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WCP SS Swerve (BLDC)- User Guide (Rev 1)



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What is the WCP SS Swerve (BLDC)?

This is the 2nd generation swerve drive sold by WCP. It was designed and modeled after Aren Hill's swerve and 1323's past module. The BLDC module is very compact at 5.5" x 5.5" wide and weighing ~ 5lbs with motors.

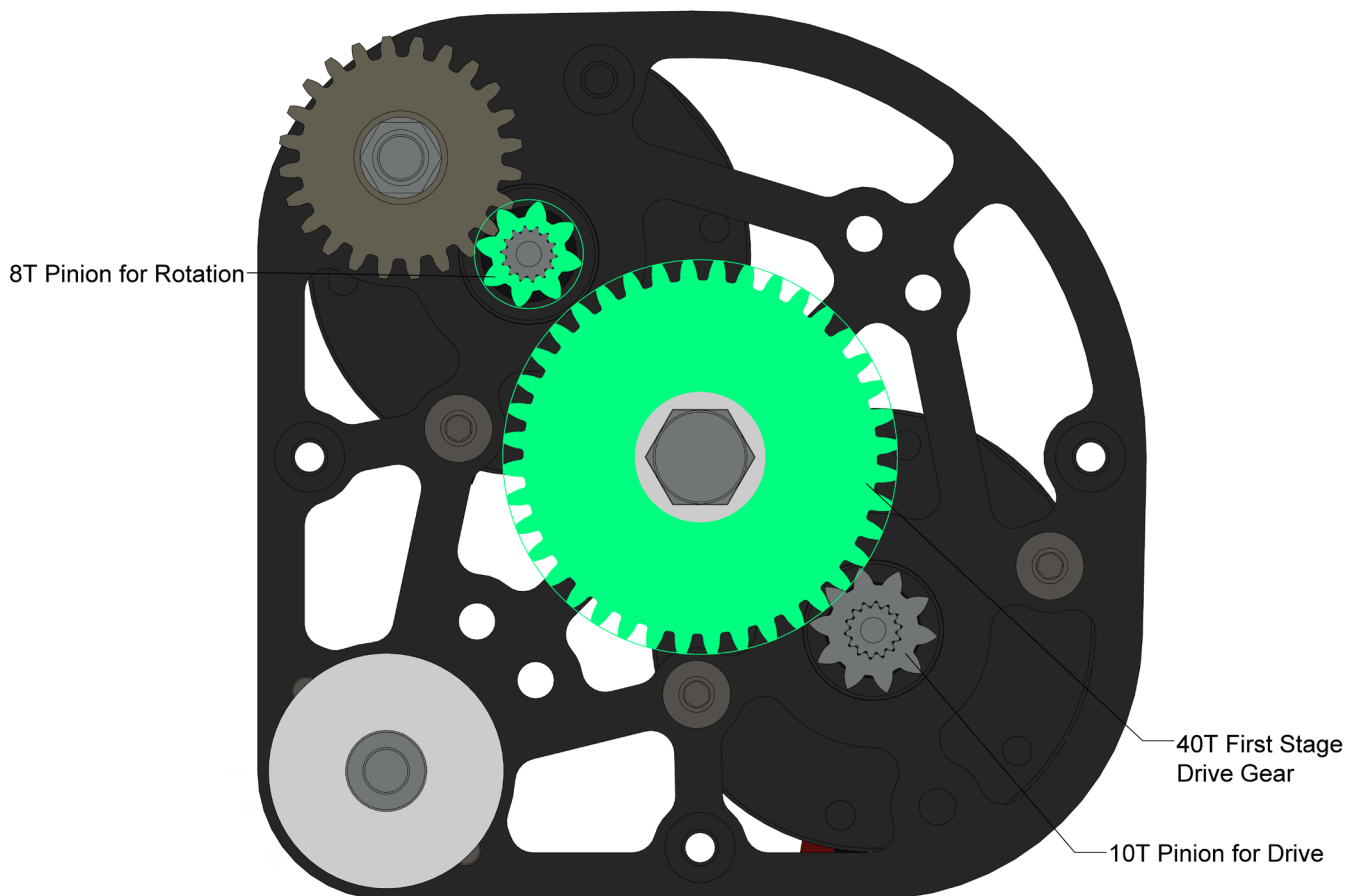
Some features:

- Aluminum wheel
- Hardened steel bevel gears
- Symmetrical Design (No need for a Left hand or Right hand module)
- Belt Azimuth Rotation for zero backlash position reading
- Natively supports Falcon 500
- Shafts with Integrated spacers
- Quick Assembly



Choosing Gear Ratios - Recommended

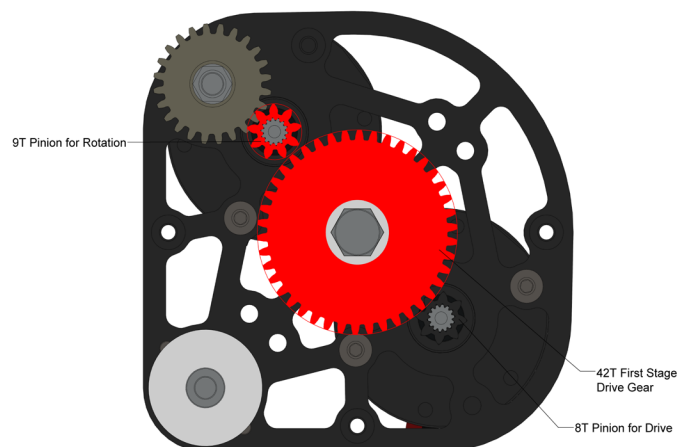
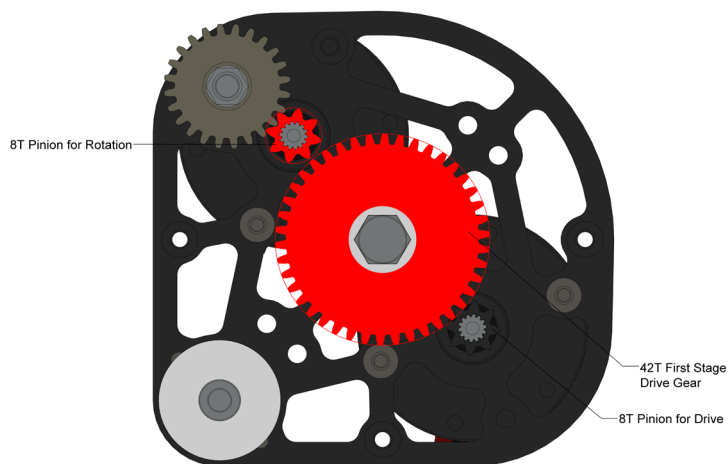
We recommend using the 8T on the rotation gearing and 10T or bigger on the wheel driven gear. Going to a 8T or 9T may cause a collision.







Choosing Gear Ratios - Possible Issues

Disclaimer: Certain drive gear ratios will get close or possibly collide with rotation pinion. This can be seen in the image below.





Recommended Tools

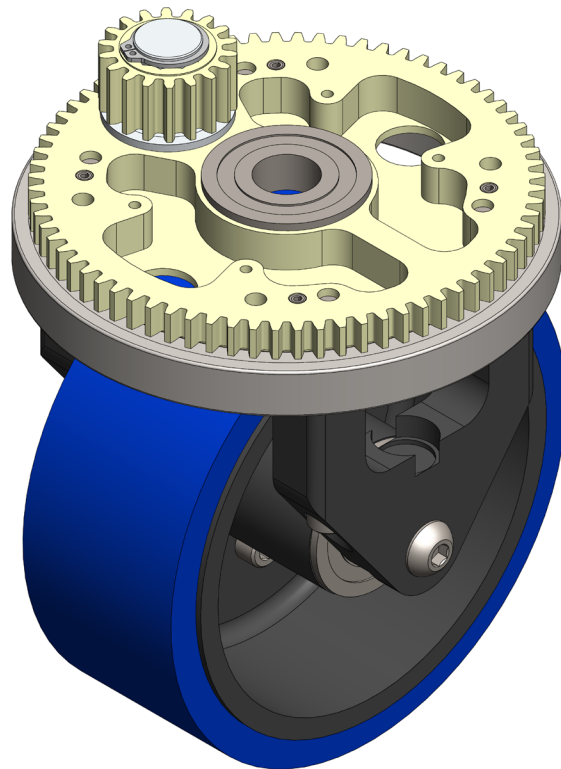
Picture	Name
	1/2" and 1/4"-3/8" Snapping Pliers
	Allen Set



Wheel Module Assembly Instructions

We recommend assembly of the wheel module first to make overall assembly easier.

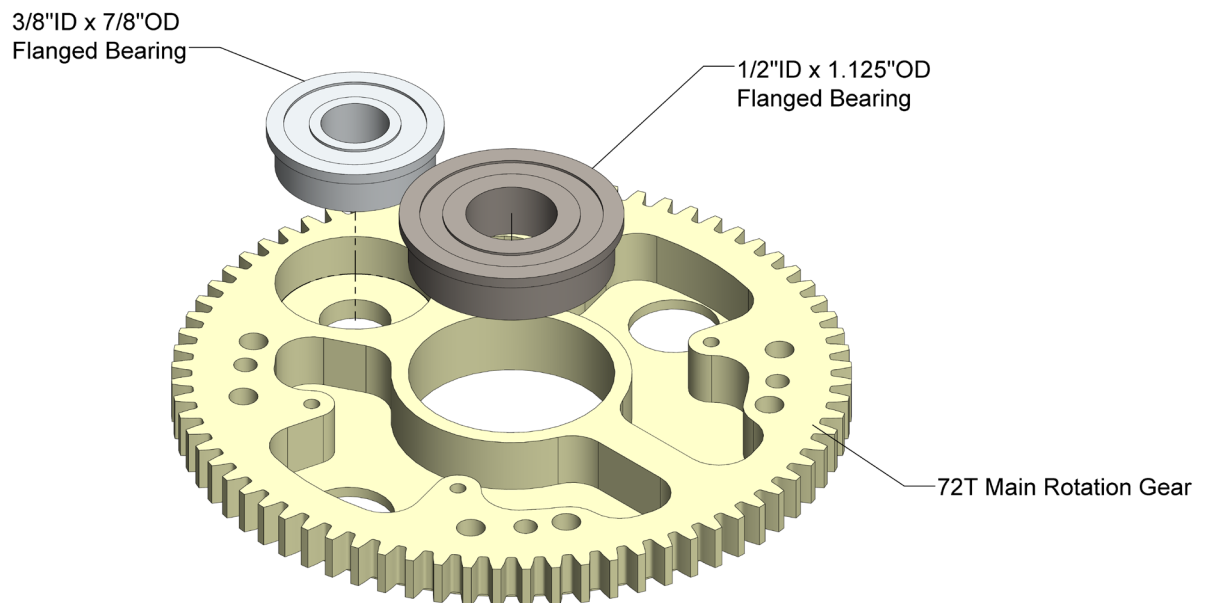
Note: Blue Loctite (McMaster P/N 1004A12) is recommended on all bolts that thread into a tapped hole.





