$77.38	\$95.00	
46	10x10x10 Acrylic Box	Collecting Warehouse	AD0704	1	\$48.77	\$48.77	\$23.92	
47	ZIF Connector (24 position)	Newark	30K5817	1	\$1.00	\$1.00	\$0.00	
	Sales Tax	1.085						
					Total	\$2,208.92	\$176.85	
						<b>Total Cost</b>	<b>\$2,573.53</b>	



All Part Numbers Referenced in the Bill of Materials

Cal Poly Mechanical Engineering

Dwg. #:1001

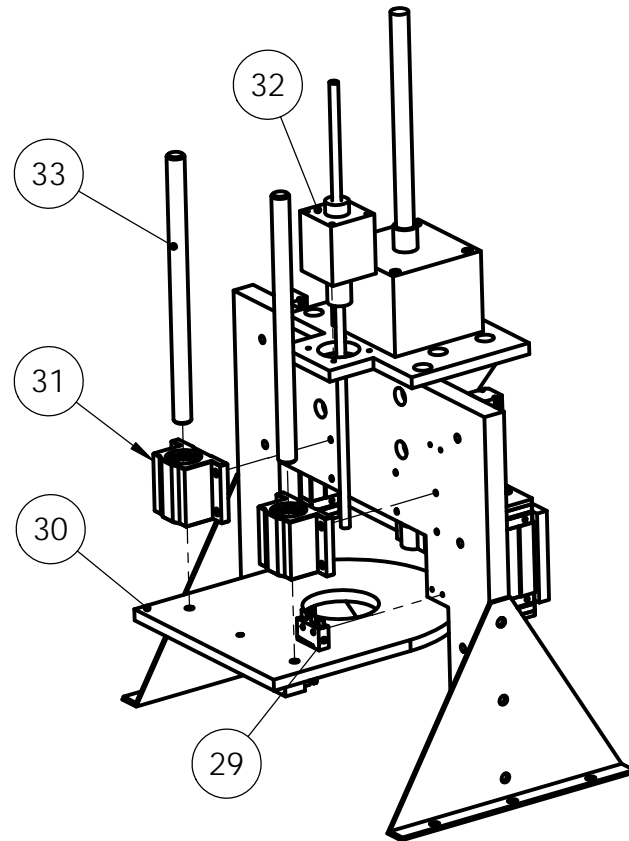
Nxt Asb: 1002

Title: Assembly 1

Date: 5/14/13

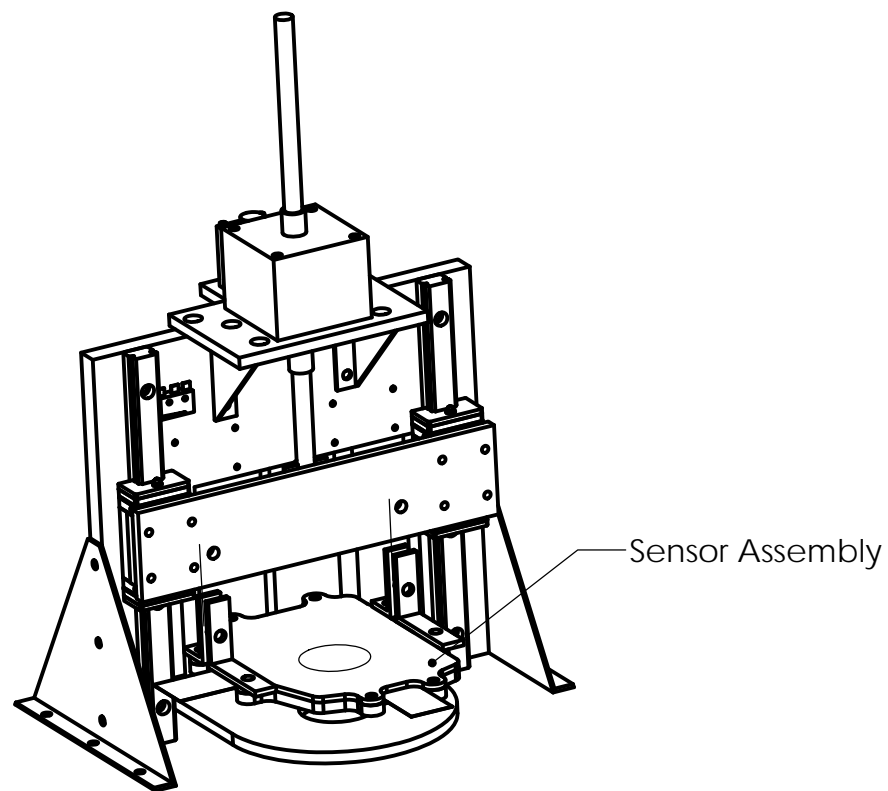
Scale: 1:4

Drwn. By: Colby Lippincott



All Part Numbers Referenced in the Bill of Materials

Cal Poly Mechanical Engineering			Title: Assembly 2		Drwn. By: Colby Lippincott
	Dwg. #:1002	Nxt Asb:1003	Date: 5/14/13	Scale: 1:4	



Cal Poly Mechanical Engineering

Dwg. #:1003

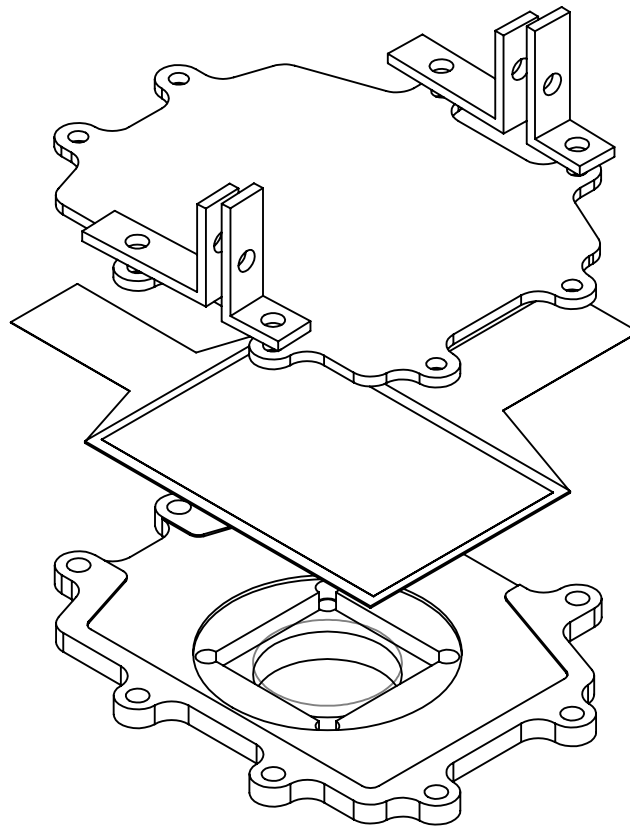
Nxt Asb:

Title: Assembly 3

Date: 5/14/13

Scale: 1:4

Drwn. By:Colby Lippincott



Cal Poly Mechanical Engineering

Dwg. #:1004

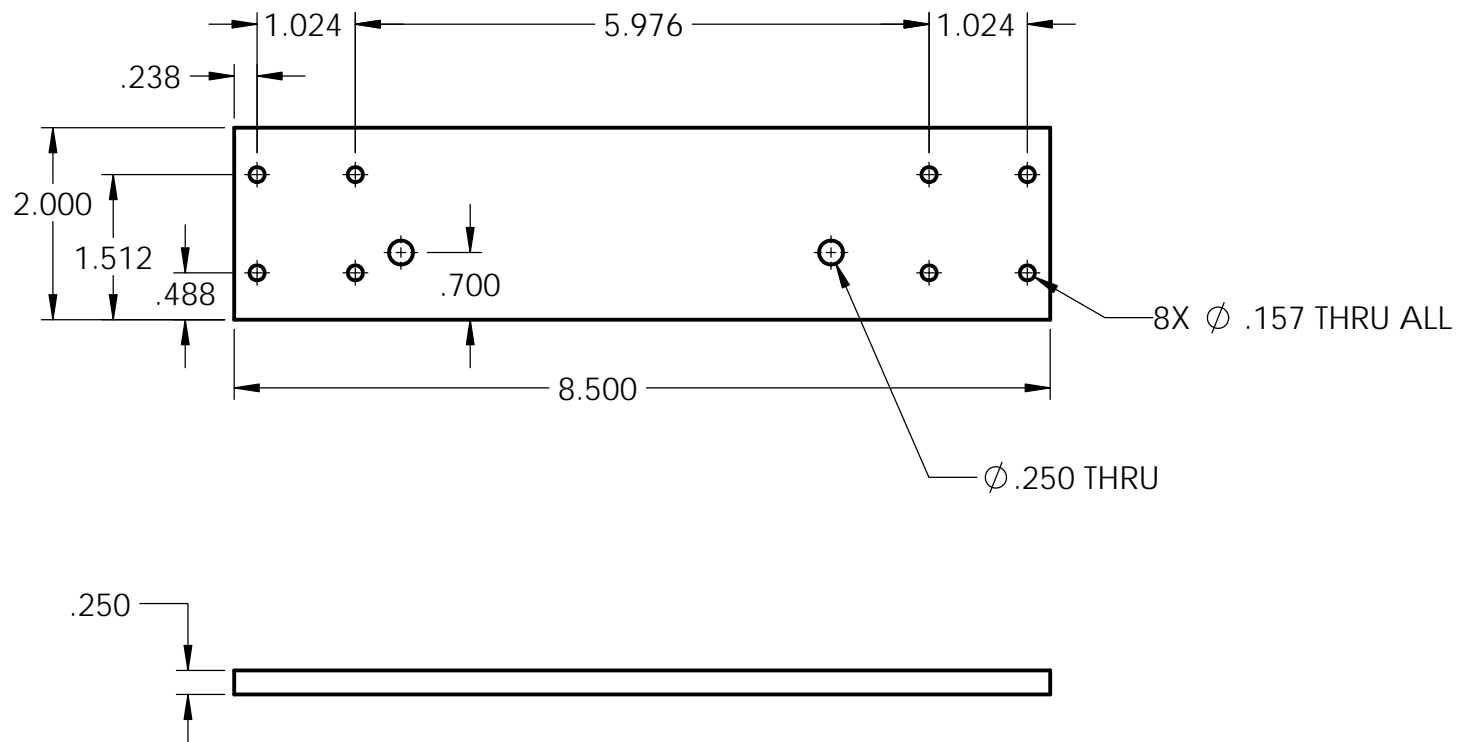
Nxt Asb:1003

Title:Sensor Assembly

Date: 12/5/13

Scale:1:2

Drwn. By: Elliot Wenzel



ALL DIMENSIONS  $\pm 0.005$  UNLESS OTHERWISE STATED

Cal Poly Mechanical Engineering

Dwg. #: 1

Nxt Asb:1001

Title: Carriage

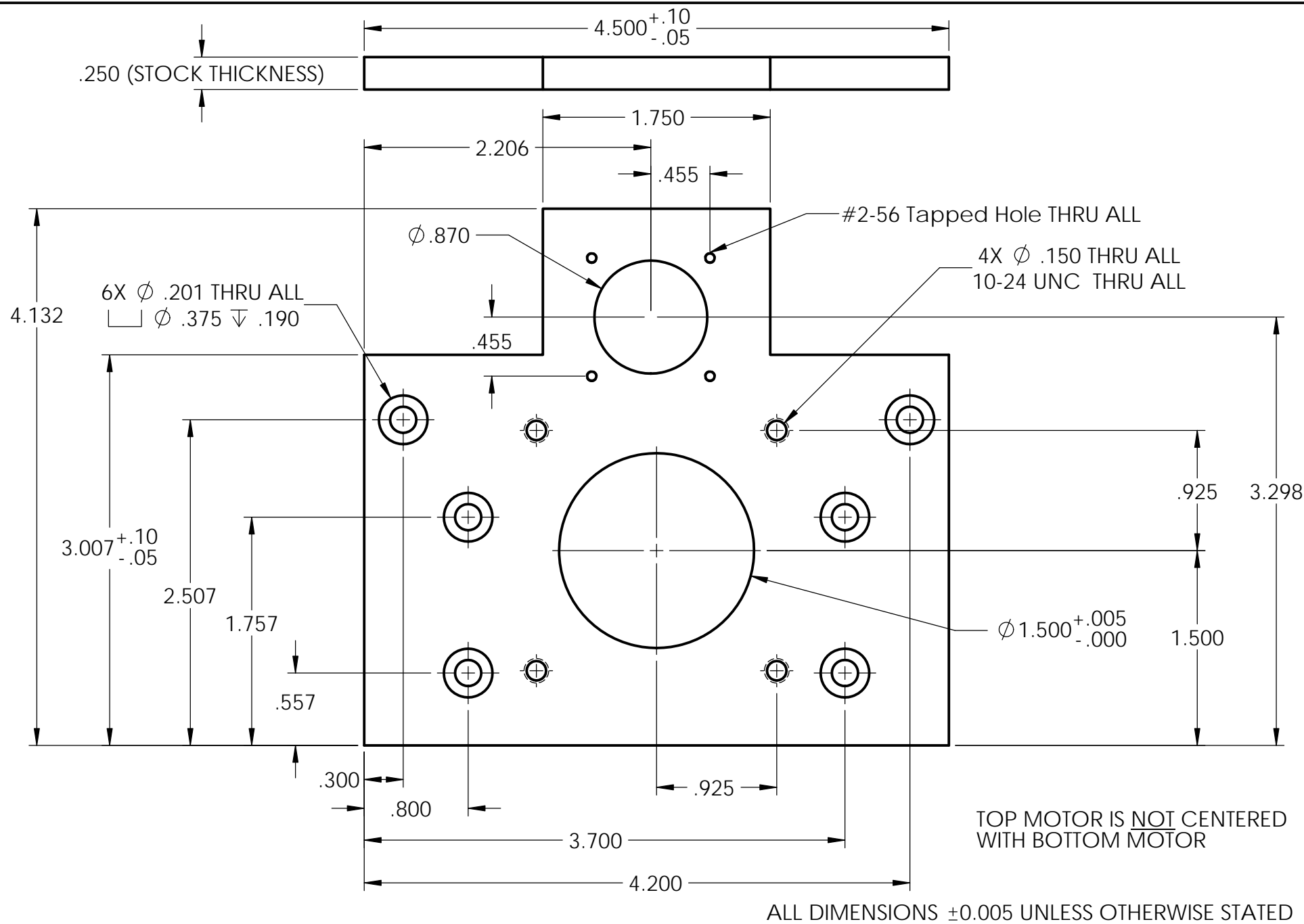
Date: 5/9/13

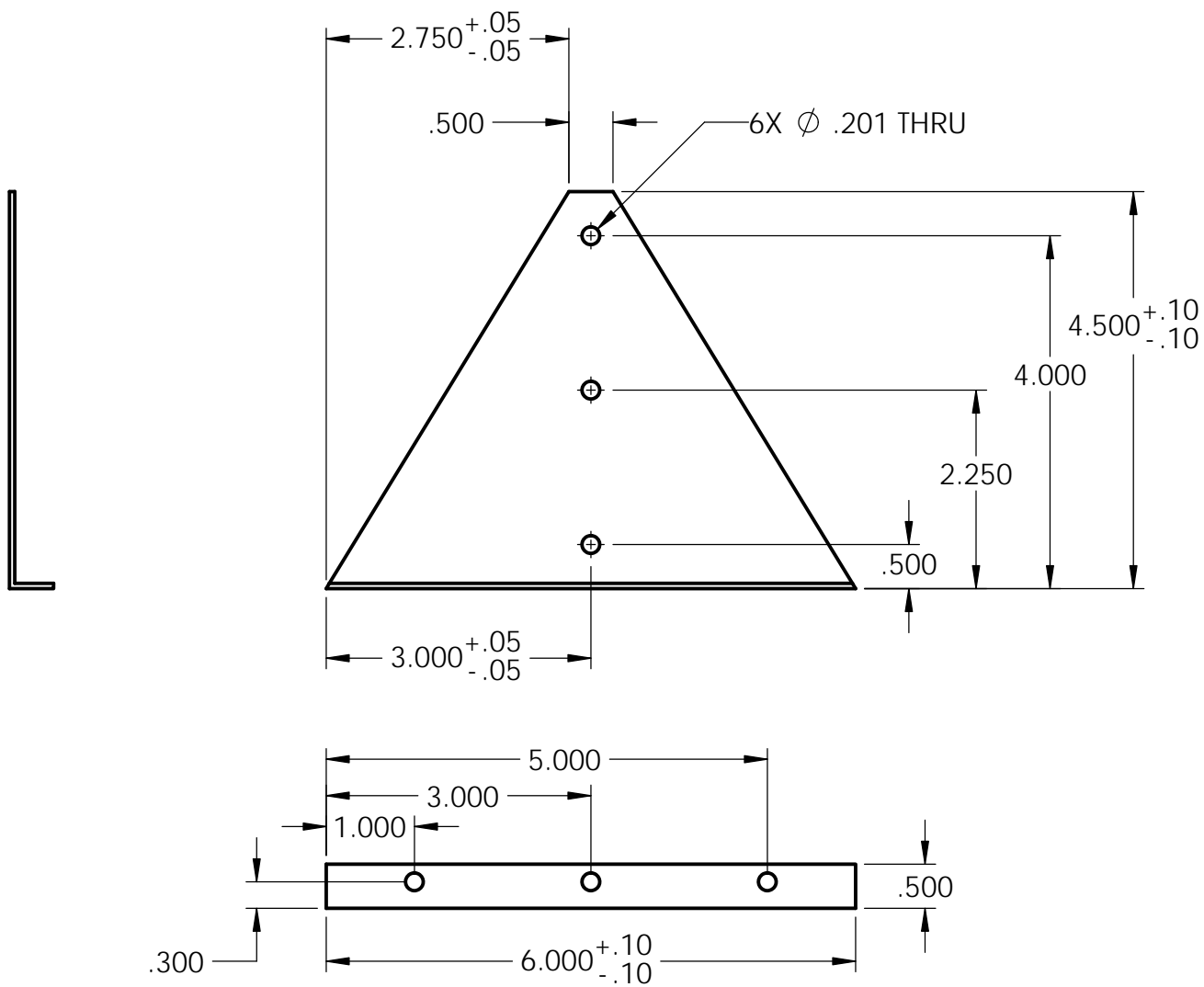
Scale: 1:1

Drwn. By: Colby Lippincott

Material: Aluminum







ALL DIMENSIONS  $\pm 0.005$  UNLESS OTHERWISE STATED

Cal Poly Mechanical Engineering

Dwg. #:6

Nxt Asb:1001

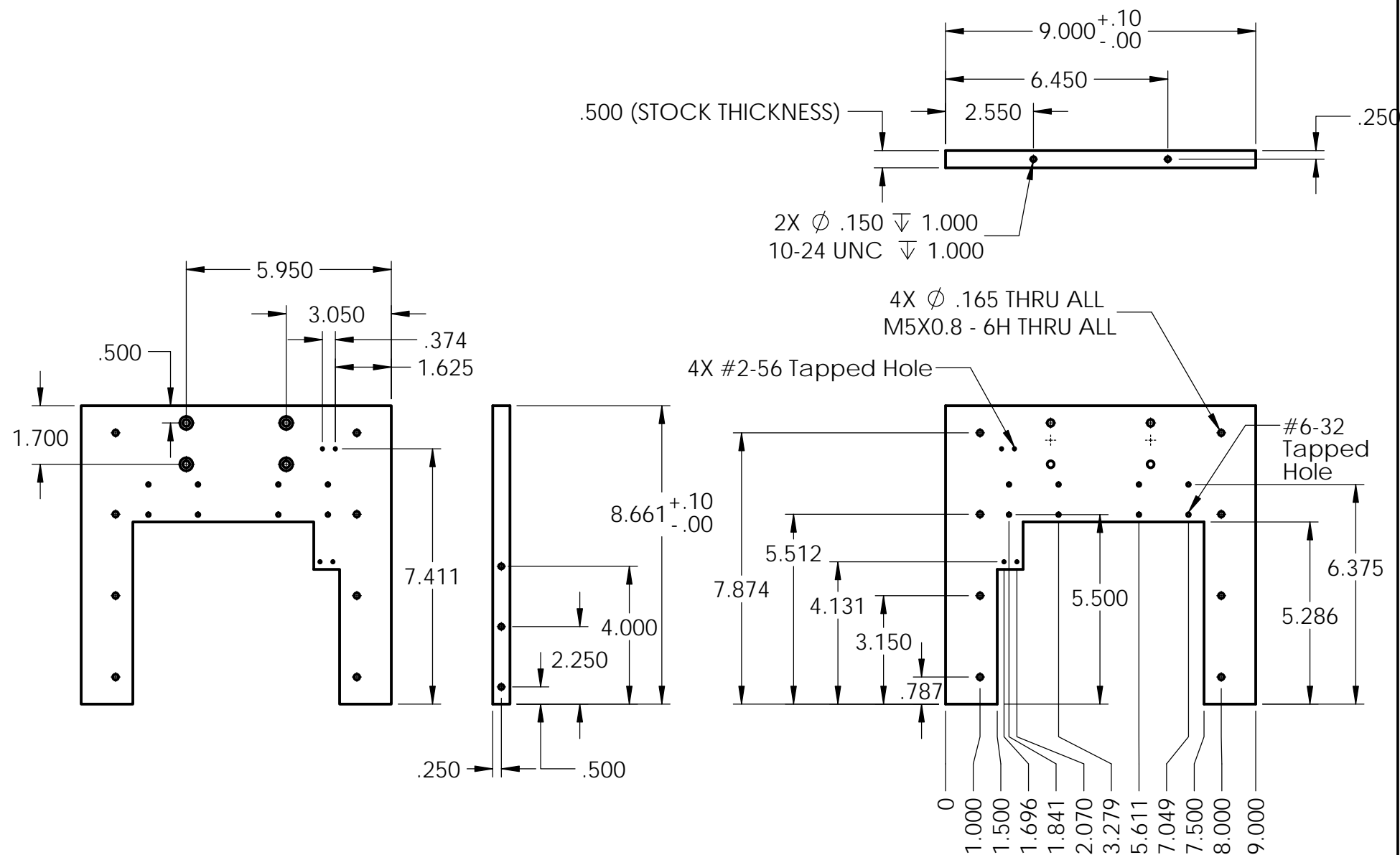
