

# BILL OF MATERIALS

This BOM includes all the major parts to build the robot. These parts were purchased from Amazon, McMaster Carr, Ebay, the local hardware store and also parts you need to print on your 3D printer. There are a few misc. screws and wires I may have missed. If there is not a note below the picture stating quantity then just buy one of the item shown.

# Amazon parts – these are in no particular order



You need a total of 3 of these bearings so I Bought 2 (2 packs)



You need a total of 4 of these bearings



You need a total of 2 of these thrust bearings





### 4mm x 5mm RC Aircraft Toy Brass Motor Shaft Coupling Connector Coupler

by uxcell

Be the first to review this item

Price: **\$5.27 & FREE Shipping**

**Note:** Not eligible for Amazon Prime.

**In Stock.**

**Estimated Delivery Date:** Aug. 9 - 12 when you choose Expedited Shipping at checkout.

Ships from and sold by uxcell.



by 3D CAM

### [3D CAM] 2 PCS Flexible Couplings 5mm to 8mm NEMA 17 Shaft for RepRap 3D Printer or CNC Machine

★★★★☆

10 customer reviews

Price: **\$9.45** ✓Prime

**Only 18 left in stock.**

**Want it Thursday, July 14?** Order within **19 hrs 53 mins** and choose One-Day Shipping at checkout. [Details](#)

Sold by DDUp and Fulfilled by Amazon.

7 new from \$9.45

#### Specifications for this item

Brand Name	3D CAM
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### MicroMall NEW Universal Regulated Switching Power Supply DC 5V 3A 15W

by MicroMall

★★★★★ 1 customer review

Price: **\$8.29** ✓Prime

**Only 20 left in stock.**

**Want it Wednesday, July 27?** Order within **5 hrs 44 mins** and choose **Two-Day Shipping** at checkout. [Details](#)

Sold by Z TDM (Ship from NJ via USPS/FedEx/DHL) and Fulfilled by Amazon. Gift-wrap available.

- Input: AC110-240V 50/60Hz
- Output: DC 5V 3A
- Power: 15W
- Protections: Overload / over voltage / short circuit
- Material: Metal



### 5 Pcs X3-0512 400V 5A 12 Position 2 Row Plastic Screw Terminal Block

by uxcell

★★★★★ 9 customer reviews

Price: **\$5.44** ✓Prime

**Only 4 left in stock.**

Sold by uxcell and Fulfilled by Amazon. Gift-wrap available.

- Product Name : Screw Terminal Block,Model : X3-0512
- Type : 12 Positions, 2 Rows,Rated Value : 400V 5A
- Cable Entry Diameter : 3.5mm/ 0.14";Size : 103 x 1.1 x 1.4cm/ 4" x 0.43" x 0.6" (L\*W\*H)
- Material(external) : Plastic,Color : White
- Weight : 66g,Package Content : 5 Pcs x Terminal Blocks

I bought 2 of these 5vdc power supplies  
One to power the stepper drivers and one  
To power my relays



by Actobotics

### 16 Tooth, 6mm Bore, 32 Pitch Pinion Gear

Be the first to review this item

Price: \$7.99 + \$6.99 shipping

**Note:** Not eligible for Amazon Prime.

**In Stock.**

**Estimated Delivery Date:** Thursday, July 7 when you choose Two-Day Shipping  
Ships from and sold by ServoCity.

#### Specifications for this item

Brand Name	Actobotics
Part Number	615258
Item Weight	0.16 ounces
Number of Items	0



### Mean Well NES-350-24 24V 350 Watt UL Switching Power Supply 120 Volt

by MEAN WELL

★★★★★ 18 customer reviews | 9 answered questions

Price: \$49.00 **Prime**

**Note:** Available at a lower price from other sellers, potentially without free Prime shipping.

**In Stock.**

**Want it tomorrow, Aug. 2?** Order within 2 hrs and choose **One-Day Shipping** at checkout. [Details](#)

Sold by DOUBLESTAR and Fulfilled by Amazon.

