

Articulating Robotic Arm

EET 503 - Introduction to Technical Project

Progress Report

Submitted By: Mathew Pellarin

Submitted To: John Schlichther

Date: December 3, 2019

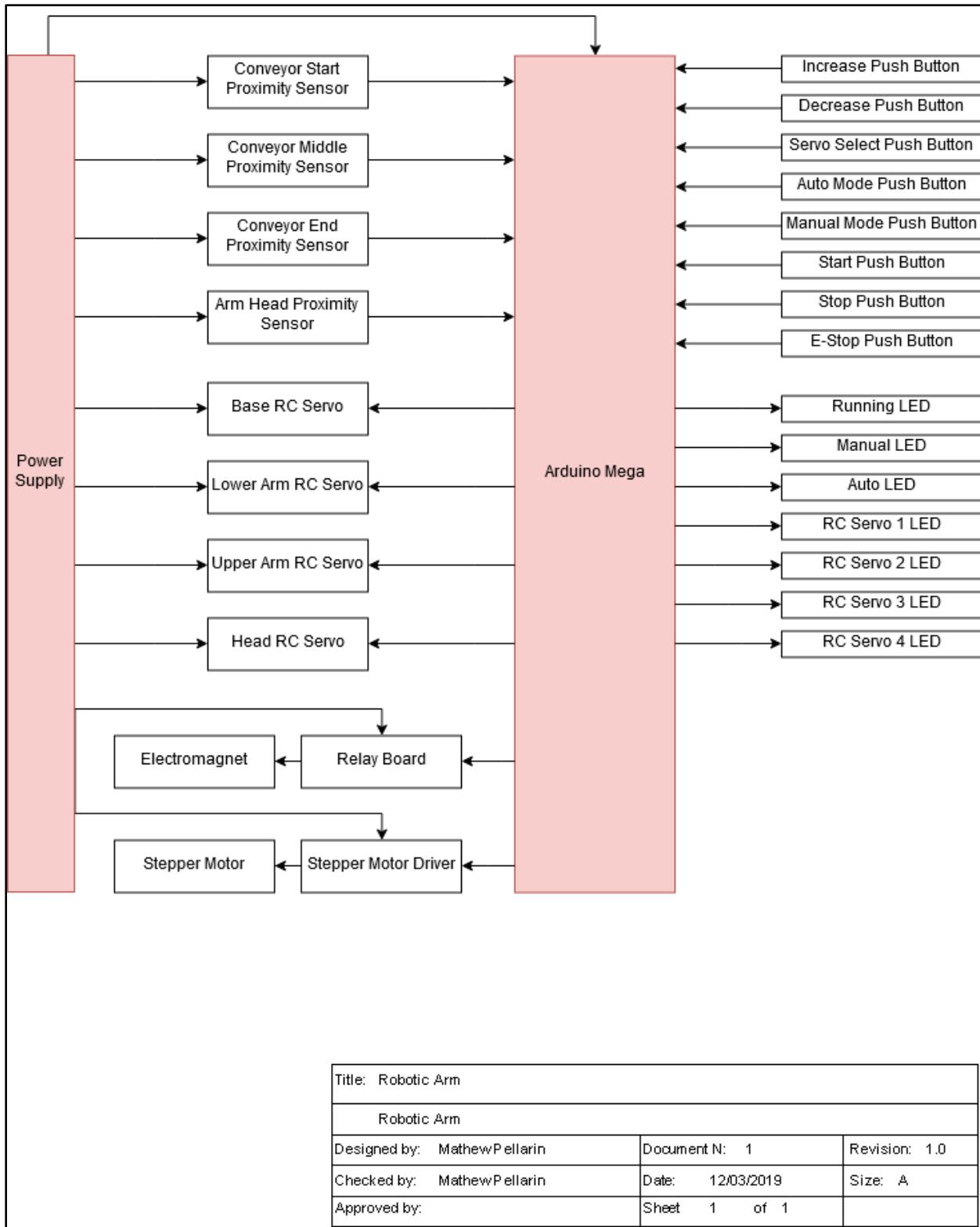
With parts becoming bigger and heavier people can no longer carry these parts alone. To reduce injuries a robotic arm can be put into place to reduce strain at work. These robots can assist humans with their daily work more efficiently and effectively. Robots can be very precise in their work and can achieve this with more quickly.

The device in construction will sense when a metal part is placed onto the conveyor. When the object is placed, the conveyor will start moving forward. When the part reaches halfway on the conveyor and the articulating robotic arm is in the ready position, the arm will pick up the part with the electromagnet. The arm will then rotate and unload the part at the unloading station. The arm will then reset by going back into the ready position unless there was another part put onto the conveyor while unloading. If a part reaches the end of the conveyor without being picked up, the conveyor will halt waiting to be unloaded.

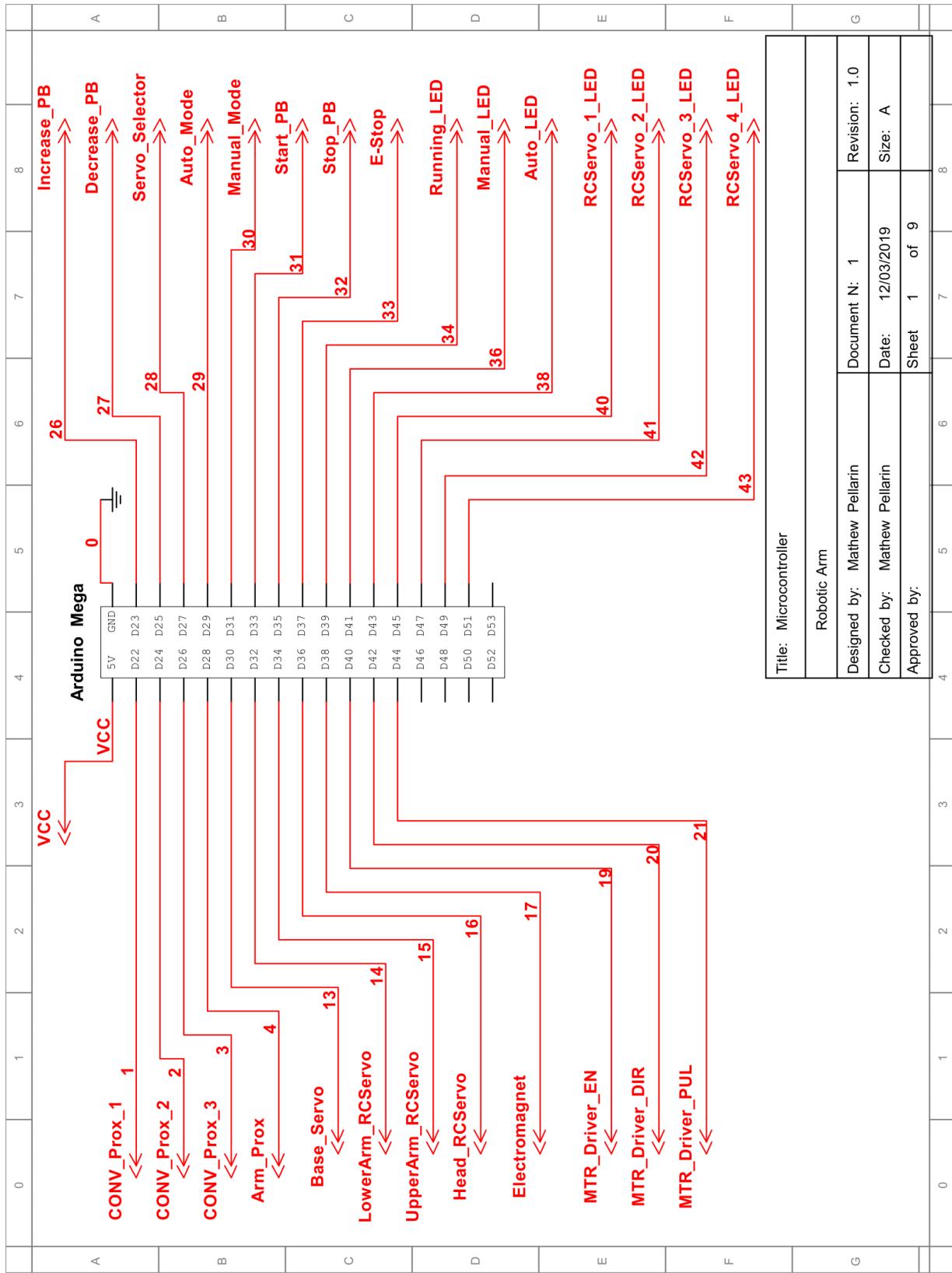
The articulating arm will primarily made of polylactic acid (PLA) printed off a 3D printer. RC servos will assist the articulating arm with motion and an electromagnet will be mounted to the end. The conveyor will be made of 2020 aluminum extrusion base. Attached to the base will be custom PVC rollers with bearings to help spin smoothly. A custom PVC belt will be used with a nema 23 stepper motor driving the entire belt.

