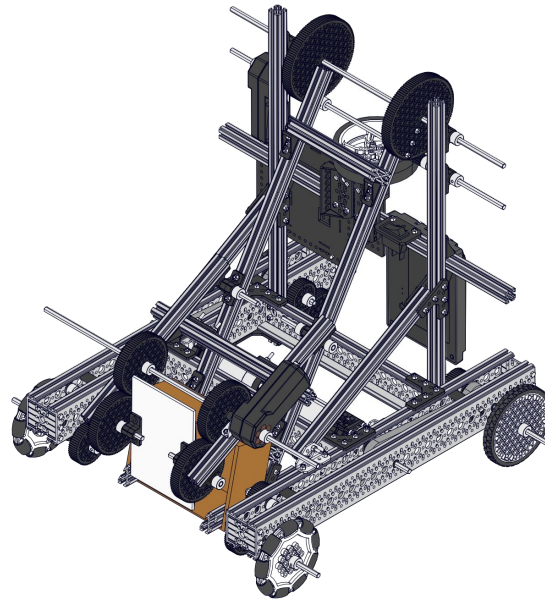




Starter Bot Build Guide

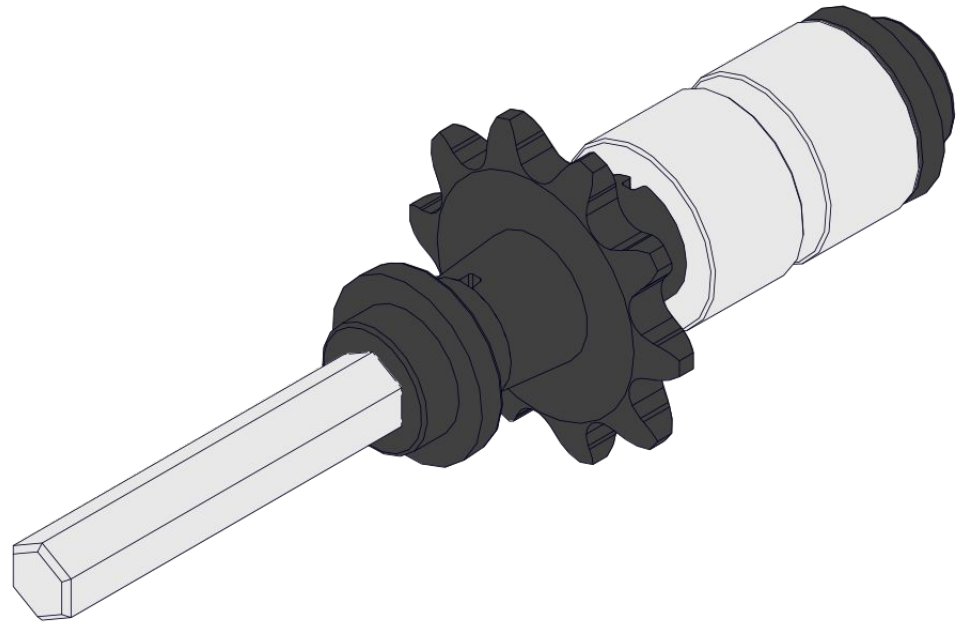


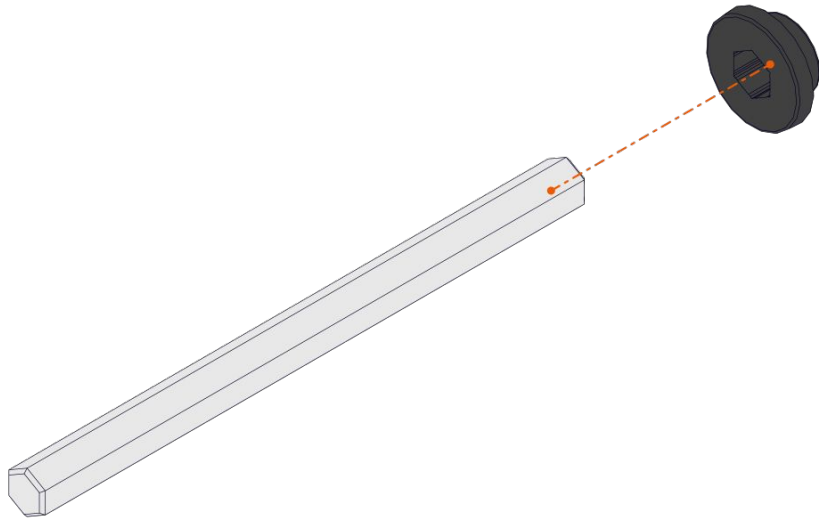
Bill of Materials

PART NUMBER	DESCRIPTION	QTY.	PART NUMBER	DESCRIPTION	QTY.
REV-41-1097	Smart Robot Servo	1	REV-41-1338	10 Tooth #25 Sprocket	8
REV-31-1387	Switch Cable and Bracket	1	REV-41-1347	5mm X 75mm Hex Shaft	10
REV-31-1595	Control Hub	1	REV-41-1349	5mm X 135mm Hex Shaft	4
REV-41-1161	Zip Ties	50	REV-41-1354	90mm Traction Wheel	2
REV-41-1163	Surgical Tubing	1	REV-41-1359	M3 x 8mm Hex Cap Screw	206
REV-41-1166	Battery Holder Plate	2	REV-41-1360	M3 X 16mm Hex Cap Screws	16
REV-41-1190	90MM OMNI WHEEL	2	REV-41-1361	M3 Nyloc Nuts	184
REV-41-1267	90mm Grip Wheel	1	REV-41-1362	5mm x 400mm Hex Shaft	3
REV-41-1300	Core Hex Motor	2	REV-41-1365	#25 Roller Chain - 10 ft	1
REV-41-1303	15mm Plastic Motion Bracket	2	REV-41-1167	M3 x 8mm T-Slot Screw	10
REV-41-1305	15mm Plastic 90 Degree Bracket	8	REV-41-1430	15mm Extrusion - 150mm - 45 degree ends	4
REV-41-1306	15mm Plastic 60 Degree Bracket	8	REV-41-1431	15mm Extrusion - 225mm - 90 degree ends	5
REV-41-1315	15mm Gearbox Motion Bracket	2	REV-41-1432	15mm Extrusion - 420mm - 90 degree ends	5
REV-41-1316	15mm Hex Pillow Block	4	REV-41-1433	15mm Metal Bent Core Hex Motor Bracket V2	4
REV-41-1317	15mm Bearing Pillow Block	16	REV-41-1485	15mm Metal Bent Servo Bracket V2	1
REV-41-1321	15mm Plastic Lap Corner Bracket	10	REV-41-1492	M3 Standoff - 40mm	8
REV-41-1323	15mm Spacer	1	REV-41-1600	UltraPlanetary Gearbox Kit	2
REV-41-1324	3mm Spacer	11	REV-41-1609	M3 x 20mm Socket Head Screw	3
REV-41-1325	1.5mm Spacers	4	REV-41-1621	UltraPlanetary Outside Mounting Bracket	2
REV-41-1326	Through Bore Bearing - Short	16	REV-41-1687	U Channel Endcap	4
REV-41-1327	Shaft Collar	39	REV-41-1702	Tensioning Bushing - 39mm	4
REV-41-1329	Through Bore Bearing - Long	16	REV-41-1762	45mm x 15mm C Channel - 408mm	4
REV-41-1331	15 Tooth Plastic Gear	2	REV-41-1767	45mm x 15mm C Channel - 248mm	2

Wheel Shaft 1 - Bill of Materials

PART NUMBER	DESCRIPTION	QTY.
REV-41-1326	Through Bore Bearing - Short	4
REV-41-1327	Shaft Collar	4
REV-41-1347	5mm X 75mm Hex Shaft	2
REV-41-1338	10 Tooth #25 Sprocket	2
REV-41-1324	3mm Spacer	2

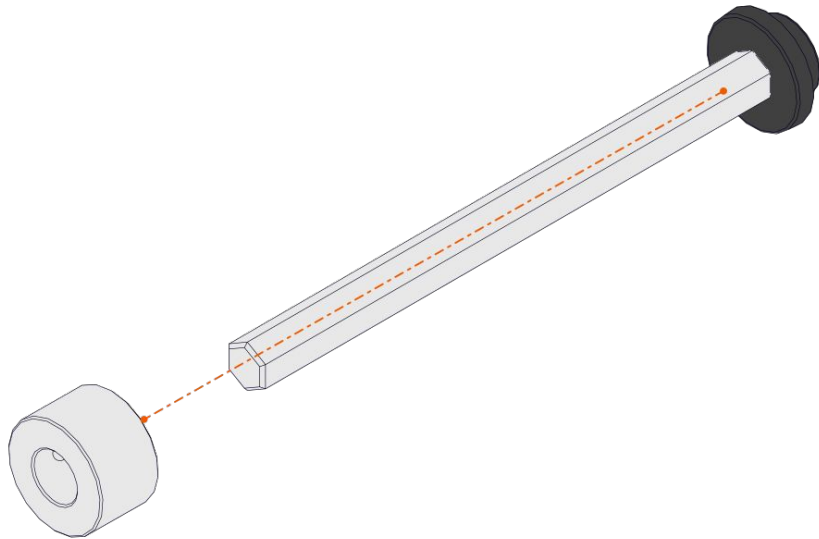




Get:

- 1 – 75mm Hex Shafts
- 1 – Short Through Bore Bearings

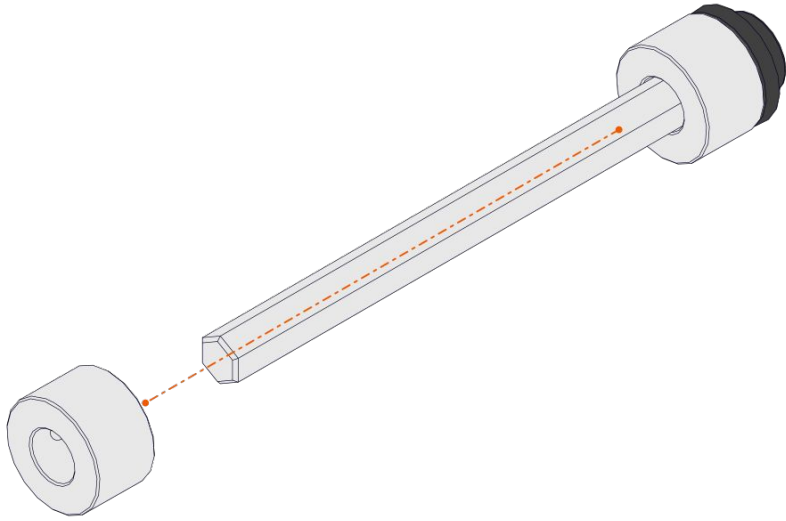
Slide the Short Through Bore Bearing on the end of the hex shaft. Have the bearing flush against the end of the shaft.



Get:

- 1 - Shaft Collar

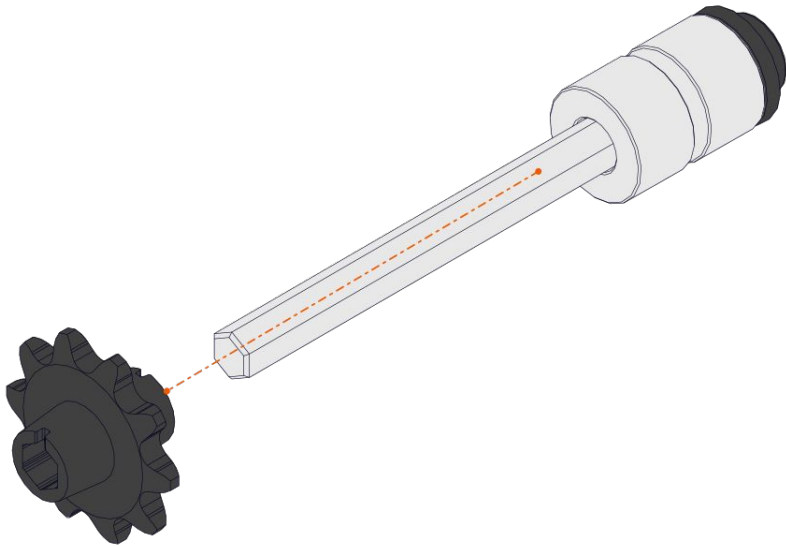
Add a shaft collar to the end of the shaft against the through bore bearing. Tighten down the shaft collar.



Get:

- 1 – Shaft collar

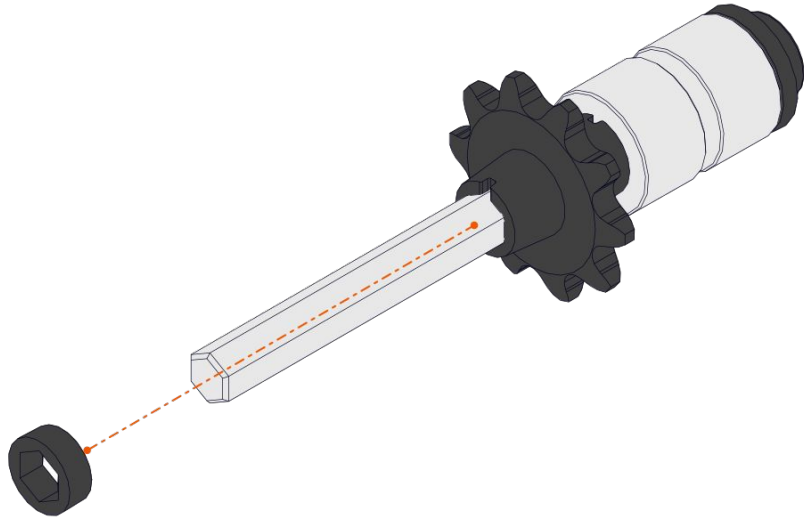
Add another shaft collar to the end of the shaft. Keep a small gap between the shaft collars. Tighten down the shaft collar.



Get:

- 1 - 10 Tooth #25 Sprocket

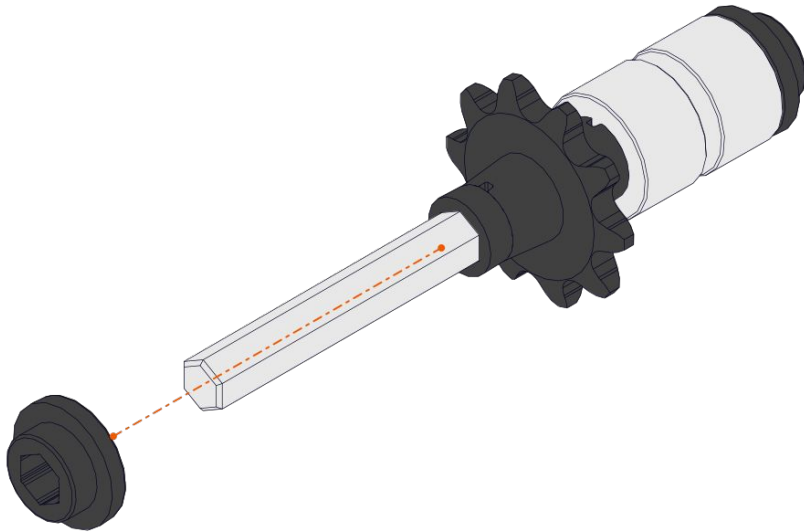
Add the 10 Tooth Sprocket to the end of the shaft. Place it flush against the shaft collar.



Get:

- 1 – 3mm Spacer

Add the 3mm Spacer to the end of the shaft. Place it flush against the sprocket.



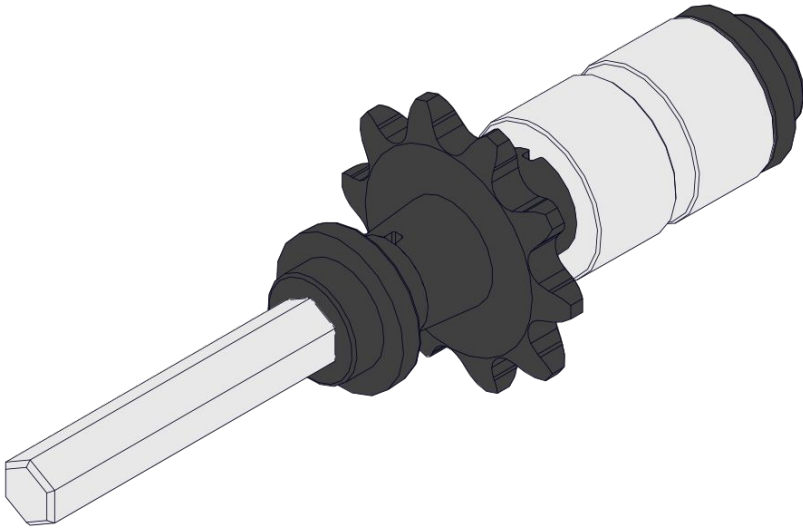
Get:

- 1 - Short Through Bore Bearing

Slide the Short Through Bore Bearing on the end of the hex shaft. Have the bearing flush against the 3mm spacer.

Assembly Complete

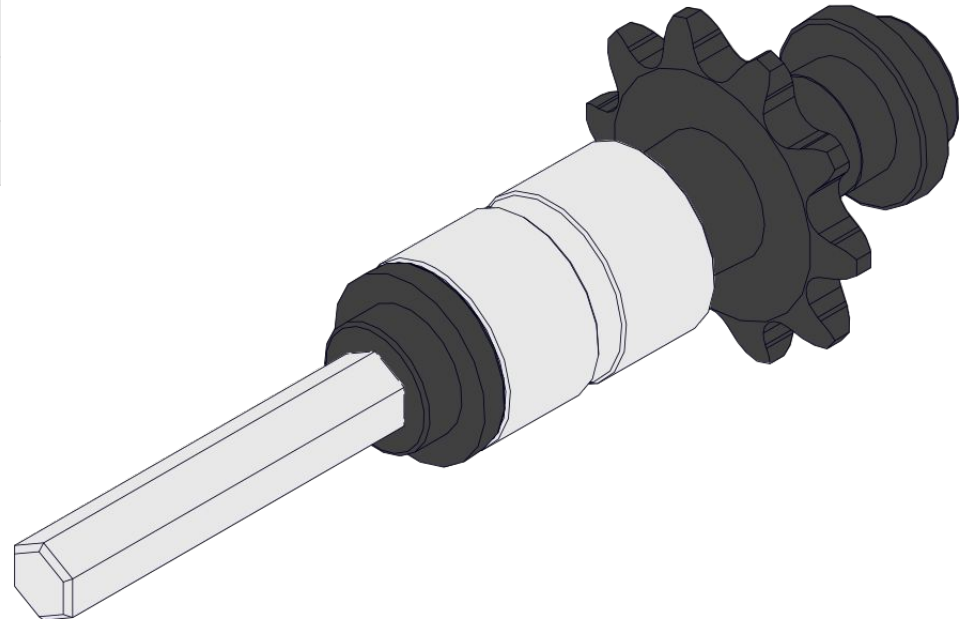
Repeat the process starting on page two until two of these shaft assemblies are done.