**Want to hire a computer technician?**

There is a cheaper power supply on Amazon that would probably work fine  
It needs to be 24vdc and 10 to 15 amp



by Actobotics

### 100 Tooth, 1" Bore, 32 Pitch Hub Gear

Be the first to review this item

Price: \$12.99 + \$6.99 shipping

**Note:** Not eligible for Amazon Prime.

**In Stock.**

**Estimated Delivery Date:** Thursday, July 7 when you choose Two-Day Shipping  
Ships from and sold by ServoCity.

#### Specifications for this item

Brand Name	Actobotics
Part Number	615234
Material Type	Aluminum
Item Weight	1.14 ounces



### New! keystudio MEGA 2560 R3 development board + USB cable compatible for arduino

by keystudio

★★★★★ 15 customer reviews

Price: \$15.99 **Prime**

We don't know when or if this item will be back in stock.

**Want to hire a computer technician?**  
Buy professional computer technician services directly on Amazon. Backed by our Happiness Guarantee. [Learn more](#)

- 100% compatible with the official version
- USB To TTL using ATME16U2 chip
- Control using ATME1 MEGA2560 chip
- Through FCC and CE certification
- Better quality and packaging





by HICTOP

### 5 Meters GT2 2mm pitch 6mm wide Timing Belt for 3D printer CNC

★★★★☆ 22 customer reviews | 4 answered questions

Price: **\$8.32** ✓Prime

**Only 1 left in stock.**

**Want it Saturday, July 16?** Order within **16 hrs 8 mins** and choose **Saturday Delivery** at checkout. [Details](#)

Sold by **Blue3D LLC** and **Fulfilled by Amazon**. Gift-wrap available.

~~11 new from \$9.99~~



Amico 2 Pcs Replacement Spiral Bevel Gear for Makita 9533 Angle Grinder

by Amico

★★★★★ 2 customer reviews

Price: **\$9.37** ✓Prime

**Only 1 left in stock.**

**Want it Tuesday, July 5?** Order within **16 hrs 51 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Sold by **uxcell** and **Fulfilled by Amazon**. Gift-wrap available.

- Product Name : Spiral Bevel Gear, Fit for : Makita 9533
- Material : Metal, Ring Gear Size : 47 x 15mm/ 1.9" x 0.6" (Dia\*Max T)
- Fit for Shaft Diameter : 12mm/ 0.47", Pinion Gear Size : 17.3 x 15mm/ 0.68" x 0.59" (Dia\*Max T)



### Frentaly MB-102 830 Point Prototype PCB Breadboard + 65pcs Jump Cable Wires + Power Supply

by Frentaly

★★★★☆ 21 customer reviews

Price: **\$8.99** ✓Prime

**Note:** Available at a lower price from **other sellers**, potentially without free Prime shipping.


**In Stock.**

**Want it Tuesday, July 5?** Order within **37 hrs 56 mins** and choose **Two-Day Shipping** at checkout. [Details](#)

Sold by **Debaser Electron** and **Fulfilled by Amazon**.

**Want to hire a computer technician?**  
Buy professional computer technician services directly on Amazon. Backed by our Happiness Guarantee. [Learn more](#)

- MB-102 830 Points Breadboard with 2 Positive & Negative Power Lines on both ends.
- Free Bonus 1: 5 Volts & 3.5 Volts Power Supply.
- Free Bonus 2: 65 pcs. Jump wires. No Soldering. 100% Plug & Play.



by Amico

### SODIAL(R) 10 x 47uF 50V 105C Radial Electrolytic Capacitor 6x11mm

★★★★★ 8 customer reviews

Price: **\$4.13** ✓Prime

**Note:** Available at a lower price from **other sellers**, potentially without free Prime shipping.

**In Stock.**

**Want it Sunday, July 3?** Order within and choose **Two-Day Shipping** at checkout. [Details](#)

Sold by **Salm's Store** and **Fulfilled by Amazon**. Gift-wrap available.