Title:Stand

Date: 5/9/13

Scale: 1:2

Drwn. By: Colby Lippincott

Material: 16 ga. Aluminum Sheet



ALL DIMENSIONS  $\pm 0.005$  UNLESS OTHERWISE STATED

Cal Poly Mechanical Engineering

Title: Frame

Drwn. By: Colby Lippincott

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g. #: 8

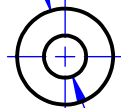
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Date: 5/9/13

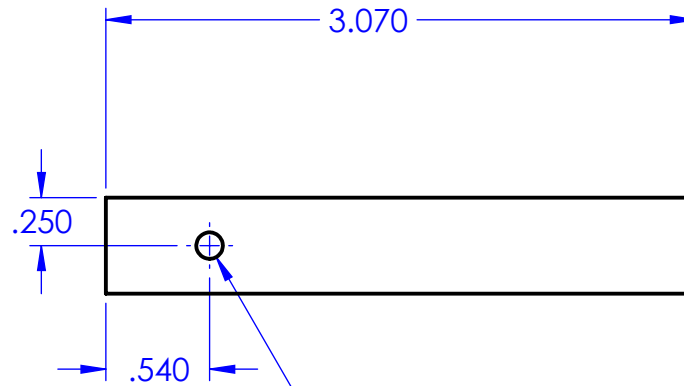
Scale: 1:1

Material: Aluminum

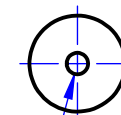
Ø .500



Ø 0.22  $\nabla$  1.32



Ø 6-32 UNC  $\nabla$  .25



Ø 4-40 UNC  $\nabla$  .5

All Tolerances +0.005 inch.  
All holes centered unless otherwise specified.