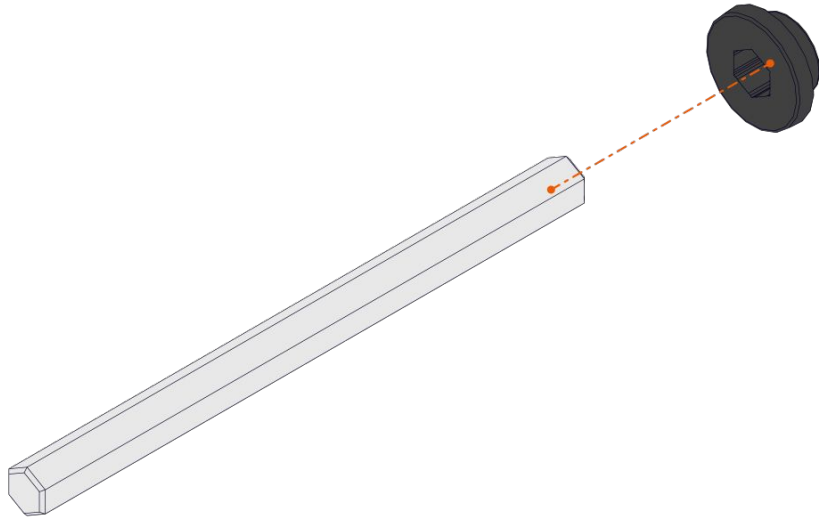


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Wheel Shaft 2 - Bill of Materials

PART NUMBER	DESCRIPTION	QTY.
REV-41-1326	Through Bore Bearing - Short	4
REV-41-1327	Shaft Collar	4
REV-41-1347	5mm X 75mm Hex Shaft	2
REV-41-1338	10 Tooth #25 Sprocket	2
REV-41-1324	3mm Spacer	2

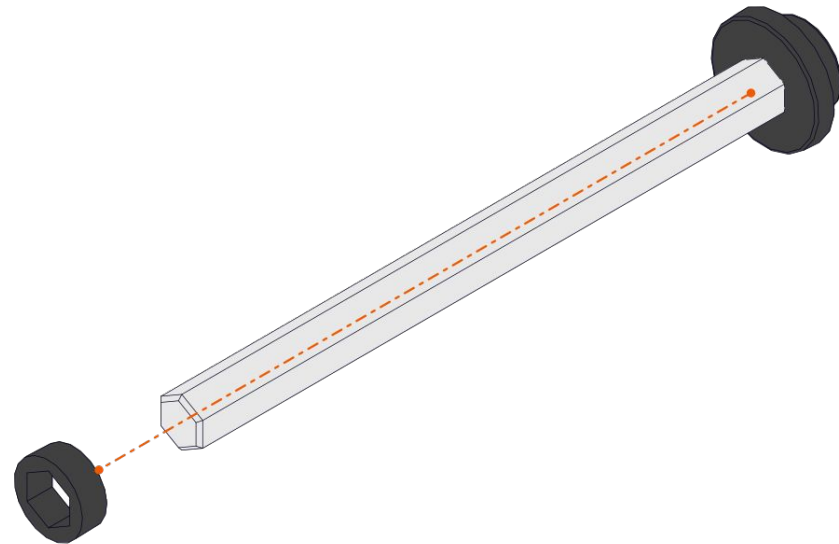




Get:

- 1 – 75mm Hex Shafts
- 1 – Short Through Bore Bearings

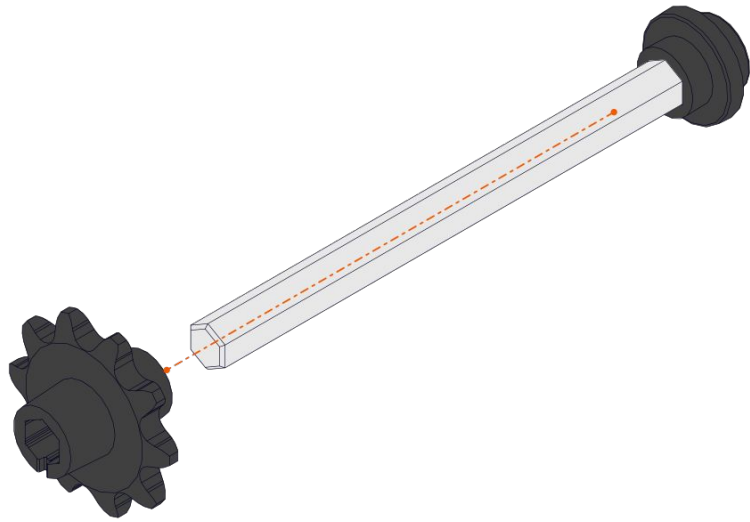
Slide the Short Through Bore Bearing on the end of the hex shaft. Have the bearing flush against the end of the shaft.



Get:

- 1 – 3mm Spacer

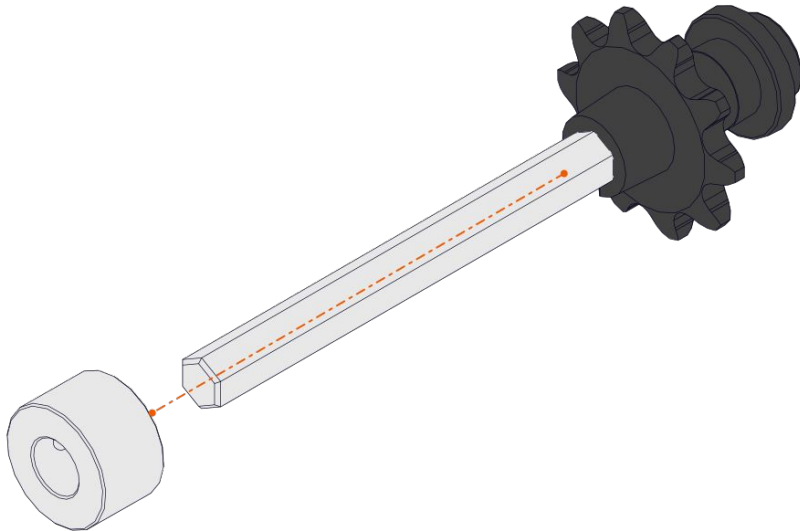
Add the 3mm Spacer to the end of the shaft. Place it flush against the Short Through Bore Bearing.



Get:

- 1 - 10 Tooth #25 Sprocket

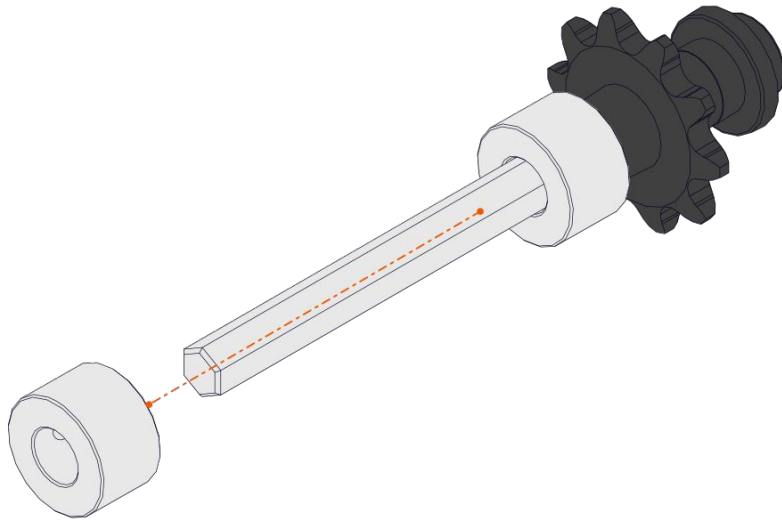
Add the 10 Tooth Sprocket to the end of the shaft. Place it flush against the shaft collar.



Get:

- 1 - Shaft Collar

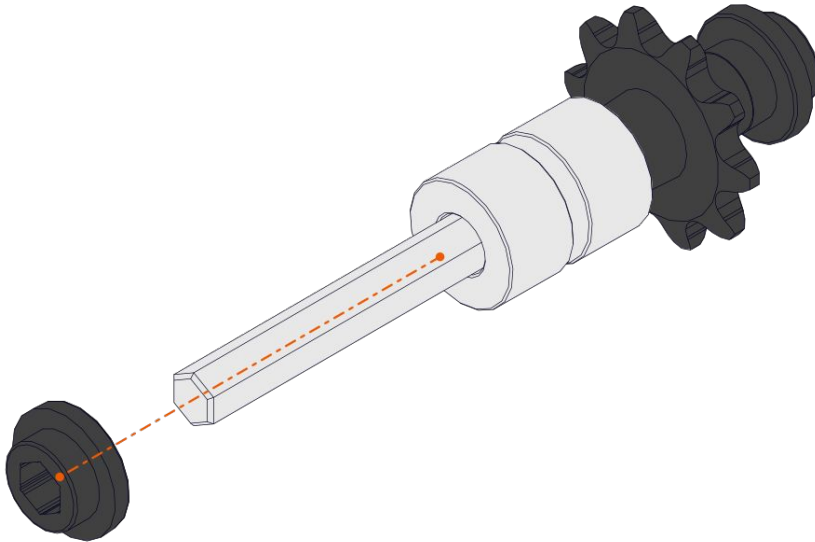
Add a shaft collar to the end of the end of the shaft against the 10 Tooth Sprocket. Tighten down the shaft collar.



Get:

- 1 – Shaft collar

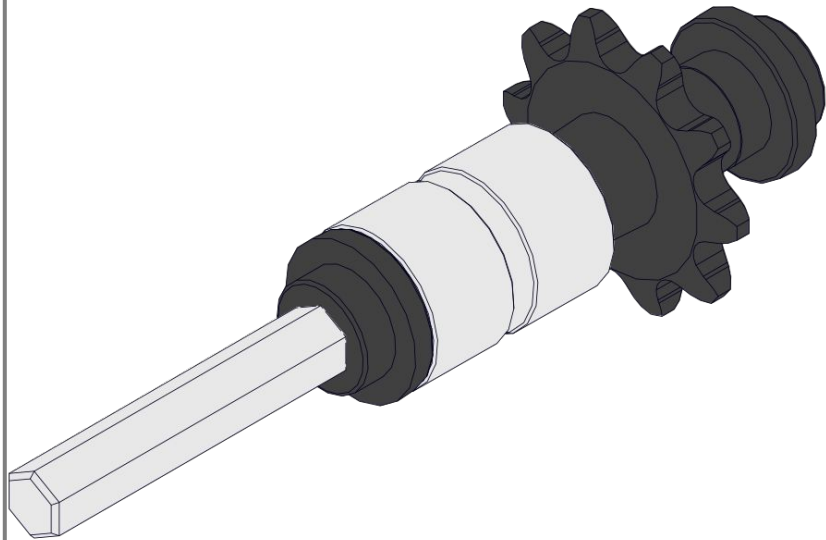
Add another shaft collar to the end of the shaft. Keep a small gap between the shaft collars. Tighten down the shaft collar.



Get:

- 1 - Short Through Bore Bearing

Slide the Short Through Bore Bearing on the end of the hex shaft. Have the bearing flush against the shaft collar.



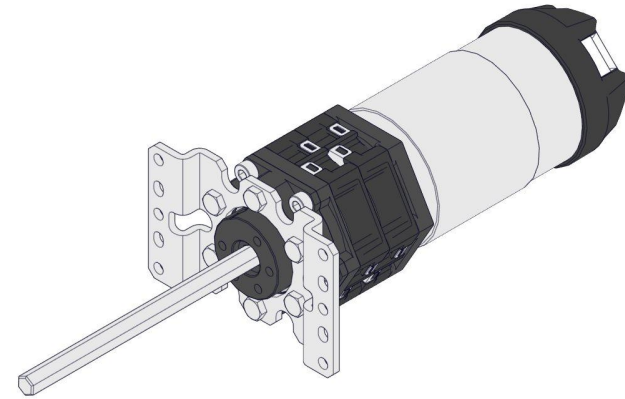
Assembly Complete

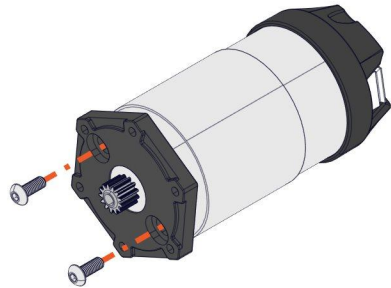
Repeat the steps starting on page nine until two of these shaft assemblies are done.

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UltraPlanetary Gearbox Assembly- Bill of Materials

PART NUMBER	DESCRIPTION	QTY
REV-41-1603	UltraPlanetary 5:1 Cartridge	2
REV-41-1607	UltraPlanetary 550 Motor Plate	2
REV-41-1609	M3 x 30mm Cap Head Screw	12
REV-41-1609	M3 x 8mm Button Head Screw	4
REV-41-1615	UltraPlanetary Output V2	2
REV-41-1291	HD Hex Motor	2
REV-41-1602	UltraPlanetary 4:1 Cartridge	2
REV-41-1621	UltraPlanetary Outside Mounting Bracket	2
REV-41-1359	M3 x 8mm Hex Cap Screw	12
REV-41-1347	5mm X 75mm Hex Shaft	2



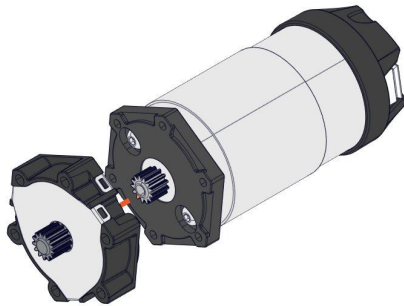


Get:

- 1 – HD Hex Motor
- 2 - 8mm Button Head Screws
- 1 - UltraPlanetary Mounting Plate

Attach the UltraPlanetary Mounting Plate to the HD Hex Motor using two 8mm Button Head Screws.

Note: Use the 2mm Allen Key to tighten these screws.

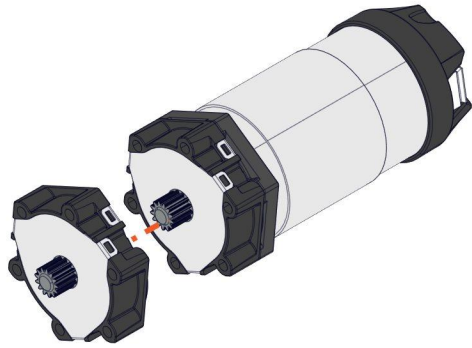


Get:

- 1 - 5:1 UltraPlanetary Cartridge

Seat the UltraPlanetary 5:1 Cartridge onto the input pinion.

Note: Placing a finger on the output of the 5:1 Cartridge and turning it helps for placement.

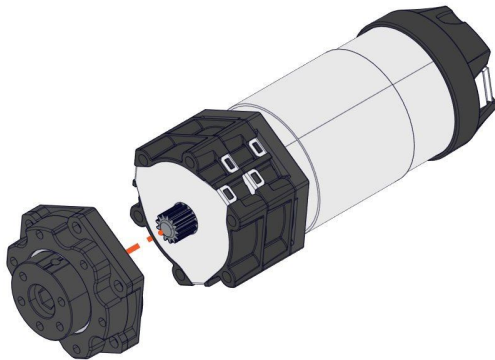


Get:

- 1 – 4:1 UltraPlanetary Cartridge

Seat the UltraPlanetary 4:1 Cartridge onto the UltraPlanetary 5:1 Cartridge.

Note: Placing a finger on the output of the 4:1 Cartridge and turning it helps for placement.



Get:

- 1 – UltraPlanetary Output

Seat the UltraPlanetary Output Stage onto the UltraPlanetary 4:1 Cartridge.

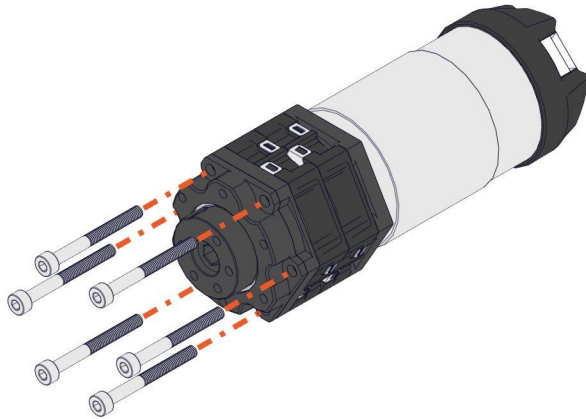
Note: Placing a finger on the output of the Output Cartridge and turning it helps for placement.

Get:

- 6 – 30mm Cap Head Screws

Insert six of the 30mm Cap Head Screws into the holes in the outer ring off the Output Cartridge. Tighten these screws down until they are snug not tight using a 2.5mm allen wrench.

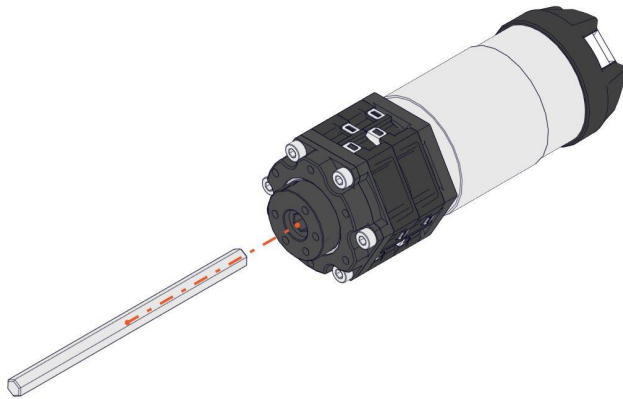
Note: The 30mm length is the 2nd longest screw provided with the UltraPlanetary Gearbox Kit.