**11 new from \$3.51**

**Specifications for this item**

Brand Name	Amico
Part Number	105A1000000000

You do not need the power supply – just the Breadboard and wires (power supply is garbage)



by [Ajax Scientific](#)

### Ajax Scientific 7 Piece Plastic Gear and Bushing Set

★★★★☆ 35 customer reviews | 7 answered questions

Price: **\$2.77** ✓Prime

**In Stock.**

**Want it tomorrow, Aug. 2?** Order within **3 hrs 57 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Ships from and sold by Amazon.com. Gift-wrap available.



by [Anycubic](#)

### Anycubic XL Type 36 Teeth Alumium Timing Pulley 6.35mm Bore Synchronous Drive Belt Wheel for 6mm Width GT2 Belt

[Be the first to review this item](#)

Price: **\$10.98** (\$5.49 / Item) ✓Prime

**Only 12 left in stock.**

**Want it Saturday, July 16?** Order within **19 hrs 8 mins** and choose **Saturday Delivery** at checkout. [Details](#)

Sold by [Anycubic](#) and [Fulfilled by Amazon](#).



by [TRIANGLE](#)

### Lazy Susan Bearings, 3", 5/16" Thick, 200-lb. Capacity

★★★★☆ 135 customer reviews | 14 answered questions

List Price: \$5.95

Price: **\$4.37** ✓Prime

You Save: **\$1.58 (27%)**

**Note:** Available at a lower price from other sellers, potentially without free Prime shipping.

**In Stock.**

**Want it Sunday, July 3?** Order within and choose **Two-Day Shipping** at checkout. [Details](#)  
Ships from and sold by Amazon.com.

9 new from **\$1.38**

Specifications for this item

Brand

Triangle

EAN

7152555168285



### MDW 240 Pcs Multicolored Breadboard Jumper Wires Ribbon Cables Kit (Multicolored)

by [MDW](#)

★★★★☆ 2 customer reviews

Price: **\$29.99**

Sale: **\$11.99** ✓Prime

You Save: **\$18.00 (60%)**

**In Stock.**



You need 2 of these needle bearings  
For axis 4



1 stepper motor for axis 6



1 stepper motor for axis 5



1 stepper motor for axis 4



by STEPPERONLINE  
**Nema 17 Stepper Motor Bipolar 2A 59Ncm(84oz.in) 48mm Body 4-lead W/ 1m Cable and Connector for 3D Printer/CNC**  
 ★★★★★ 20 customer reviews | 10 answered questions

Price: \$15.99 Prime

In Stock.

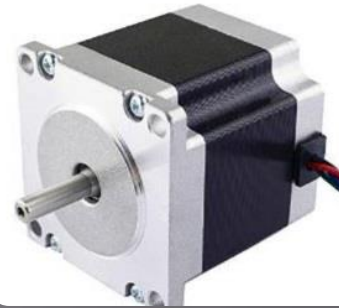
Want it Sunday, July 3? Order within and choose **Two-Day Shipping** at checkout. [Details](#)  
 Sold by [StepperOnline](#) and [Fulfilled by Amazon](#).

2 new from \$15.99

Specifications for this item

Brand Name	STEPPERONLINE	EAN	0701056358779
Part Number	17HS19-2004S1	Is Recalled?	N

1 stepper motors for axis 3



**Nema 23 CNC Stepper Motor 2.8A 178.5oz.in/1.26Nm CNC Stepping Motor DIY CNC Mill**  
 by STEPPERONLINE  
 ★★★★★ 6 customer reviews | 5 answered questions

Price: \$27.98 Prime

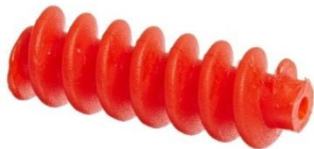
In Stock.

Want it Tuesday, July 5? Order within **16 hrs 54 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Sold by [StepperOnline](#) and [Fulfilled by Amazon](#). Gift-wrap available.