Wheel Module - Step 1

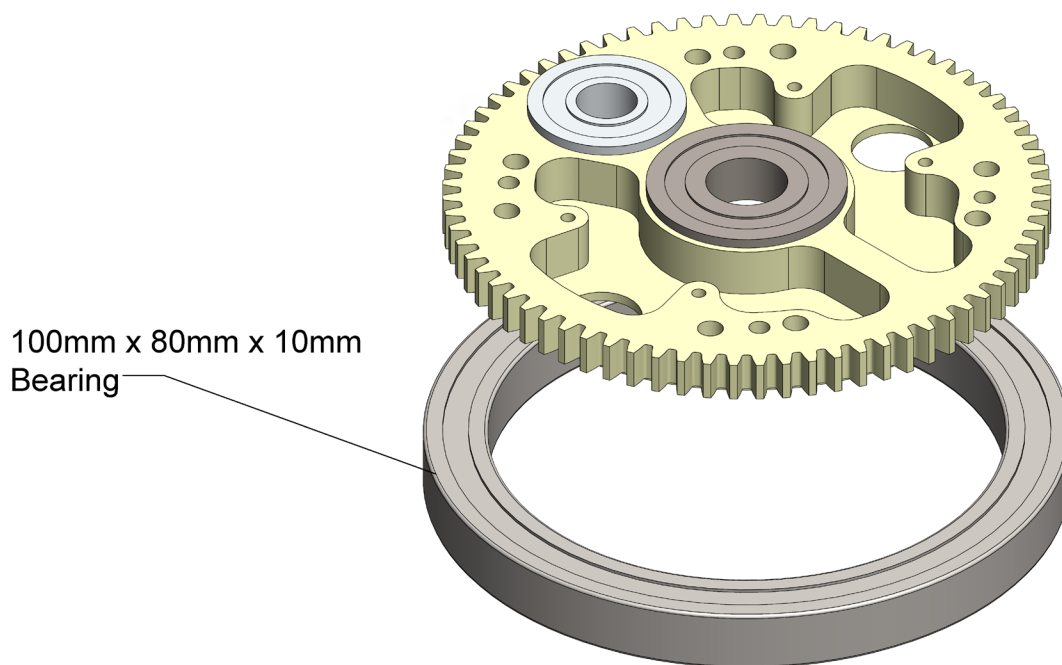
Bearings will come prepressed into the 72T rotation gear. If removal is required, the bearings should be a light press fit.





Wheel Module - Step 2

The 72T should be able to be pressed in by hand. If necessary use a deablow hammer to lightly tap it in.





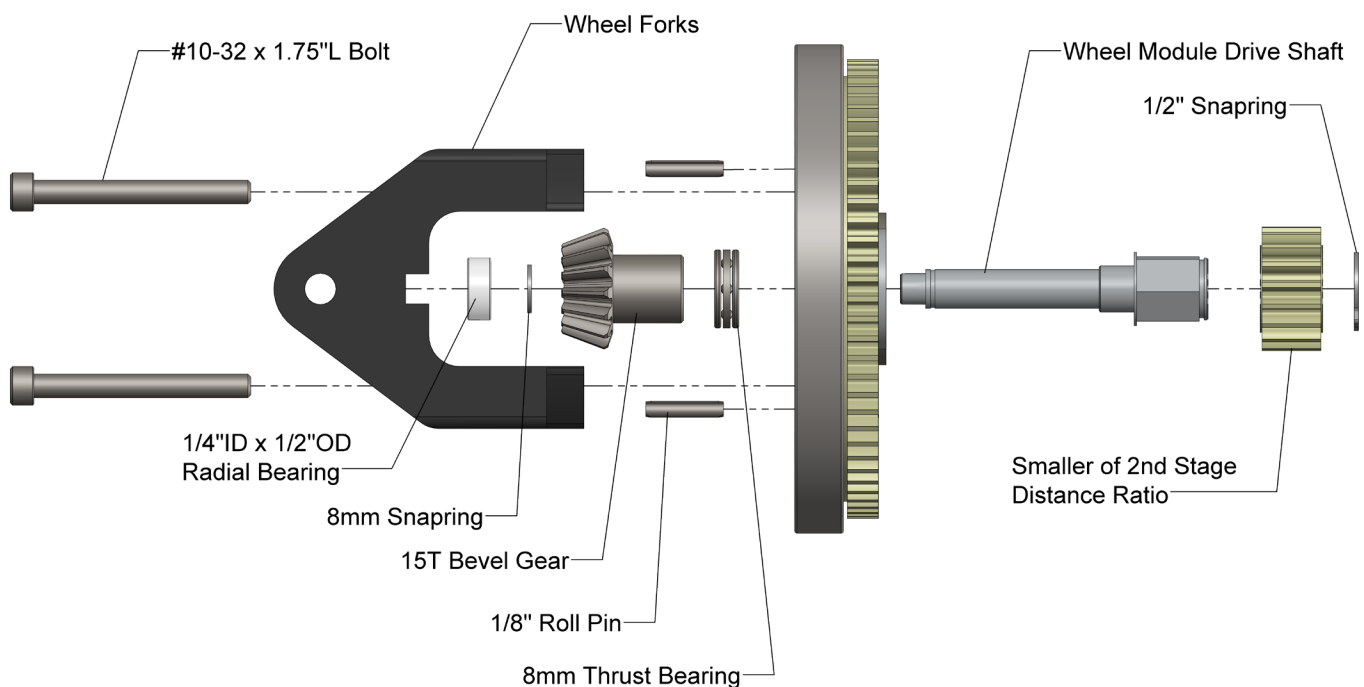
Wheel Module - Step 3

The drive shaft and all the components on the shaft should be inserted first. The wheel module drive shaft goes into the 3/8"ID bearing. The 1/4"ID x 1/2"OD bearing should be able to be pressed in by hand into the forks. Only the fork that that aligns with the drive shaft needs a bearing.

Note: Roll pins are optional and not included in the kit.

The roll pins should be tapped into the forks using a hammer. We recommend holding the fork in a bench vise to do this. The roll pins will be tight fit into the 72T gear. This is intended and you can use the #10-32 bolts to pull everything together. If a slip fit is preferred for the roll pins, the holes in the 72T gear may be drilled out for a slip fit. This is acceptable as well.

Note: Do not forget to insert key before putting the 8mm snapping on.



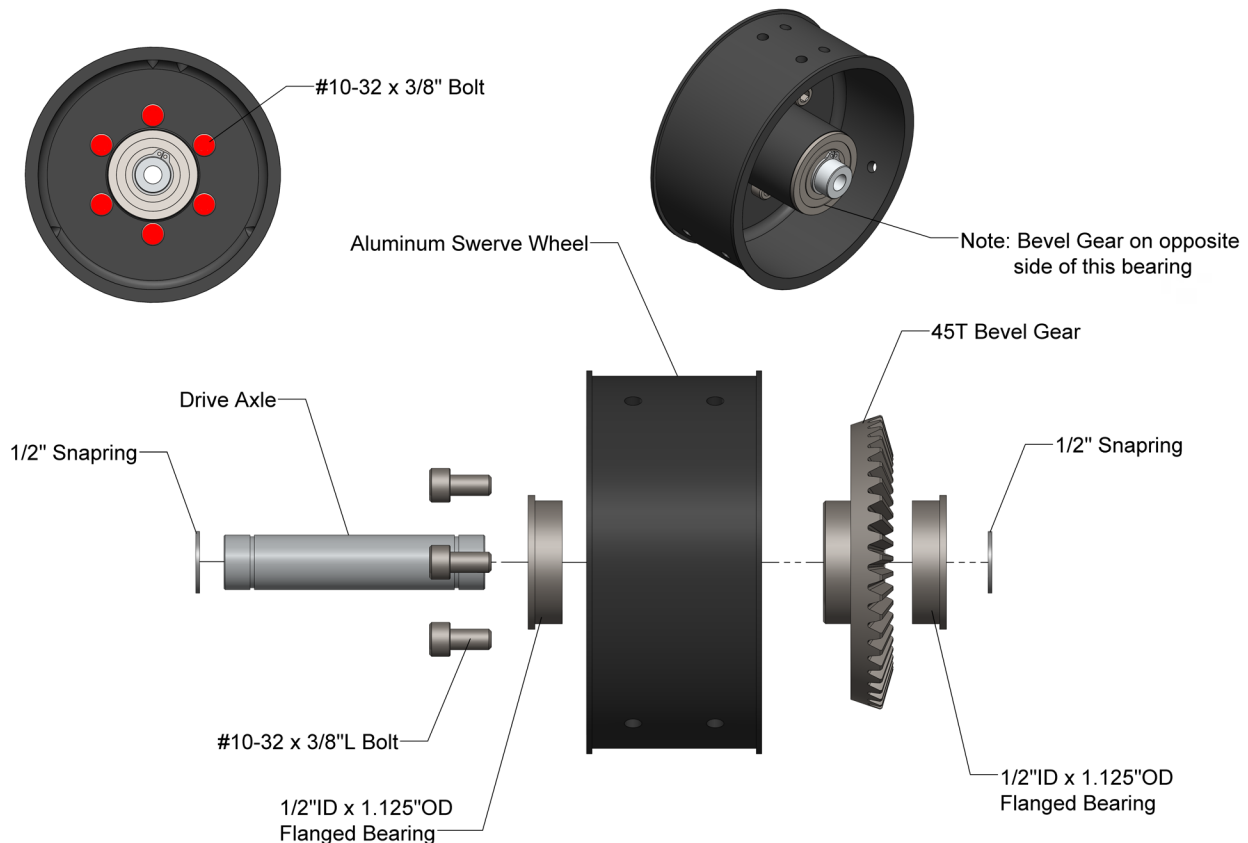


Wheel Module - Step 4

Insert the 45T bevel gear by either tapping it in with a deadblow or using an arbor press. The #10-32 bolts can be used to pull the bevel gear flat.

Warning: Be sure to align the bolt holes in the gear and wheel before pressing in.

The drive axle is symmetric. The orientation it is assembled in does not matter.