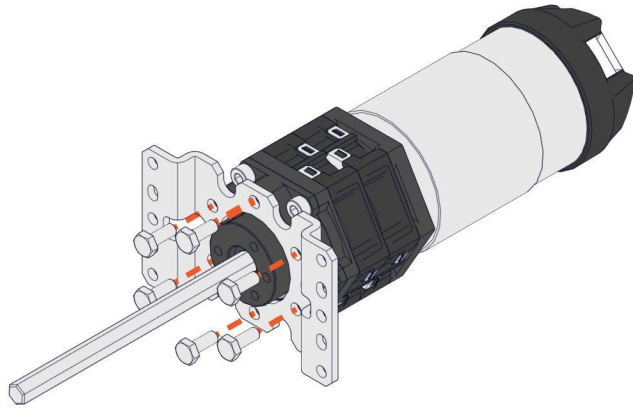


Get:

- 1 – 75mm Hex Shaft
- 1 – M3 Set Screw

Add the 75mm Hex Shaft into the UltraPlanetary Output. Tighten down the M3 Set Screw to hold the shaft in place.

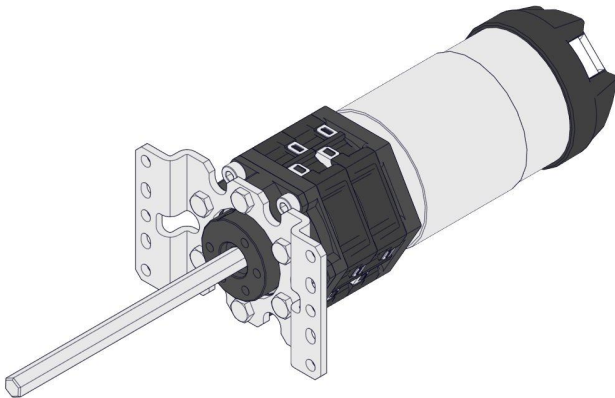




Get:

- 1 – UltraPlanetary Outside Mounting Bracket
- 6 – 8mm Hex Cap Screws

Align the UltraPlanetary Outside Mounting Bracket with the mounting holes on the Output Cartridge. Insert six 8mm Hex Cap Screws into the mounting holes. Tighten the screws until they are snug.



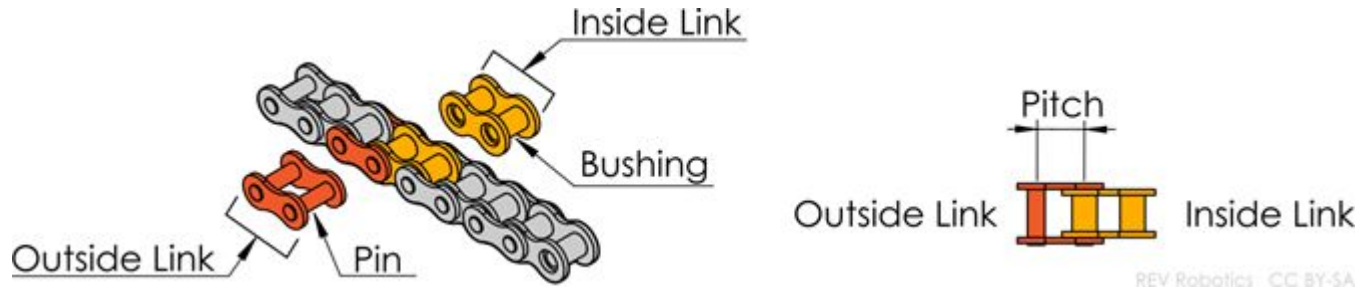
UltraPlanetary Assembly Complete

Repeat the steps starting on page fourteen until there are two completed UltraPlanetary Assemblies. Set aside for later.

Breaking and Reforming Chain

Basics of Chain

This drivetrain uses sprockets and chain to transmit motion from the UltraPlanetary Gearbox and Drive Shaft to the rest of the drivetrain. The figure below shows the major components of chain.



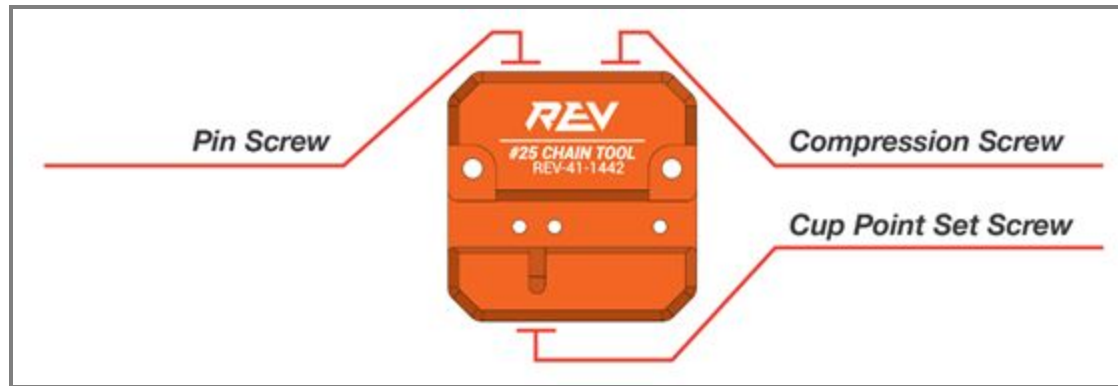
Outside Links consist of two outside plates which are connected by two **pins** that are pressed into each plate. The **pins** in the outside link go through the inside of the hollow **bushings** when the inner and outer links are assembled. The **pins** can freely spin on the inside of the **bushings**.

Inside Link consist of two inside plates that are connected by two hollow **bushings** which are pressed into each plate. The teeth of the sprocket contact the surface of the **bushings** when the chain is wrapped around a sprocket.

Pitch is the distance between the centers of two adjacent **pins**. The REV 15mm Build System uses #25 (0.25") chain.

Introduction to the Chain Tool

This custom-designed tool allows users to easily break and re-assemble #25 chain. The mandrel is used to push out the chain pin. If using master links, the pin can be completely removed, but the depth guide screw allows the option of partially pressing out the pin and then re-assembling without master links.



For more information on the #25 Chain Tool, see the Chain Tool product page for the User's Manual and How To video.

Creating the Chain Loops

For this drivetrain, four chain loops that are 56 links long are needed. When counting chain length, count the number of bushings to get the correct length. To successfully reform chain, the total count of bushings must be an even number with one inner link and one outer link exposed. This allows the chain tool to press the pin back into the bushing, through an inner and outer link, reconnecting the chain. Below are the steps to use the #25 Chain Tool to reset the pin into the chain. If you would like to use master links see the #25 Chain Tool User's Manual for more information.

For these steps you will need the #25 Chain Tool and #25 Chain.



Unscrew the Pin Screw and Compression Screw such that they are flush with the chain channel.

Ensure the Cup Point Set Screw is fully engaged in the Chain Tool.



Insert #25 chain into the chain channel and align the desired link between the two vertical pins in the channel.

Note: Count 56 bushings from an exposed inner link.



Next secure the chain in place with the compression screw. Tighten until the chain cannot shift within the channel.

Note: Be **careful** to not overly push the pin out in the next step it will be impossible to put it back in, and a master link will be needed. As result of manufacturing tolerances, the cup point set crew may not be close enough to use as a hard stop for the pin.



Screw the Pin Screw down until the pin almost touches the Cup Point Set Screw. The user should stop pushing the pin out before it leaves the back plate the outer link. Considerable pressure will be felt before the pin comes all the way out. Removing the chain from the tool to check if the pin is fully unseated from the bushing is recommended.



Put the Inner Link bushing into the Outer Link. Align the Pin in the Compression Screw hole.



Turn the Compression Screw until the Pin is fully seated back into the chain channel.

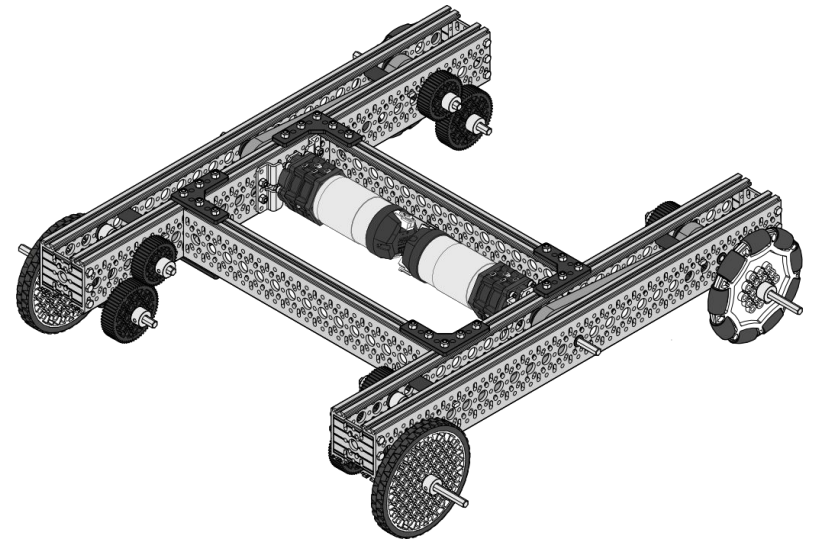


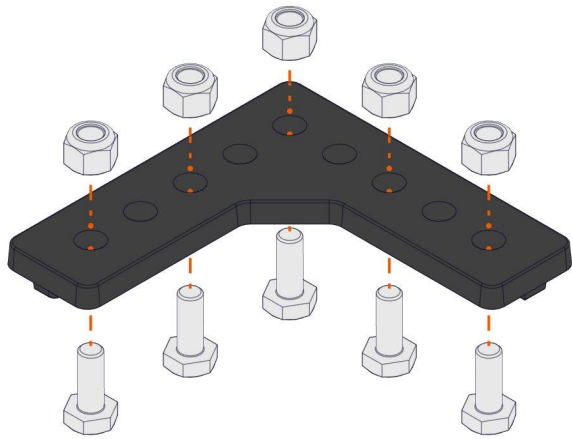
56 Link Chain Assembly Complete

Repeat these steps starting on page 21 until you have four 56 Link Chain Assemblies.

Drivetrain Assembly - Bill of Materials

PART NUMBER	DESCRIPTION	QTY.
N/A	UltraPlanetary Gearbox Assembly	2
N/A	Wheel Shaft Assembly - 1	2
N/A	Wheel Shaft Assembly - 2	2
N/A	56 Link Chain Run	4
REV-41-1190	90MM OMNI WHEEL	2
REV-41-1305	15mm Plastic 90 Degree Bracket	8
REV-41-1317	15mm Bearing Pillow Block	8
REV-41-1324	3mm Spacer	2
REV-41-1326	Through Bore Bearing - Short	2
REV-41-1327	Shaft Collar	12
REV-41-1329	Through Bore Bearing - Long	8
REV-41-1334	45 Tooth Gear	4
REV-41-1335	60 Tooth Gear	4
REV-41-1338	10 Tooth #25 Sprocket	4
REV-41-1349	5mm X 135mm Hex Shaft	4
REV-41-1354	90mm Traction Wheel	2
REV-41-1359	M3 x 8mm Hex Cap Screw	96
REV-41-1361	M3 Nyloc Nuts	64
REV-41-1492	M3 Standoff - 40mm	4
REV-41-1687	U Channel Endcap	4
REV-41-1702	Tensioning Bushing - 39mm	4
REV-41-1762	45mm x 15mm C Channel - 408mm	4
REV-41-1767	45mm x 15mm C Channel - 248mm	2

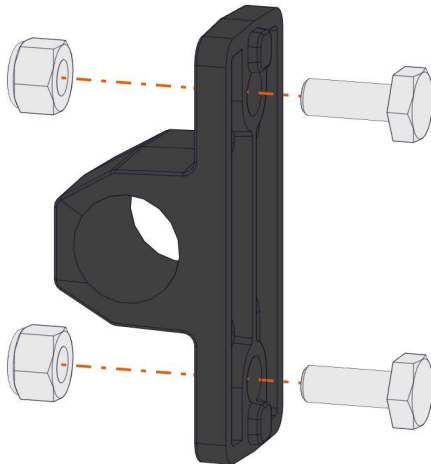




Get:

- 40 – 8mm M3 Bolts
- 40 – M3 Locknuts
- 8 – 90 Degree Brackets

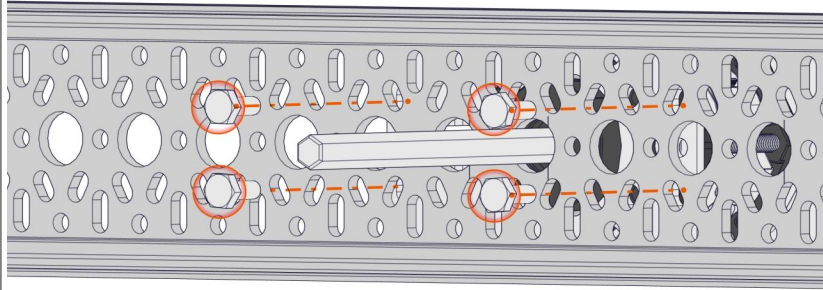
Pre-load the 90 Degree Brackets with 5 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 16 – 8mm M3 Bolts
- 16 – M3 Locknuts
- 8 – Bearing Pillow Blocks

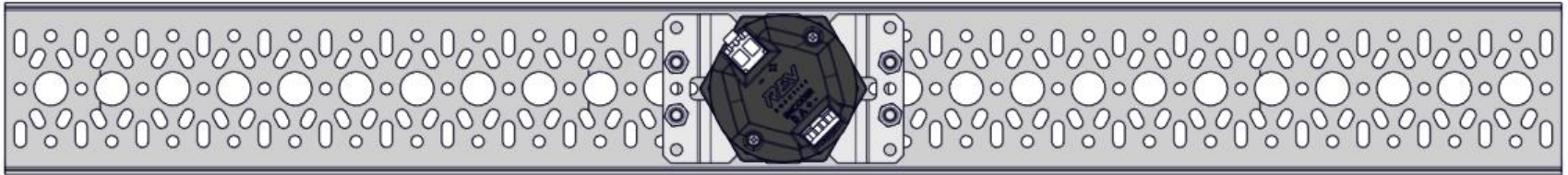
Pre-load the Bearing Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



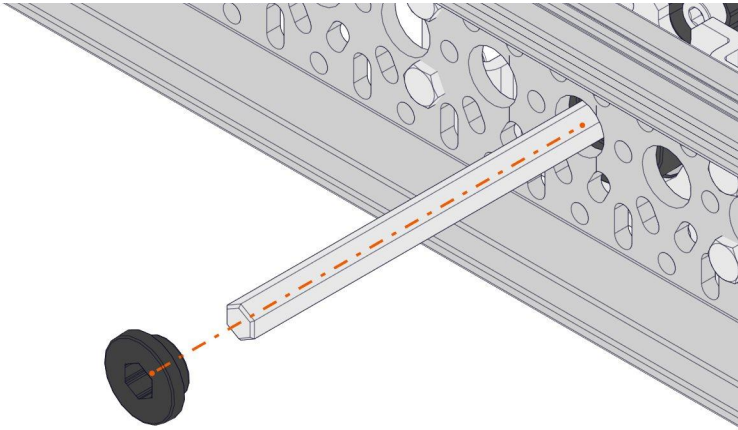
Get:

- 1 – UltraPlanetary Assembly
- 4 – 8mm Hex Cap Screws
- 4 – M3 Locknuts
- 1 – 45mm X 15mm C Channel - 408mm

Place M3 Screws and M3 Lock Nuts in the correct locations. Tighten until nuts are snug.



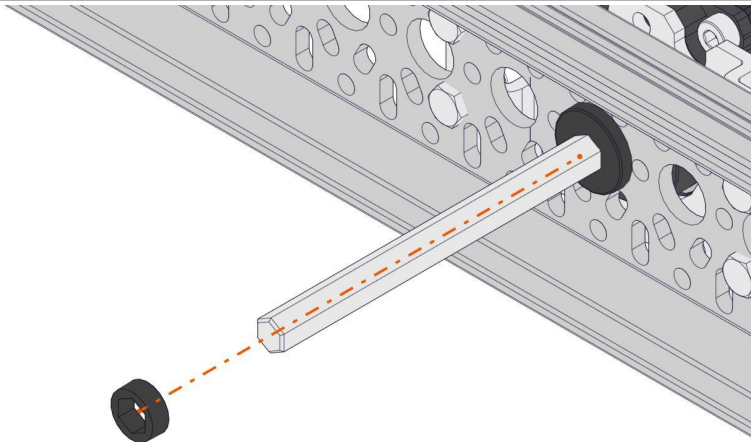
Note: The UltraPlanetary Assembly lines up with the 13th large (9mm) hole from the end of the channel



Get:

- 1 – Short Through Bore Bearing

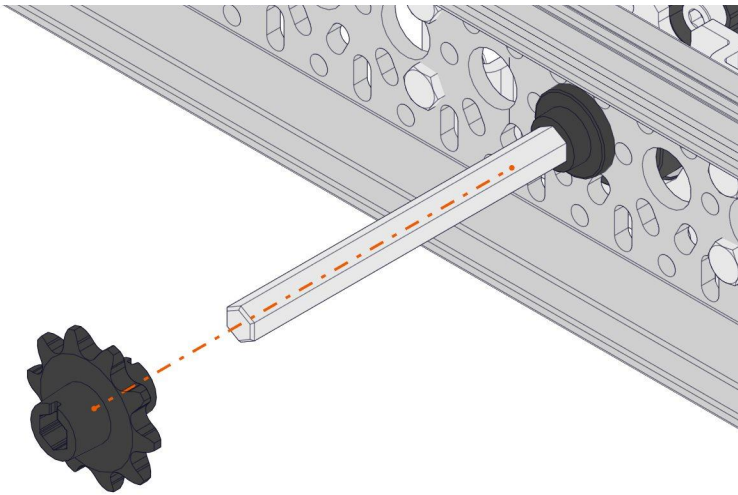
Slide the Short Through Bore Bearing on the end of the hex shaft. Have the bearing full seated in the C Channel.