- Higher Torque
  - 1.26Nm(178.5oz.in) holding torque
  - NEMA 23 bipolar 2.24"x2.24"x2.2" 4-wire
  - 1.8 deg. step angle(200 steps/rev)
  - Rated current 2.8A & resistance 0.9ohms
- [See more product details](#)

You need 2 of these stepper motors for axis 1 and 2



by Ajax Scientific  
**Ajax Scientific Plastic Gear Worm, 0.82cm Diameter x 2.46cm Length, Small, Red (Pack of 10)**  
 ★★★★★ 2 customer reviews

Price: \$9.81 (\$0.98 / Gear Worms) Prime

In Stock.

Want it tomorrow, Aug. 2? Order within **1 hr 56 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Ships from and sold by Amazon.com. Gift-wrap available.

Specifications for this item



**JBtek 8 Channel DC 5V Relay Module for Arduino Raspberry Pi DSP AVR PIC ARM**  
 by JBtek  
 ★★★★★ 112 customer reviews | 38 answered questions

Price: \$8.98 Prime

In Stock.

Want it Wednesday, July 27? Order within **5 hrs 48 mins** and choose **Two-Day Shipping** at checkout. [Details](#)

Sold by [JBtek](#) and [Fulfilled by Amazon](#). Gift-wrap available.

**Want to hire a computer technician?**  
 Buy professional computer technician services directly on Amazon. [Back to top](#)





**TowerPro SG90 Micro Servo 2pk**  
by TowerPro  
★★★★★ 11 customer reviews | 7 answered questions

Sale: **\$7.75** ✓ Prime

**In Stock.**  
**Want it Wednesday, July 27?** Order within **19 hrs 2 mins** and choose **Two-Day Shipping** at checkout. [Details](#)  
Sold by American Robotic Supply, LLC and Fulfilled by Amazon.

- Pack of two TowerPro SG90 micro servos
- Great for small projects on a budget, most notably the Mendel 90
- Includes servo arms and screws
- Analog modulation



**CycleMore 5 PCS Aluminum 2GT GT2 Pulleys 20 Teeth Bore 8mm for 3D Printer Reprap Mendel Prusa**  
★★★★★ 1 customer review

Price: **\$9.99** ✓ Prime

**In Stock.**  
**Want it Saturday, July 16?** Order within **5 hrs 51 mins** and choose **Two-Day Shipping** at checkout. [Details](#)  
Sold by CycleMore and Fulfilled by Amazon. Gift-wrap available.



**Robotlinking A4988 Stepstick Stepper Motor Driver Module + Heat Sink for 3d Printer Reprap (Pack of 5 Pcs)**  
by Robotlinking  
★★★★★ 18 customer reviews | 4 answered questions  
#1 Best Seller in Computer Printer Control Cards

Price: **\$10.99** ✓ Prime

**Note:** Available at a lower price from other sellers, potentially without free Prime shipping.

**In Stock.**  
Sold by TranCh and Fulfilled by Amazon.

- A4988 surface mount QFN package (ES), the size of 5 mm \* 5 mm nominal overall package height of 0.90 mm??, and with exposed pad for enhanced thermal dissipation.
- The package is Pb (lead-free) with 100% molten tin leadframe plating.

You need a total of 6 stepper drivers – so you  
Will need to purchase 2 (5 packs)

This tubing was purchased  
From McMaster Carr

#### Round Tubes—Unpolished (Cold Drawn)



- Yield Strength: 70,000 psi
- Hardness: Hard (Rockwell C19)
- Can be hardened up to Rockwell C49

Meet AMS-T-6736 and MIL-T-6736B. Straightness tolerance is 0.030" per 3 feet. Length tolerance is  $\pm 1"$ .

OD	ID	OD Tolerance		1 ft.	3 ft.	6 ft.
0.028" Wall Thick. ( $\pm 0.004"$ )						
1.000"	0.944"	$\pm 0.010"$	89955K499	\$8.64	\$20.04	\$34.56

#### Product Detail

Easy-to-Weld 4130  
Alloy Steel Round  
Tube, 1.000" OD, .028"  
Wall Thickness

1 Each

ADD TO ORDER

In stock

Length  
✓ 1 ft.