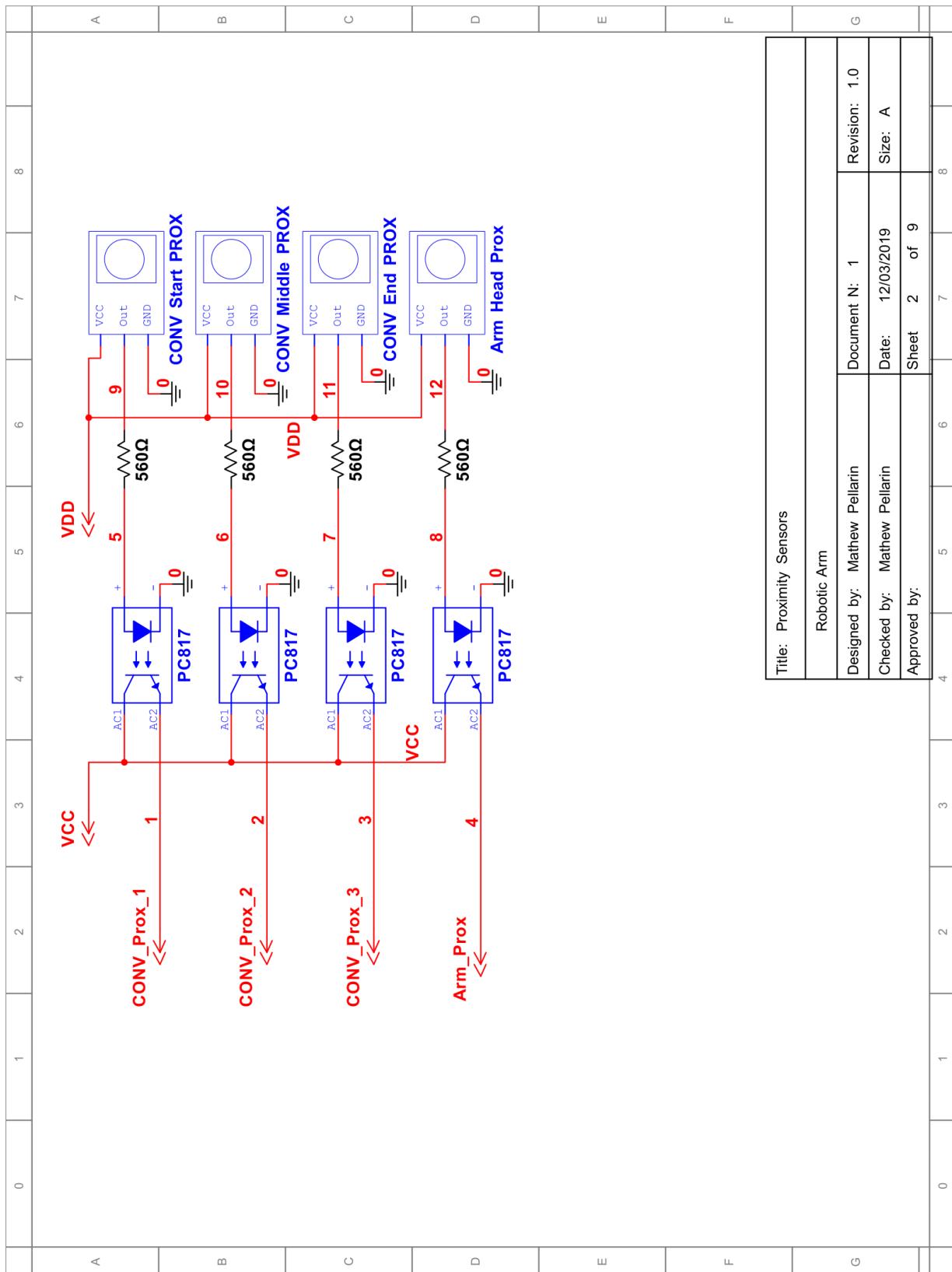


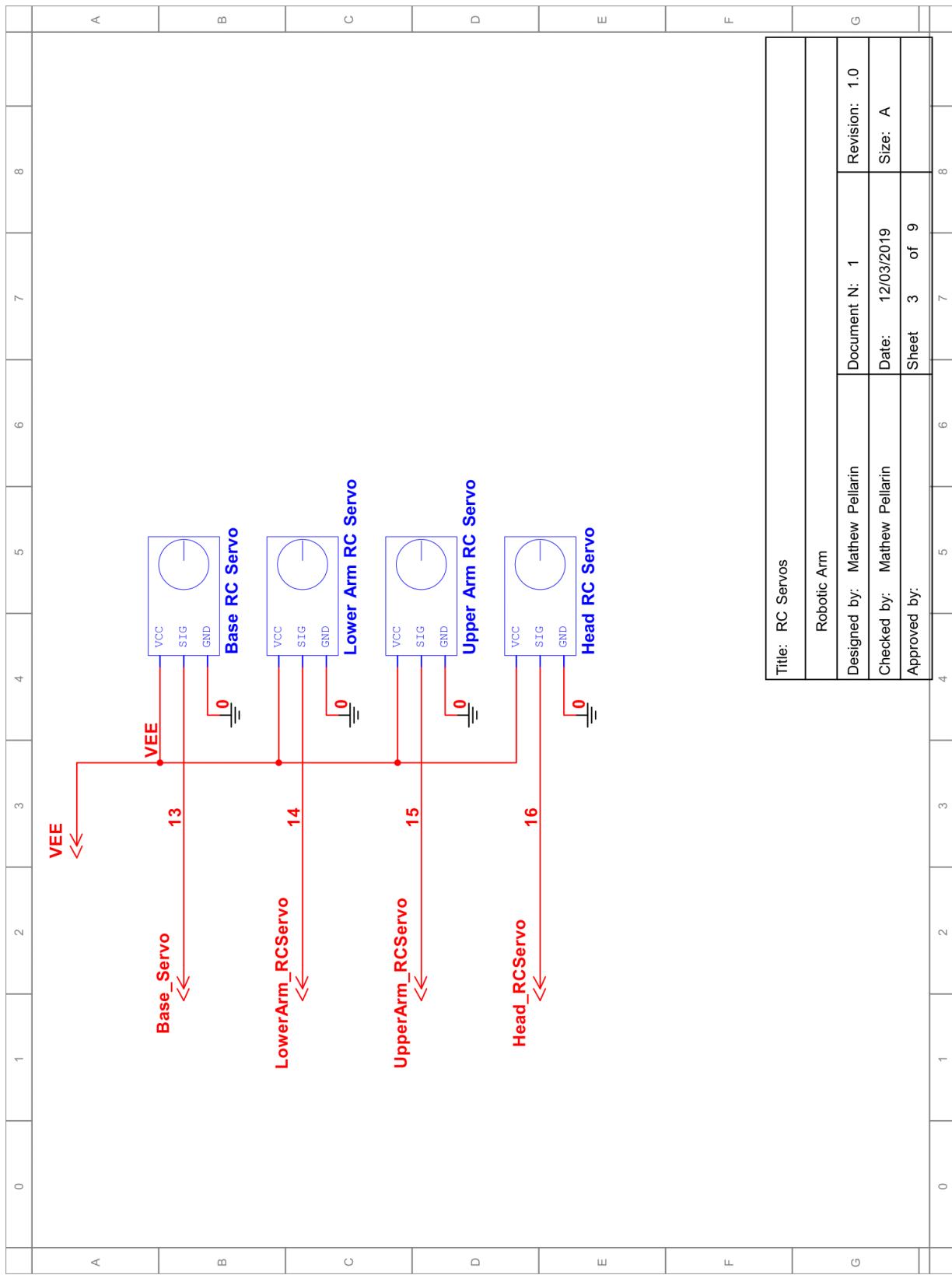
Block Diagram

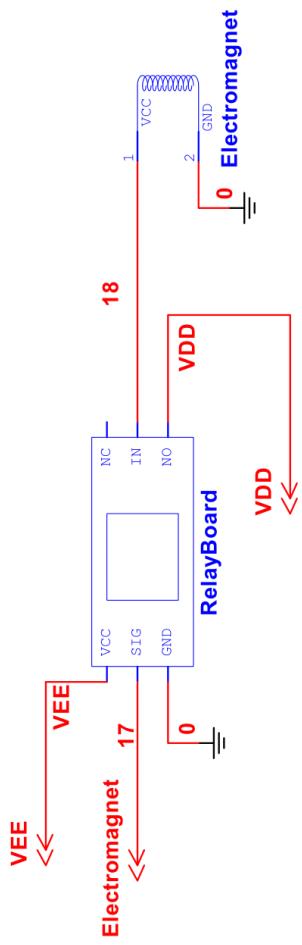


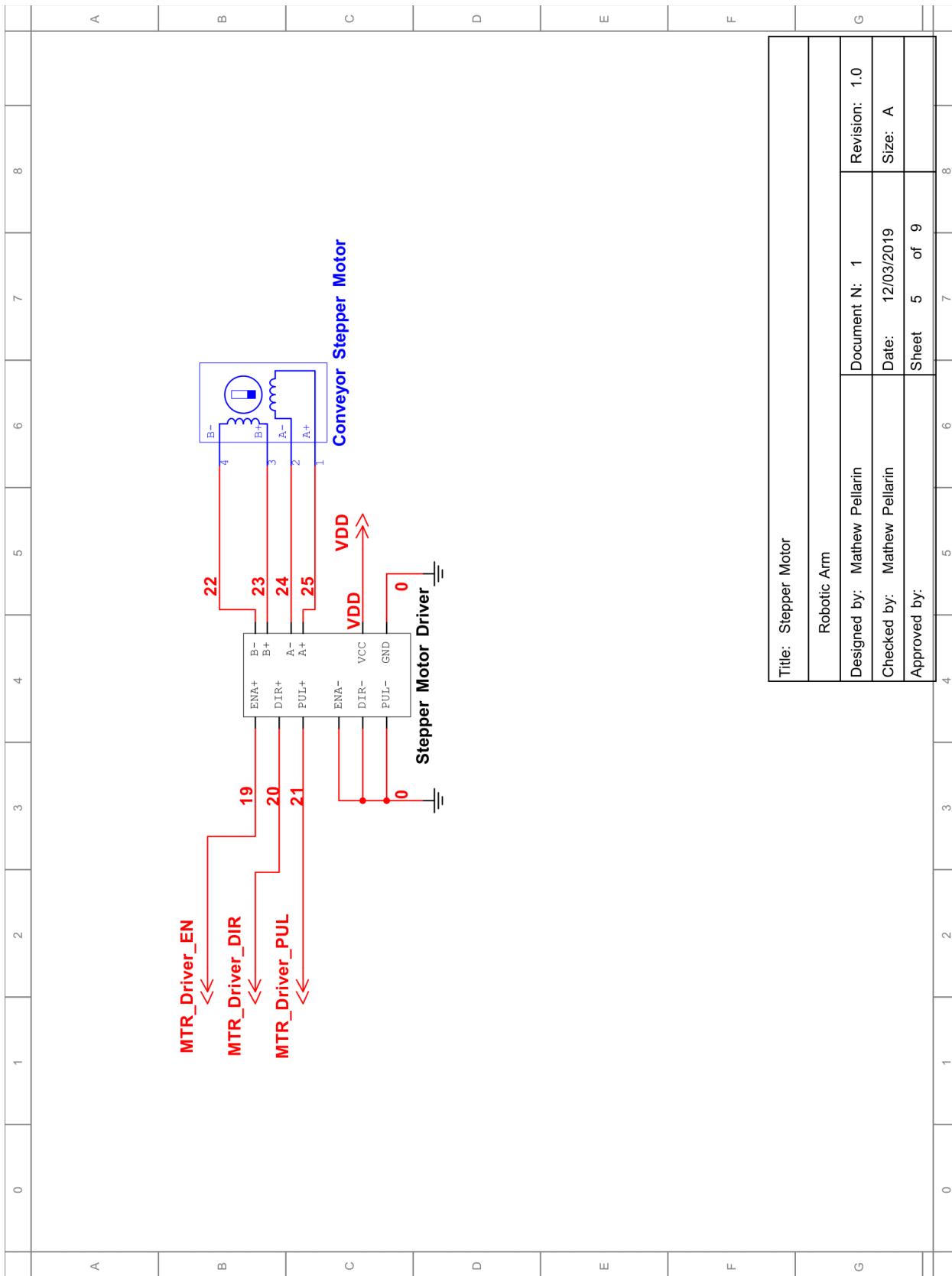
Electrical Diagram

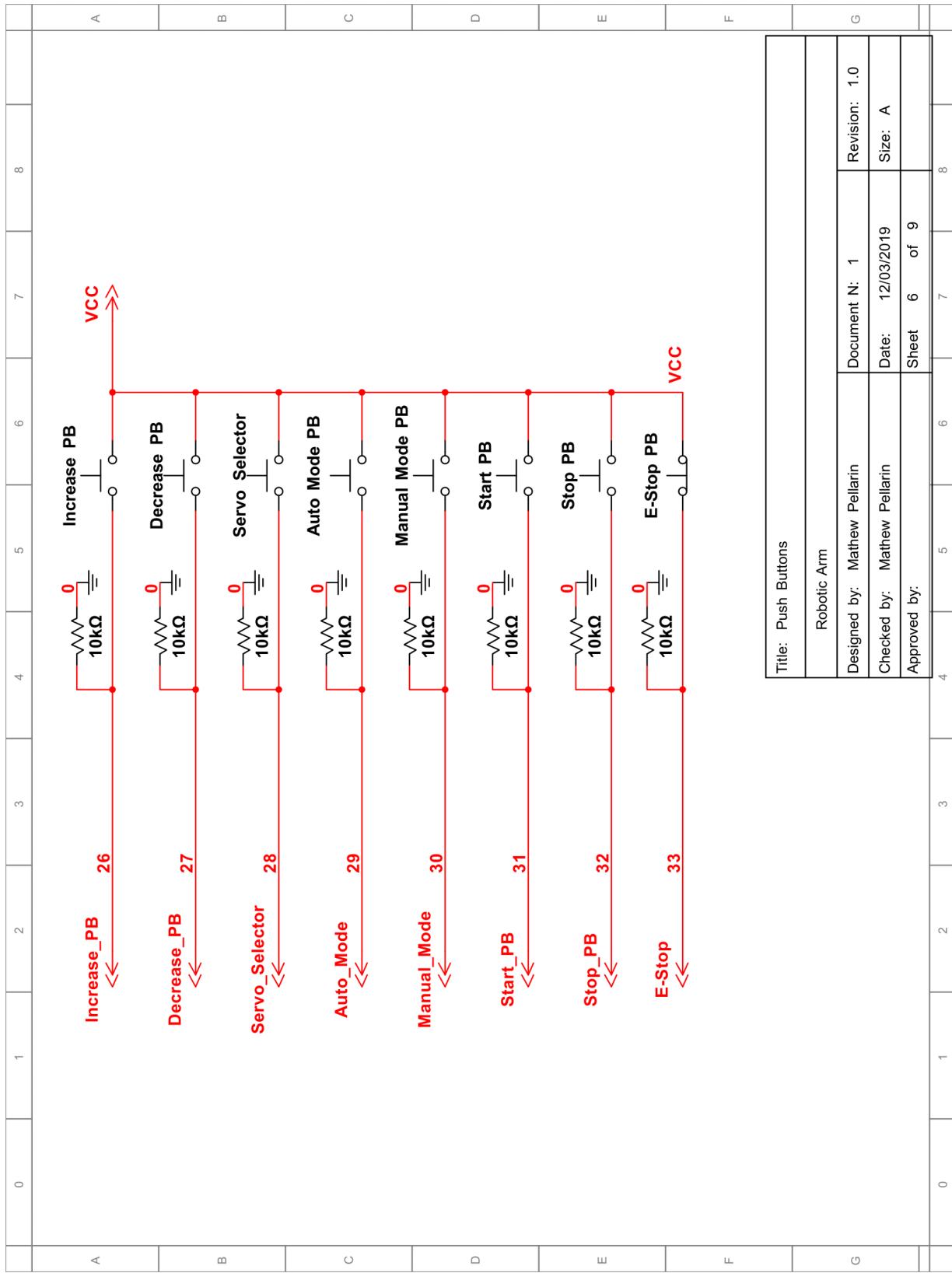


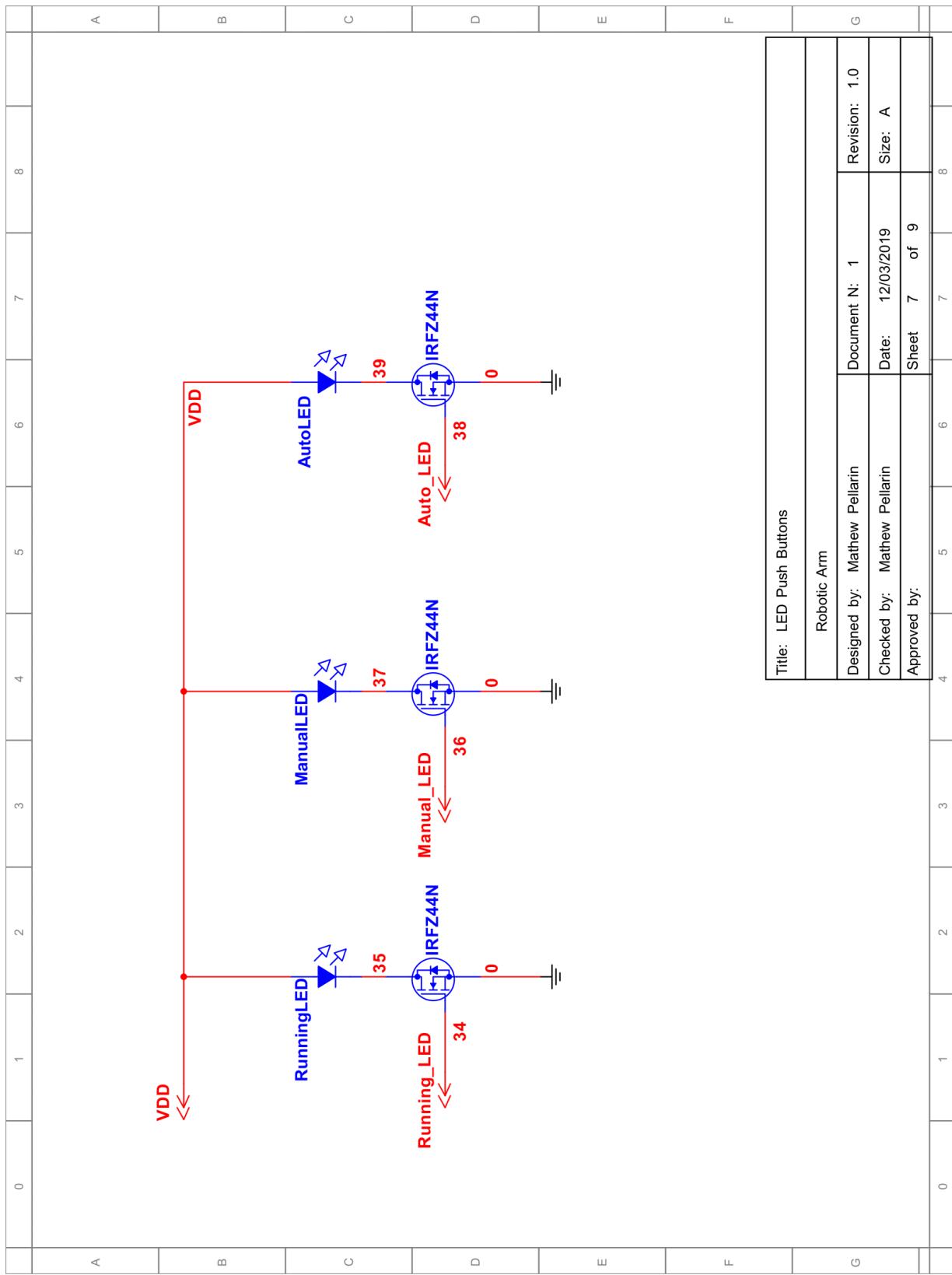


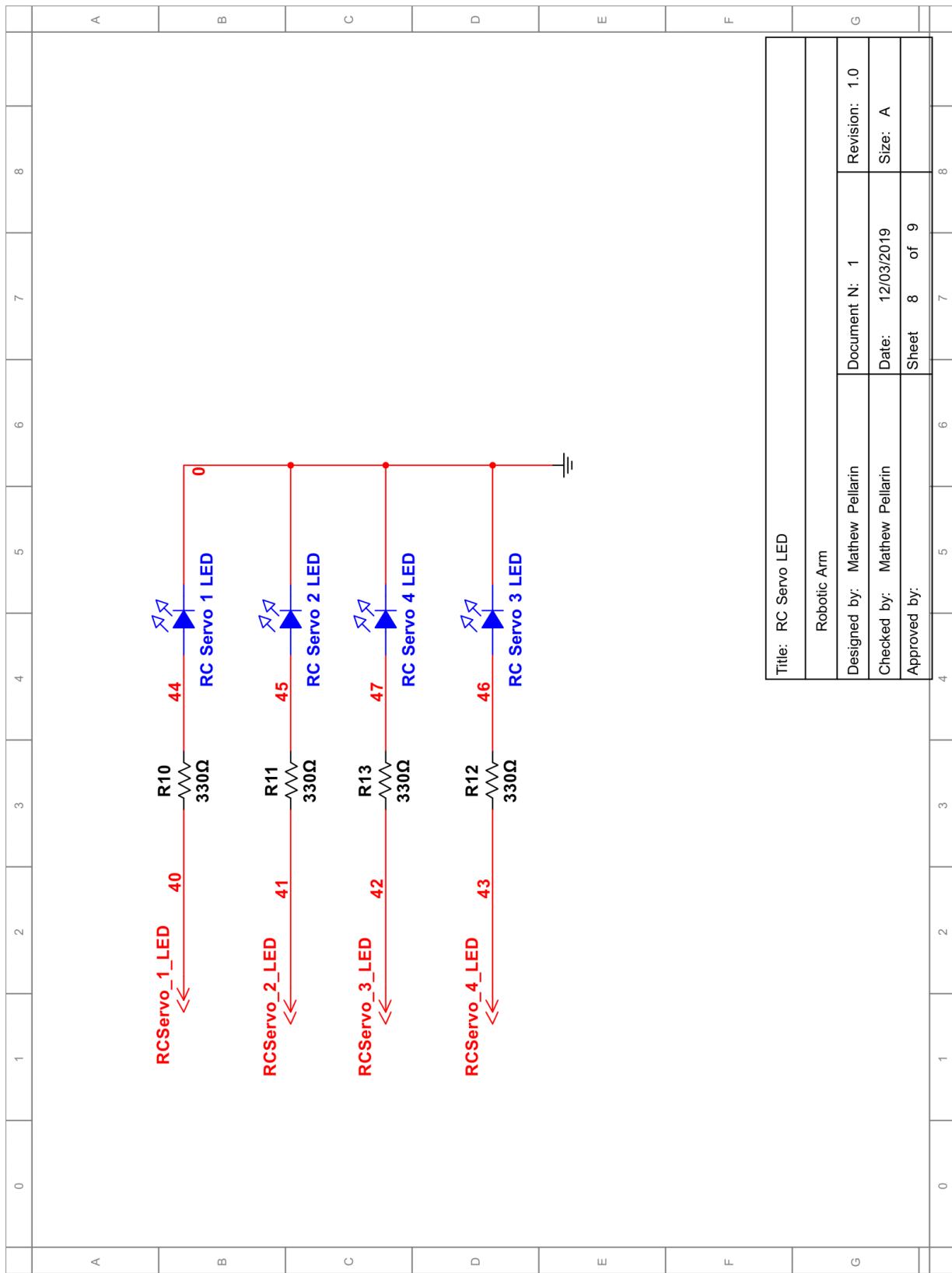


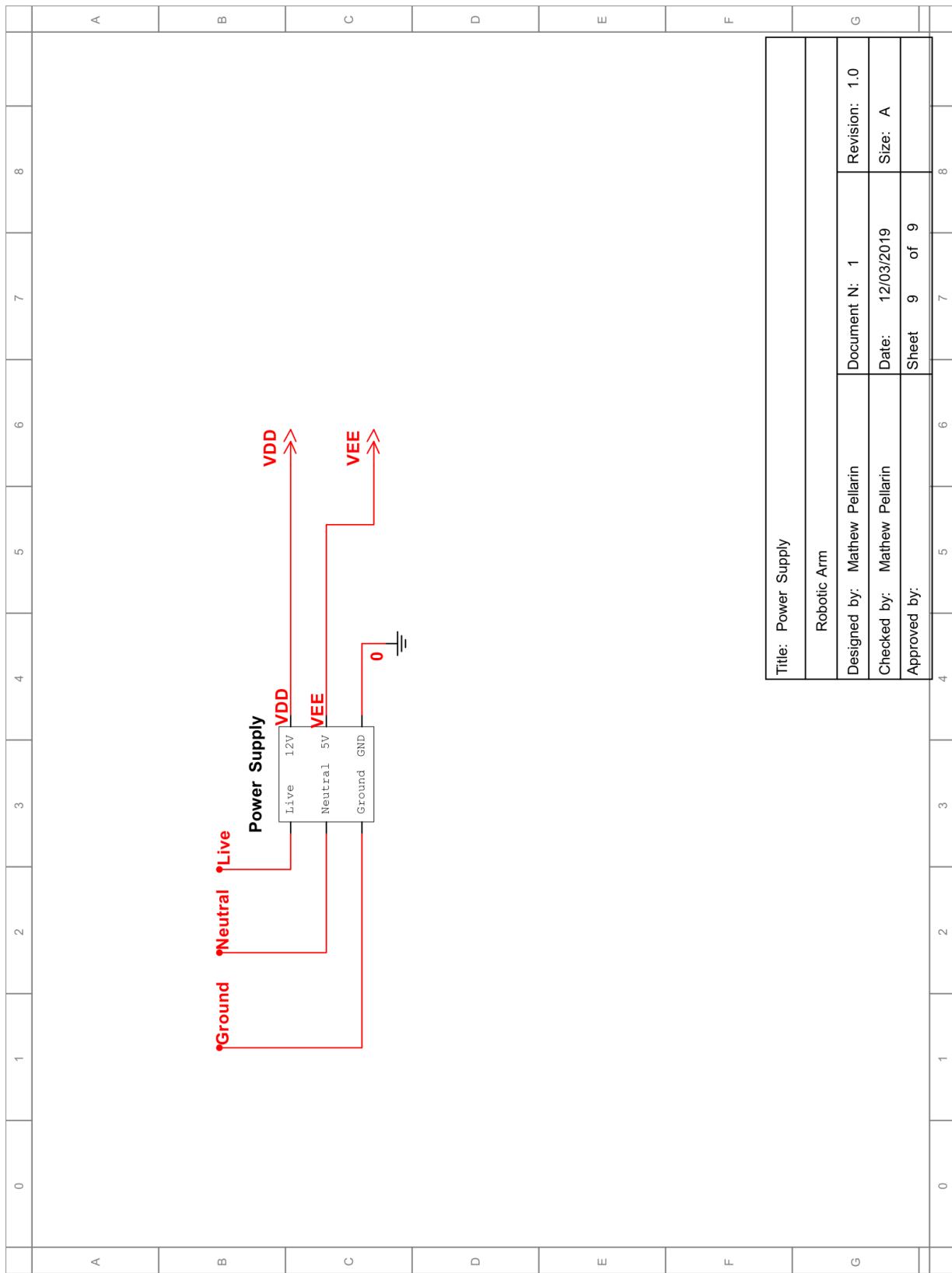






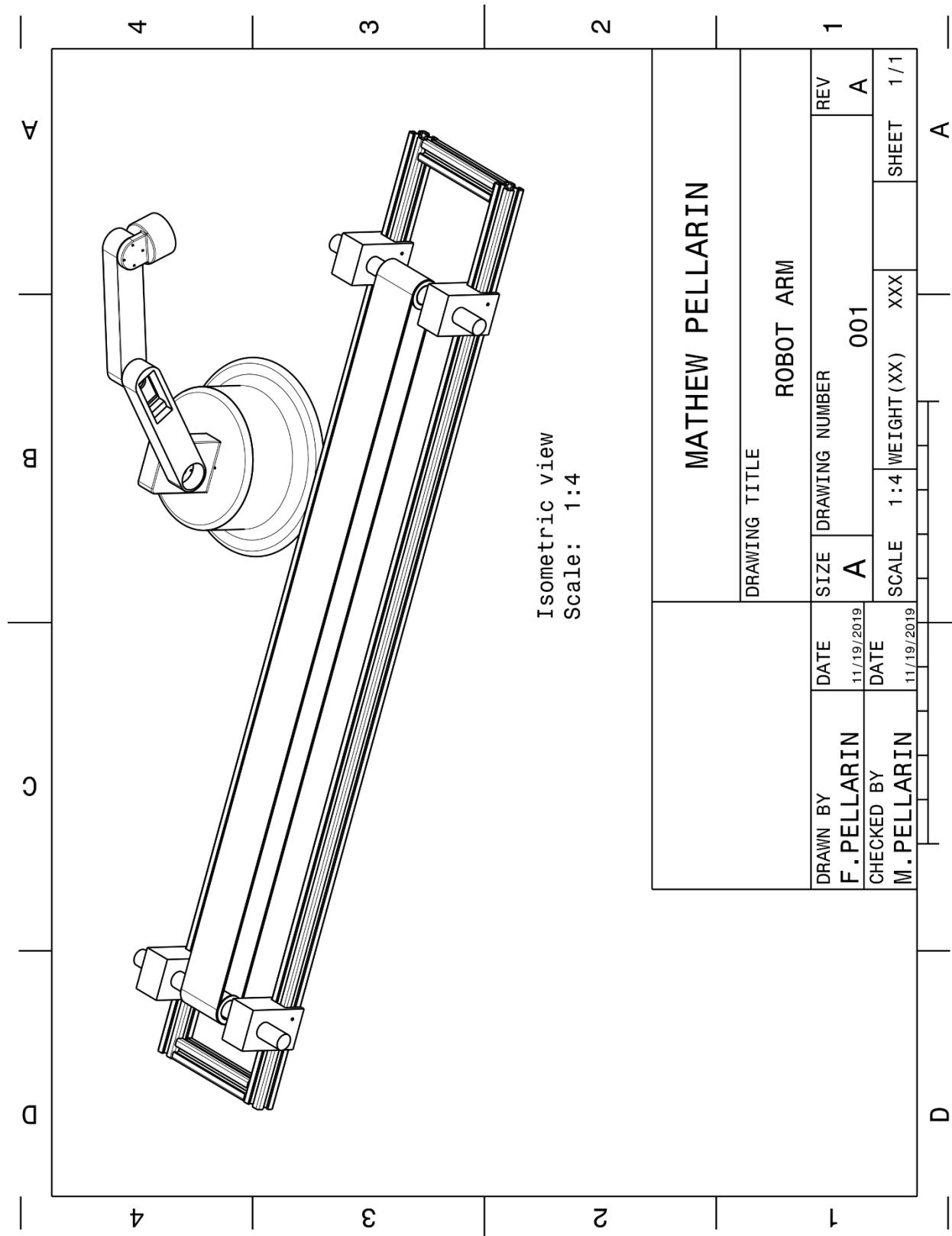


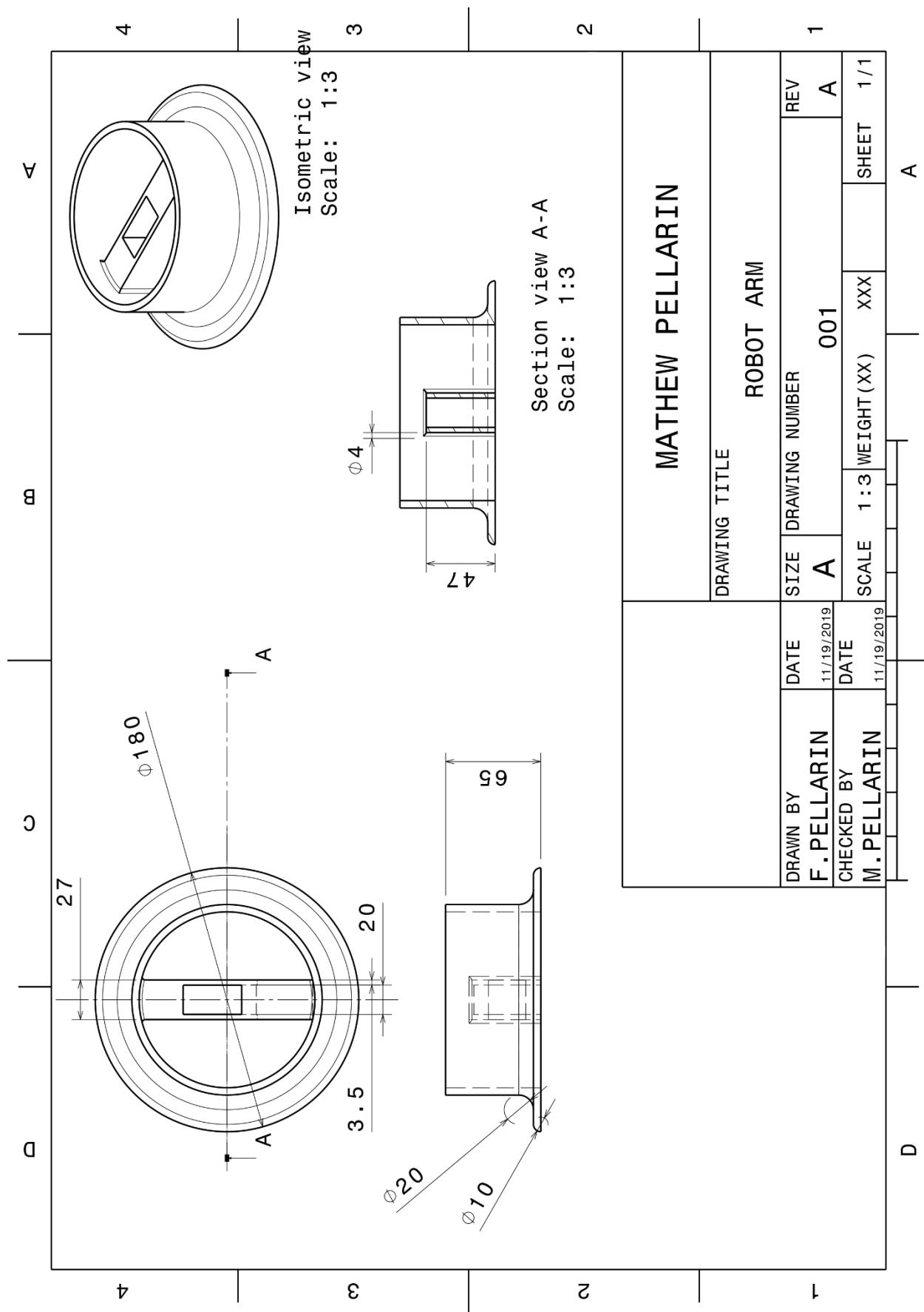


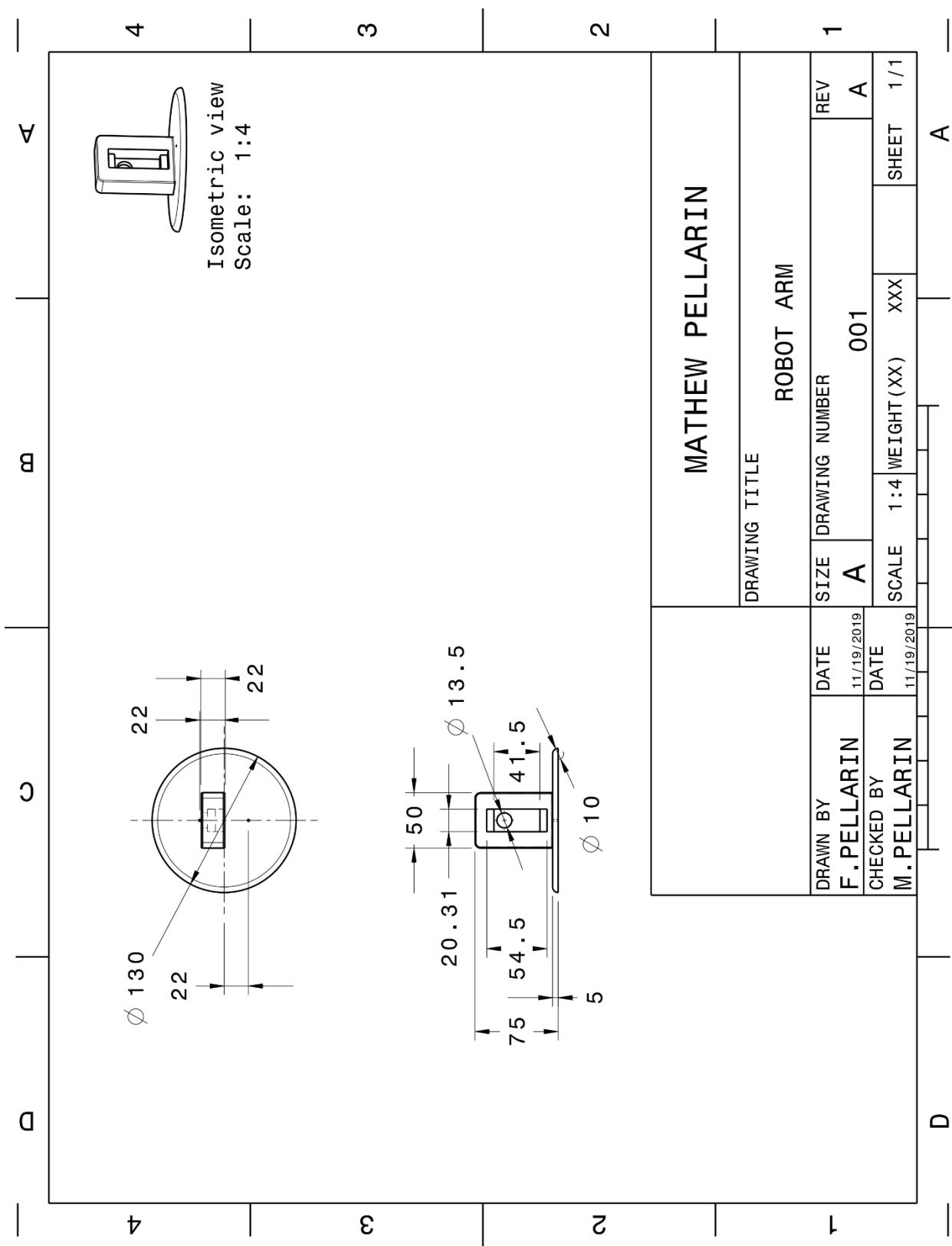


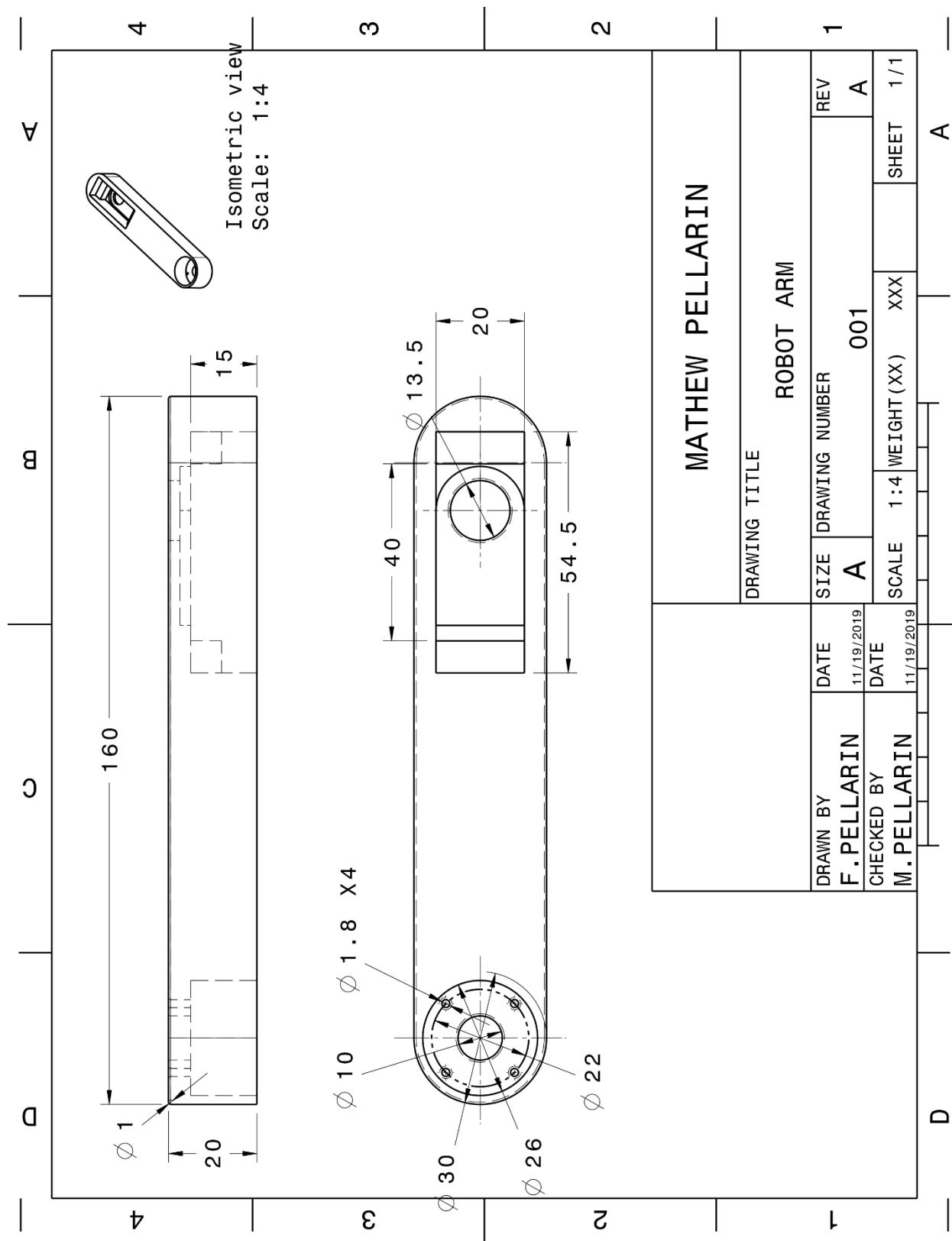
Mechanical Drawings

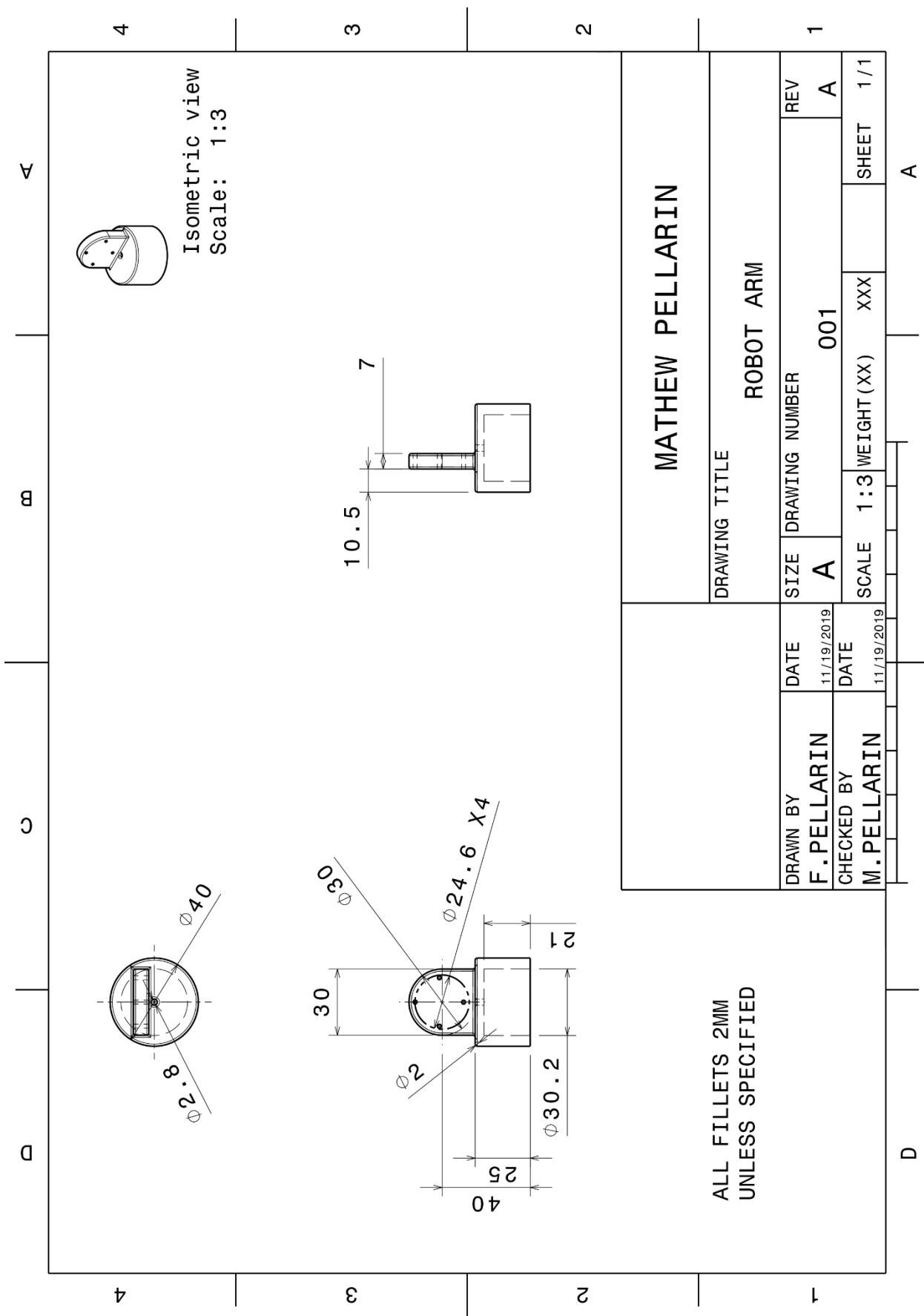
*All units are in millimeters

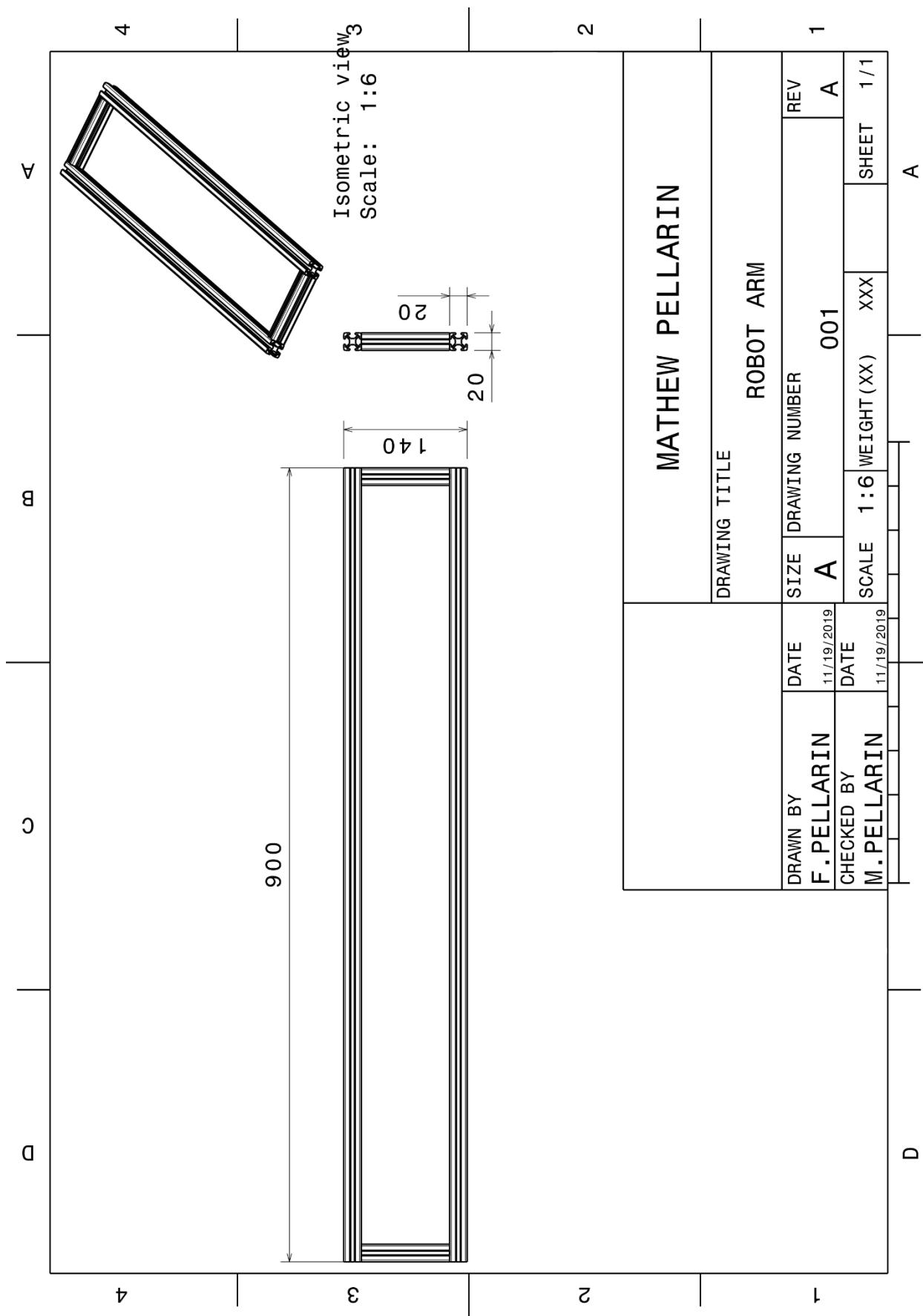


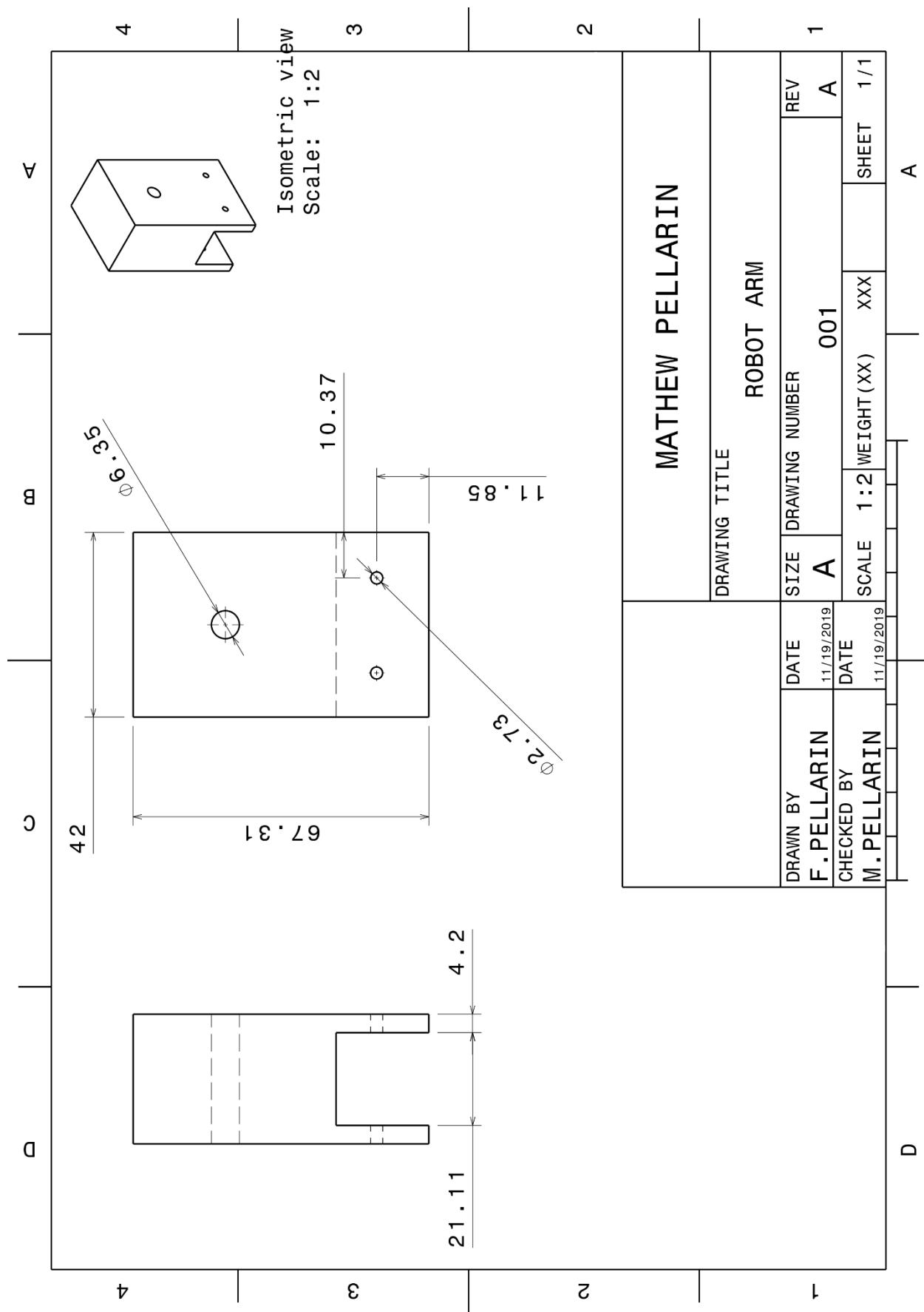


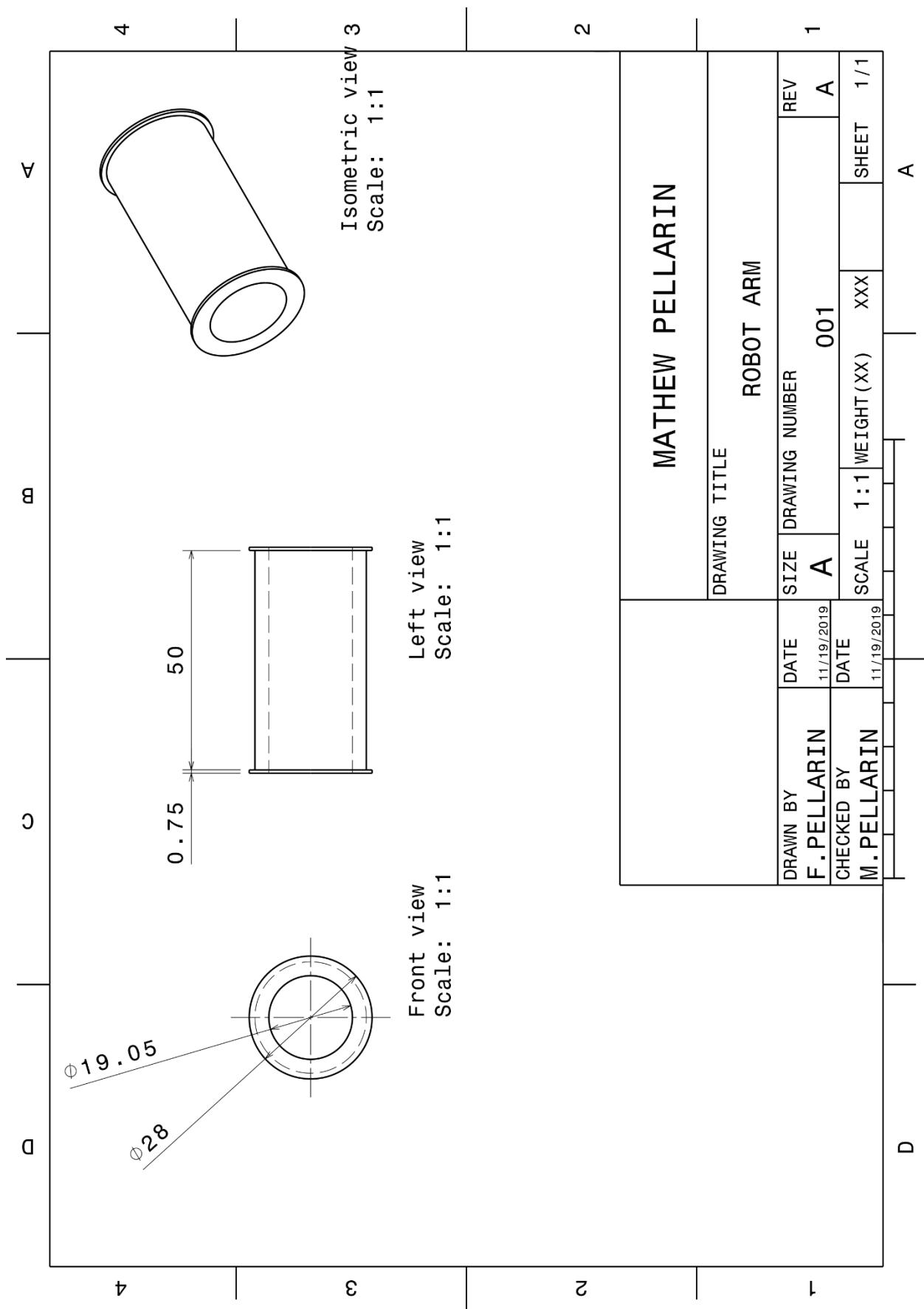




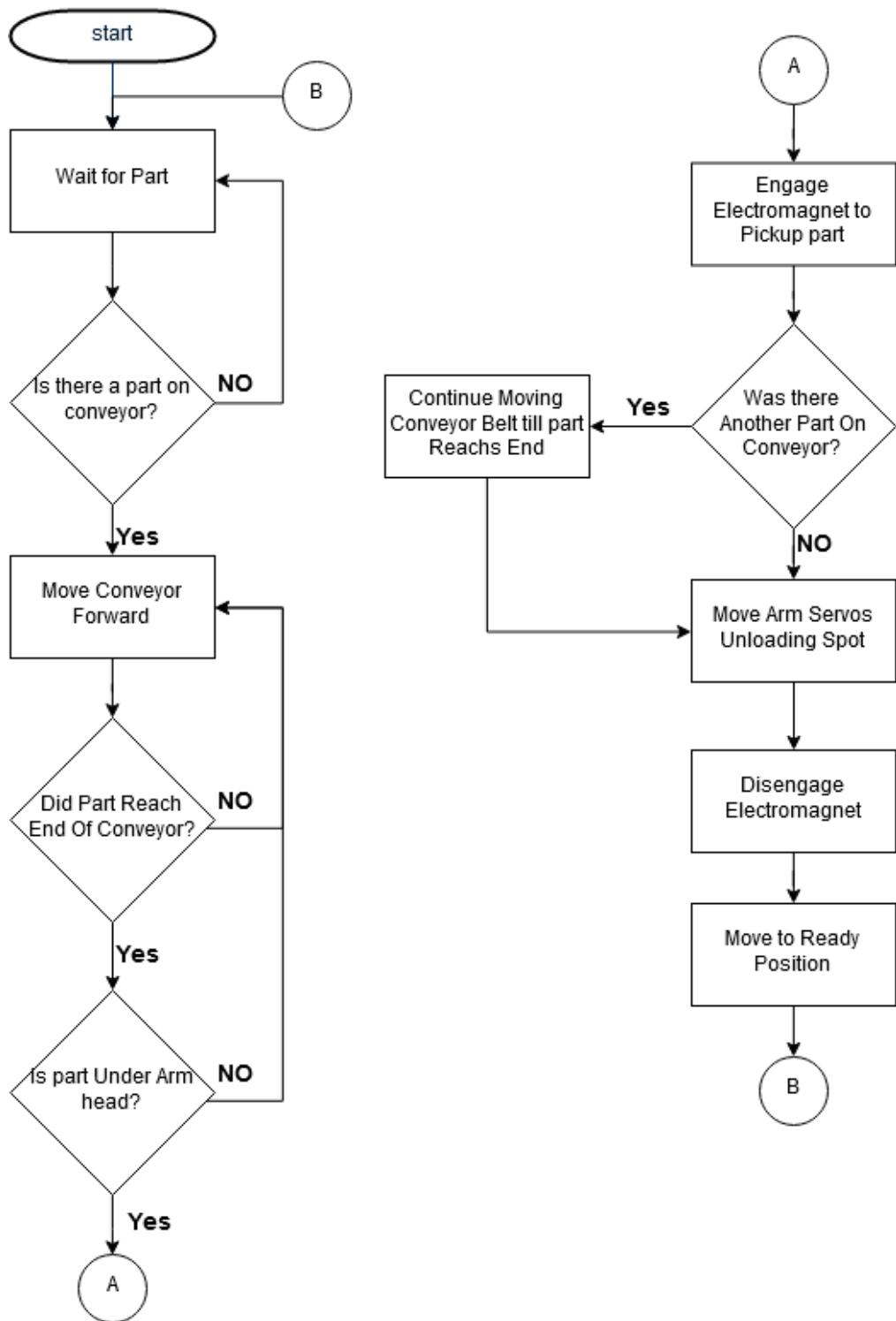








Software Design



Bill of Material

Part	QTY (on Hand)	Status	Supplier	Appendix
Arduino Mega	3	Delivered	Used Market	24
Optocouplers (PC817)	20	Delivered	Amazon	25