Cal Poly Mechanical Engineering

Dwg. #:1100

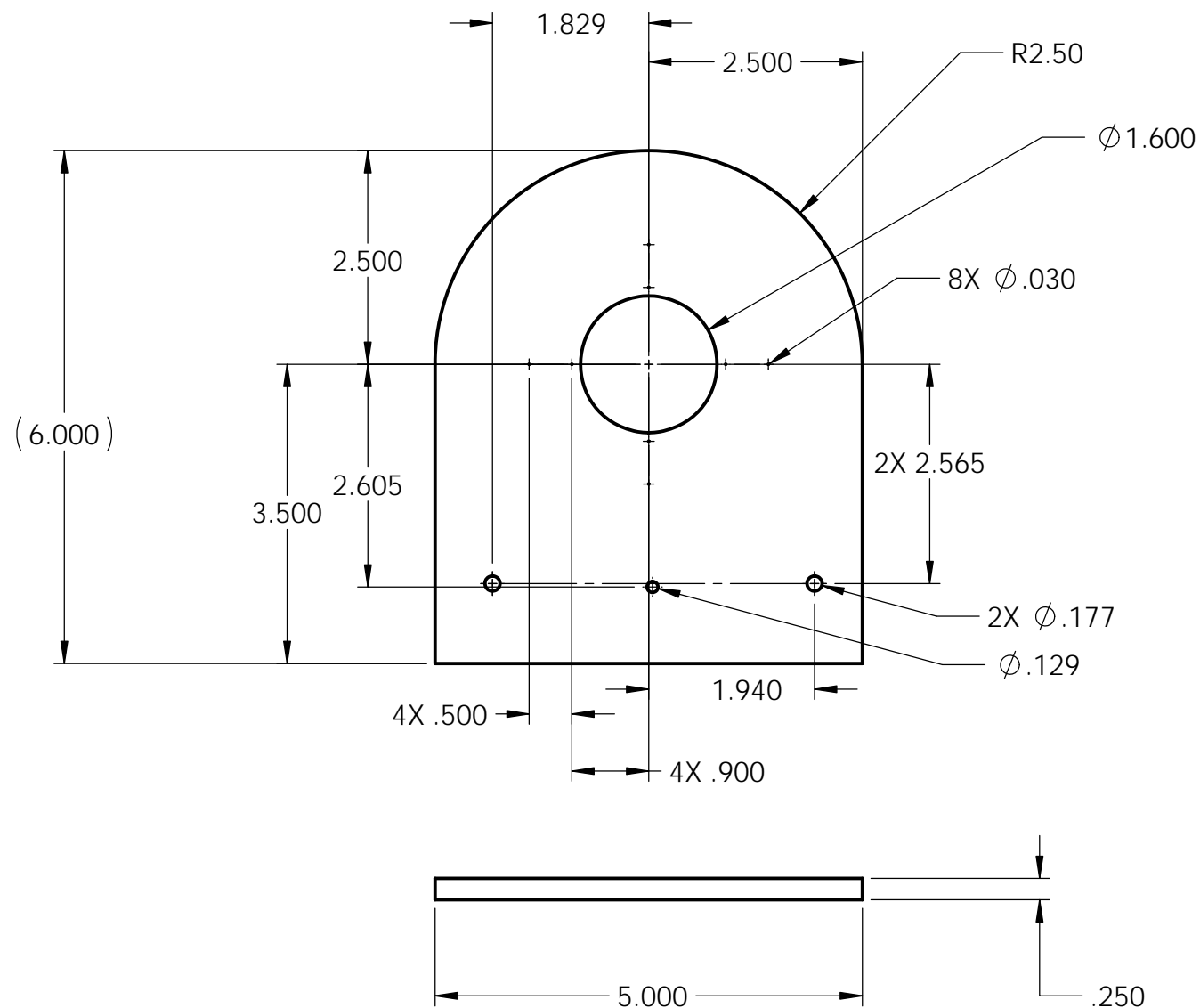
Nxt Asb:

Title: Extension rod for lead screw retaining ring

Date: 12/7/13

Scale: 1:1

Drwn. By: Rick Hayes



ALL DIMENSIONS  $\pm 0.005$  UNLESS OTHERWISE STATED

Cal Poly Mechanical Engineering

Dwg. #:30

Nxt Asb:1002

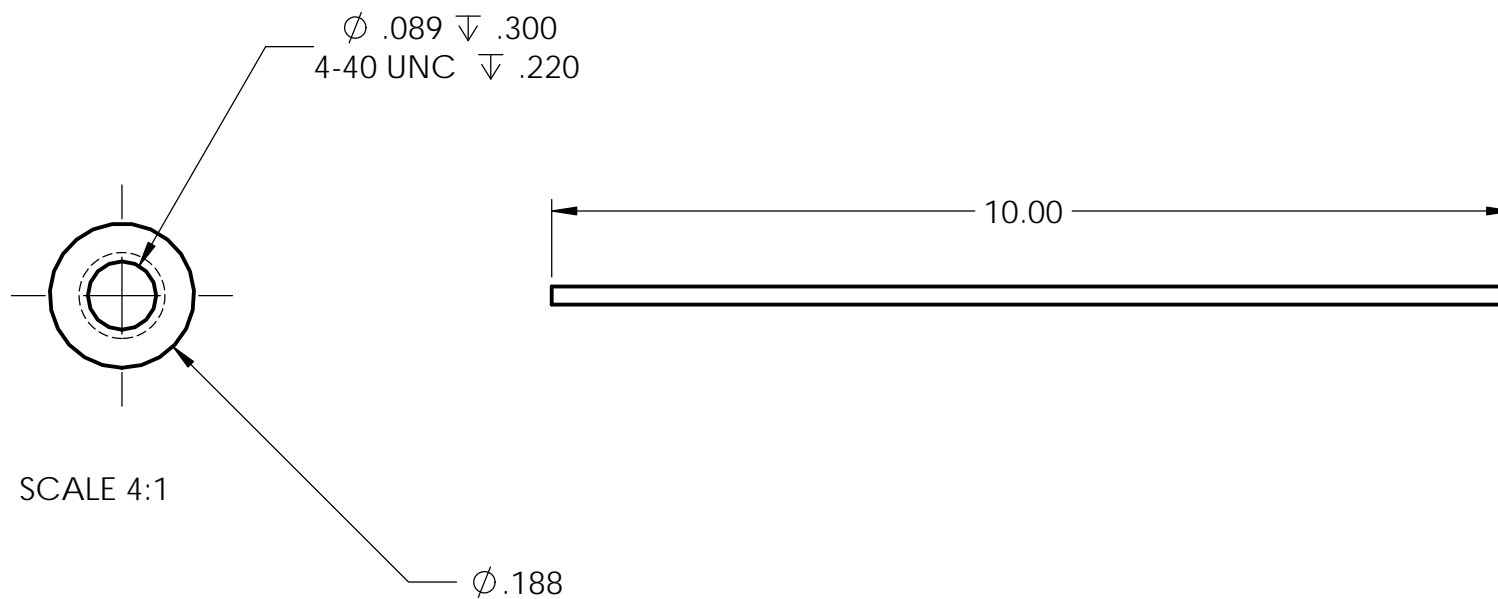
Title: Retaining Ring

Date: 5/12/13

Scale: 1:2

Drwn. By: Rick Hayes

Material: Acrylic



ALL DIMENSIONS  $\pm 0.005$  UNLESS OTHERWISE STATED

Cal Poly Mechanical Engineering

Dwg. #:32

Nxt Asb:1002

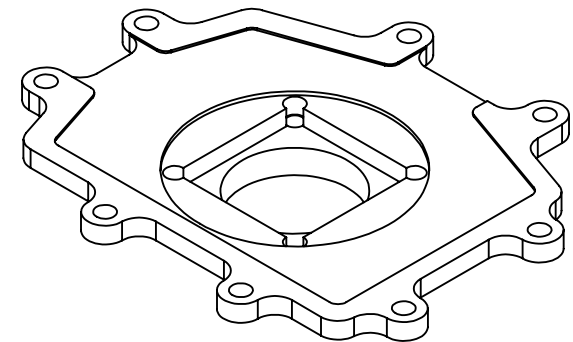
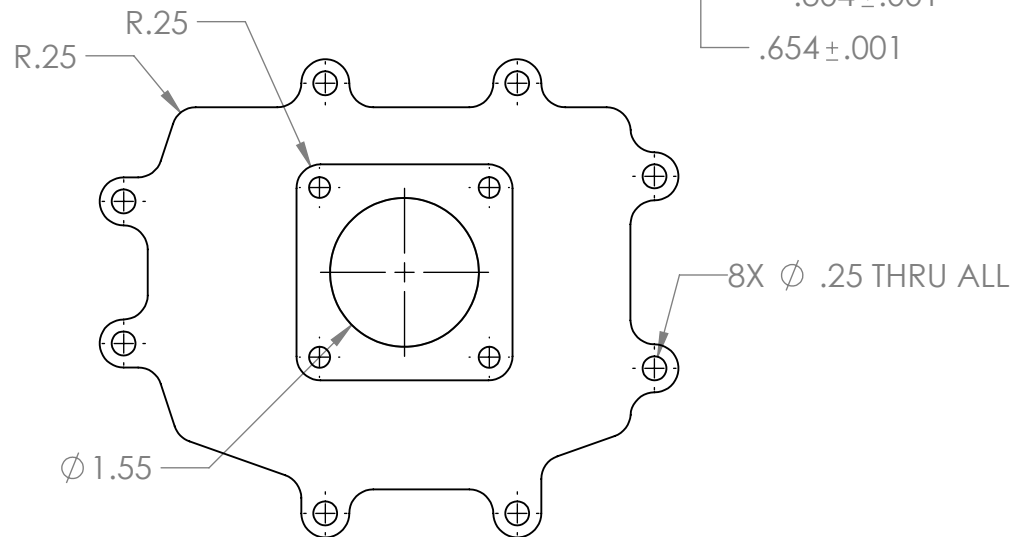
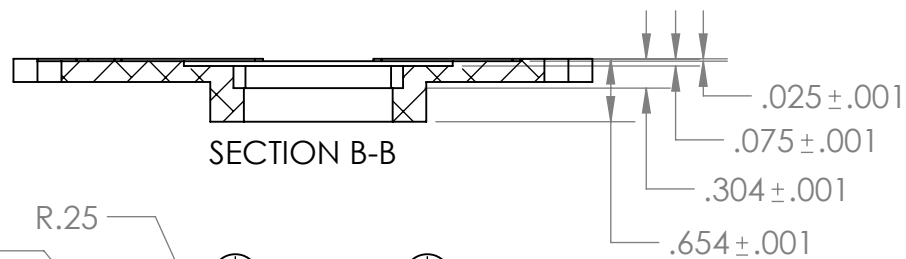
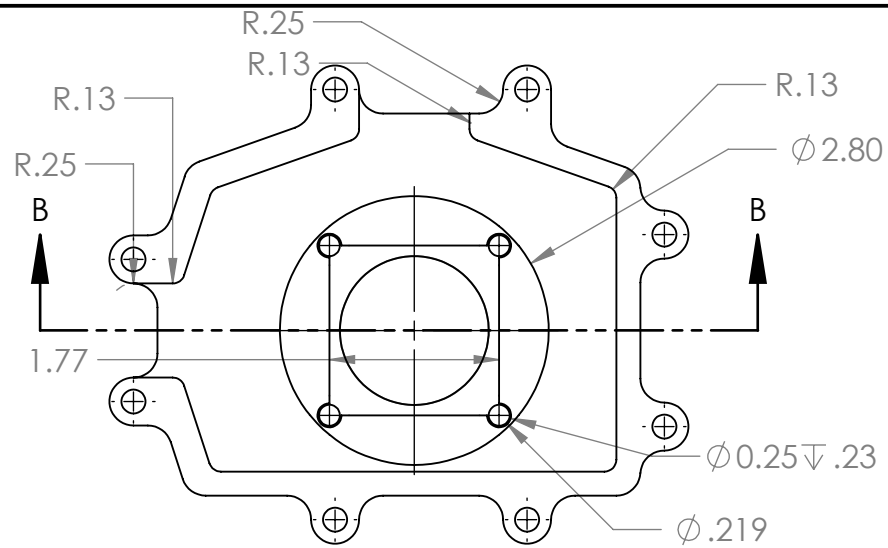
Title: Retaining Ring Lead Screw

Date: 5/12/13

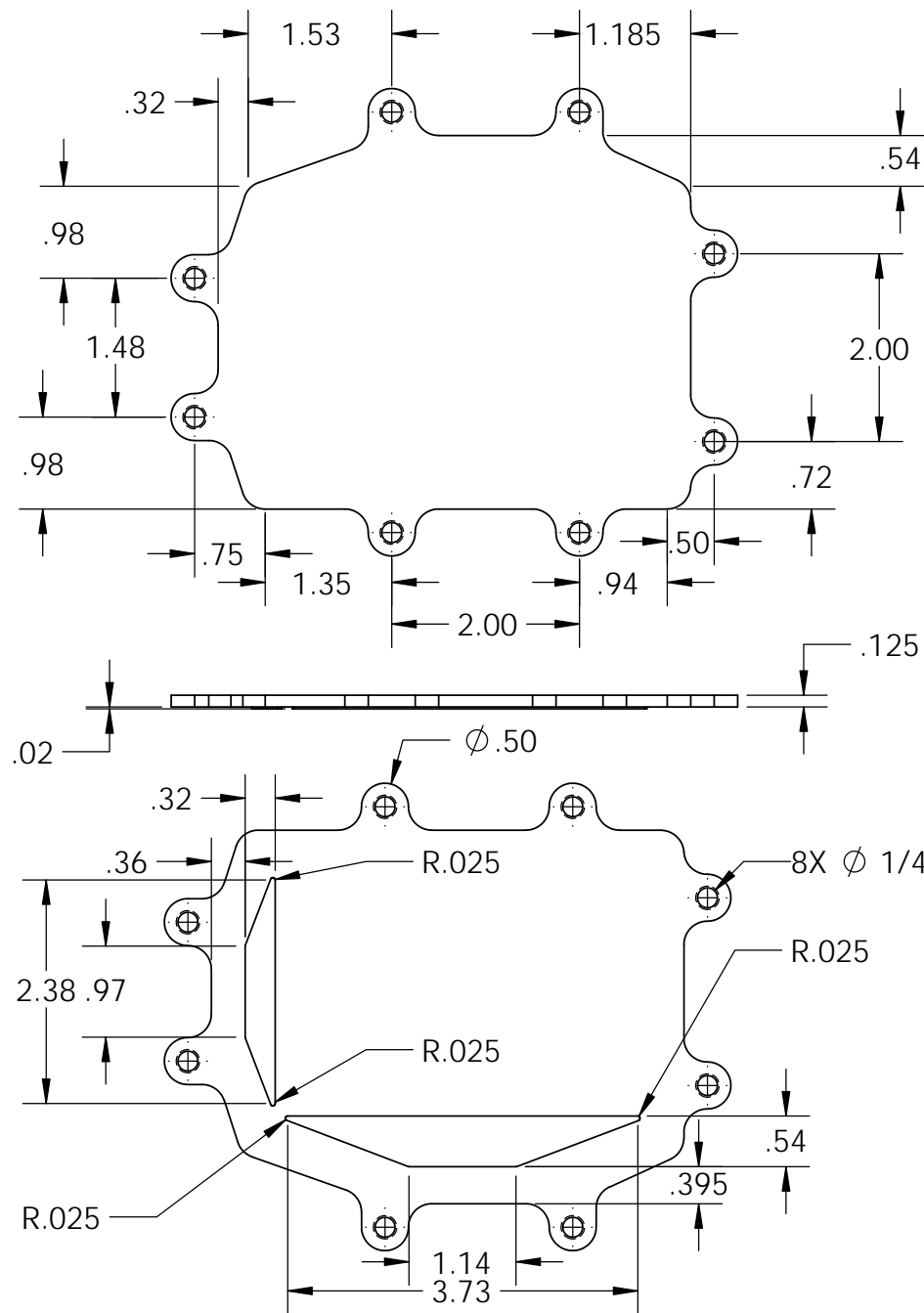
Scale: 1:2

Drwn. By: Rick Hayes

Material: Stainless Steel



- All inside fillets are 0.125 in
- All outside fillets and rounds are 0.25 in
- Part intended for CNC machining
- Tolerances to 0.002in unless otherwise specified



- All Fillets and rounds are 0.25 in radius unless otherwise specified
- Part intended for CNC machining
- Tolerances to 0.005in unless otherwise specified