This gear was from Ebay



**New Metal Worm Wheel Plastic Gear Reducer Reduction Gear set for DIY Access**  
1 sold in last hour

Item condition: New other (see details)

Quantity: 1 More than 10 available / 99 sold

Price: US \$1.50

Buy It Now

Add to cart

13 watching

Add to watch list

Add to collection

99 sold

30-day returns

Free shipping

Material: Plastic + Steel

Shape: Worm gear

Metal hole diameter: 4mm/0.15"

Plastic gear diameter: 28mm/1.10"

Metal length: 33mm/1.30"

Color: As the picture shows

Weight: About 28g

Quantity: 1 Set

Shipping: FREE Economy Shipping from outside

See details about international shipping here

Item location: Hong Kong, Hong Kong

Ships to: Americas, Europe, Asia, Australia

Delivery: Estimated between Tue, Jul, 19

Please note the delivery estimate is

Payments: PayPal VISA MasterCard

http://ad.doubleclick

## Parts purchased from local hardware store



NEED 4 #14 SCREWS TO MOUNT BASE



NEED #6 SCREW 1/2" AND 3/8" LONG





SMALL SHEET OF PLYWOOD TO MOUNT ROBOT





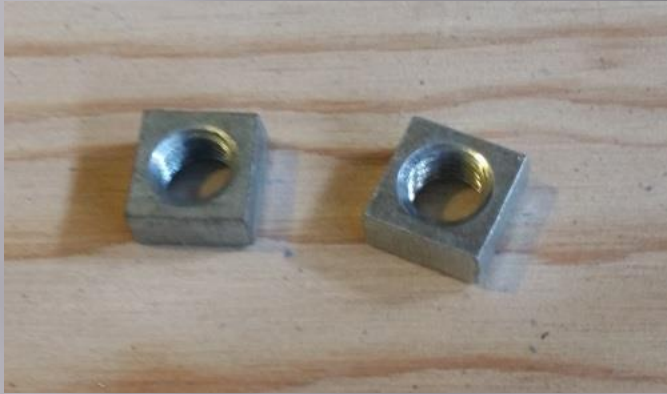
$\frac{1}{2}$ " SHAFT COLLAR, YOU NEED 2 OF THESE, YOU COULD ORDER THEM ON AMAZON - I JUST HAPPENED TO FIND THEM AT THE HARDWARE STORE



$\frac{1}{4}$ " DOWELS - YOU NEED 4 OF THESE -  $\frac{1}{2}$ " LONG



Length of  $\frac{5}{16}$ " fine thread rod just over 3.5" long



Qty 2 - 5/16" fine thread square nuts



1/2" bolt that you can cut the head off  
Of leaving 5" shaft as shown. (also need a  
Couple 1/2" nuts and washers)



1/4" bolt that you can cut the head off of  
Leaving 1/2" threads and 1/2" shaft



1/4-20" plywood T nut



ADDITIONALLY YOU WILL NEED  
A NUMBER OF METRIC MACHINE  
SCREWS, 2mm & 3mm. I was able to  
find what I needed at the hardware store  
but you can also get screw assortments  
on Amazon.

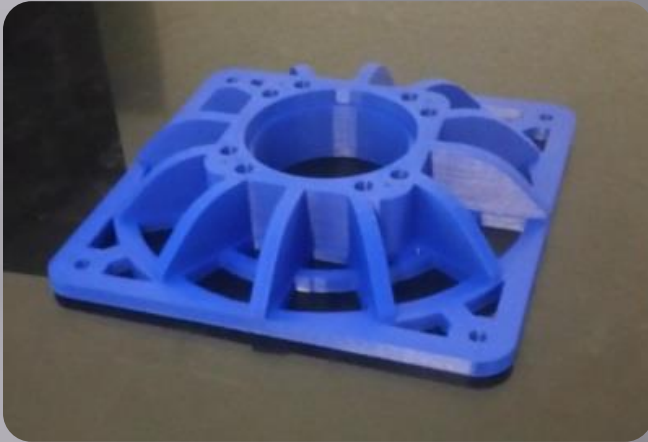
$\frac{1}{4}$ -20" bolt that you can cut  
The head off leaving total 1" long  
With .5" threads and .5" shaft.