Proximity Sensors	4	Delivered	Bangood	26
RC Servos 25kg	2	Delivered	Amazon	27
RC Servos MG996R	5	Delivered	Amazon	28
Relay Board	1	Delivered	Used Market	29
Stepper Motor (Nema 23)	1	Delivered	Used Market	29
Stepper Motor Driver (4A)	1	Delivered	Amazon	30
Electromagnet	1	Delivered	Amazon	31
LEDs	100+	Delivered	Used Market	32
MOSFET (IRFZ44N)	13	Delivered	eBay	32
Standard Push Buttons	4	Delivered	Used Market	33
LED Push Buttons	9	Delivered	Used Market	33
E-Stop Push Button	1	Delivered	Used Market	34
10kΩ Resistors	100	Delivered	Amazon	34
330Ω Resistors	100	Delivered	Amazon	35
560Ω Resistors	50+	Delivered	Used Market	35
Screw Terminals	100	Delivered	Amazon	36
Computer Power Supply	1	Delivered	Used Market	37
Wire 16 Gauge	1	Delivered	Princess Auto	37
Wire 22 Gauge	1	*On Order	Amazon	38
Protoboard	10	Delivered	Used Market	38
PLA Filament	2	Delivered	Amazon	39
Aluminum Extrusion 2020 900mm	2	Delivered	Bangood	39
Aluminum Extrusion 2020 100mm	2	Delivered	Bangood	39
Conveyor Belt	1	Delivered	Ali Express	40