Get:

- 1 – 3mm Spacer

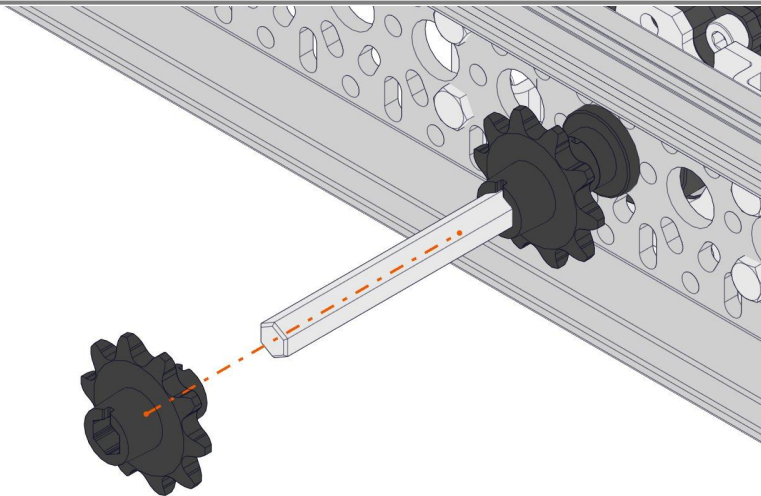
Slide the 3mm Spacer down the hex shaft. Have the spacer pressed against the bearing.



Get:

- 1 – 10 Tooth Sprocket

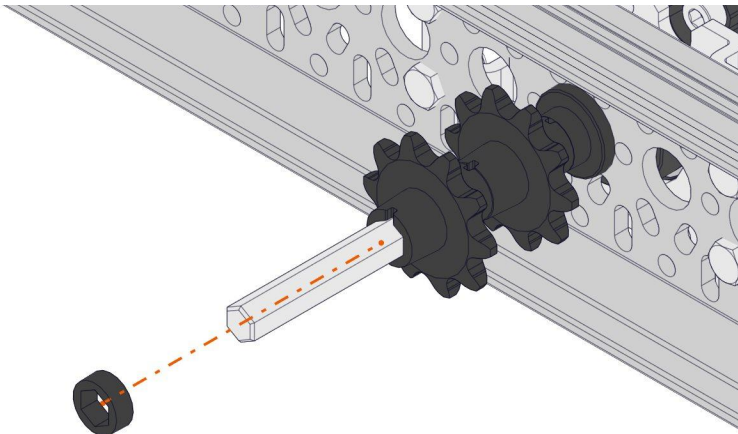
Slide the 10 Tooth Sprocket on the hex shaft. Have the sprocket flush against the 3mm spacer.



Get:

- 1 – 10 Tooth Sprocket

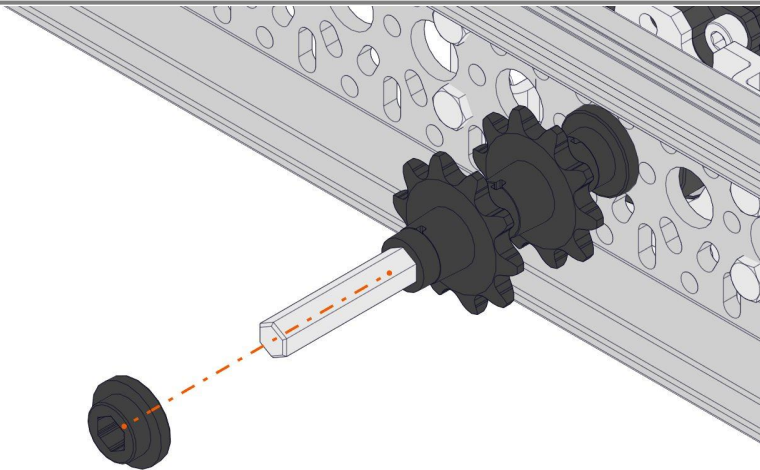
Slide the 10 Tooth Sprocket on the hex shaft. Have the sprocket flush against the other 10 Tooth Sprocket.



Get:

- 1 – 3mm Spacer

Slide a 3mm Spacer onto the hex shaft. Have the sprocket flush against the 10 Tooth Sprocket.



Get:

- 1 – Short Through Bore Bearing

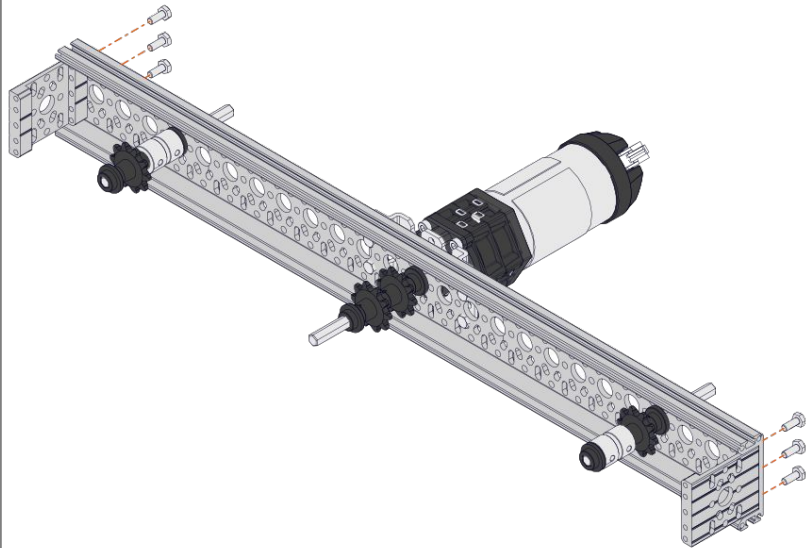
Slide a 3mm Spacer onto the hex shaft. Have the sprocket flush against the 10 Tooth Sprocket.



Get:

- 1 – Wheel Shaft Assembly 1
- 1 – Wheel Shaft Assembly 2

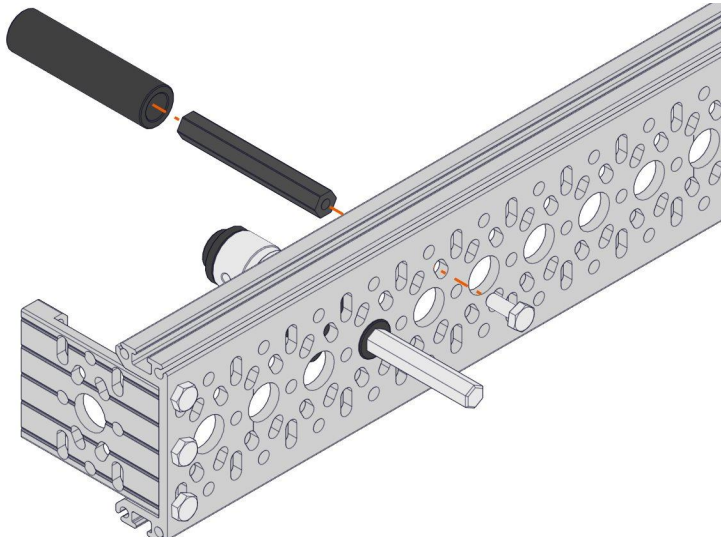
Set the Wheel Shaft Assemblies in the 4th large hole (9mm) from the ends of the C Channel.



Get:

- 2 – Channel End Caps
- 6 – 8mm Hex Cap Screws

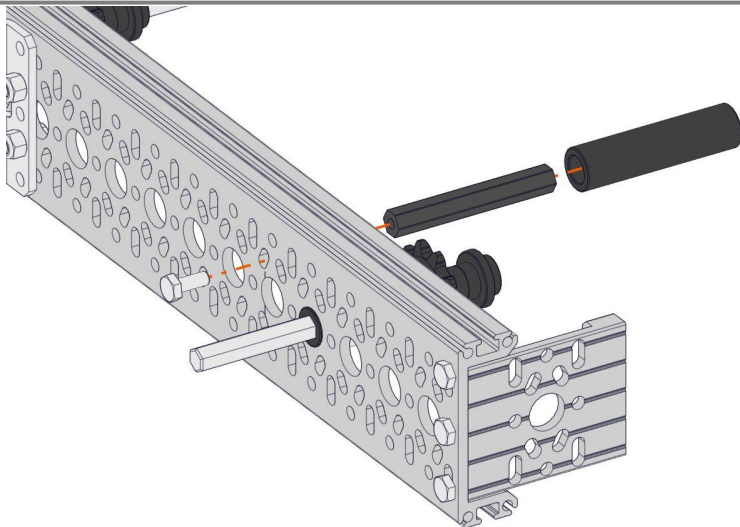
Attach the Channel End Caps with 3 8mm Hex Cap Screws per end cap.



Get:

- 1 – 40mm M3 Standoff
- 1 – Tensioning Bushing
- 1 – 8mm Hex Cap Screw

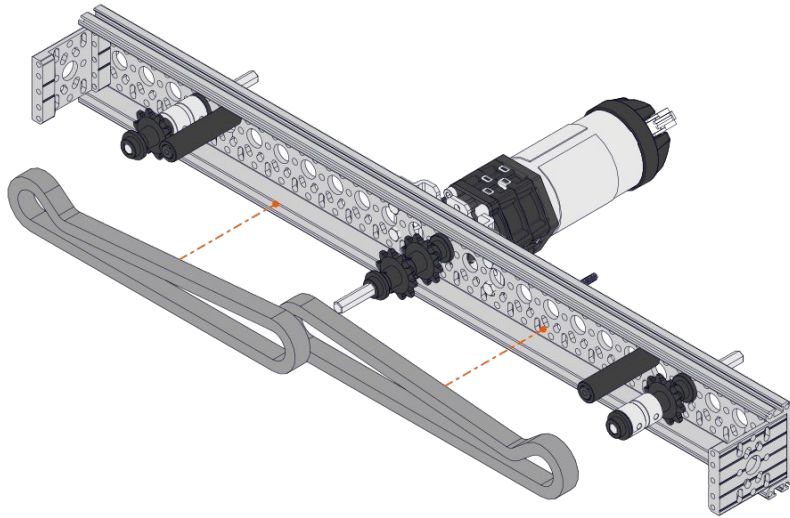
Attach 1 40mm M3 Standoff in the slotted hole of the C Channel with a 8mm Hex Cap Screw. Slide the tensioning bushing onto the standoff.



Get:

- 1 – 40mm M3 Standoff
- 1 – Tensioning Bushing
- 1 – 8mm Hex Cap Screw

Attach 1 40mm M3 Standoff in the slotted hole of the C Channel with a 8mm Hex Cap Screw. Slide the tensioning bushing onto the standoff.

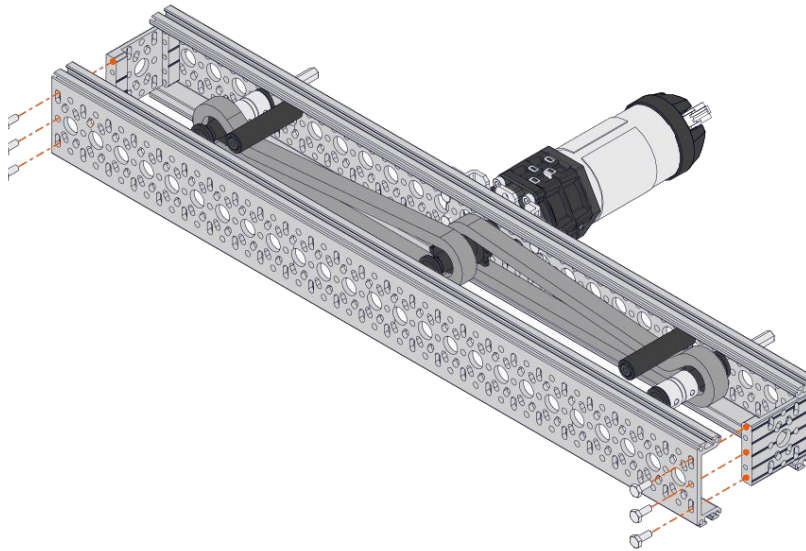


Get:

- 2 – 56 Link Chain Loops

Add the 56 Link Chain Loops to the Sprockets. Start with the inner loop then the outer loop.

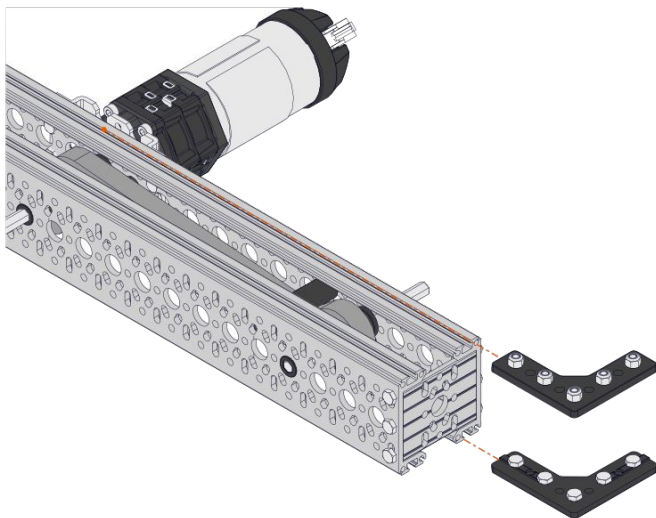
Note: Keeping the Standoffs with Tensioning Bushings loose can help getting the chain loops on the Drive Rails.



Get:

- 8 – 8mm Hex Cap Screws
- 1 – 45mm X 15mm C Channel - 408mm

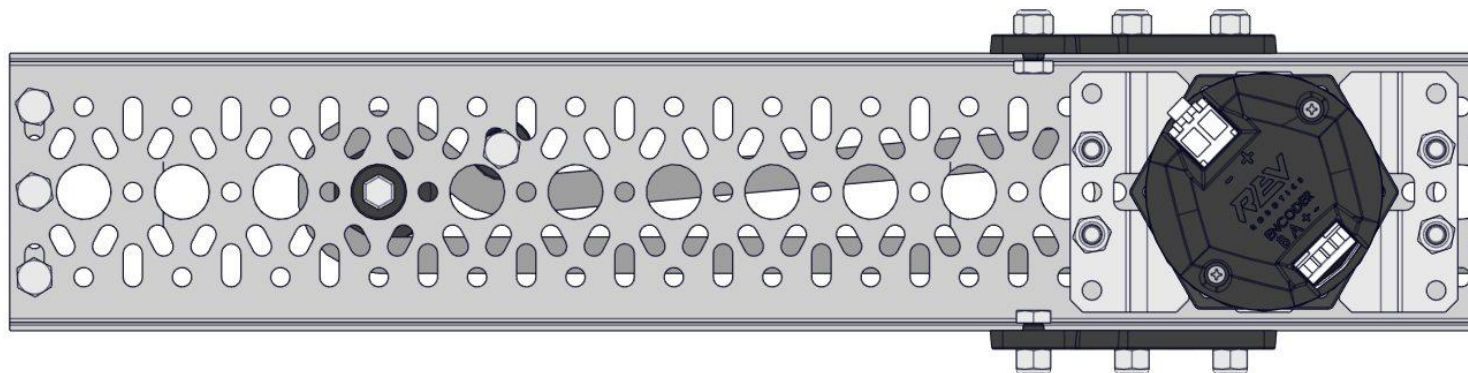
Seat the C Channel on the bearings for each shaft. Take 8 Hex Cap Screws and secure the C Channel in place.

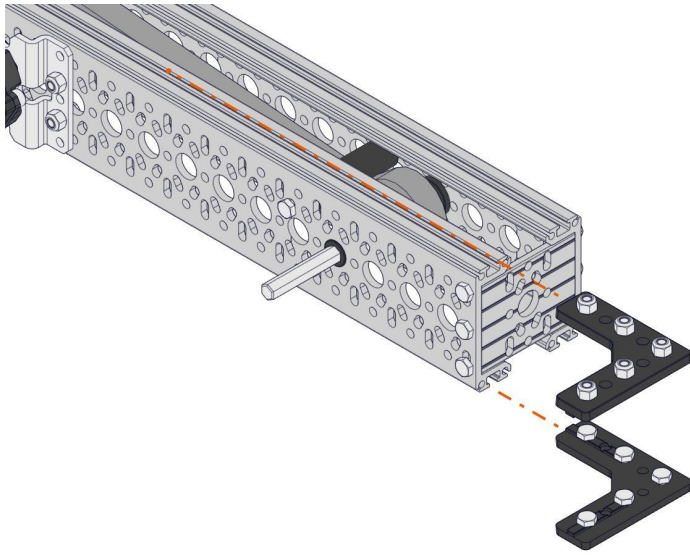


Get:

- 2 – Pre-loaded 90 degree brackets
- 1 – Drive Rail

Slide 2 of the preloaded 90 Degree Brackets onto the Drive Rail Assembly, one on top and another on the bottom. Once complete go back to page 26 and repeat the steps until you have two complete drive rails.



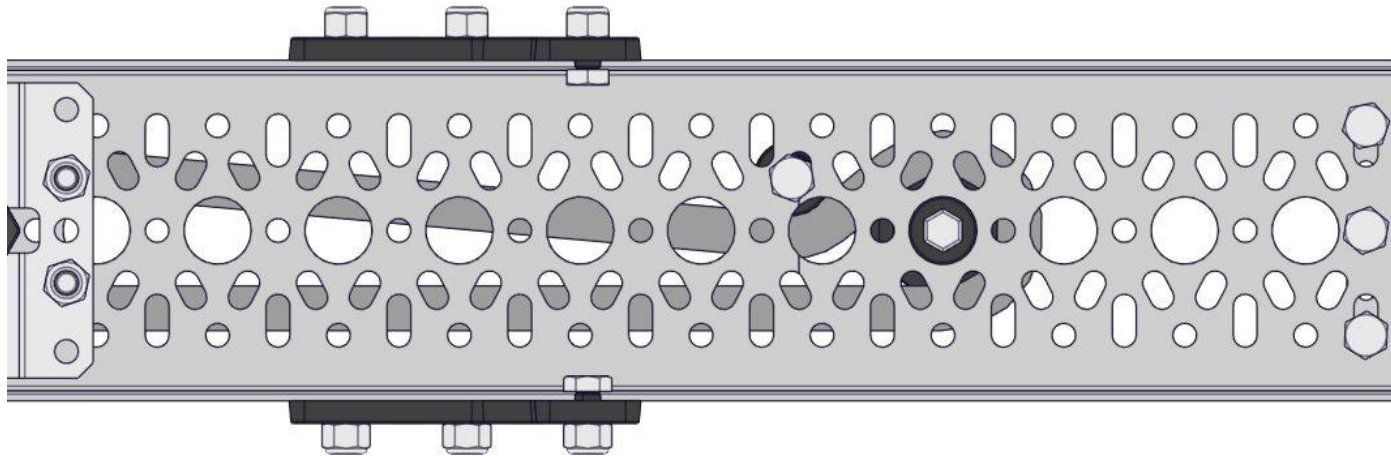


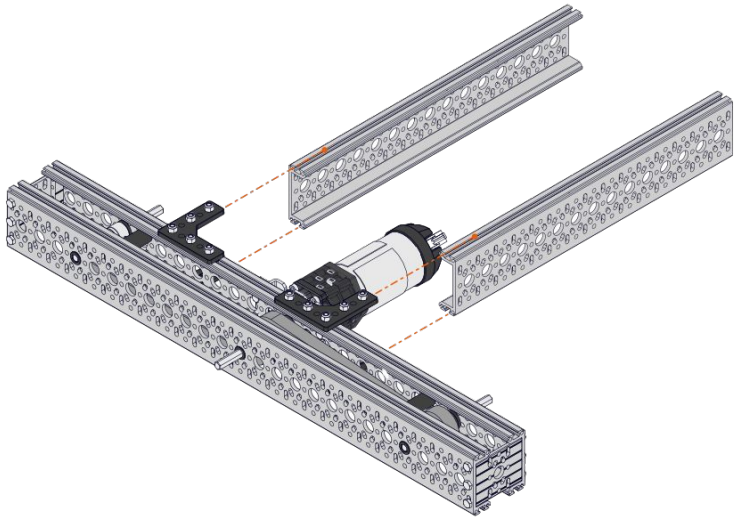
Get:

- 2 – Pre-loaded 90 degree brackets
- 1 – Drive Rail

Slide 2 of the preloaded 90 Degree Brackets onto the Drive Rail Assembly, one on top and another on the bottom.