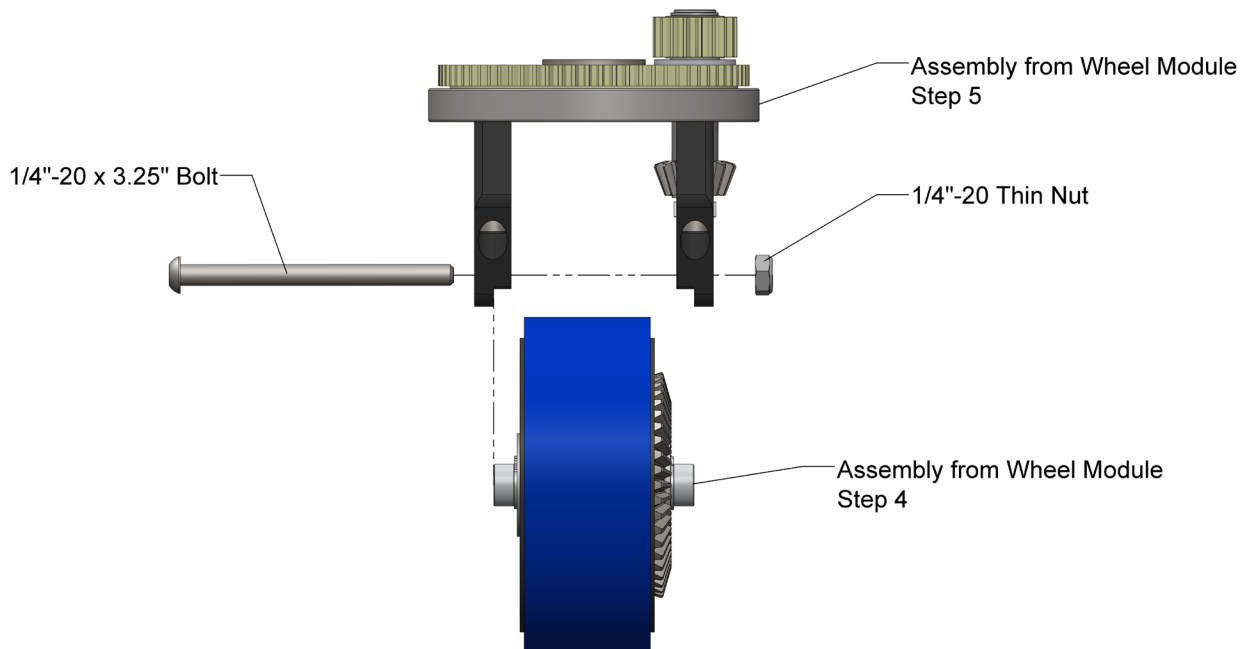




Wheel Module - Step 5

This step can be done now or after final assembly of the complete module.

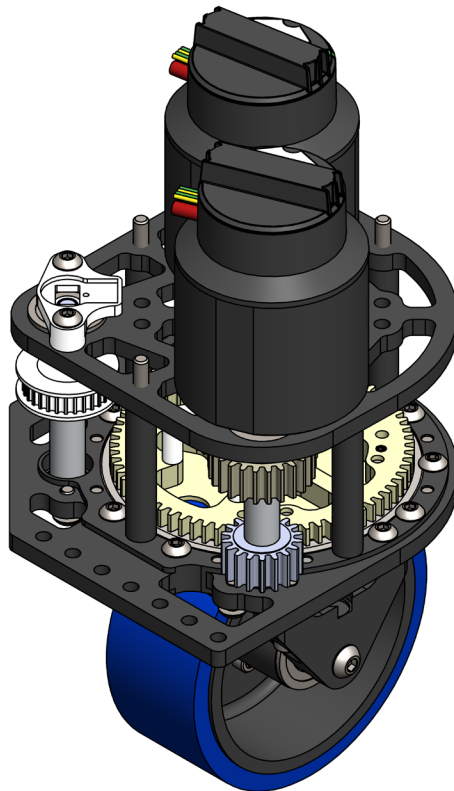
Note: It is easier to put the tread on the wheel before installing in the module.





WCP SS Swerve (BLDC) Assembly Instructions

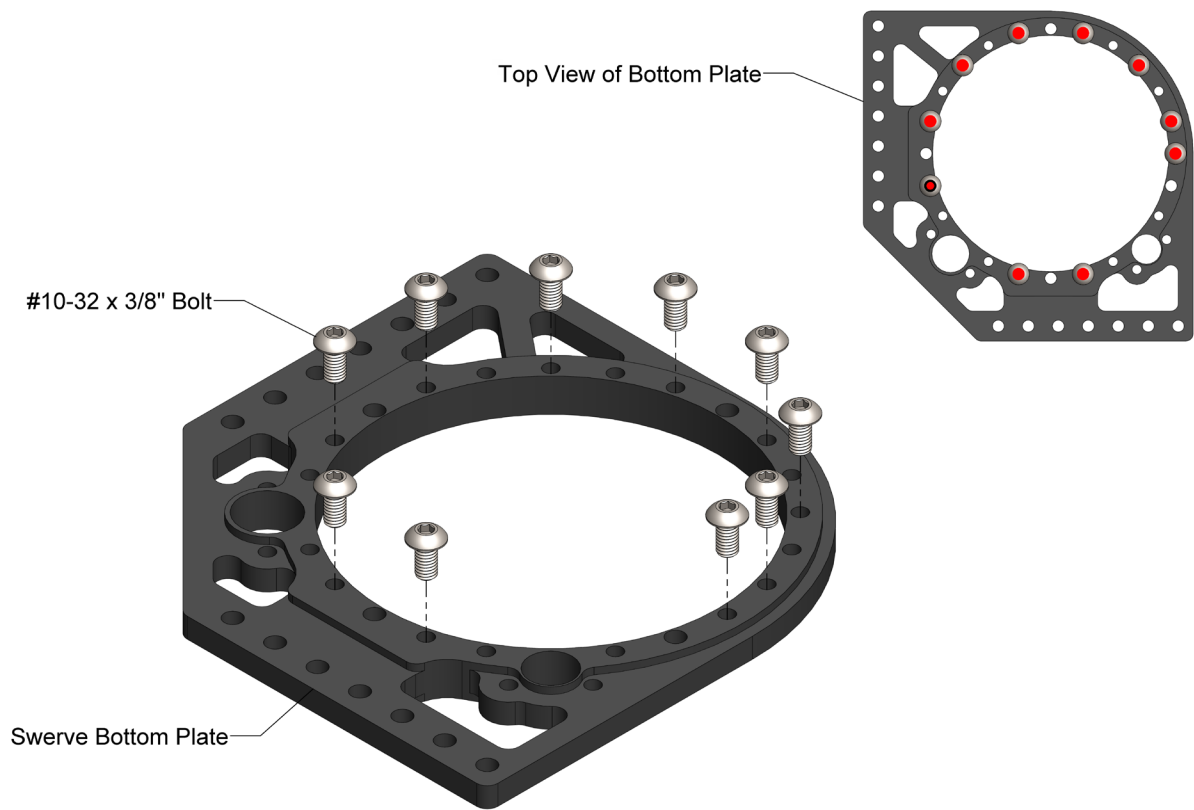
Note: Blue Loctite (McMaster P/N 1004A12) is recommended on all bolts that thread into a tapped hole.





Step 1

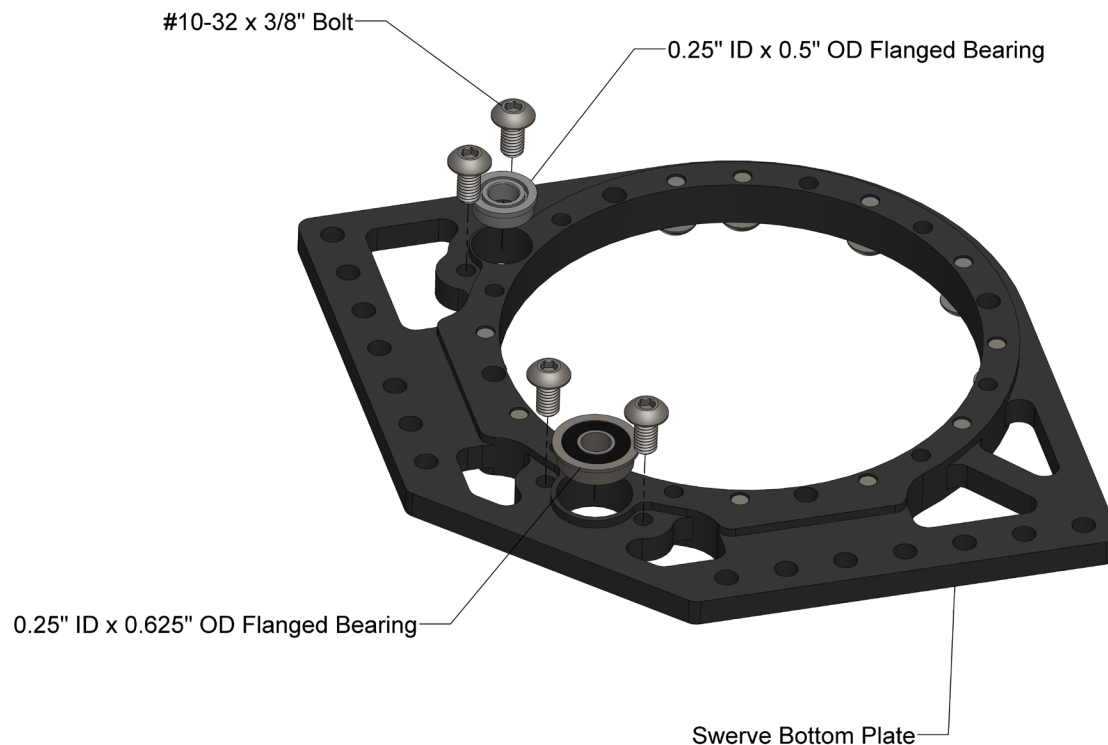
Insert the 10 #10-32 x 3/8" L bolts into the hole location, marked in red, from the top of the plate. The bolts should thread all the way in.





Step 2

The bearings are installed from the bottom side of the plate, opposite the bolt heads in the previous step. The bearings should be a slip fit and are retained by the bolts.