Stepper Motor Coupler	1	Delivered	Used Market	40
1/4" Threaded Rod 3'	1	Delivered	Home Depot	41
PVC Pipe for DIY Roller	2	Delivered	Home Depot	41
3/4" x 1/4" Bearings	6	1 - Delivered **6 - On Order	Canadian Bearings	42
Assorted M4 Screws	90	Delivered	Amazon	42
Assorted M2/M3/M4 Screws	420	Delivered	Amazon	43
T-nuts M3 for 2020	100	Delivered	Amazon	44
Ethernet Cable	100'+	Delivered	Used Market	45
RJ45 Jack	50+	Delivered	Amazon	45
RJ45 Socket	20	Delivered	Ali Express	46

RJ45 Breakout Board	20	Delivered	Ali Express	47
MDF 5/8"x 49"x 97"	1	***Not On Order	Home Depot	

* Estimated time of arrival: Friday, December 6, 2019

** Estimated time of arrival: Tuesday, December 3, 2019

*** Amount Undermined but easily obtainable through any home improvement store

Progress to Date

All parts have been model and carefully thought-out. Majority of parts have been 3D printed but will be reprinted stronger and with less weight. All servos have been tested as well as the electromagnet. The arm has manual controls to allow debugging and stress testing to be done at this time. Majority of conveyor pieces are on hand but bearings. Canada bearings shipment has been delayed and should arrive Tuesday, December 3, 2019. Once they come in, the conveyor will soon be built and tested as well.



Appendices

Arduino Mega



Optocouplers



Order Placed: October 21, 2019

Amazon.ca order number: 702-5946912-4262647

Order Total: CDN\$ 8.99

Shipped on October 22, 2019

Items Ordered

1 of: Gikfun OPTOCOUPлер DIP-4 PC817C PC817 for Arduino Diy (Pack of 20pcs) AE1143
Sold by: Gikfun_Official_Store ([seller profile](#))

Price

CDN\$ 9.99

Condition: New

Proximity Sensors



Product Information

Product	Product Attributes	Status	Options
 TL-W5MC1 5mm Detecting Inductive Proximity Sensor Detection Switch NPN...		Shipped	Repair & Refund & Resending

Order Totals

Sub-Total:	CA\$9.04
Shipping insurance:	CA\$0.18
Shipping Fee:	CA\$4.09
Total:	CA\$13.31

RC Servos 25kg



Order Placed: August 29, 2019