Go back to page 26 and repeat the steps for a second drive rail. Proceed when you have 2 drive rails.

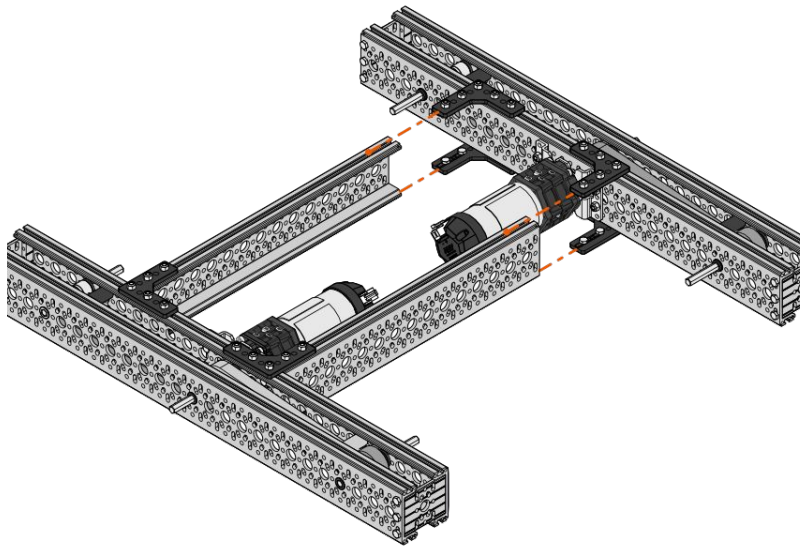




Get:

- 2 – 45mm x 15mm C Channel - 248mm

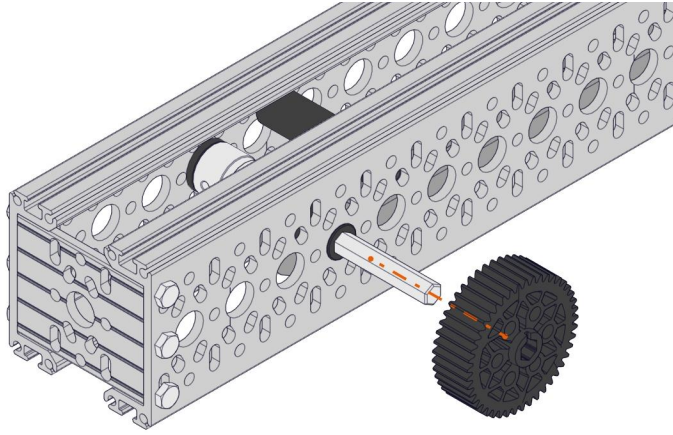
Slide the 45mm X 15m C Channel - 248MM onto the Preloaded Brackets as shown. Tighten the Nyloc Nuts until they are snug.



Get:

- 1 – Drive Rail Assembly

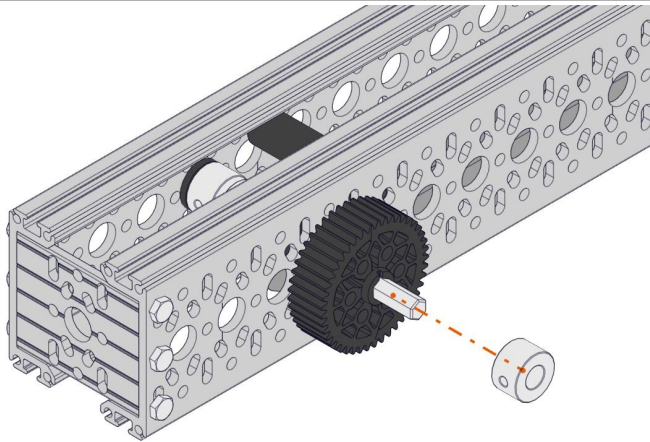
Slide on and attach the other completed Drive Rail Assembly.



Get:

- 1 – 45 Tooth Gear

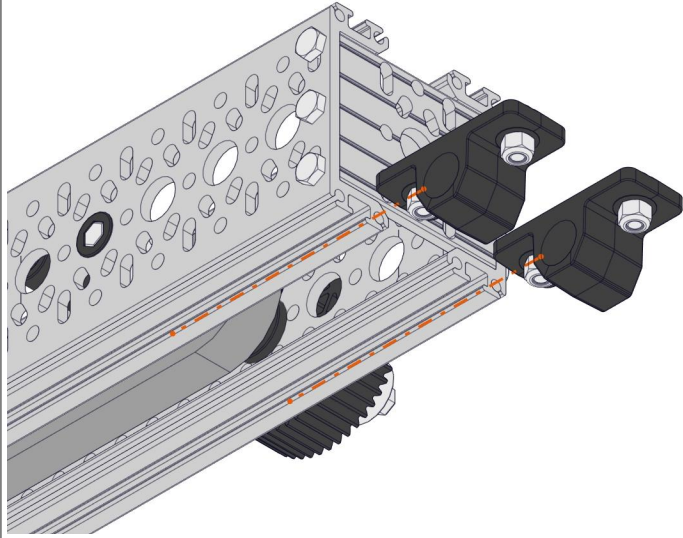
Slide the 45 Tooth Gear on the Wheel Shaft assembly.



Get:

- 1 – Shaft Collar

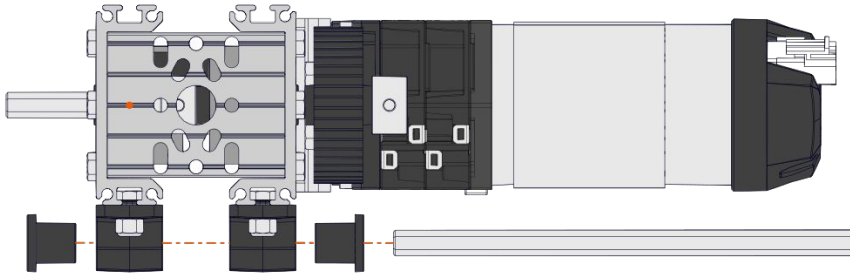
Add a shaft collar and tighten it down to hold the gear in place.



Get:

- 2 – Preloaded Bearing Pillow Blocks

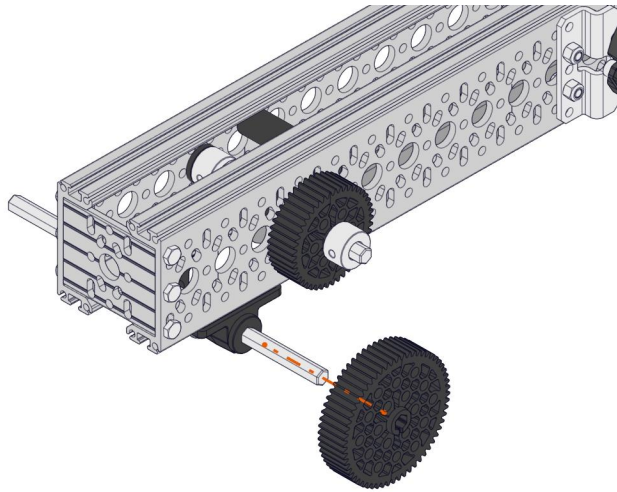
Slide the Bearing Pillow Blocks onto the bottom of the Drive Rail. Keep them loose as they will be adjusted later.



Get:

- 2 – Long Through Bore Bearings
- 1 - 135mm Hex Shaft

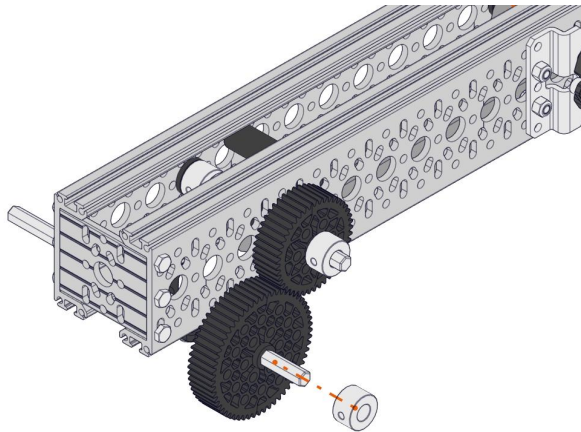
Slide a 135mm Hex Shaft through 2 Long Through Bore Bearings that are seated in the Pillow blocks.



Get:

- 1 – 60 Tooth Gear

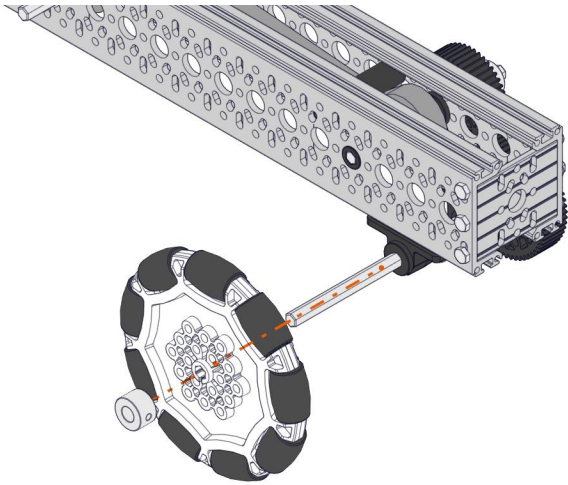
Add a 60 Tooth Gear to the end of the 135mm Hex Shaft.



Get:

- 1 – Shaft Collar

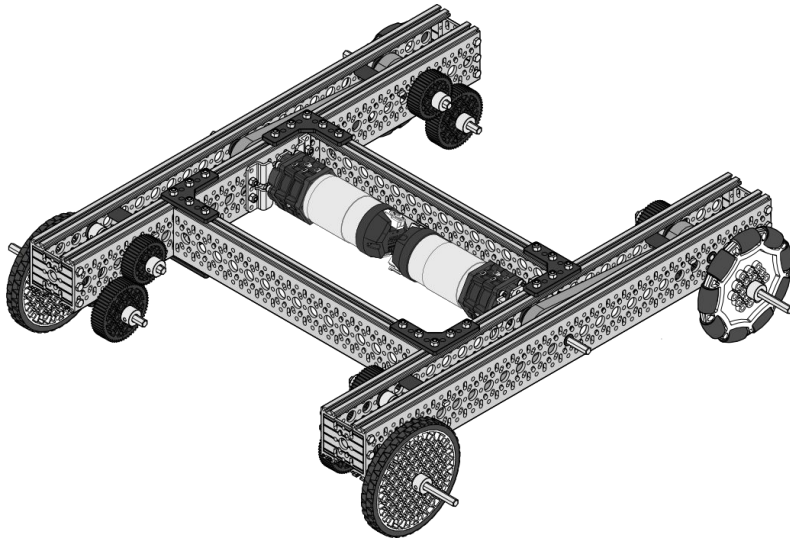
Add a shaft collar to the end of the 135mm Hex Shaft. After the shaft collar is secure, adjust the assembly towards the 45 tooth gear and secure the Pillow Blocks in place.



Get:

- 1 – 90mm Wheel (Omni or Traction)
- 1 – Shaft Collar

Slide a 90mm Wheel onto the shaft and add a shaft collar to hold the wheel in place. Secure the shaft collar.



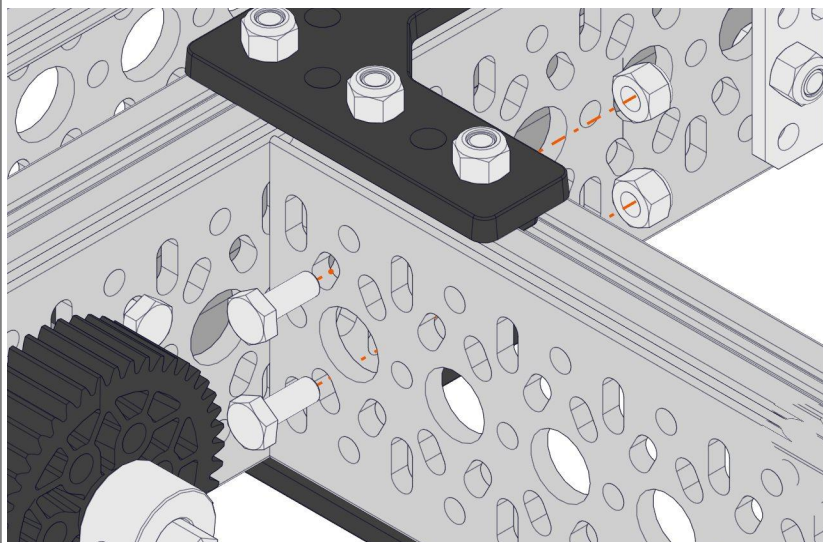
Repeat the series of steps starting on page 36 for each of the four corners of the drivetrains.

Note: For this build you will need two 90mm omni wheels and two 90mm traction wheels. Use the graphic to highlight wheel placement and orientation. Once you have secured all four wheels the drivetrain is done.

Tower Assembly - Bill of Materials

PART NUMBER	DESCRIPTION	QTY
N/A	Drivetrain Assembly	1
REV-41-1300	Core Hex Motor	1
REV-41-1306	15mm Plastic 60 Degree Bracket	4
REV-41-1317	15mm Bearing Pillow Block	1
REV-41-1321	15mm Plastic Lap Corner Bracket	4
REV-41-1327	Shaft Collar	6
REV-41-1329	Through Bore Bearing - Long	1
REV-41-1331	15 Tooth Plastic Gear	2
REV-41-1359	M3 x 8mm Hex Cap Screw	46
REV-41-1360	M3 X 16mm Hex Cap Screws	4
REV-41-1361	M3 Nyloc Nuts	48
REV-41-1432	15mm Extrusion - 420mm - 90 degree ends	3
REV-41-1433	15mm Metal Bent Core Hex Motor Bracket V2	3

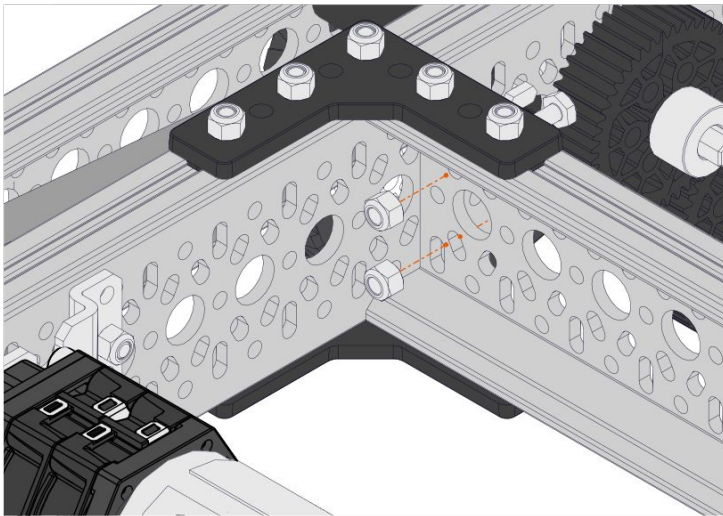




Get:

- 2 – 8mm Hex Cap Screws
- 2 – Locknuts

Add 2 Hex Cap screws and lock nuts to the 248mm C Channel closest to the traction wheels. Keep these finger tight with the hex head on the outside of the C Channel.



Get:

- 2 – 8mm Hex Cap Screws
- 2 – Locknuts

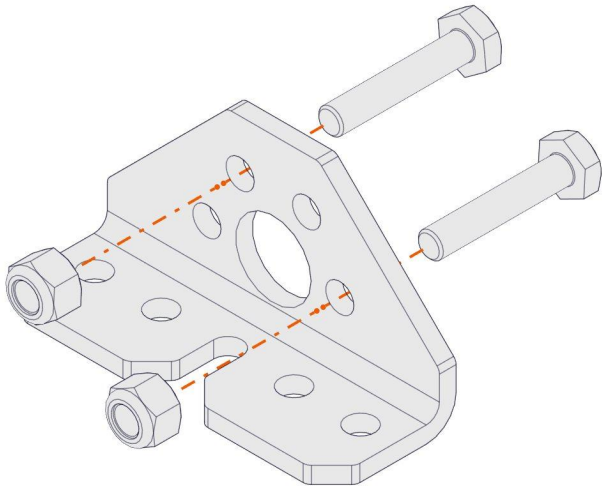
Add 2 Hex Cap screws and lock nuts to the 248mm C Channel closest to the traction wheels. Keep these finger tight with the hex head on the outside of the C Channel.



Get:

- 2 – 420mm Extrusion

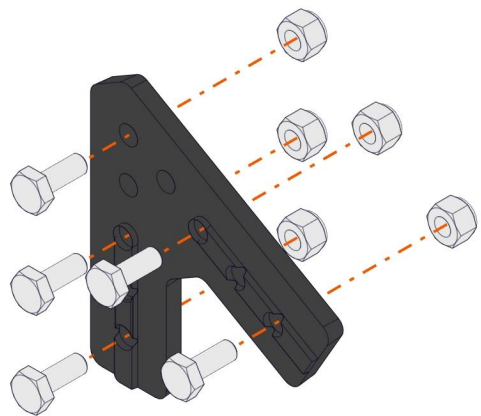
Slide the 420mm Extrusion onto the hex head screws from the previous step. The extrusion is flush with the bottom of the 40 Tooth Gear. Tighten down the lock nuts after the uprights are set.