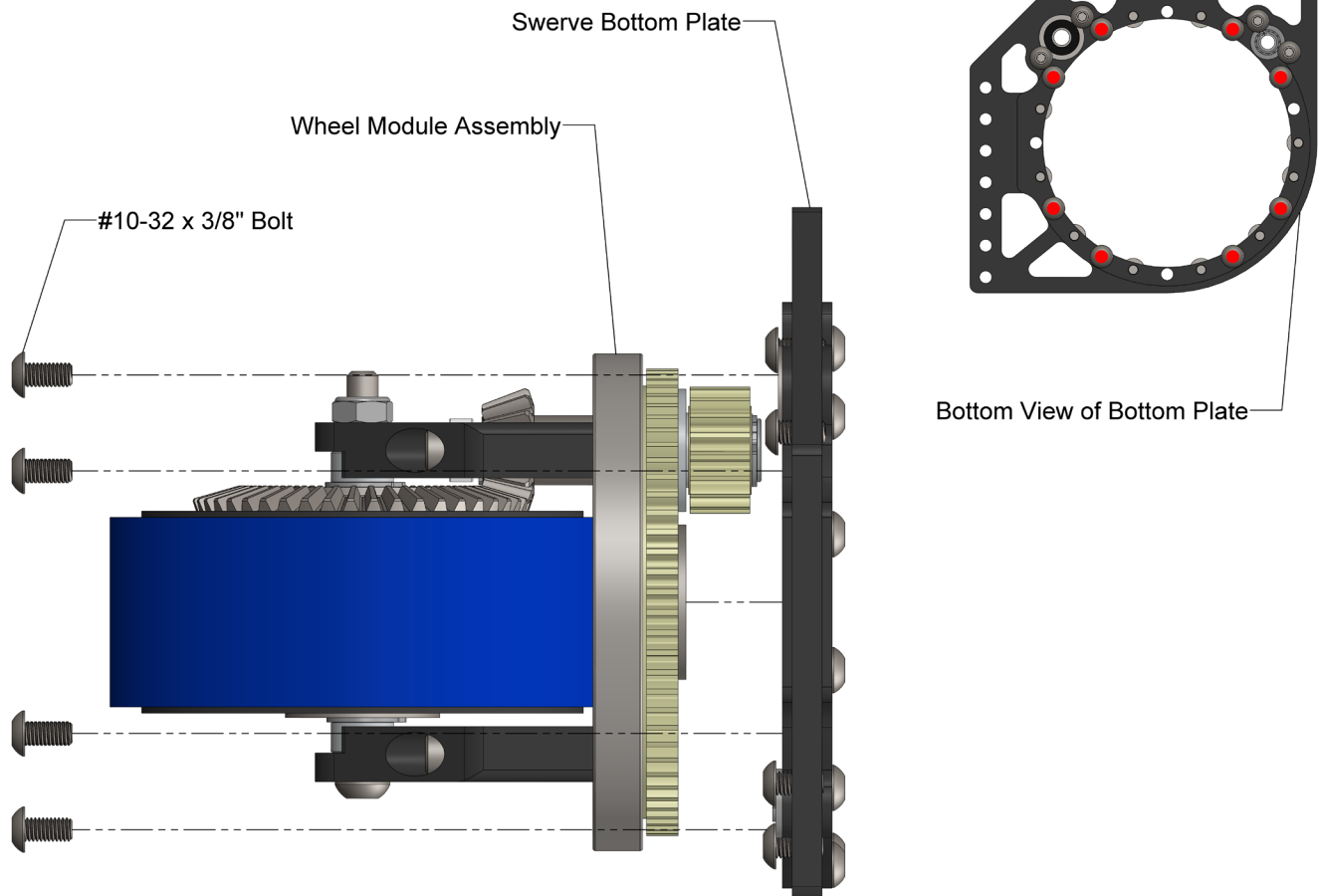




Step 3

This step requires the previously assembled wheel module. The module is installed from the bottom of the plate. The wheel module should be a tight slip fit and may require a bit of rocking from side to side to get fully seated. The bearing should sit flush with the plate.

Once the module is fully in, use the 8 #10-32 x 3/8" L bolts to capture the bearing. If the bearing was not fully seated, these bolts should push the bearing fully in.

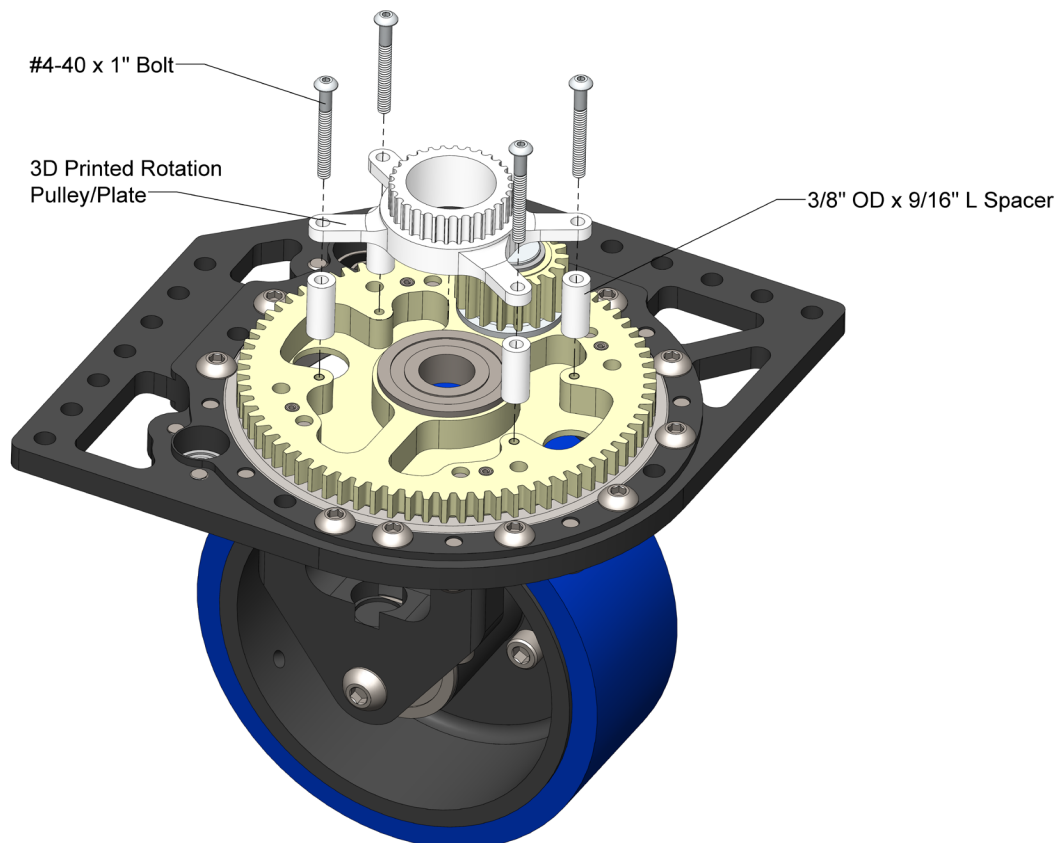




Step 4

Use 4 #4-40 x 1" L bolts to attach the 3D printed parts.

Warning: DO NOT over tighten the bolts. You may crush the 3D printed parts.



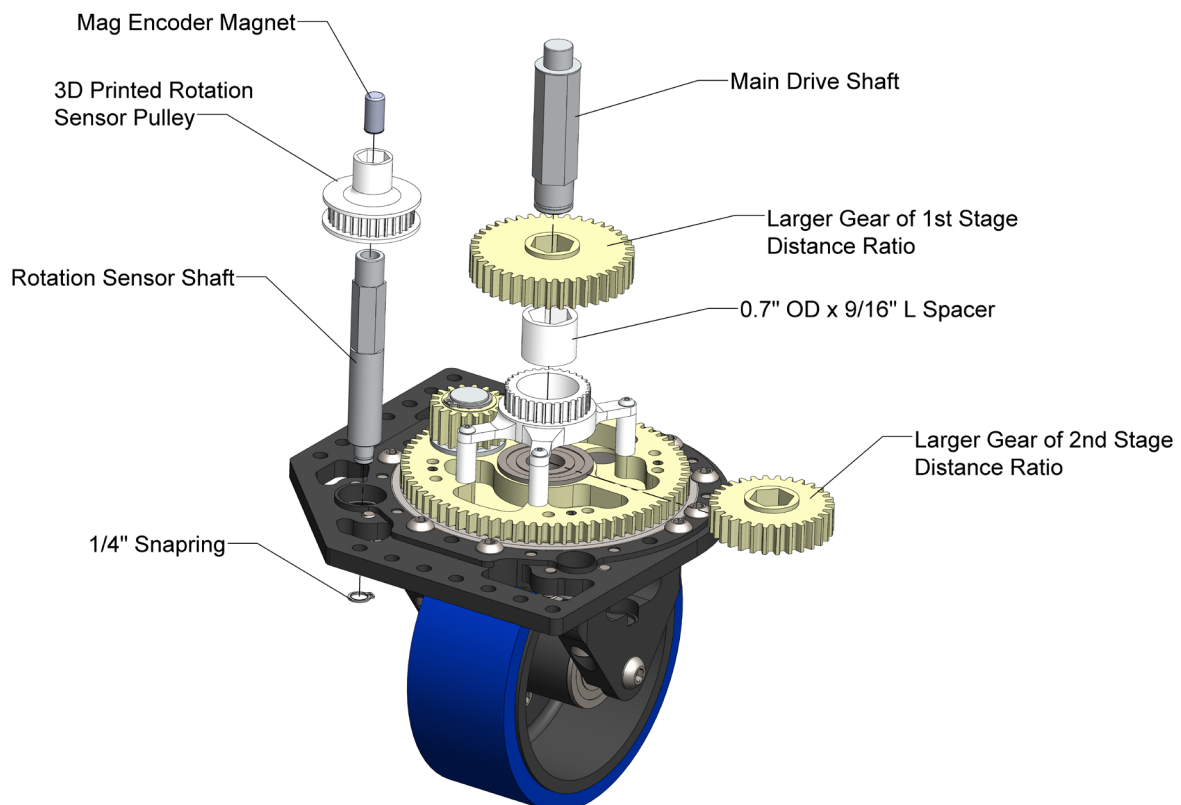


Step 5

The Mag Encoder magnet will come prepressed into the rotation sensor shaft.

Slide all gears and shafts into position. There is an option 1/2" snapping that can be installed onto the main drive shaft once it is in place. This will help hold the shaft in place during installation but is not critical to the overall function.

Note: During this step the 70T belt that was provided needs to be installed. This can be done by rolling the belt onto either of the two pulleys.