Amazon.ca order number: 701-7190670-1151424

Order Total: CDN\$ 45.99

Shipped on August 30, 2019

1 of: ZOSKAY Waterproof servo Update servo 25KG Full Metal Gear Digital servo Baja servo for Baja Cars(Control Angle 270)

CDN\$ 30.00

Sold by: Zemei lu ([seller profile](#))

Condition: New

Order Placed: November 25, 2019

Amazon.ca order number: 702-8476777-8881853

Order Total: CDN\$ 30.00

Shipped on November 26, 2019

Items Ordered

1 of: ZOSKAY Waterproof servo Update servo 25KG Full Metal Gear Digital servo Baja servo for Baja Cars(Control Angle 270)

CDN\$ 30.00

Sold by: Zemei lu ([seller profile](#))

Condition: New

RC Servos MG995R



Order Placed: June 9, 2019

Amazon.ca order number: 702-0178936-6932251

Order Total: CDN\$ 51.99

Shipped on June 9, 2019

Items Ordered

1 of: *Longrunner 10 x MG996R Metal Gear Torque Digital Servo Motor For RC Model Car Boat Helicopter LKY62*

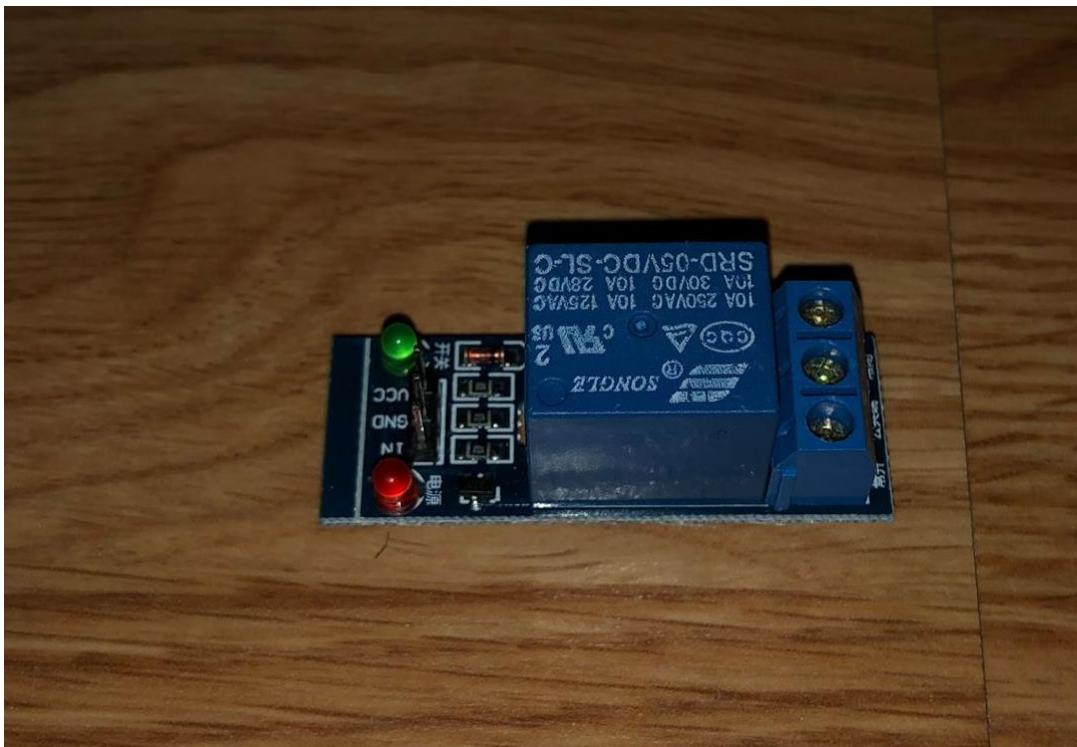
Sold by: Longrunner ([seller profile](#))