Get:

- 2 – Core Hex Motor Brackets
- 4 – Lock Nuts
- 4 – 16mm Hex Head Screws

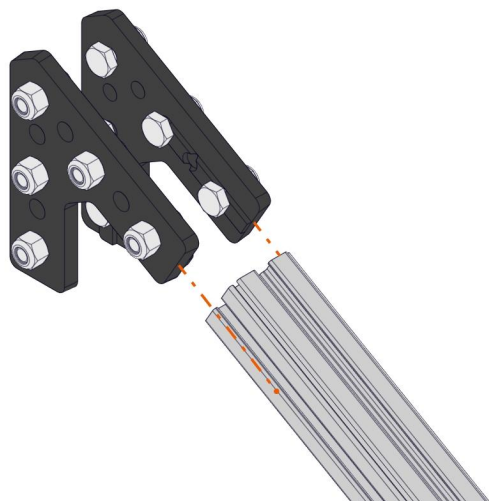
Add 2 16mm screws with locknuts finger tight on the Core Hex Motor Bracket as shown.



Get:

- 20 – 8mm M3 Bolts
- 20 – M3 Locknuts
- 4 – 60 Degree Brackets

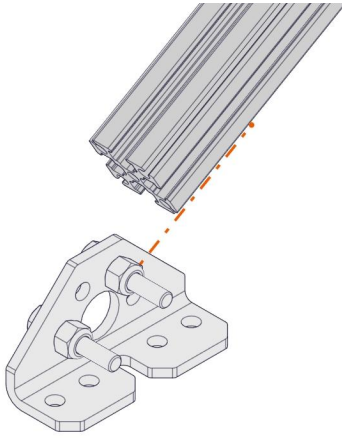
Pre-load the 60 Degree Brackets with 5 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- Preloaded 60 Degree Brackets
- 2 - 225mm Extrusion

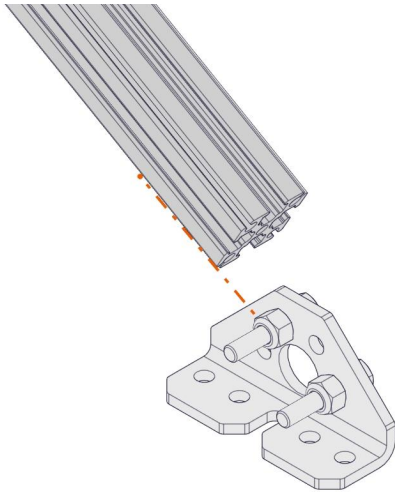
Slide the preloaded 60 degree brackets on the end of the extrusion. Make sure to leave 3 screws exposed for a later step. Tighten down. Repeat for second extrusion.



Get:

- 1 – Preloaded Core Hex Bracket
- 1 – 225mm Extrusion with Bracket Assembly

Add preloaded Core Hex Bracket to the end of the extrusion. See photo for reference.

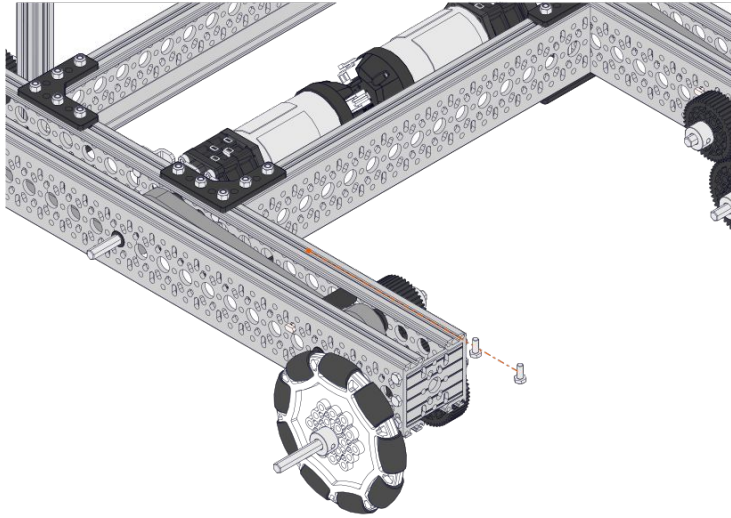


Get:

- 1 – Preloaded Core Hex Bracket
- 1 – 225mm Extrusion with Bracket Assembly

Add preloaded Core Hex Bracket to the end of the extrusion. See photo for reference.

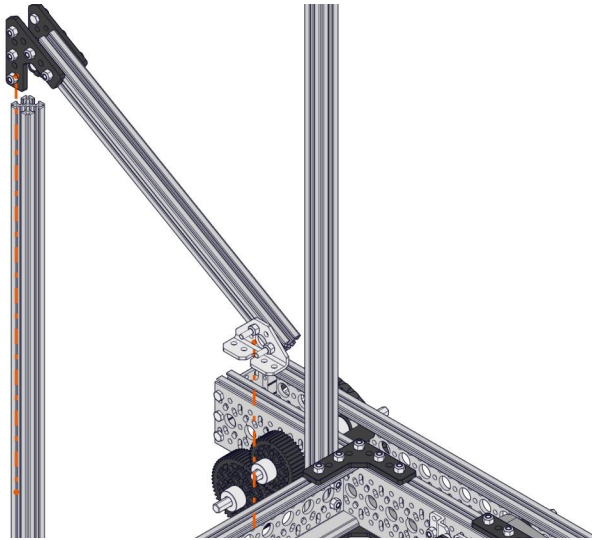
Note: this assembly is mirrored from the previous assembly



Get:

- 2 – 8mm Hex Cap Screws

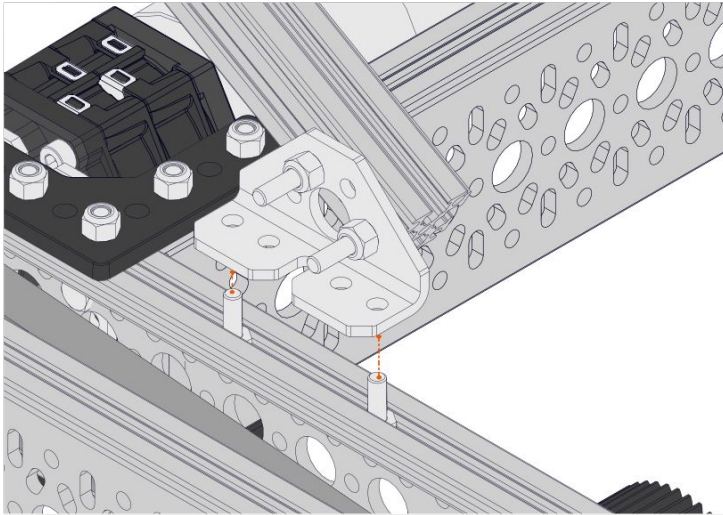
Load 2 8mm Hex Cap Screws into the inner slot of the drive rail.



Get:

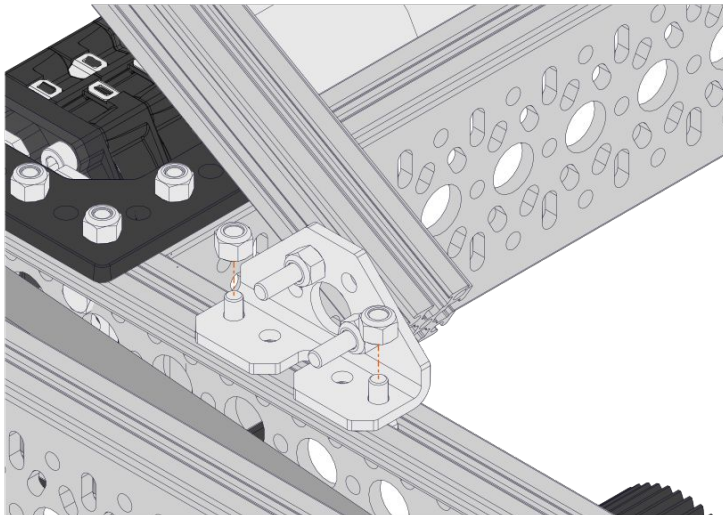
- Extrusion Support Assembly

Slide the Extrusion Support Assembly on the tower upright.



Align the preloaded screws and the hole in the Core Hex Bracket.

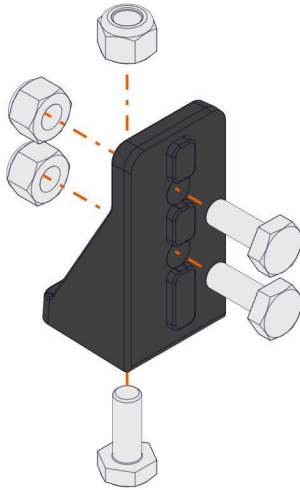
Note: fine adjustments might be needed depending on how brackets were attached. Loosening the brackets to have a bit of extra flexibility is helpful for this step.



Get:

- 2 – Locknuts

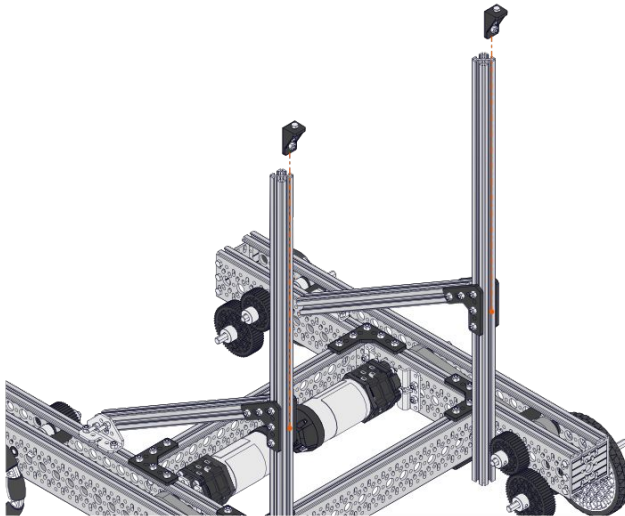
Once seated correctly add two lock nuts and tighten the Core Hex Bracket down. Tighten down any other loose screws and nuts for this assembly and repeat on the other side of the robot.



Get:

- 12 – 8mm M3 Bolts
- 12 – M3 Locknuts
- 4 – Lap Corner Brackets

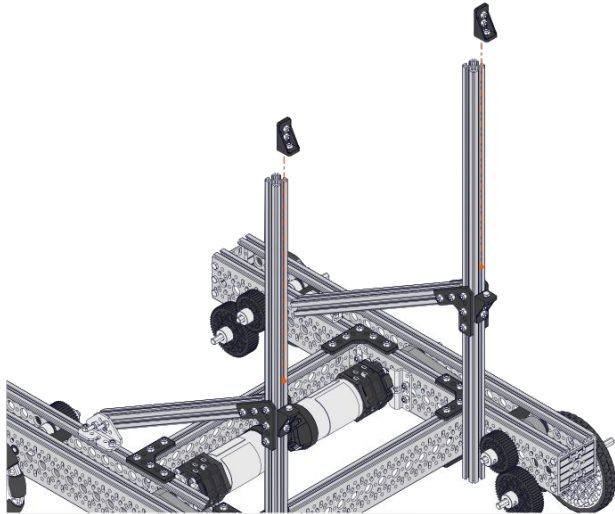
Pre-load the Lap Corner Brackets with 3 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 2 – Preloaded Lap Corner Brackets

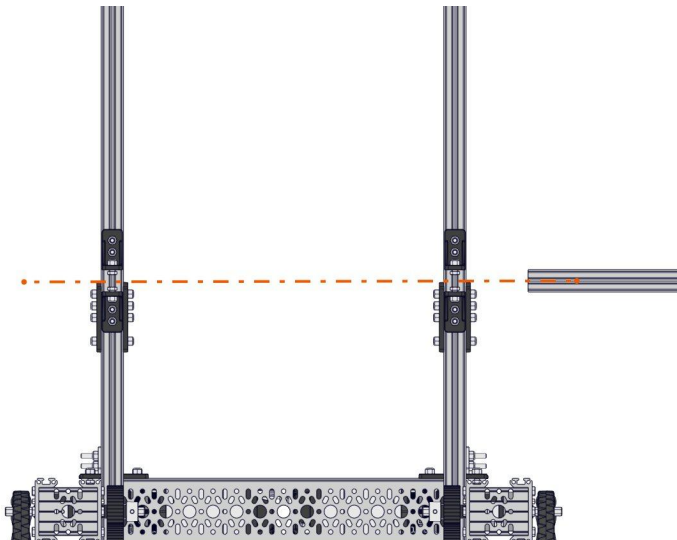
Slide 2 Lap Corner Brackets onto the Extrusion uprights. Tighten them down where the 60 Degree Bracket is located.



Get:

- 2 – Preloaded Lap Corner Brackets

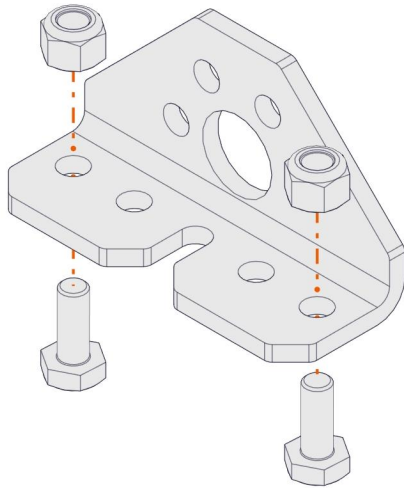
Slide 2 Lap Corner Brackets onto the Extrusion uprights. Keep these Lap Brackets loose for the next step.



Get:

- 1 – 420mm Extrusion

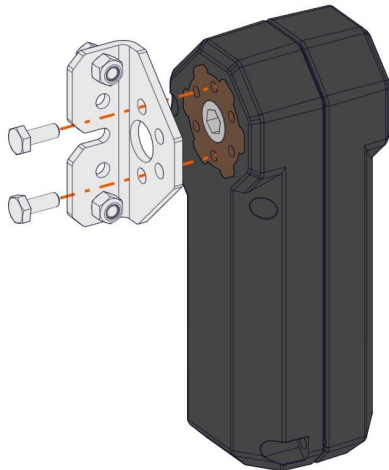
Slide the 420mm Extrusion through both pairs of Lap Brackets. Adjust the top Lap Bracket to its final location and tighten it in place.



Get: 2

- 1 – Core Hex Motor Mount
- 2 – Locknuts
- 2 – 8mm Hex Cap Screws

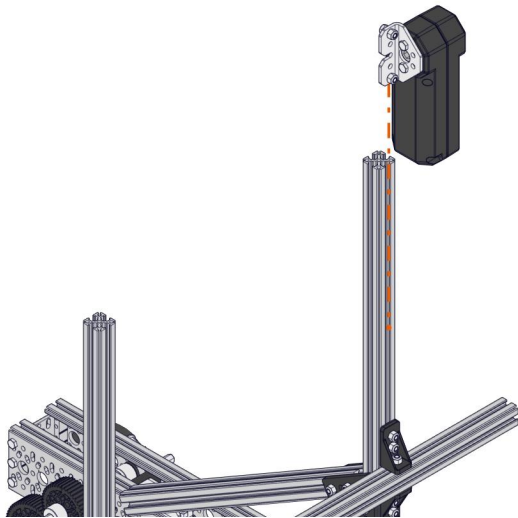
Preload the Core Hex Motor Mount.



Get:

- Preloaded Core Hex Motor Mount
- 1 – Core Hex Motor
- 2 – 8mm Hex Head Screws

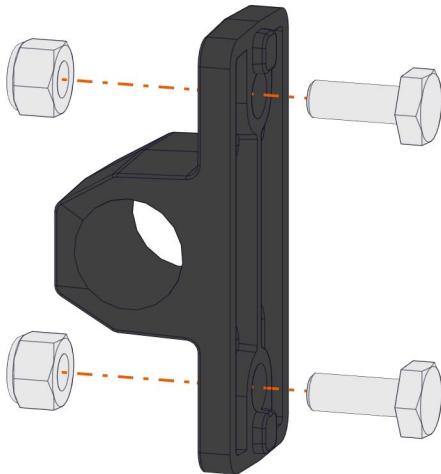
Attach Core Hex Motor to the Core Hex Motor Mount.



Get:

- 1 – Core Hex Motor with Mount

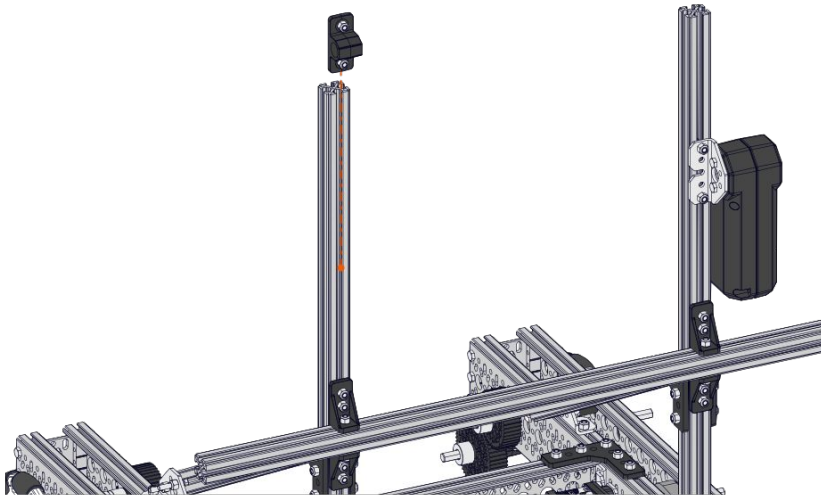
Slide the Core Hex Motor and mounting bracket onto the upright.