2" long coil springs - I got these out  
Of a harbor freight spring assortment I had.

## Parts you need to print on your 3D printer

(I printed all these on a Davinci XYZ 1.0 - unless otherwise noted these were all printed at 50% solid, thick shells, 2mm layers, slow speed with no supports)



J1 Base



J1 Alignment Ring



J1 Turret



J1 Turret Cover

I didn't have good luck using supports for these larger thin wall holes  
So I built the model with cut outs you will need to grind out with a dremel

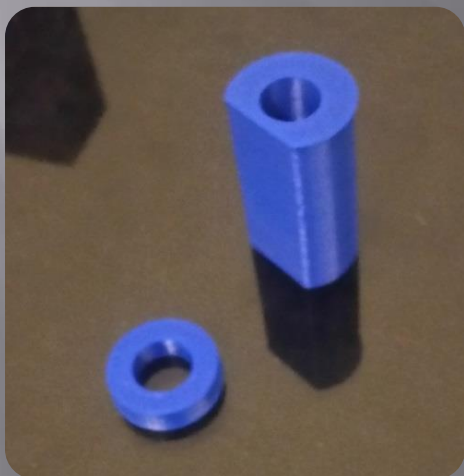




J2 Arm Left



J2 Arm Right



J2 Spacers



J2 Motor Support  
Used supports on this one



J2 Drive Rod Support Block

Used supports on this one

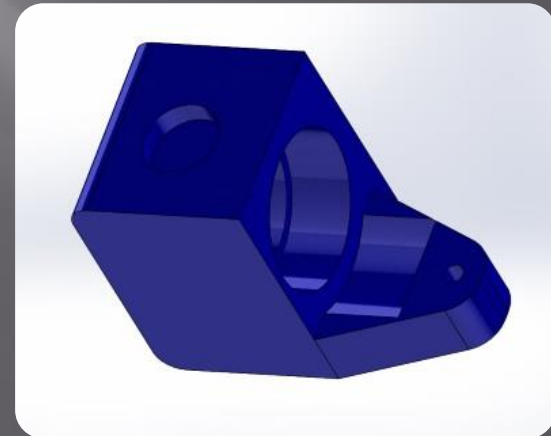


J2 Drive Block

Used supports on this one



J2 Arm Cover (x2)



J3 Turret

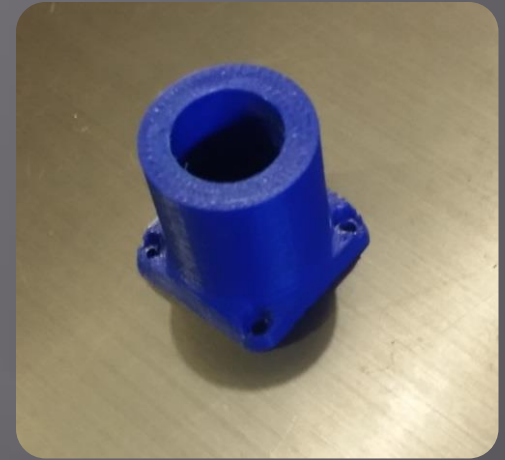
Used supports on this one



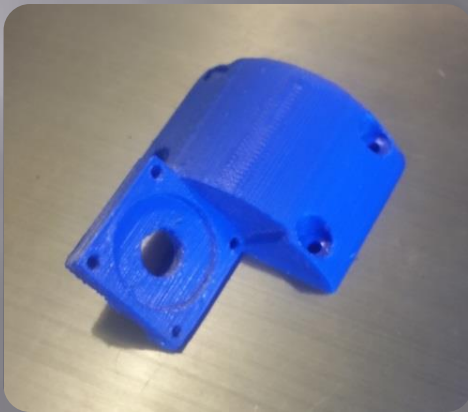
J3 Spindle



Collar 1 inch



J5 Motor Mount



J3 Turret Cap

Used supports on this one



J4 Boom – Left & Right (left not pictured)