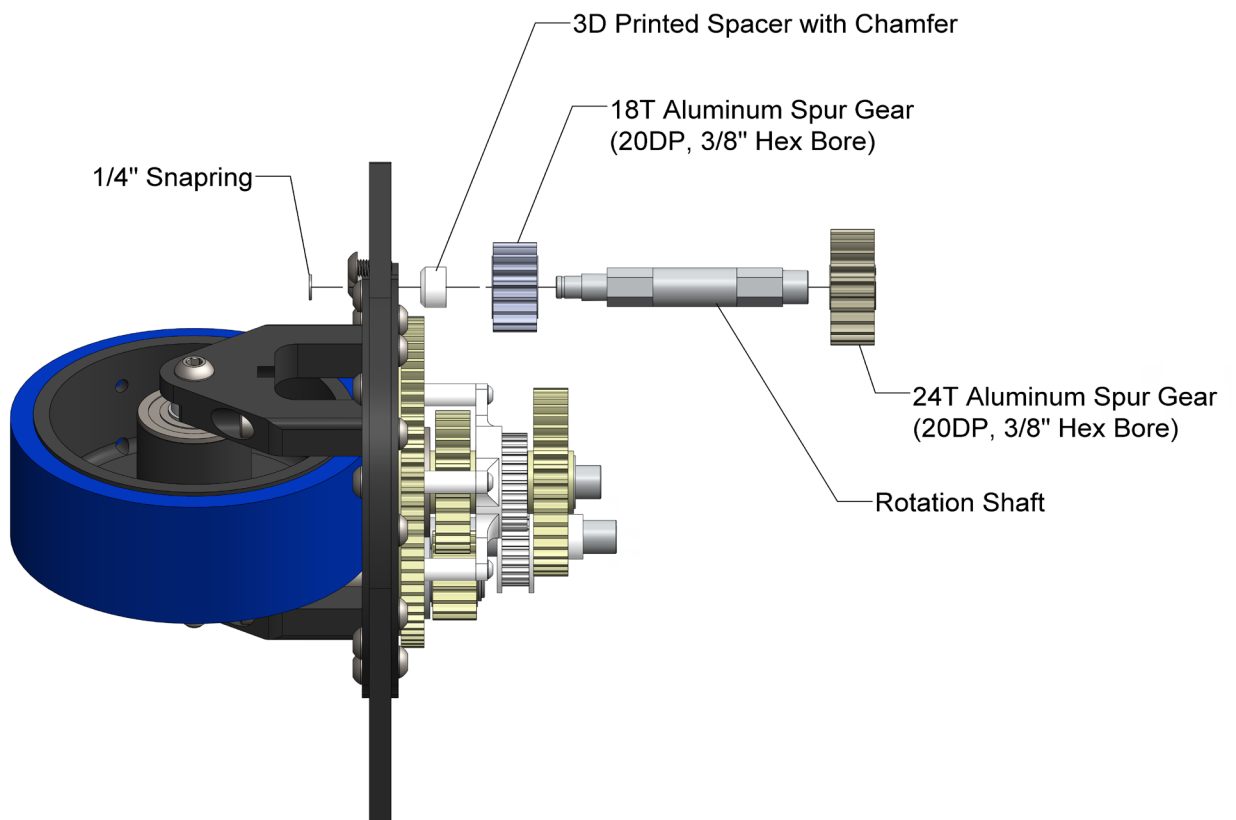




Step 6

Slide the gears and spacer onto the shaft. Install the 1/4" snapping once the shaft is in place.

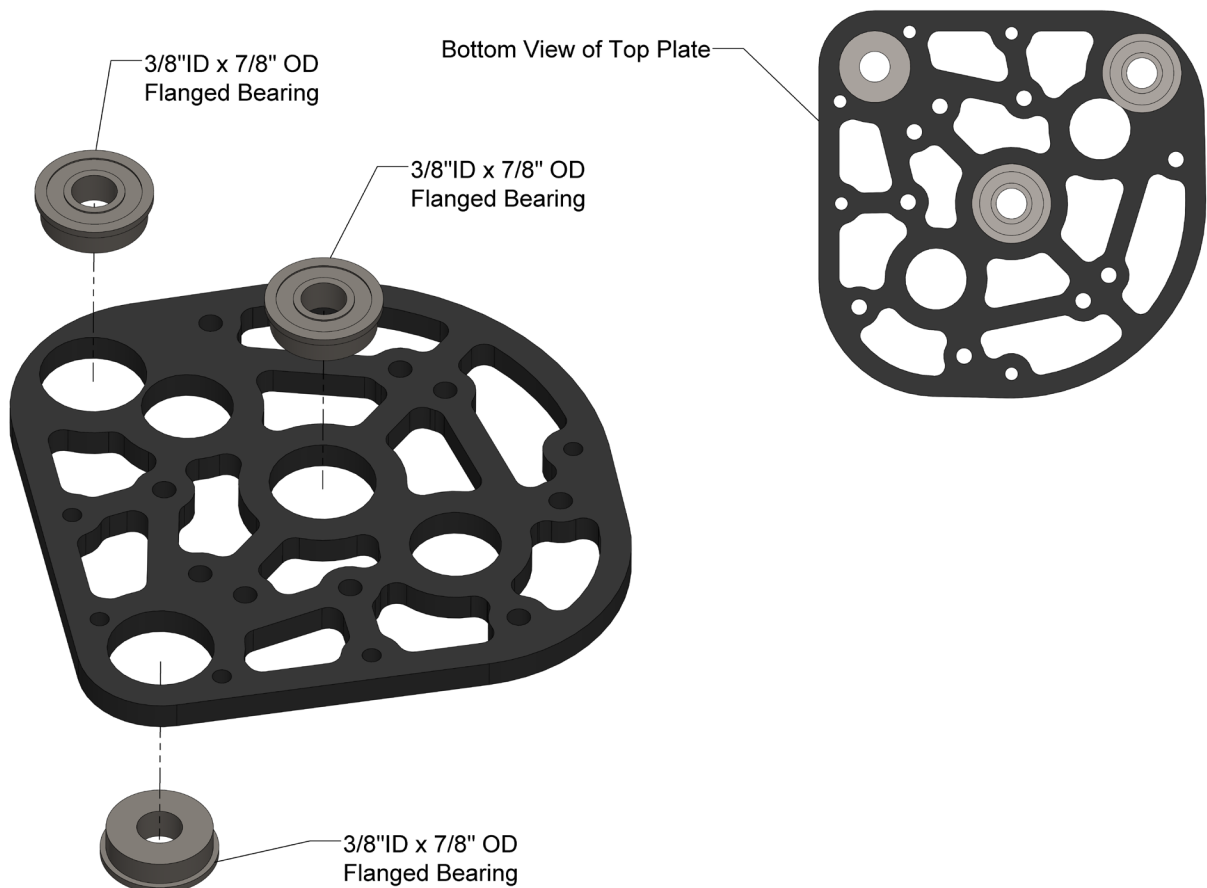
Note: The chamfer on the spacer needs to face the bearing or it will rub.





Step 7

These bearing will be a light press fit and may be pressed in by hand or with an arbor press. The image below shows the side the bearings need to be pressed in from. It is critical that the flanges are on the correct side so that the Falcons or other motors will sit flat.



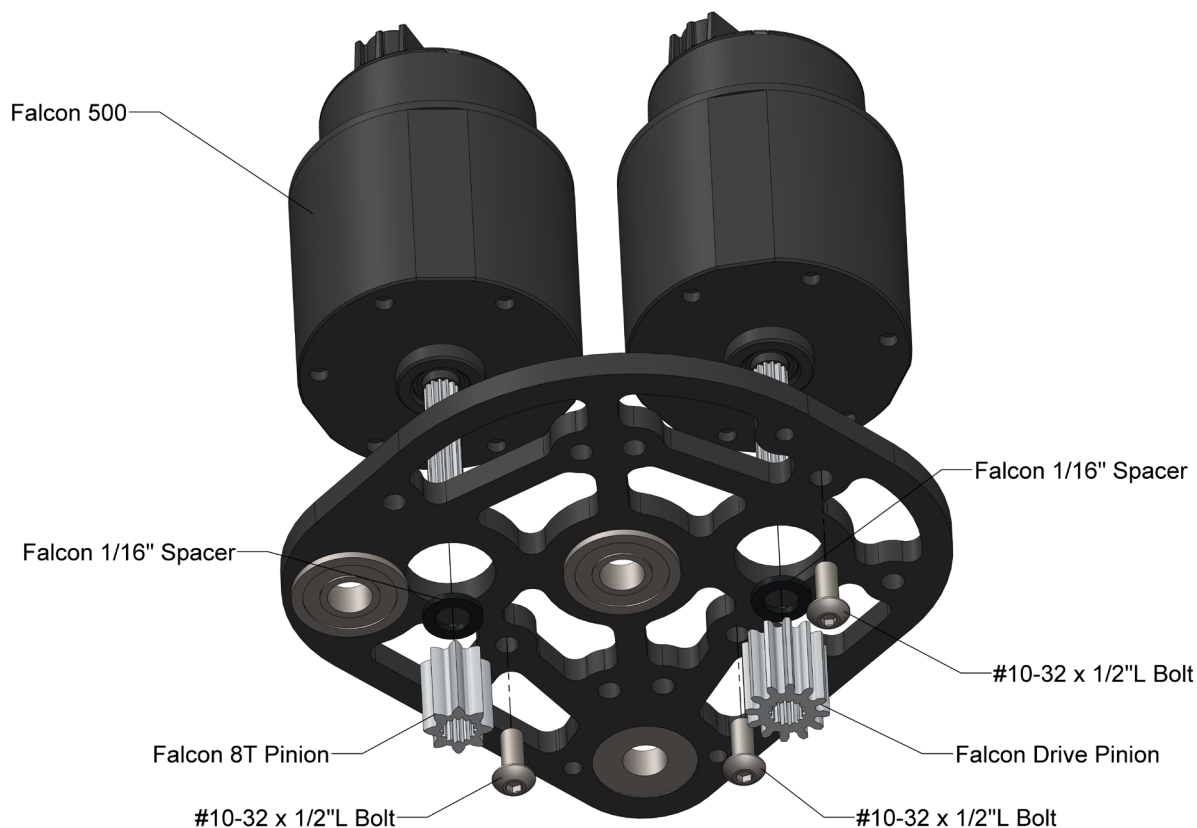


Step 8

The shafts of the Falcons or other motors will need to be shortened for clearance. We recommend installing the motors and then making them to the desired length. To retain the pinions, we recommend that you use a

If you do not want to cut the shafts, we recommend using the Motor Space from Swerve Drive Specialists and install that with the motors.

Note: Only three bolts are required in this step. The fourth bolt to hold the motors on is installed in the next step.