Get:

- 2 – 8mm M3 Bolts
- 2 – M3 Locknuts
- 1 – Bearing Pillow Blocks

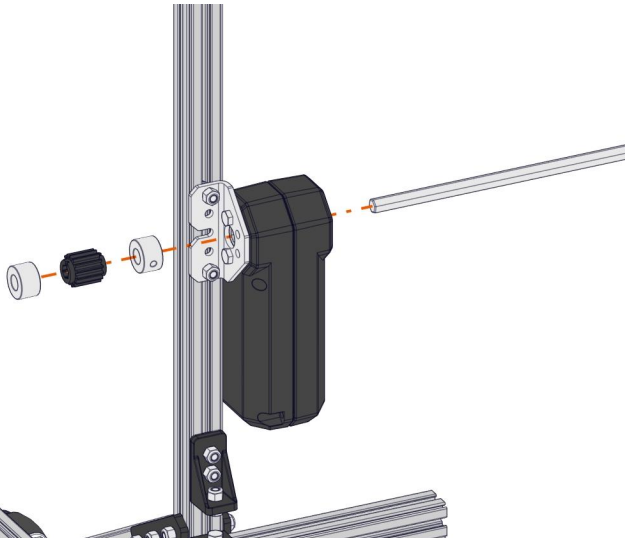
Pre-load the Bearing Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 1 – Preloaded Bearing Pillow Block

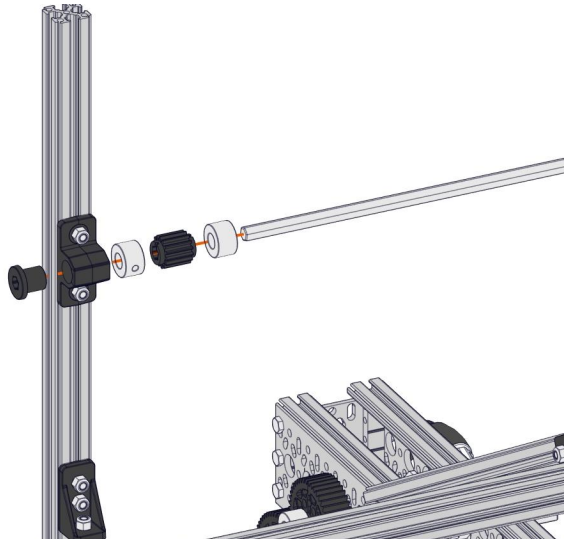
Slide the Bearing Pillow Block down the upright opposite of the Core Hex Motor.



Get:

- 1 – 420mm Hex Shaft
- 2 – Shaft Collars
- 1 – 15 Tooth Gear

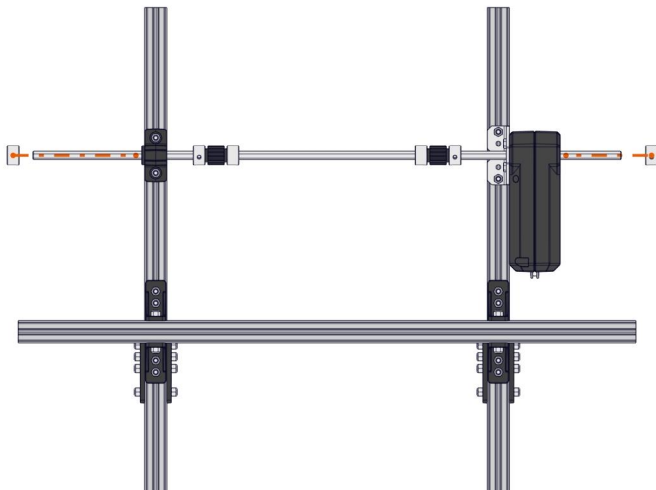
Slide a 420mm long Hex Shaft through the Core Hex Motor. Add a shaft collar, 15 tooth gear, and another shaft collar as shown.



Get:

- 1 – Long Through Bore Bearing
- 2 – Shaft Collars
- 1 – 15 Tooth Gear

Continue to Slide the 420mm long Hex Shaft towards the Bearing Pillow Block. Add a shaft collar, 15 tooth gear, and another shaft collar as shown. Seat the Shaft in a Long Through Bore Bearing.



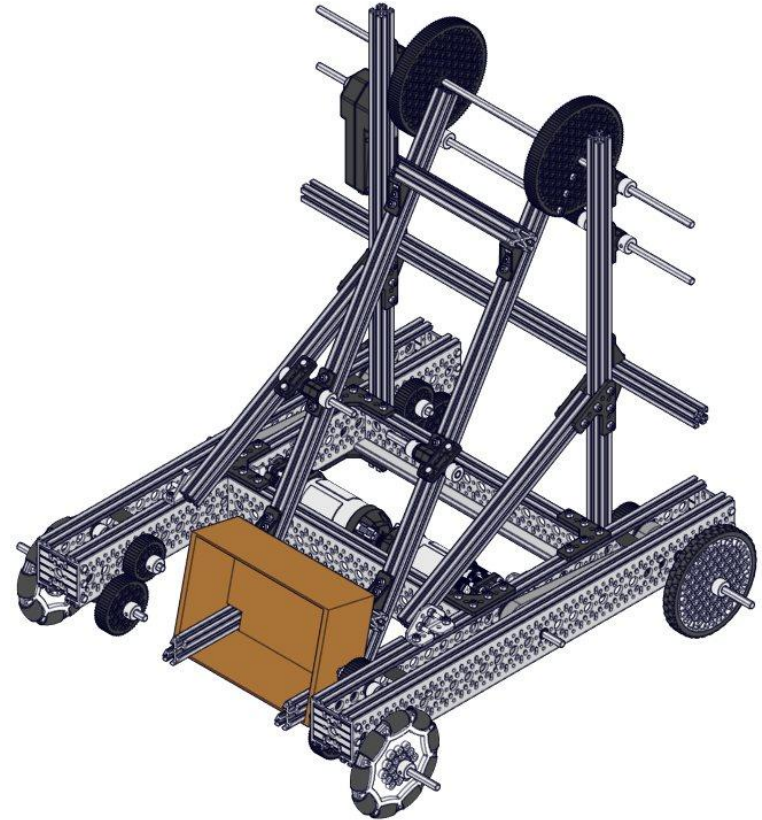
Get:

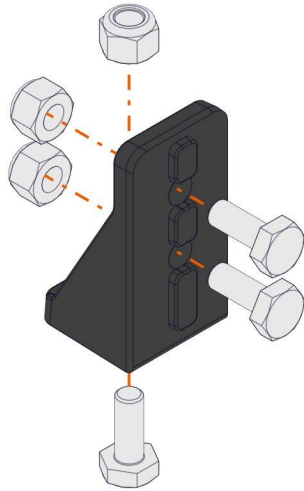
- 2 – Shaft Collars

Add shaft collars to the end of the shaft once it is fully through. Shaft collars are flush against the Core Hex Motor and Long Through Bore Bearing.

Arm Assembly - Bill of Materials

PART NUMBER	DESCRIPTION	QTY
N/A	Drivetrain and Tower Assembly	1
REV-41-1306	15mm Plastic 60 Degree Bracket	4
REV-41-1317	15mm Bearing Pillow Block	4
REV-41-1321	15mm Plastic Lap Corner Bracket	4
REV-41-1430	15mm Extrusion - 150mm - 45 degree ends	2
REV-41-1161	Zip Ties	10
N/A	UltraPlanetary Gearbox Kit Box	1
REV-41-1316	15mm Hex Pillow Block	2
REV-41-1333	125 Tooth Plastic Gear	2
REV-41-1327	Shaft Collar	6
REV-41-1362	5mm x 400mm Hex Shaft	1
REV-41-1329	Through Bore Bearing - Long	2
REV-41-1359	M3 x 8mm Hex Cap Screw	44
REV-41-1360	M3 X 16mm Hex Cap Screws	6
REV-41-1361	M3 Nyloc Nuts	50

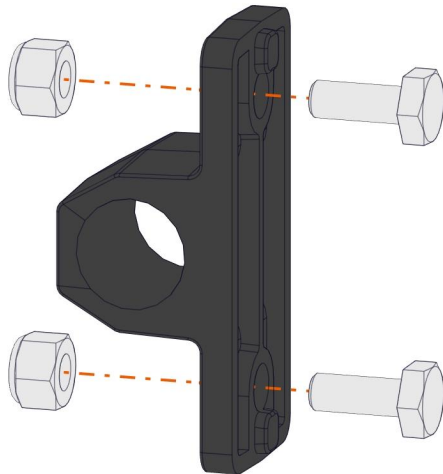




Get:

- 12 – 8mm M3 Bolts
- 12 – M3 Locknuts
- 4 – Lap Corner Brackets

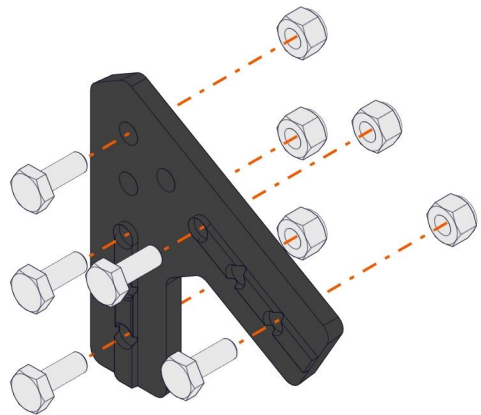
Pre-load the Lap Corner Brackets with 3 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 4 – 8mm M3 Bolts
- 4 – M3 Locknuts
- 2 – Bearing Pillow Blocks

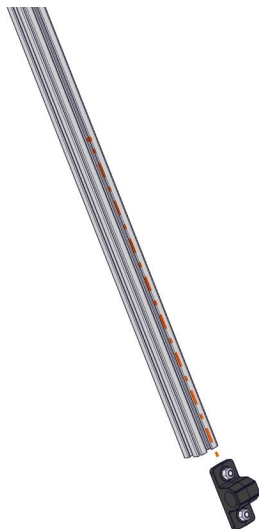
Pre-load the Bearing Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 20 – 8mm M3 Bolts
- 20 – M3 Locknuts
- 4 – 60 Degree Brackets

Pre-load the 60 Degree Brackets with 5 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 2 – Preloaded Bearing Pillow Block
- 2 – 420mm Extrusion

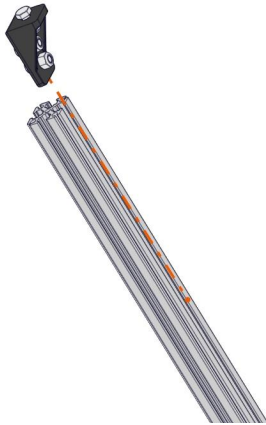
Slide a Bearing Pillow Block towards the middle of the 420mm Extrusion. Repeat until there are two 420mm Extrusions with pillow blocks.



Get:

- 2 – Preloaded Lap Corner Bracket
- 2 – 420mm Extrusion

Slide a Lap Corner Bracket between the Pillow Block and end of the 420mm Extrusion. Repeat until there are two 420mm Extrusions with this set up.



Get:

- 2 – Preloaded Lap Corner Bracket
- 2 – 420mm Extrusion

Slide a Lap Corner Bracket between the Pillow Block and end of the 420mm Extrusion. Repeat until there are two 420mm Extrusions with this set up.



Get:

- 2 – Preloaded 60 degree Brackets
- 2 – 420mm Extrusion

Slide the 60 degree bracket on the end of the 420mm Extrusion. Leave three hex heads exposed from the angle bracket. Repeat until there are two 420mm Extrusions with this set up.



Get:

- 2 – 150mm Extrusion with 45 Degree ends
- 2 – 420mm Extrusion

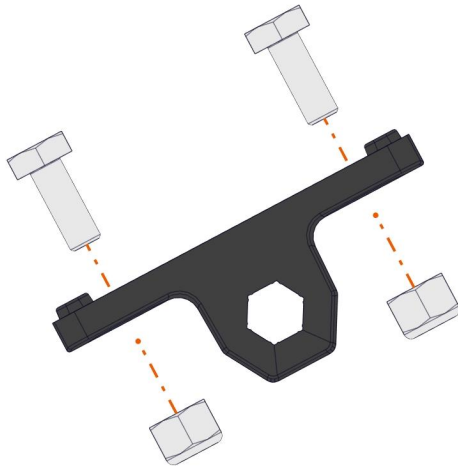
Slide the 150mm Extrusion into the 60 Degree Bracket. Repeat for both 420mm Extrusion assemblies.



Get:

- 2 – 150mm Extrusion with 45 Degree ends
- 2 – 420mm Extrusion

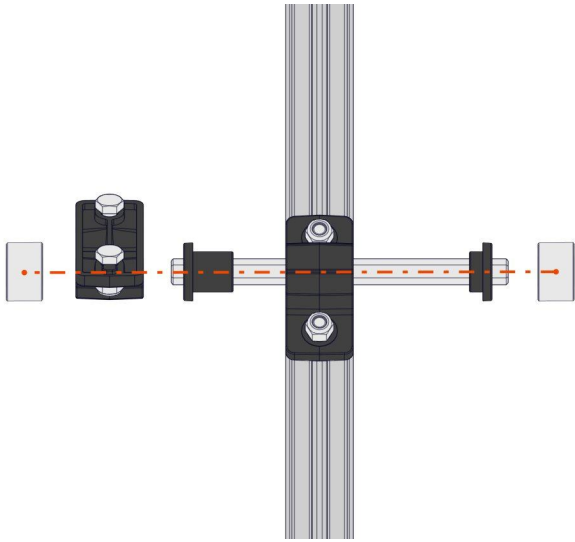
Slide the 150mm Extrusion across the two 420mm pieces into the lap brackets.



Get:

- 4 – 8mm M3 Bolts
- 4 – M3 Locknuts
- 2 – Hex Pillow Blocks

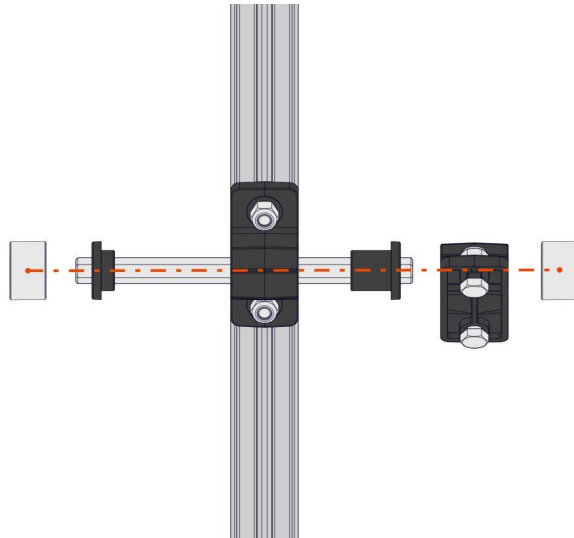
Pre-load the Hex Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 2 – Shaft Collars
- 1 – Pre-loaded Hex Pillow Block
- 1 - Short Through Bore Bearing
- 1 - Long Through Bore Bearing
- 1 - 75mm Hex Shaft

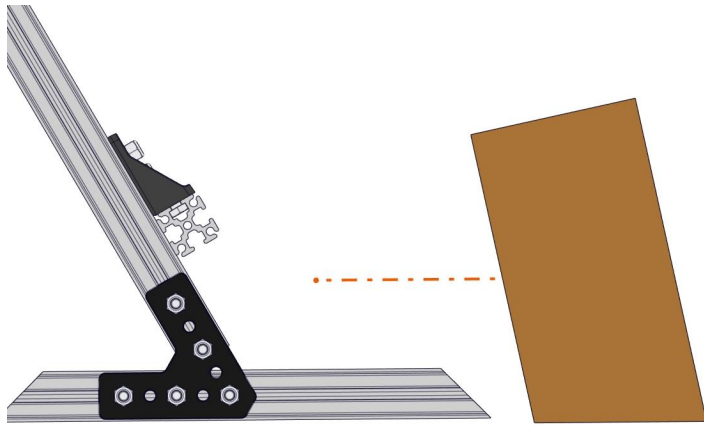
Slide the 75mm Hex Shaft through the Pillow Block on the left side of the arm. Add components in the order shown. Make sure the Hex Pillow Block is on the outside of the arm.



Get:

- 2 – Shaft Collars
- 1 – Pre-loaded Hex Pillow Block
- 1 - Short Through Bore Bearing
- 1 - Long Through Bore Bearing
- 1 - 75mm Hex Shaft

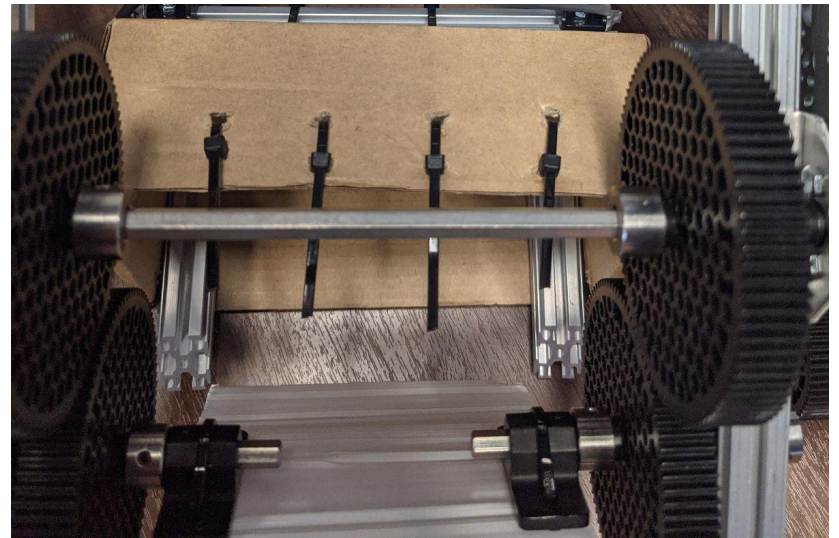
Slide the 75mm Hex Shaft through the Pillow Block on the right side of the arm. Add components in the order shown. Make sure the Hex Pillow Block is on the outside of the arm.



Get:

- UltraPlanetary Gearbox Kit Box
- Zipties

For a hopper for the game elements the box from the UltraPlanetary kit is used. Ziptie the front of the box closed, use zipties to retain box to rear support rail, and punch holes for the extrusion.

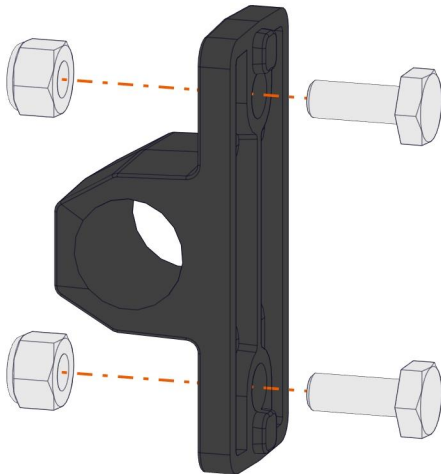




Get:

- 2 – 125 Tooth Gears
- 6 – M3 Locknuts
- 6 – 16mm Hex Cap Screws
- 1 – Arm Assembly

Add screws and nuts to the 125 Tooth Gear and slide the gears onto the top of the Arm Assembly.