Used supports on this one



J5 Clevis Center



J5 Clevis Left Arm & Right Arm



J5 Turret Left and Right Arms / J5 Turret Center



Gear J5 Ring Carrier / Gear J5 Ring Carrier Cap  
Gear J5 Worm Bushing

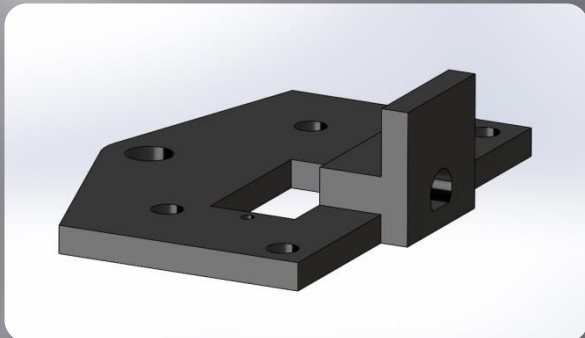




Timing Belt Coupler

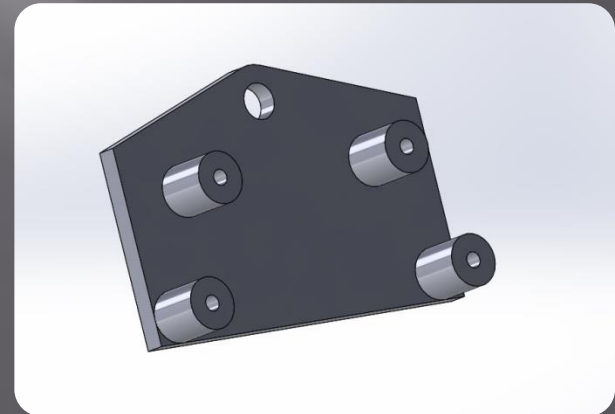


J4 Wire Holder (x2)

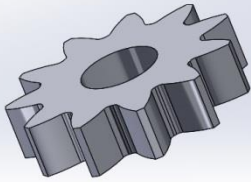


Gripper Motor Side Plate

Printed 90% solid on this one – wanted area where J6 motor  
Shaft inserts to be solid

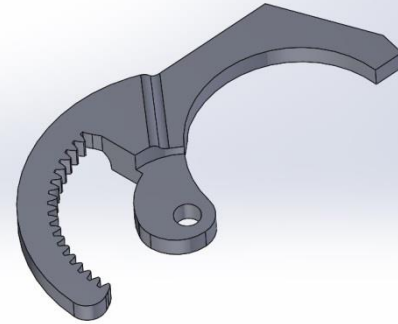


Gripper Cover Side Plate



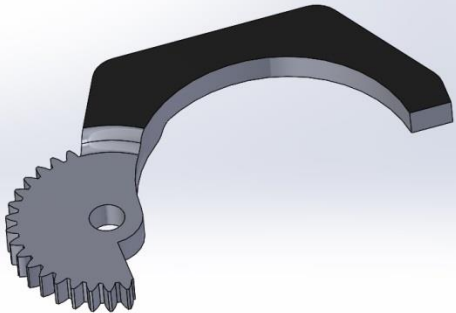
Gripper Center Spur Gear

Printed 90% solid on this one



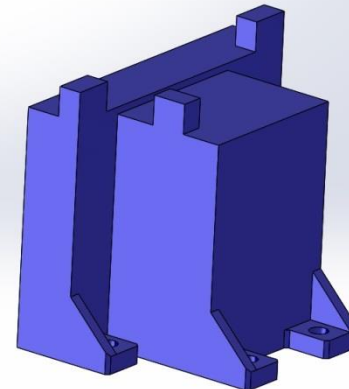
Gripper Right Jaw

Printed 90% solid on this one



Gripper Left Jaw

Printed 90% solid on this one



Home Cradle

Printed 30% solid on this one – this part doesn't need much strength  
And is too large to print with much mass



Relay Board Mount