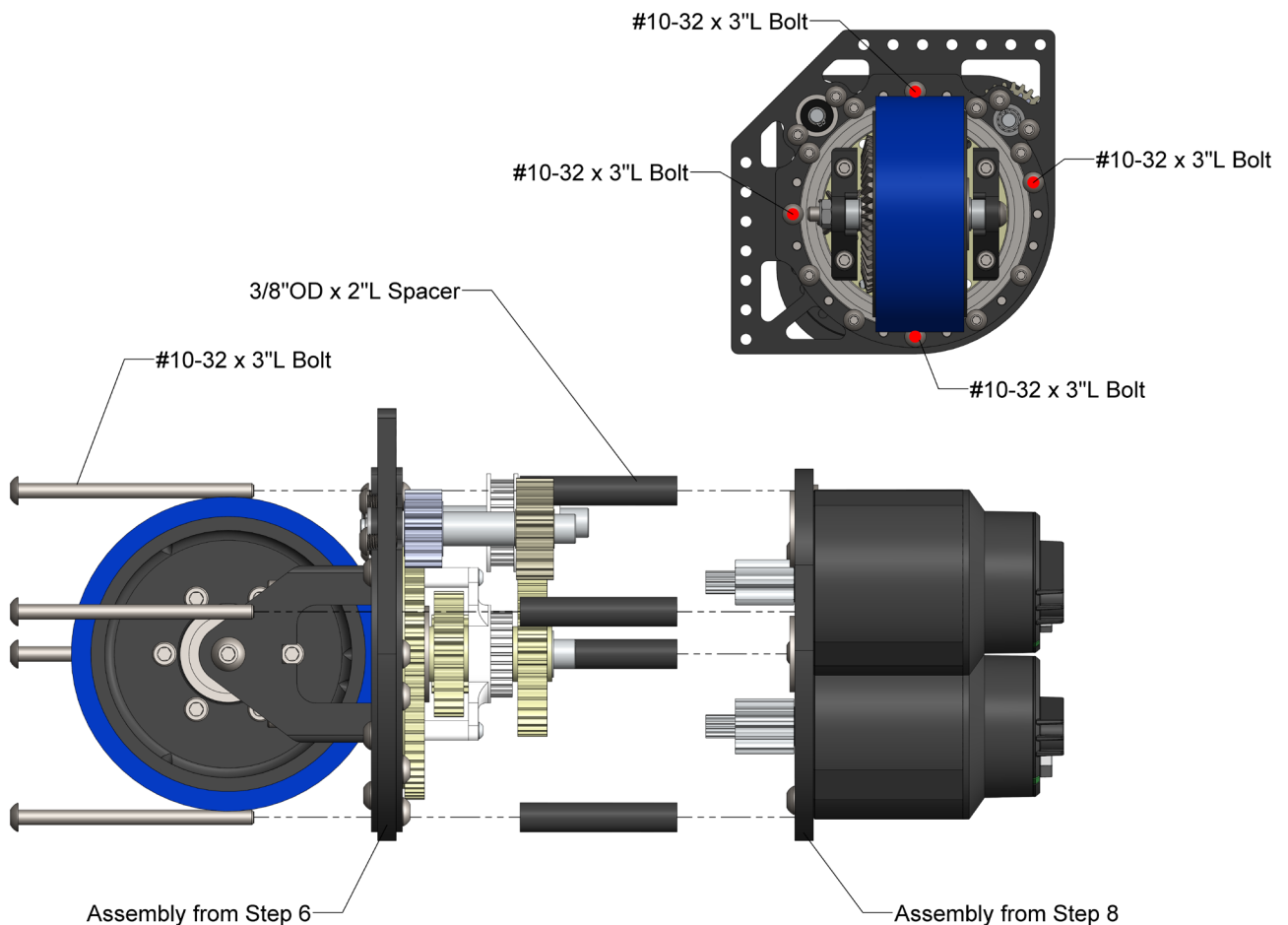




Step 9

Use the 4 #10-32 x 3"L bolts and the 4 2"L spacers to attach the two halves of the gear-box. The bolt locations can be seen highlighted in red. These holes should be clearance holes for a #10-32 bolt.

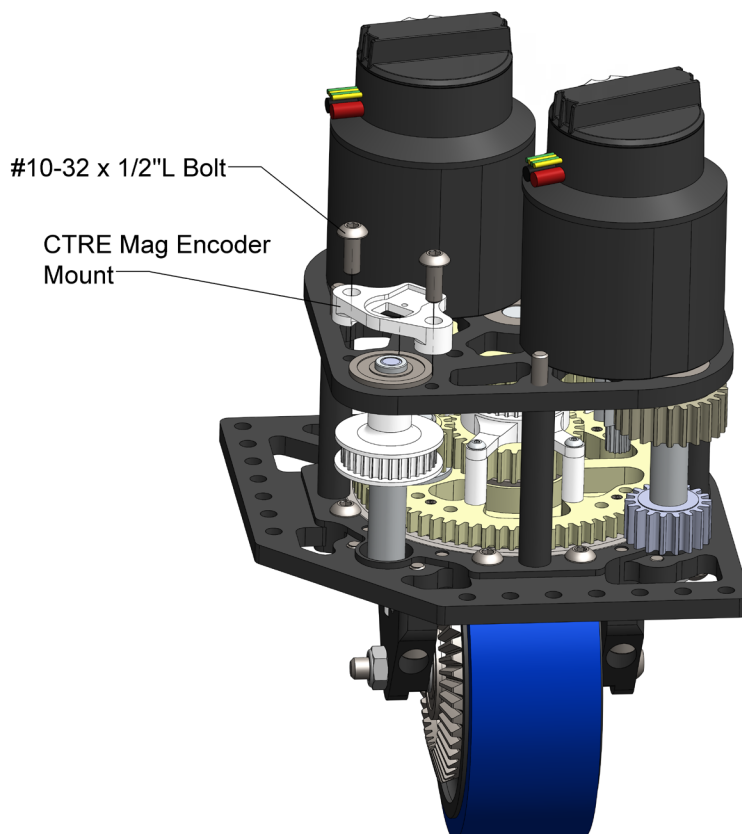
Note: The one bolt that goes through all the plates and threads into the motor may need a washer if it hits the internals of the motor.





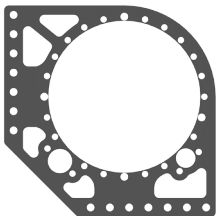
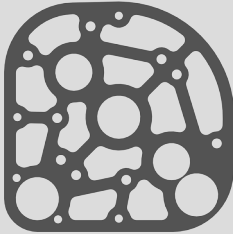

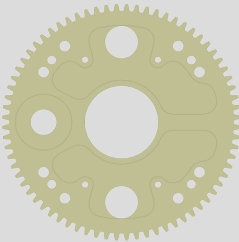

Step 10

Install the 3D printed mount using the 2 #10-32 x 1/2" L bolts. To install the Mag Encoder, remove the board from the case and fit it into the cutout on the 3D printed mount. Use the mounting bolts from the Mag Encoder to attach the sensor. The CANcoder is an acceptable replacement if that is preferred.



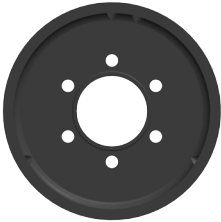
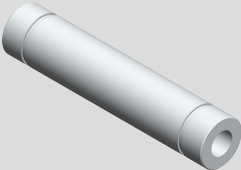
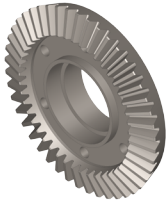
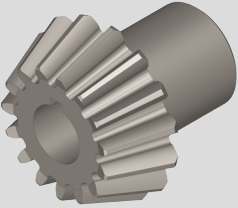
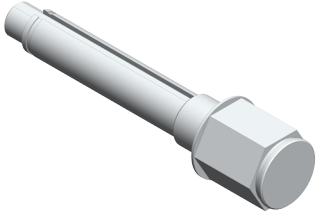


Kit Contents

Picture	Name	QTY	Kit
	Swerve Bottom Plate	1	Base Kit
	Swerve Top Plate	1	Base Kit
	100mm x 80mm x 10mm Bearing	1	Base Kit
	72T Custom Roation Gear	1	Base Kit
	Wheel Forks	2	Base Kit

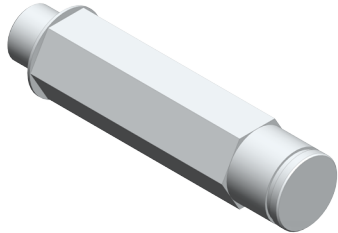
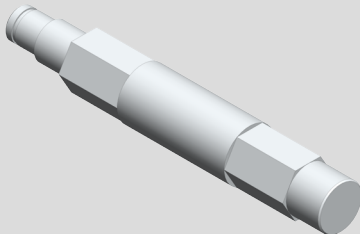
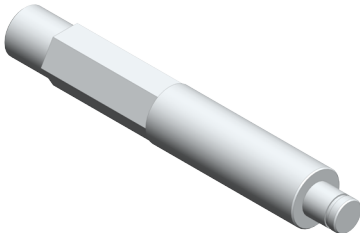

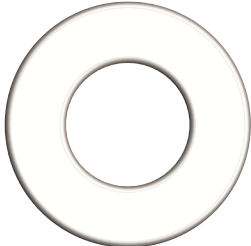
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Picture	Name	QTY	Kit
	Wheel	1	Base Kit
	Wheel Axle	1	Base Kit
	45T Bevel Gear	1	Base Kit
	15T Bevel Gear	1	Base Kit
	Wheel Module Drive Shaft	1	Base Kit

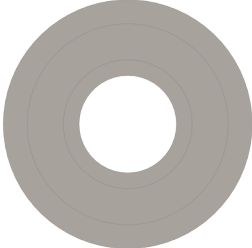


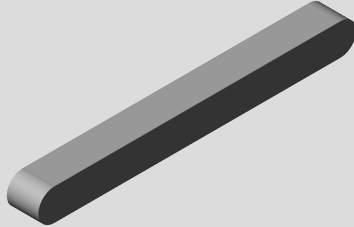
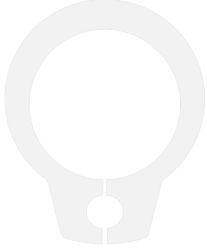
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Picture	Name	QTY	Kit
	Main Drive Shaft	1	Base Kit
	Rotation Shaft	1	Base Kit
	Rotation Sensor Shaft	1	Base Kit
	1/4"ID x 1/2"OD Radial Bearing	1	Base Kit
	8mm Thrust Bearing	1	Base Kit