Price

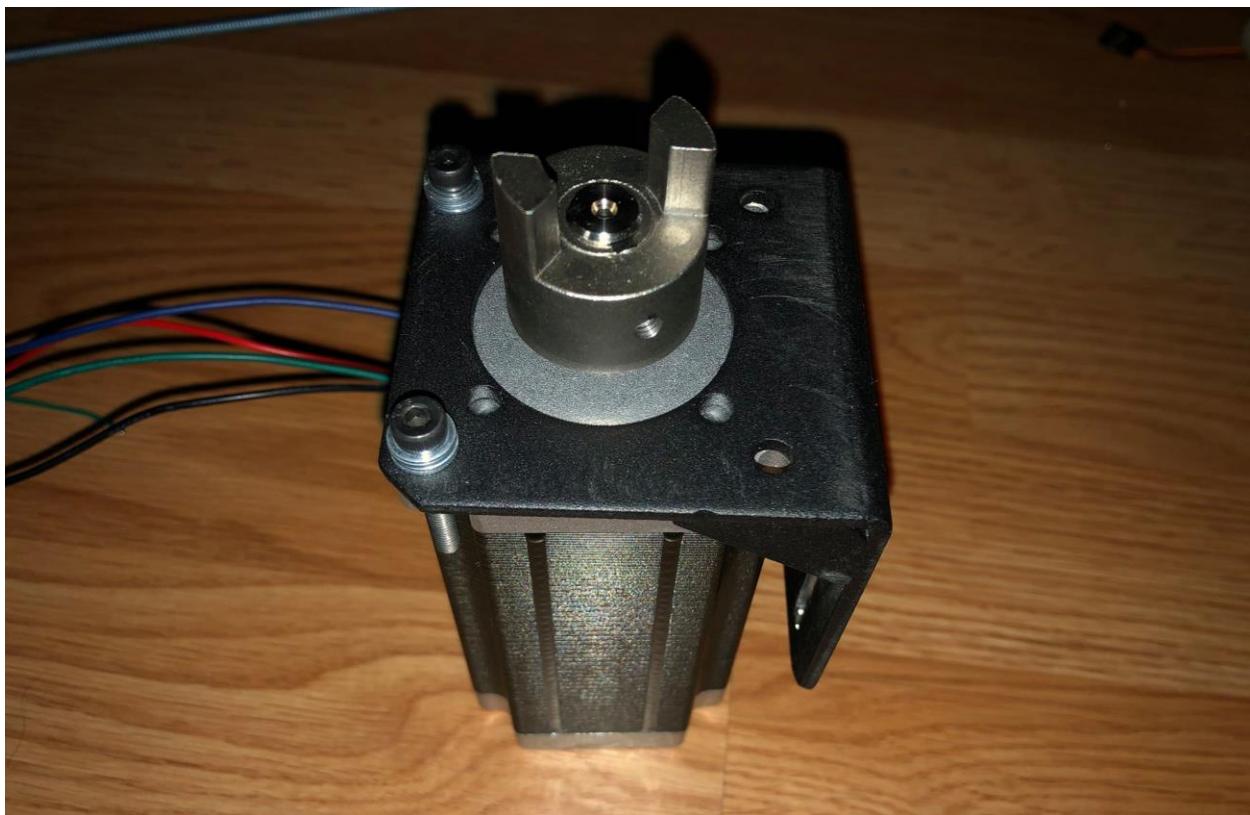
CDN\$ 51.99

Condition: New

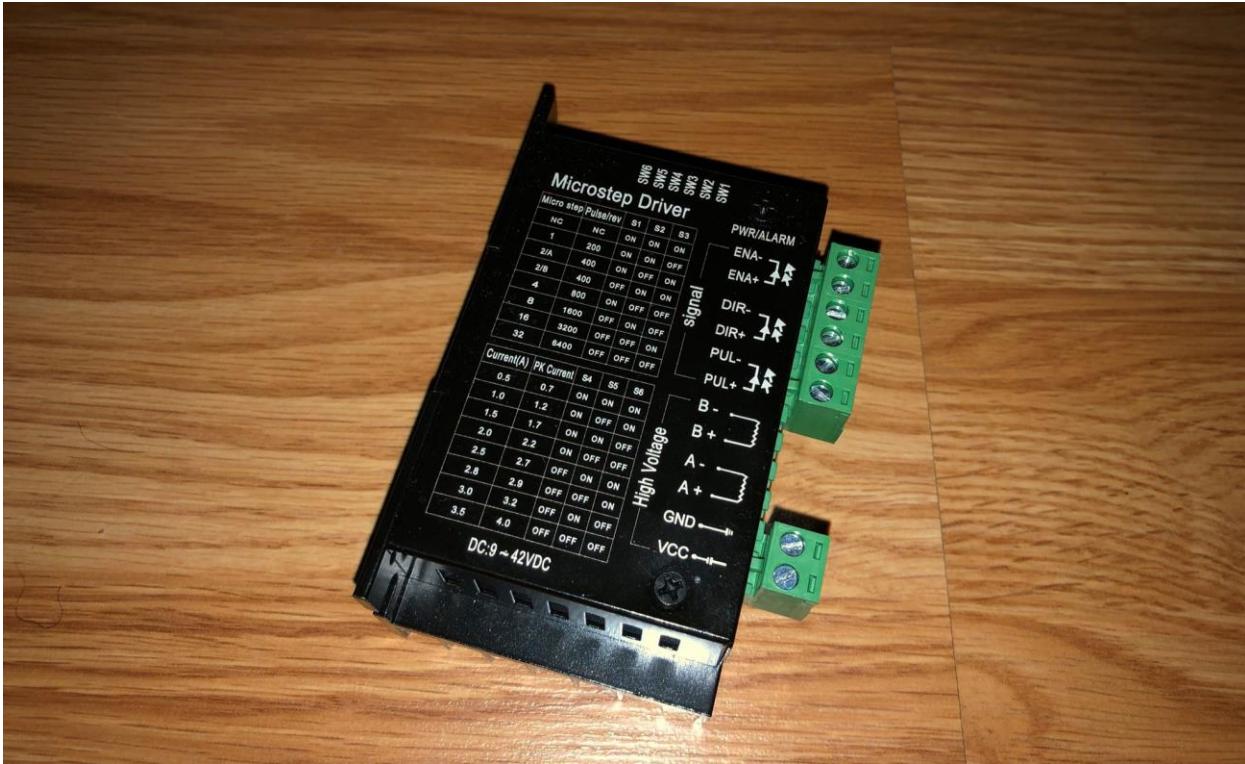
Relay Board



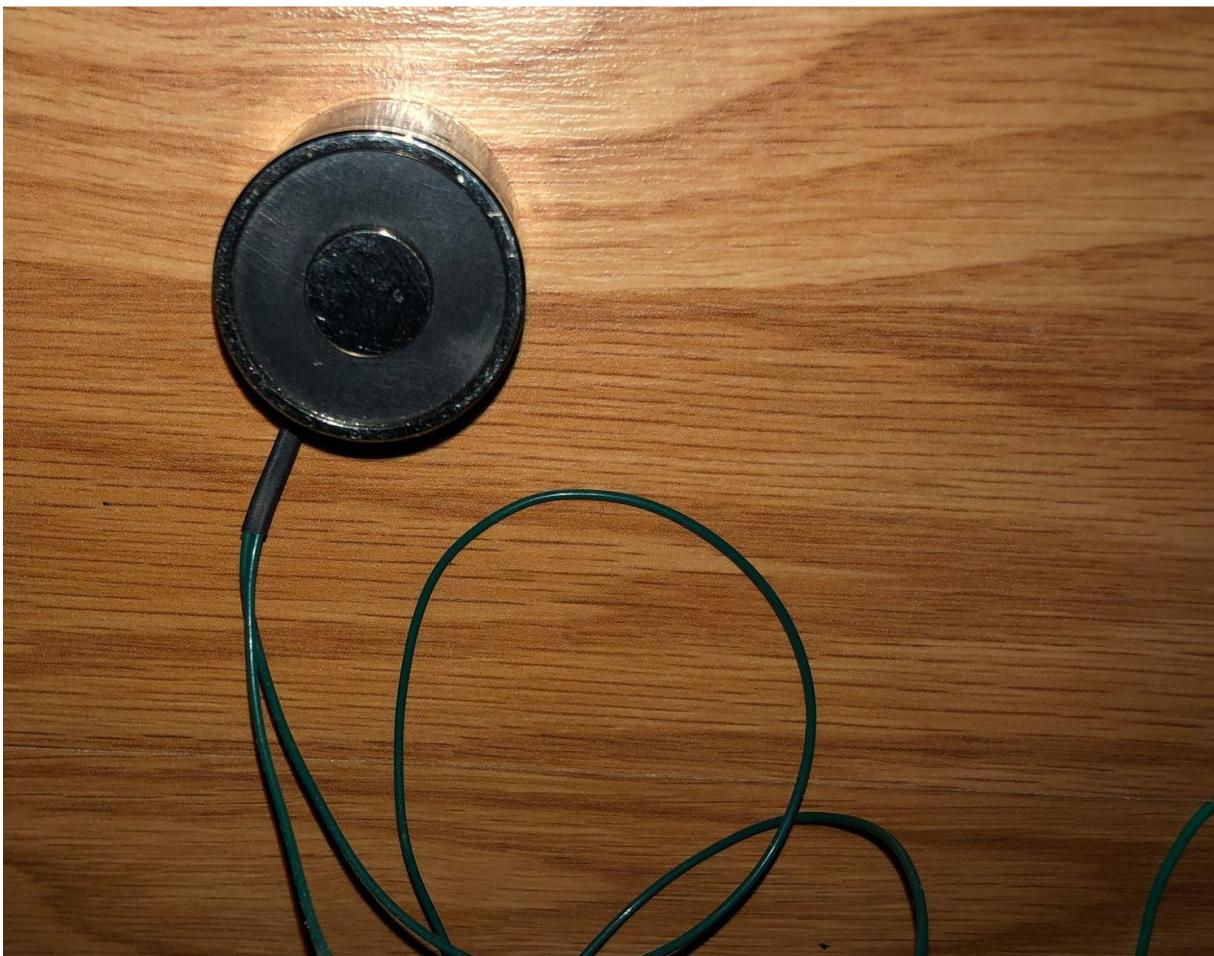
Stepper Motor (Nema 23)



Stepper Motor Driver (4A)

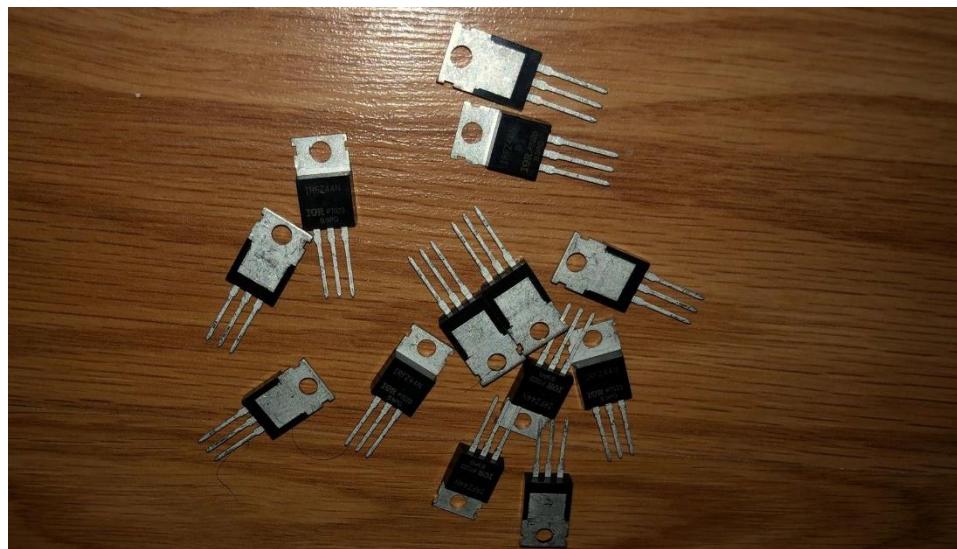


Electromagnet



Order Placed: July 19, 2019
Amazon.ca order number: 701-1290529-4085045
Order Total: CDN\$ 110.58

Shipped on July 20, 2019	
Items Ordered 1 of: <i>Uxcell Electric Lifting Magnet Electromagnet Solenoid, 12V, 10 kg/22 lb, 30 mm</i> Sold by: Amazon.com.ca, Inc. Condition: New	Price CDN\$ 20.24

LEDs**MOSFET (IRFZ44N)**

Sold by [czb6721960](#) (287955)
Processed by PayPal

[+ Show additional actions](#)

**50Pcs IRFZ44N IRFZ44 N-Channel
49A 55V Transistor MOSFET**

[Contact seller](#)

Item price US\$7.07
Quantity 1
Item number 130806048727
Shipping service Standard International Shipping