Cal Poly Mechanical Engineering

Dwg. #:35

Nxt Asb:1004

Title: Sensor Cover Plate

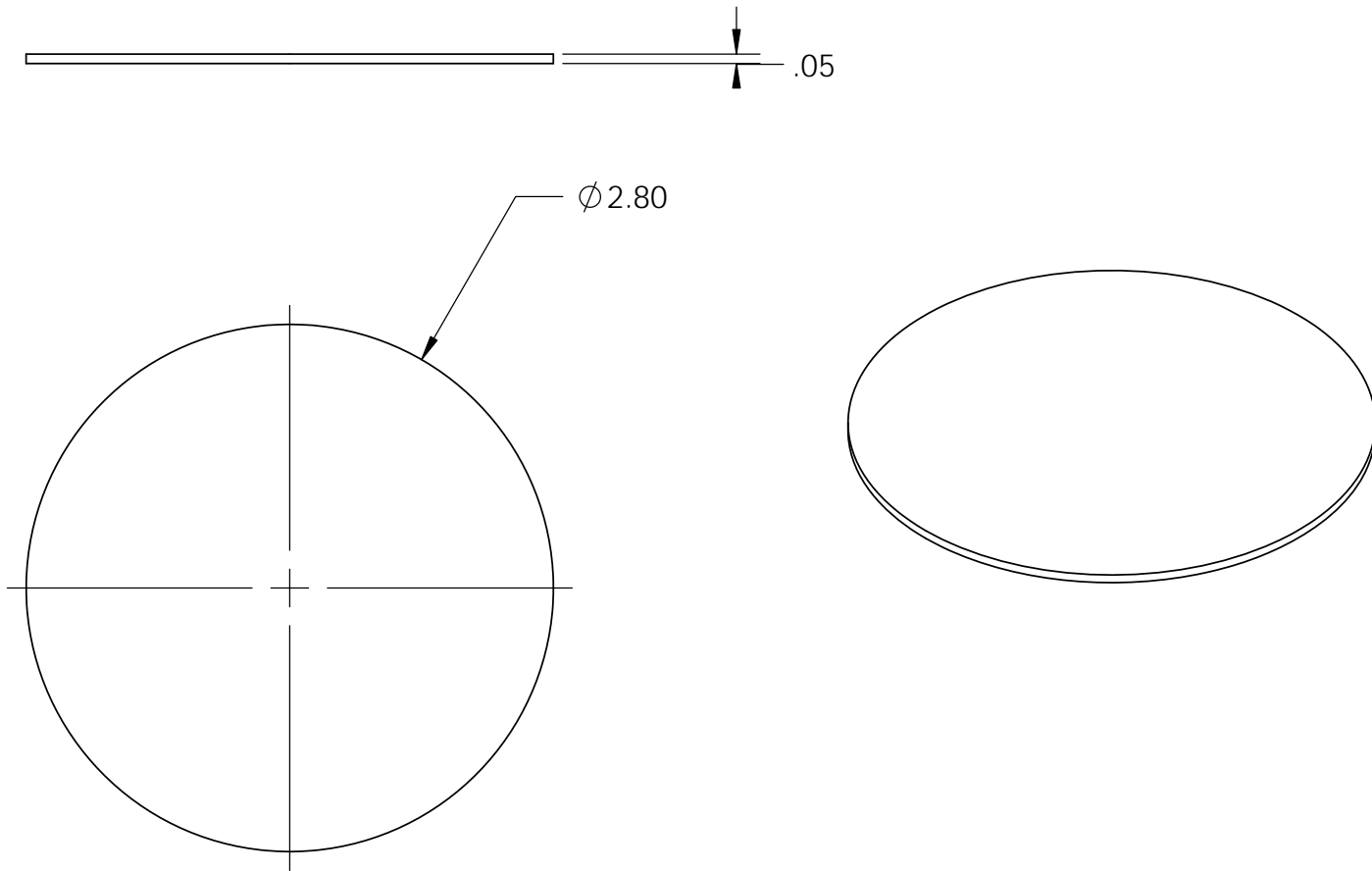
Date: 5/14/13

Scale:1:2

Drwn. By: Elliot Wenzel

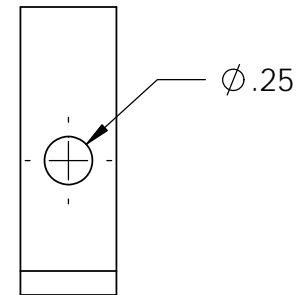
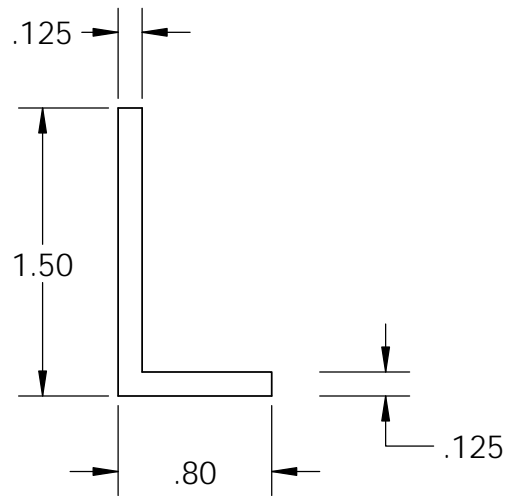
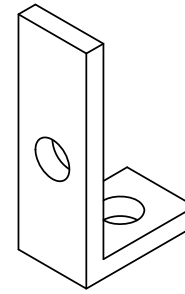
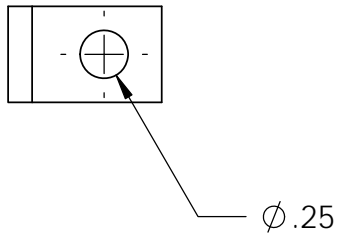
Material: Aluminum





Molded from Food Safe Urethane Rubber (Reynold's Advanced Materials)

Cal Poly Mechanical Engineering			Title: Sensor Protection Pad		Drwn. By: Elliot Wenzel
	Dwg. #:36	Nxt Asb:1004	Date: 5/14/13	Scale: 1:2	Urethane Rubber



-Cut from 2x1.5in Aluminum L-beam

-Tolerances to 0.005in unless ptherwise specified

Cal Poly Mechanical Engineering

Dwg. #: 38-2

Nxt Asb:1004

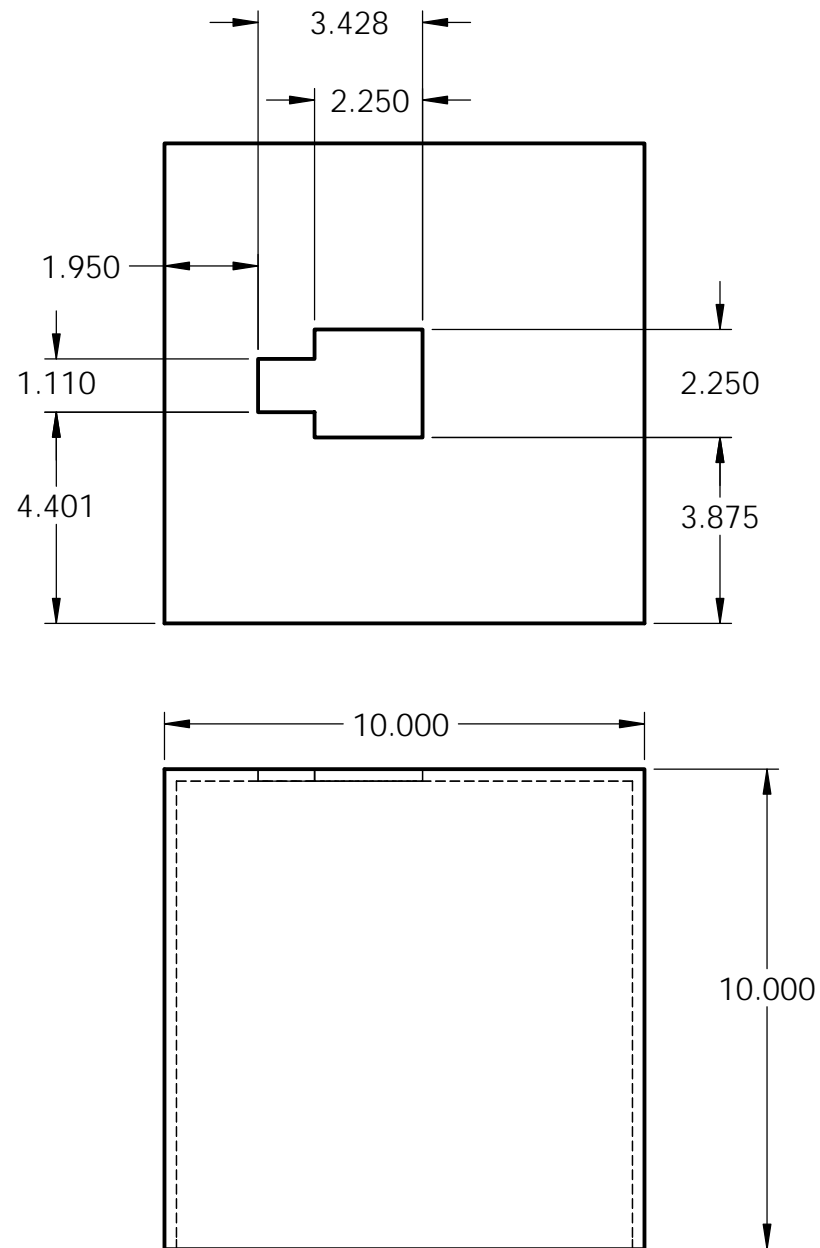
Title: 1x1.5in Aluminum Bracket

Date: 5/14/13

Scale: 1:1

Drwn. By: Elliot Wenzel

Material: Aluminum



All dimensions  $\pm .005$

Cal Poly Mechanical Engineering

Dwg. #:46

Nxt Asb:

Title: Acrylic Box

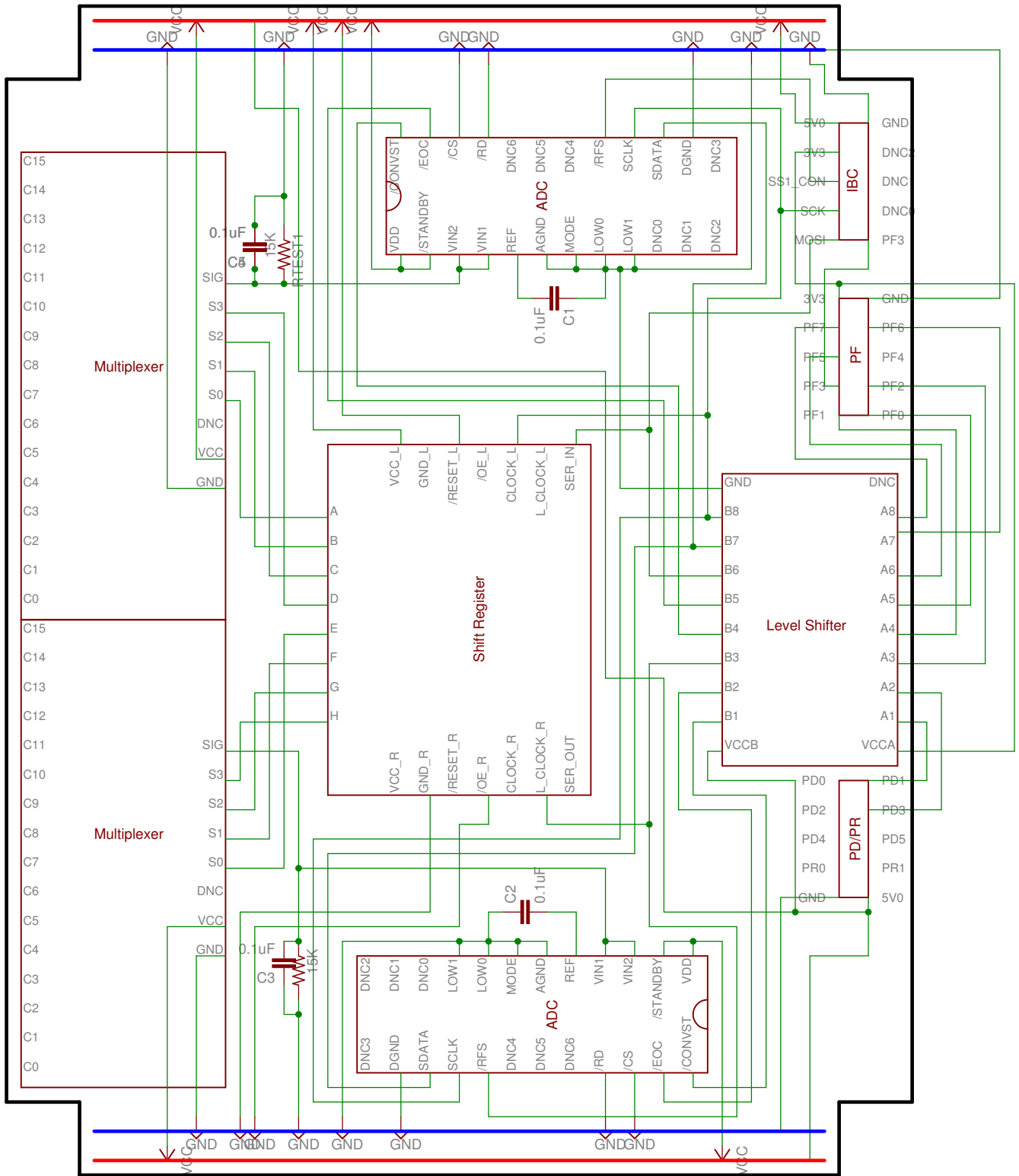
Date: 5/22/13

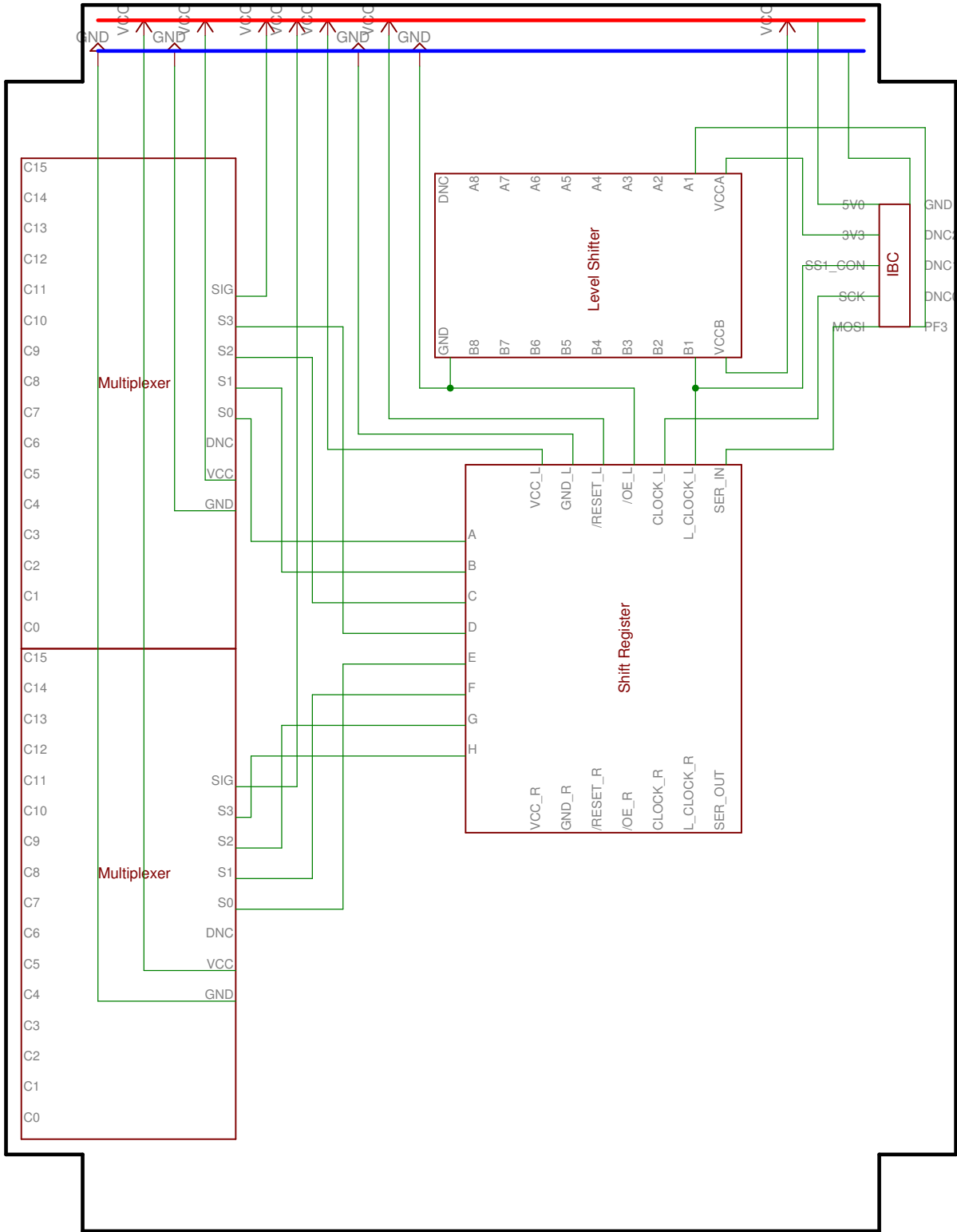
Scale: 1:4

Drwn. By: Colby Lippincott

Material: 10x10x10 Acrylic Box









## Pit Detection Algorithm

### Legend

**[signal]**

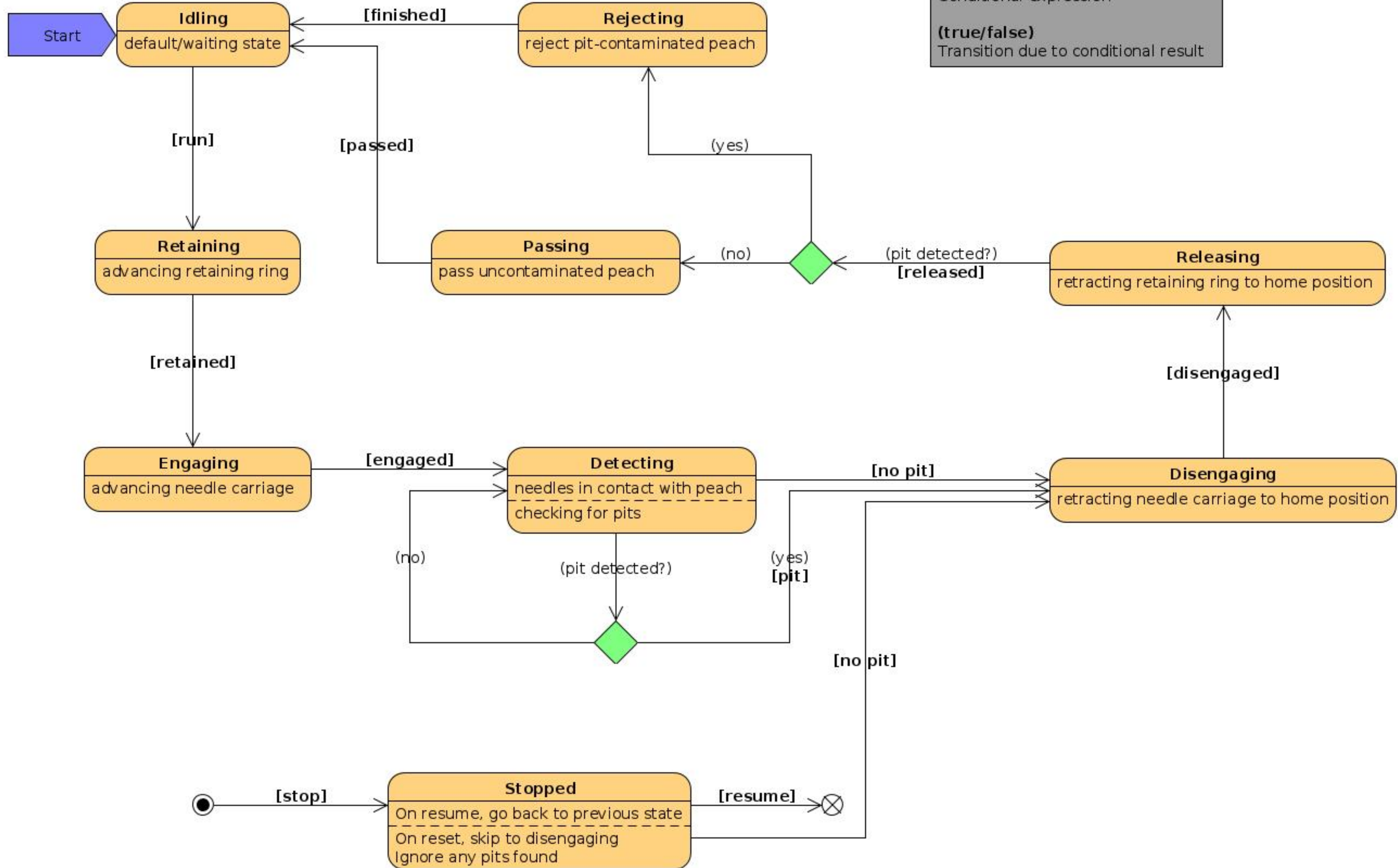
Signal initiates transition

**(conditional?)**

Conditional expression

**(true/false)**

Transition due to conditional result