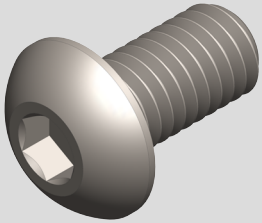
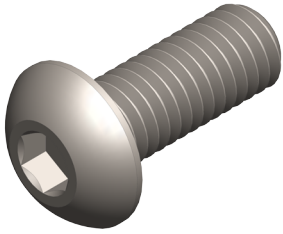
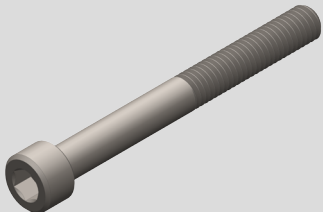
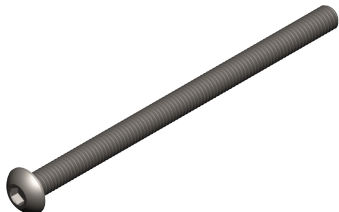
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Picture	Name	QTY	Kit
	3/8" ID x 7/8"OD Flanged Bearing	4	Base Kit
	1/2" ID x 1.125"OD Flanged Bearing	3	Base Kit
	70T GT2 3mm x 7mm Belt	1	Base Kit
	2mm Machine Key	1	Base Kit
	8mm Snapring	1	Base Kit

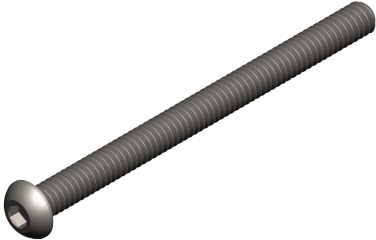
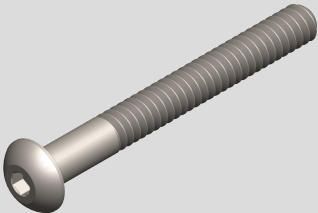
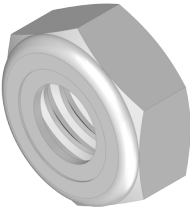
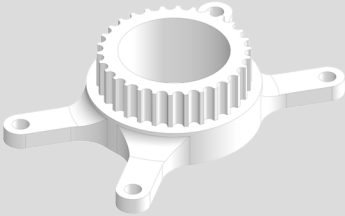
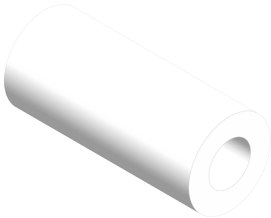
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Picture	Name	QTY	Kit
	1/2" Snapring	4	Base Kit
	#10-32 x 3/8"L Bolt	28	Base Kit
	#10-32 x 1/2"L Bolt	2	Base Kit
	#10-32 x 1.75"L Bolt	1	Base Kit
	#10-32 x 3"L Bolt	4	Base Kit

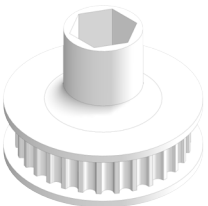
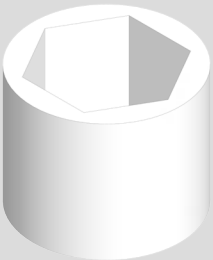
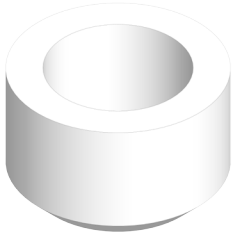
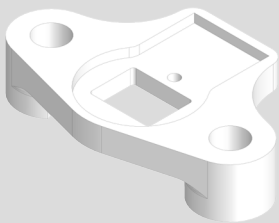

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Picture	Name	QTY	Kit
	1/4"-20 x 3.25"L Bolt	1	Base Kit
	#40-40 x 1"L Bolt	4	Base Kit
	1/4"-20 Thin Nut	1	Base Kit
	3D Printed Rotation Pulley/Plate	1	Base Kit
	3/8"OD x 9/16"L Spacer	4	Base Kit


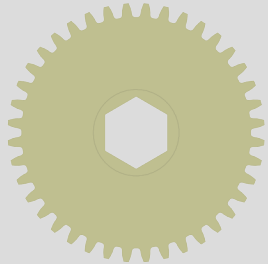
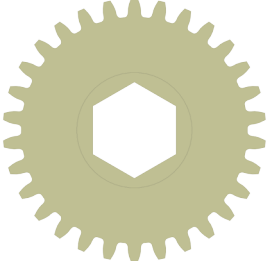
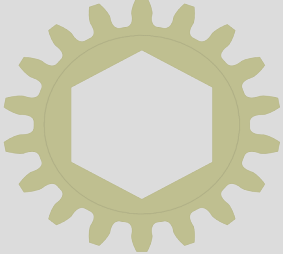

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Picture	Name	QTY	Kit
	3D Printed Rotation Sensor Pulley	1	Base Kit
	0.7"OD x 9/16"L Spacer	1	Base Kit
	3D Printed Spacer with Chamfer	1	Base Kit
	CTRE Mag Encoder Mount	1	Base Kit
	Mag Encoder Magnet	1	Base Kit



Recommended Parts to Buy

Picture	Name	QTY
	Falcon Drive Pinion	1
	Larger Gear of 1st Stage Distance Ratio	1
	Larger Gear of 2nd Stage Distance Ratio	1
	Smaller Gear of 2nd Stage Distance Ratio	1
	Falcon 8T Pinion	1

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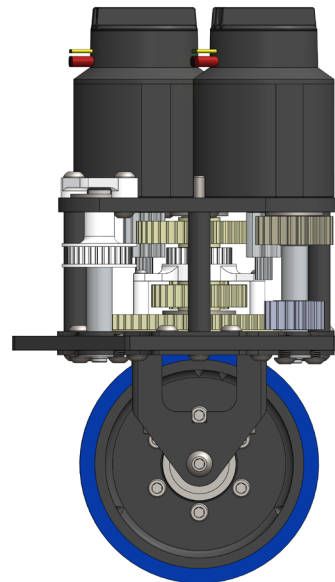
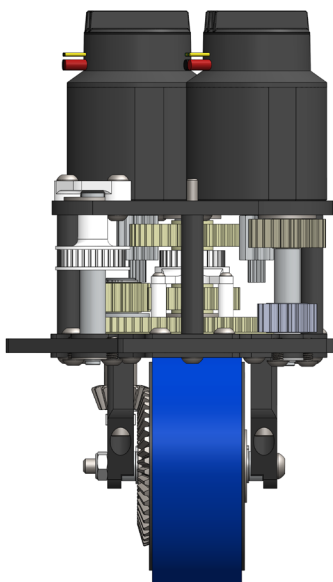
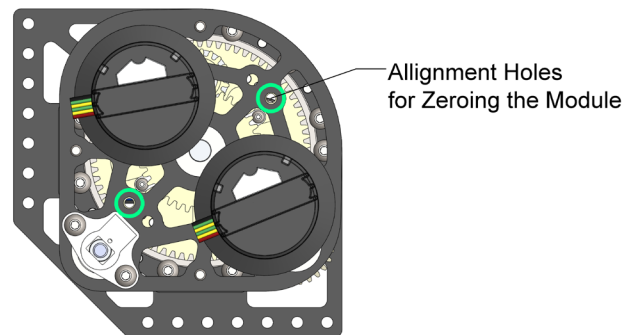
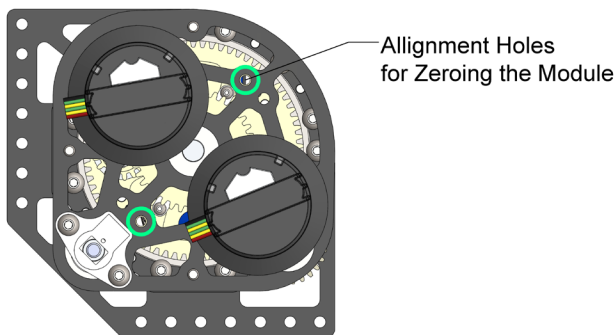
Picture	Name	QTY
	24T Aluminum Spur Gear (20DP, 3/8" Hex Bore)	1
	18T Aluminum Spur Gear (20DP, 3/8" Hex Bore)	1
	Falcon 500 Motor	2
	3/8"OD x 2"L Spacer	4
	1.5" Wide Roughtop Tread, 10ft Long (217-2888)	1



Zeroing the Module

Depending on the location that the module is mounted, one of two sets of tapped holes in the 72T rotation gear will align with a set of holes in the top plate. These sets of holes should align the wheel to the module so that a zero can be set in code.

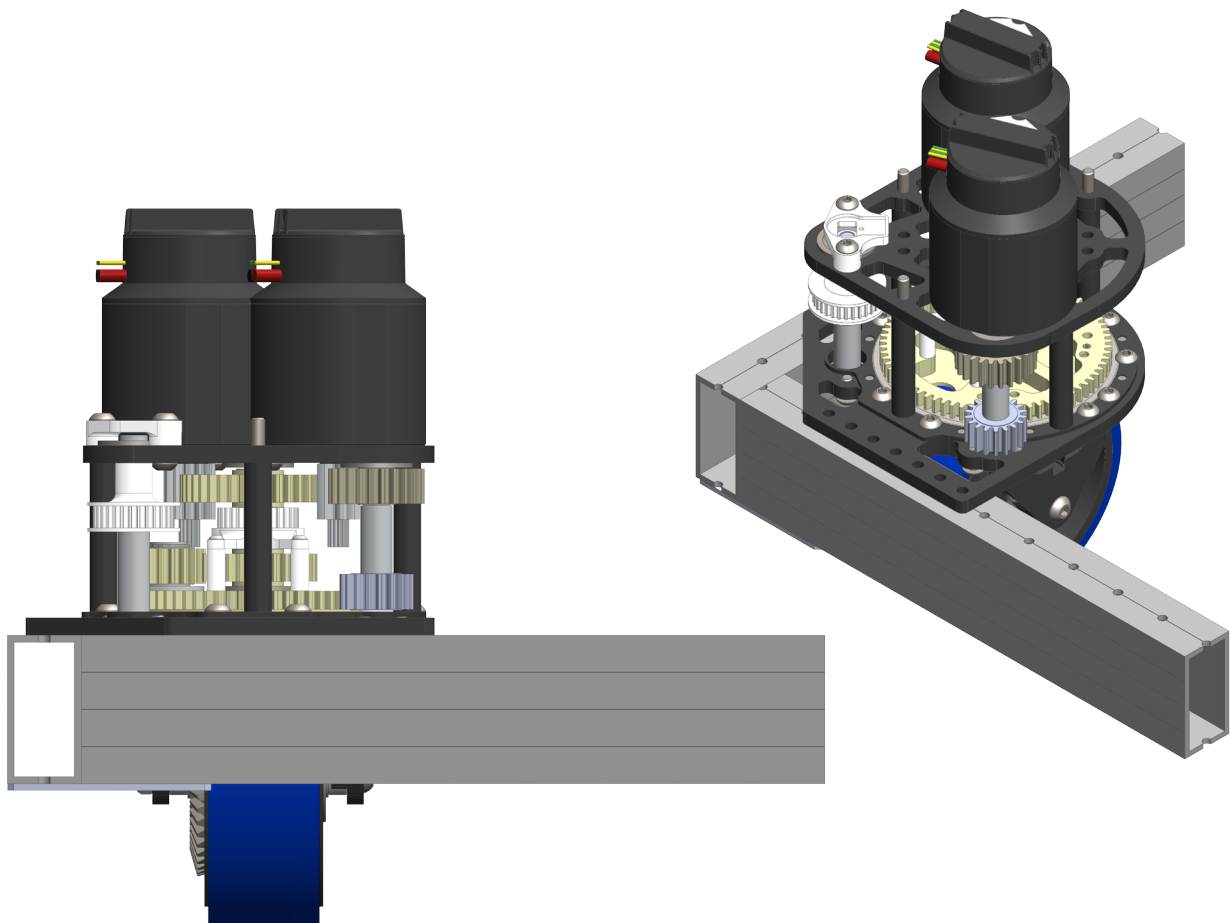
To align the wheel, determine the correct set of hole to use for the desired direction. Manually align the wheel and then use a #10-32 x 2.5" L bolt for the final alignment. Lightly tighten the bolt while gently turning the module to get the perfect alignment. Once the position is calibrated, remove the bolts.