Standard Push Buttons



LED Push Buttons



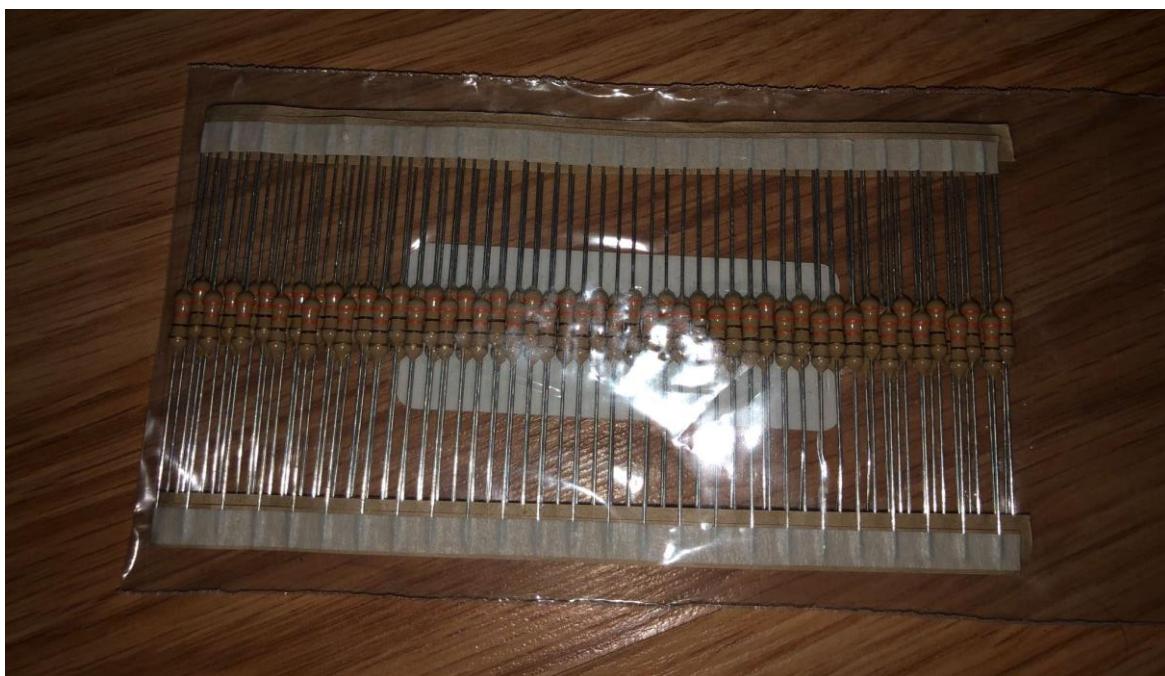
E-Stop Push Button**10kΩ Resistors****Order Placed:** November 25, 2019**Amazon.ca order number:** 702-5153384-9889858**Order Total:** CDN\$ 38.31**Shipped on November 26, 2019****Items Ordered**

1 of: *E-Projects 100EP11410K0 10k Ohm Resistors, 1/4 W, 1% (Pack of 100)*
Sold by: E-Projects, LLC ([seller profile](#))

Condition: New

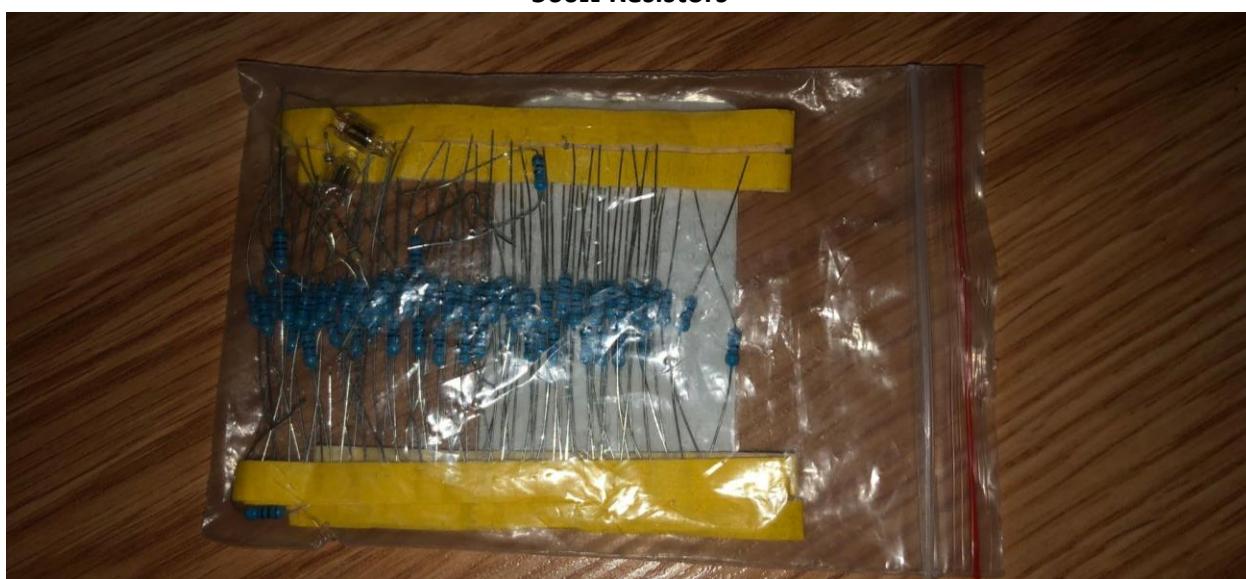
Price

CDN\$ 9.12

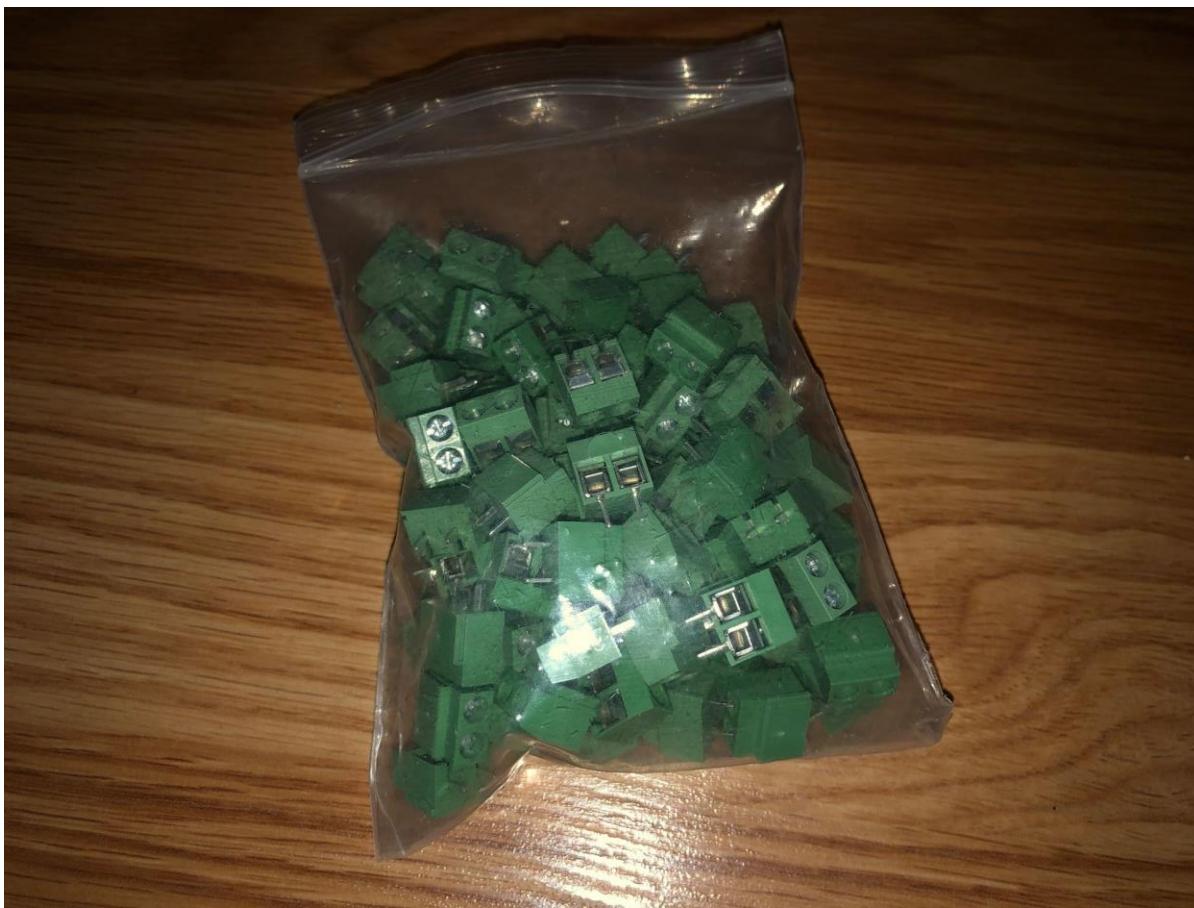
330Ω Resistors**Order Placed:** November 25, 2019**Amazon.ca order number:** 702-5153384-9889858**Order Total:** CDN\$ 38.31**Shipped on November 26, 2019****Items Ordered****1 of: E-Projects 100EP512330R 330 Ohm Resistors, 1/2 W, 5% (Pack of 100)**
Sold by: E-Projects, LLC ([seller profile](#))**Price**

CDN\$ 9.20

Condition: New

560Ω Resistors

Screw Terminals



Order Placed: November 25, 2019

Amazon.ca order number: 702-5153384-9889858

Order Total: CDN\$ 38.31

Shipped on November 26, 2019

Items Ordered

1 of: 100PCS 2 Pole 5mm Pitch PCB Mount Screw Terminal Block 10A 300V
Sold by: Md trade ([seller profile](#))

Price
CDN\$ 19.99

Condition: New

Computer Power Supply



Wire 16 Gauge



Wire 22 Gauge

Order Placed: December 2, 2019
Amazon.ca order number: 702-2304891-8402668
Order Total: **CDN\$ 20.99**

Not Yet Shipped	
Items Ordered	Price
1 of: <i>Striveday Flexible Silicone 22AWG 300V Copper Hook Up Electric Wire</i> Sold by: Striveday (seller profile)	CDN\$ 20.99
Condition: New Brand new	

Protoboard



PLA Filament



Order Placed: July 19, 2019
Amazon.ca order number: 701-1290529-4085045
Order Total: CDN\$ 110.58

Shipped on July 20, 2019

Items Ordered	Price
2 of: AMZ3D 1.75mm PLA 3D Printer Filament, Black, 1 Kg spool (2.2 lbs) Sold by: AMZ3D (seller profile)	CDN\$ 25.99
Condition: New	

Aluminum Extrusion 900mm and Aluminum Extrusion 100mm



Conveyor Belt



Order ID: 8004211464887447 [View Detail](#)

Order time: 17:00 Oct. 13 2019

Store name: Bossli Decoration Ideas Store

[View Store](#) | [Contact Seller](#)

Order amount:

C\$ 26.98



Perimeter:1500mm Width:50mm Thickness:2mm
Green Industrial Transmission Line Belt Conveyor
PVC Belt(Can Customized Size)
[Transaction Screenshot]

C\$ 26.98 X1



Confirmation Received
[Open Dispute](#)

Finished

[Mobile Order](#)

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Stepper Motor Coupler



1/4" Threaded Rod 3'



PVC Pipe for DIY Roller



3/4" x 1/4" Bearings**Assorted M4 Screws****Order Placed:** June 14, 2017**Amazon.ca order number:** 701-9154795-9993050**Order Total:** CDN\$ 75.99**Shipped on June 15, 2017**

Items Ordered	Price
1 of: <i>Hilitchi 420pcs M2 3 4 304 Stainless Steel Hex Socket Head Cap Screws Nuts Assortment Kit with Box (304 Stainless Steel)</i> Sold by: LITCHI (seller profile)	CDN\$ 26.99
Condition: New	

Assorted M2/M3/M4 Screws



Order Placed: November 27, 2019

Amazon.ca order number: 701-3755275-6097014

Order Total: CDN\$ 20.98

Shipped on November 27, 2019

Items Ordered

Price

1 of: *Hilitchi 180pcs M4 Stainless Steel Hex Socket Head Cap Screws Nuts Assortment Kit with Box (M4 Steel Sockets)* CDN\$ 16.99

Sold by: LITCHI ([seller profile](#))

Condition: New

T-nuts**Order Placed:** June 14, 2017**Amazon.ca order number:** 701-9154795-9993050**Order Total:** CDN\$ 75.99**Shipped on June 15, 2017****Items Ordered**

1 of: *TOPINSTOCK 2020 Drop In Post Assembly M4 T-nut for 20 x 20 Aluminum Extrusion...*
Sold by: TopinStock ([seller profile](#))

Price

CDN\$ 25.99

Condition: New

Ethernet Cable



RJ45 Jack



RJ45 Socket



Order ID: 102651767737447 [View Detail](#)

Order time: 22:00 Jun. 09 2019

Store name: First Chioce House Improvement Store

[View Store](#) | [Contact Seller](#)

Order amount:

C\$ 8.60



10Pcs/set RJ45 Network Ethernet 8P 8C Female
Socket Connectors 8Pin PCB Mount RJ45 8P8C Single
Network Port

[Transaction Screenshot]

C\$ 2.37 X2



Confirmation Received

[Open Dispute](#)

Finished

[Mobile Order](#)

[Add to Cart](#)

RJ45 Breakout Board



Order ID: 102651767747447 [View Detail](#)

Order time: 22:00 Jun. 09 2019

Store name: PZWG Tech Store

[View Store](#) | [✉ Contact Seller](#)

Order amount:

C\$ 12.33



20 Pcs RJ45 Connector (8P8C) and Breakout Board
Kit for Ethernet Jacks Check Ethernet Cable and
Connectors
[Transaction Screenshot]

C\$ 10.63 X1

Product properties: Other



Confirmation Timeout
[Open Dispute](#)

Finished
[Mobile Order](#)

[Add to Cart](#)