Class Legend

GREEN

RTOS Task

BLUE

Hardware Driver

Has A

Message Queue

Note:

All instance variables are private by default

Class Methods Legend

#

Class Method

+

Instance Method

DEFAULT FONT WEIGHT

Public Method

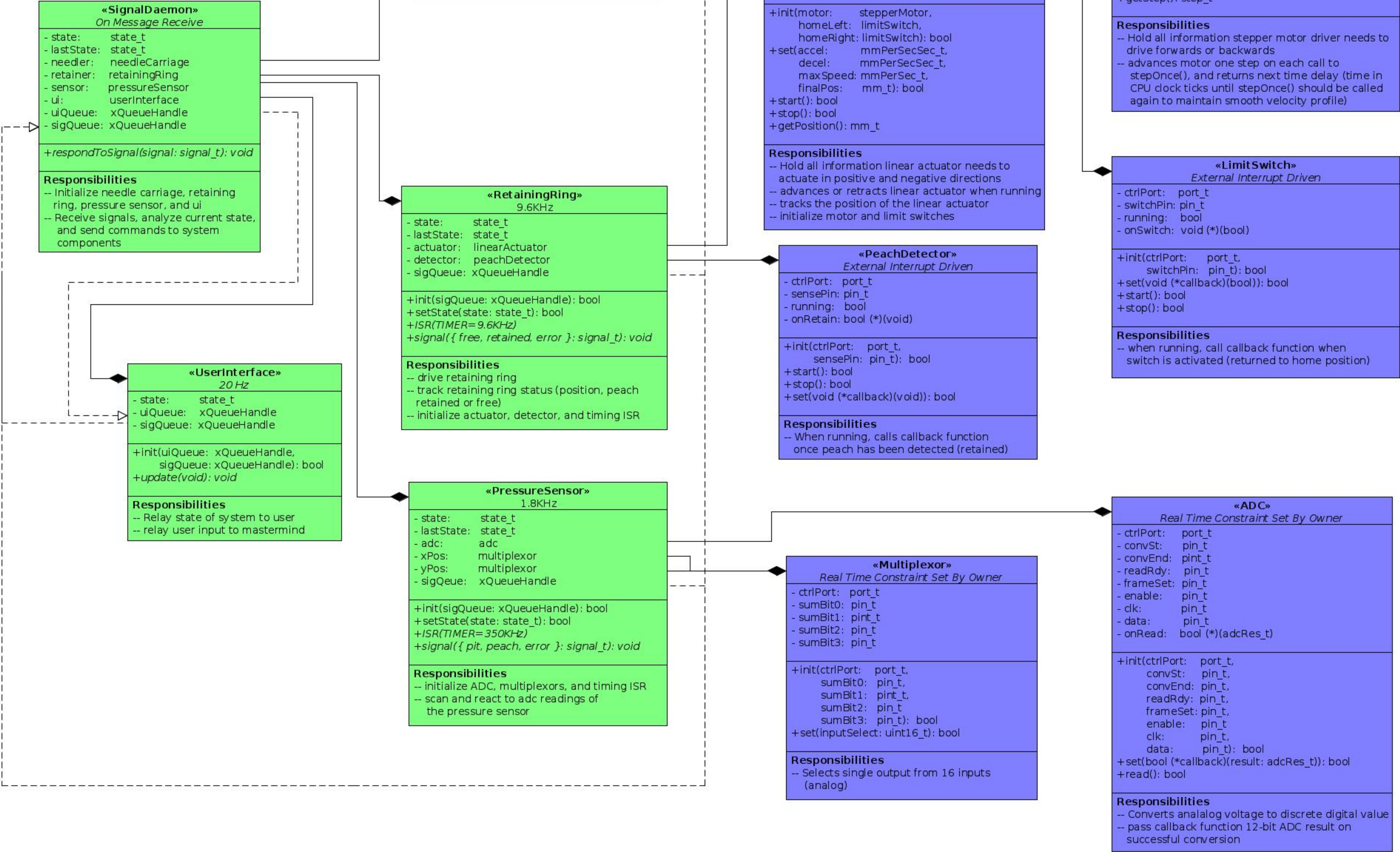
ITALICS

Private Method

{ COMMA SEPARATED VALUES }

Enumeration

Class Diagram





# Sequence Diagram