Application Example - VersaTubing Low Ground Clearance

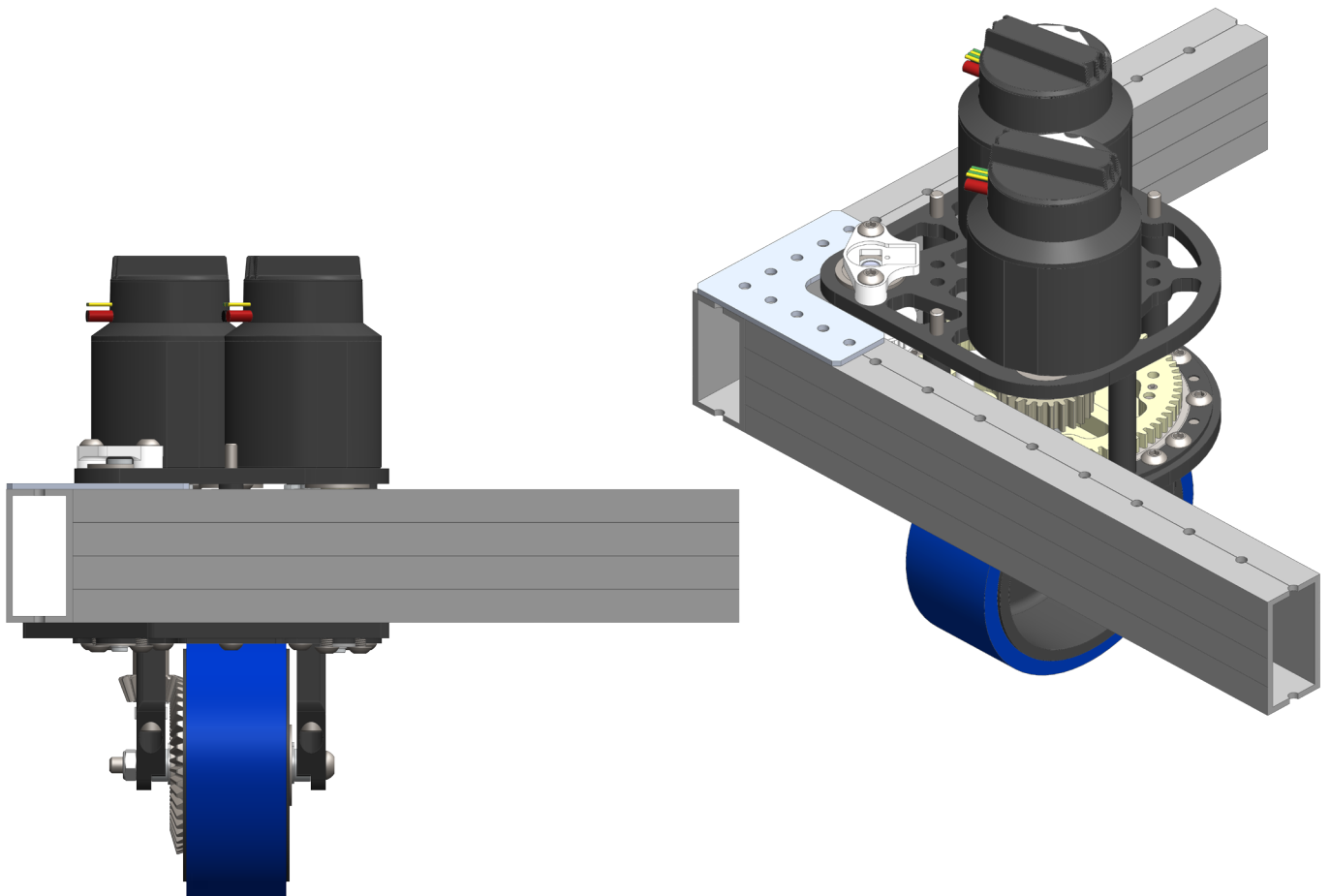
This application is a good option for teams that want a lower overall frame and do not have the resources to machine custom rails.





Application Example - VersaTubing High Ground Clearance

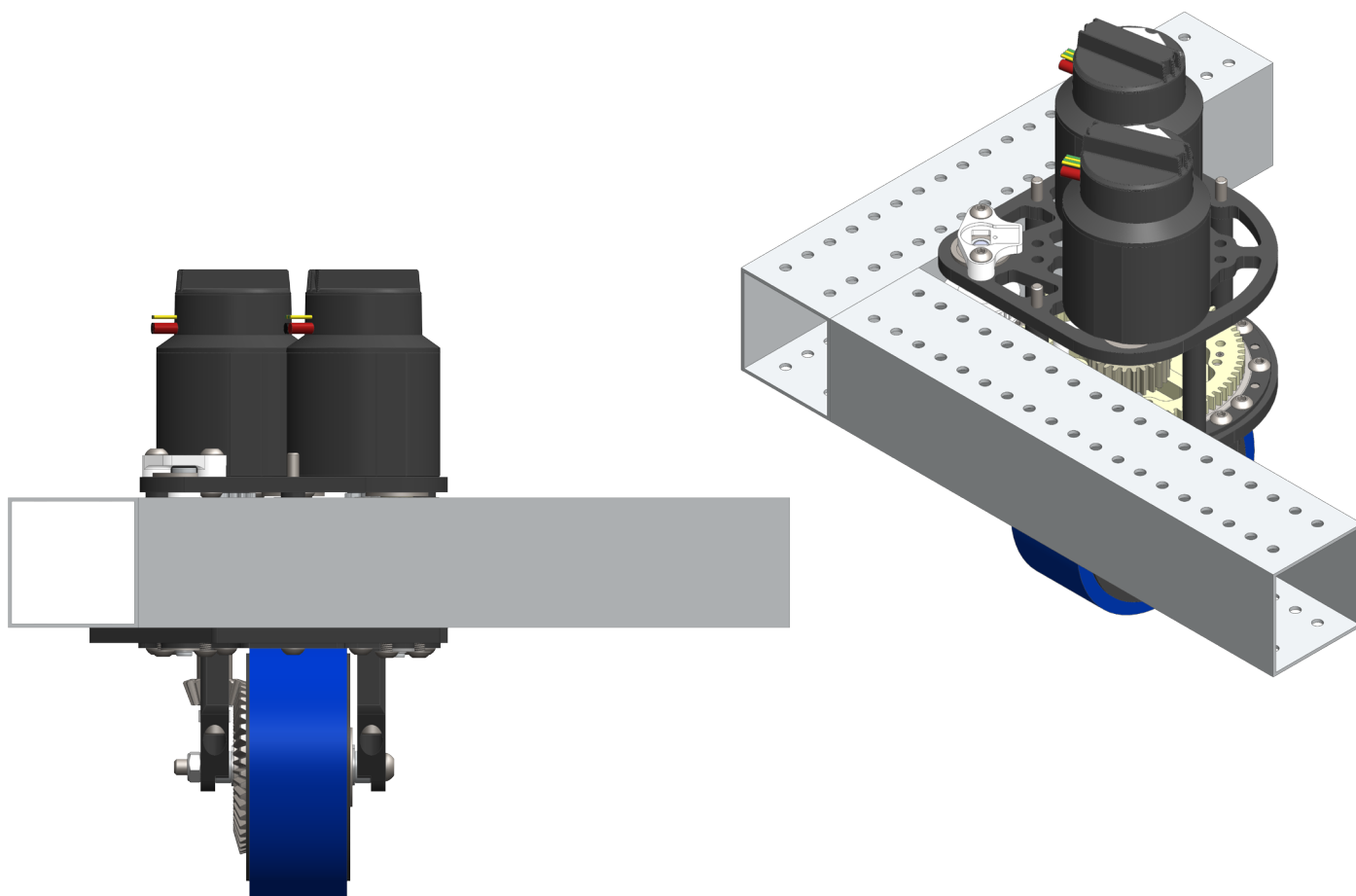
This application is a good option for teams that want plenty of ground clearance for going over obstacles and do not have the resources to machine custom rails. This option also protects the internals of the swerve module from being damaged.





Application Example - 1323 Style Mounting (2" x 2" x 1/16" Tubing)

This is the method that FRC Team 1323 prefers to use when mounting their swerve modules. The 2x2 is preferred over the 2x1 because it gives extra space in the corners in case any other mechanisms or bumpers need to be mounted there. This option also protects the internals of the swerve module from being damaged and sets the module further into the frame for protection from field elements, such as the 2019 Cargo Ship.





FAQ

Q: Which tread is recommended?

A: Any 1.5" Tread will work, the recommended options are the rougtop or wedgetop sold by WCP or McMaster.

Q: Can I use other motors besides a Falcon?

A: Yes you can.



Revision Table

Revision Date	Revision #	Description
1/17/2020	1.1	First revision created.