Get:

- 4 – 8mm Hex Cap Screws
- 4 – M3 Locknuts
- 2 – Bearing Pillow Blocks

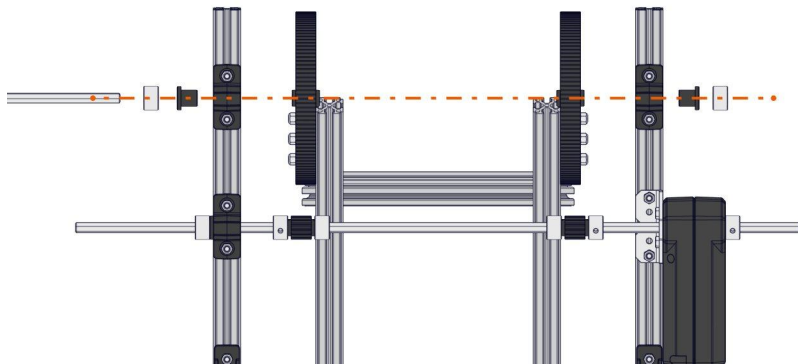
Pre-load the Bearing Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 2 – Preloaded Bearing Pillow Blocks
- 1 – Robot with Arm Uprights

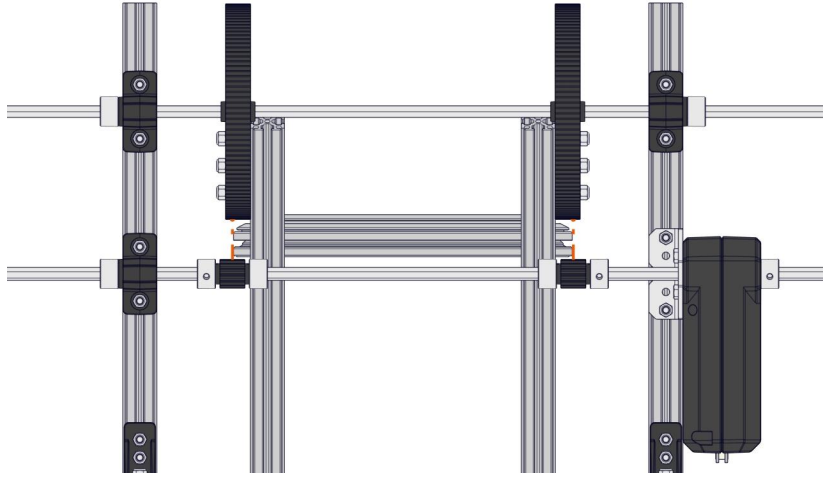
Slide the preloaded Bearing Pillow Blocks onto the up rights.



Get:

- 2 – Shaft Collars
- 2 – Long Through Bore Bearings
- 1 – Arm Assembly
- 1 – 420mm Hex Shaft

Slide the 420mm long Hex Shaft through the Long Through Bore Bearings and the Arm Assembly. Add a shaft collars to the end and secure them.

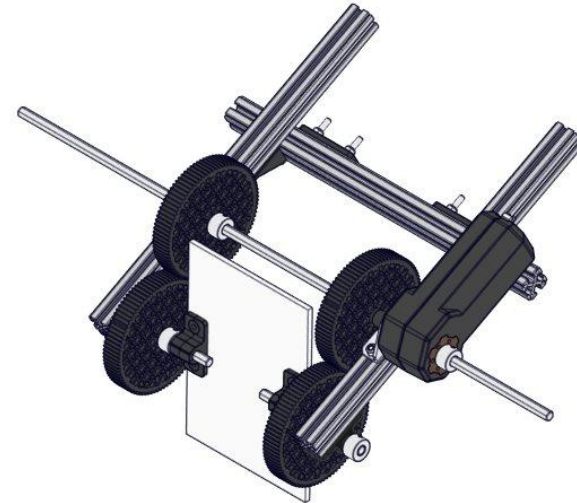


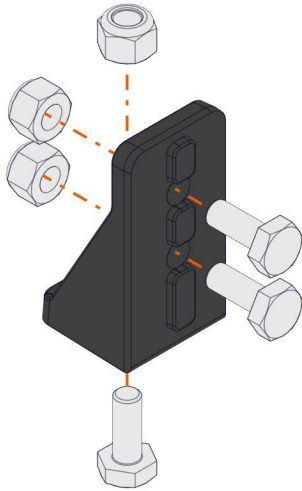
Adjust the Assembly so the Gears are meshing properly and the 125 Tooth Gear does not go above the uprights.

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Intake Assembly - Bill of Materials

PART NUMBER	DESCRIPTION	QTY
N/A	Drivetrain, Tower, and Arm Assembly	1
REV-41-1303	15mm Plastic Motion Bracket	2
REV-41-1317	15mm Bearing Pillow Block	3
REV-41-1321	15mm Plastic Lap Corner Bracket	4
REV-41-1433	15mm Metal Bent Core Hex Motor Bracket V2	1
REV-41-1327	Shaft Collar	3
REV-41-1362	5mm x 400mm Hex Shaft	1
REV-41-1329	Through Bore Bearing - Long	3
REV-41-1337	90 Tooth Gear	4
REV-41-1359	M3 x 8mm Hex Cap Screw	16
REV-41-1360	M3 X 16mm Hex Cap Screws	4
REV-41-1361	M3 Nyloc Nuts	20
REV-41-1316	15mm Hex Pillow Block	2
REV-41-1326	Through Bore Bearing - Short	2
REV-41-1300	Core Hex Motor	1
REV-41-1839	Corrugated Plastic Sheet - Intake Flap	1
REV-41-1431	15mm Extrusion - 225mm - 90 degree ends	3
REV-41-1323	15mm Spacer	1
REV-41-1347	5mm X 75mm Hex Shaft	2
REV-41-1316	15mm Hex Pillow Block	2

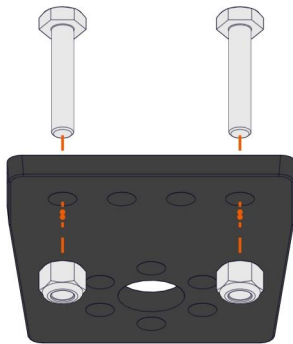




Get:

- 6 – 8mm Hex Cap Screws
- 6 – M3 Locknuts
- 2 – Lap Corner Brackets

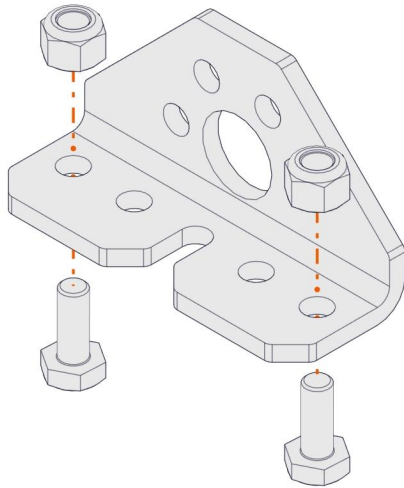
Pre-load the Lap Corner Brackets with 3 8mm Hex Cap Screws with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 4 – 16mm Hex Cap Screws
- 4 – M3 Locknuts
- 2 – Motion Brackets

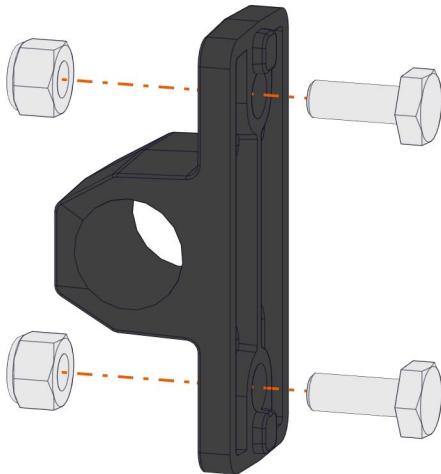
Pre-load the Motion Brackets with 2 16mm Hex Cap Screws with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get: 2

- 1 – Core Hex Motor Mount
- 2 – Locknuts
- 2 – 8mm Hex Cap Screws

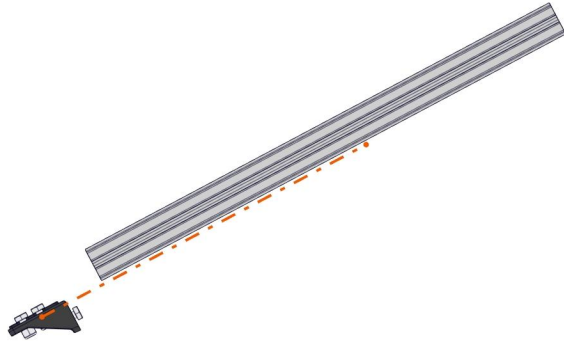
Preload the Core Hex Motor Mount with 2 8mm Hex Cap Screws with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 4 – 8mm M3 Bolts
- 4 – M3 Locknuts
- 2 – Bearing Pillow Blocks

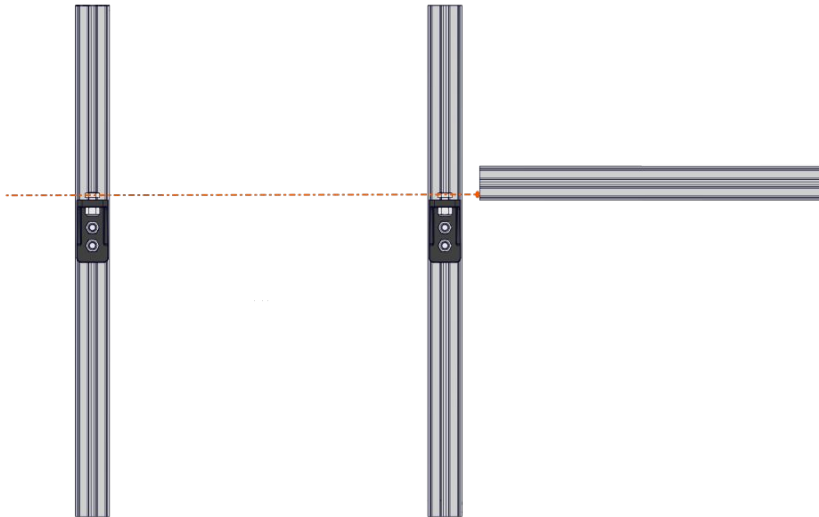
Pre-load the Bearing Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet.



Get:

- 2 - Pre-loaded Lap Bracket
- 2 - 15mm x 225mm Extrusion

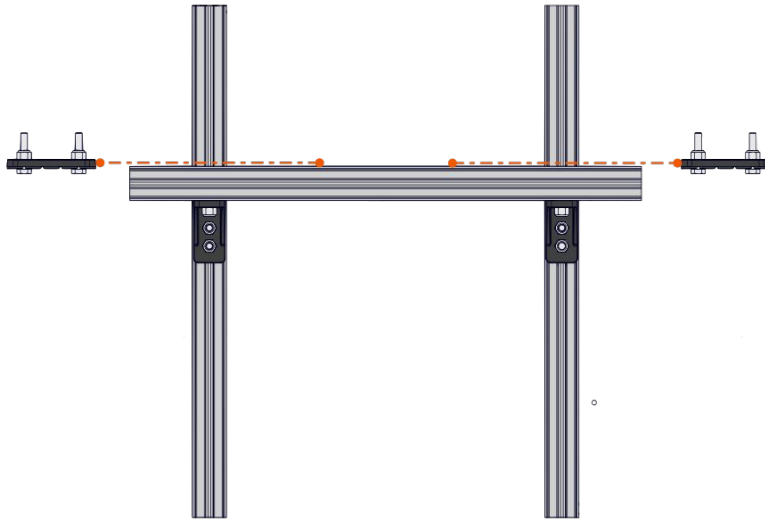
Add a pre-loaded Lap Bracket to each piece of Extrusion. Each bracket should be roughly centered to the Extrusion, Tighten lock nuts to lock them in place.



Get:

- 1 - 15mm x 225mm Extrusion
- 2 - 15mm x 225mm Extrusion w/ Lap Brackets

Slide the Extrusion through the Lap Brackets to create a cross member. Adjust Brackets so that the Extrusion is all level.



Get:

- 2 - Pre-loaded Motion Brackets
- Intake Assembly

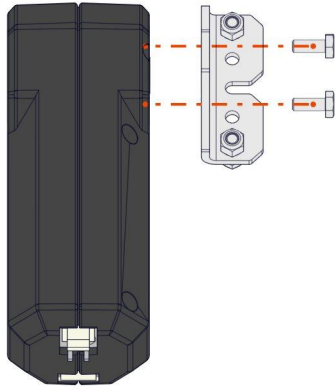
Add both motion brackets to the intake assembly's cross member. Center the motion bracket over the perpendicular Extrusion.



Get: 2

- 1 - Pre-loaded Bearing Pillow Block

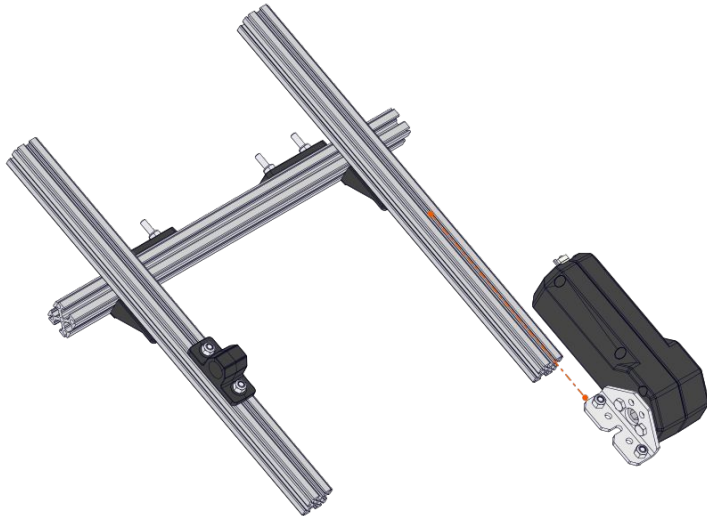
Slide the Bearing Pillow Block onto the intake assembly as shown. Tighten The locknuts to keep it in place for now, it made need to adjusted later.



Get:

- 1- Core Hex Motor
- 1 - Pre-loaded Core Hex Motor Bracket
- 2 - M3 8mm Bolt

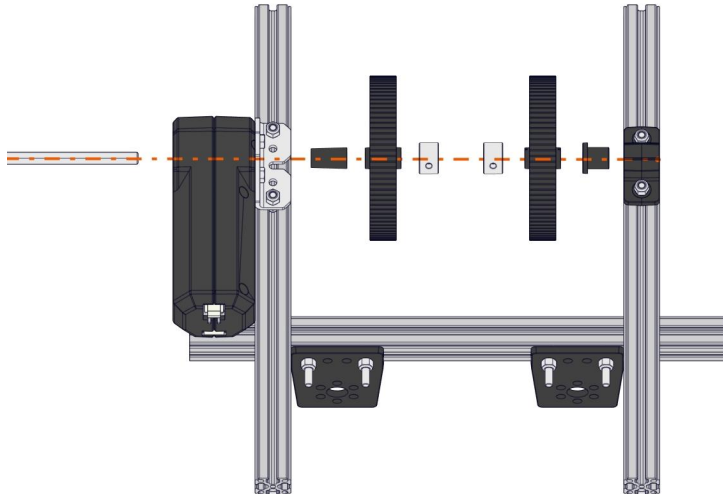
Attach the Core Hex Motor Bracket to the Core Hex Motor as shown.



Get:

- Core Hex Motor Assembly
- Intake Assembly

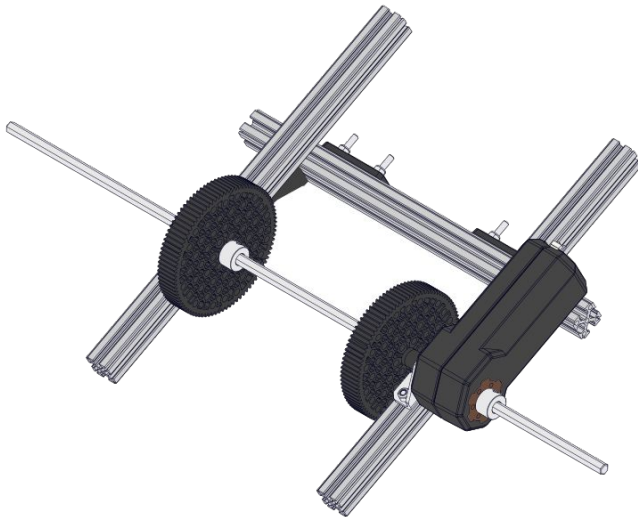
Slide the Core Hex Motor onto the intake assembly as shown. It should be roughly aligned with the adjacent Bearing Pillow Block. Tighten the locknuts



Get:

- 1 - 5mm x 400mm Hex Shaft
- 1 - 15mm Spacer
- 2 - 90 Tooth Plastic Gears
- 2 - Shaft Collars
- 1 - Through Bore Bearing - Long

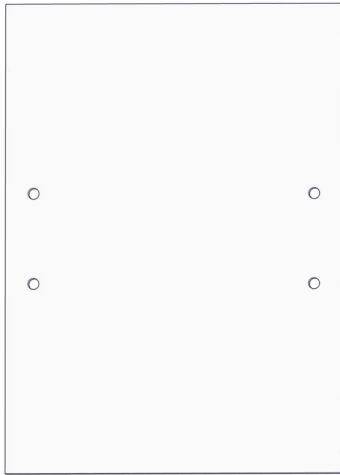
Slide the 400mm Hex Shaft through the Core Hex Motor. Add the listed components in the order shown



Get:

- Intake Assembly
- 1 - Shaft Collar

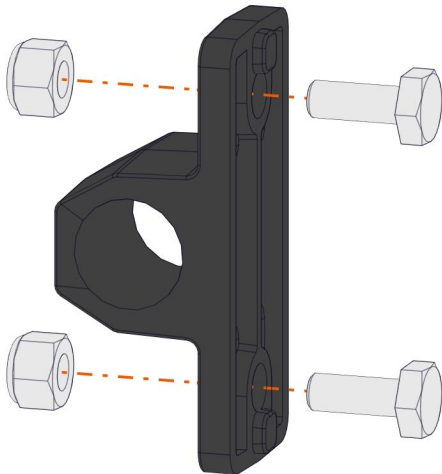
Space the components so that each gear is flush against opposing sides of the shaft. Add another shaft collar to the Core Hex Motor side of the shaft. Tighten the set screws on each shaft collar.



Get:

- 1- sheet of corrugated plastic

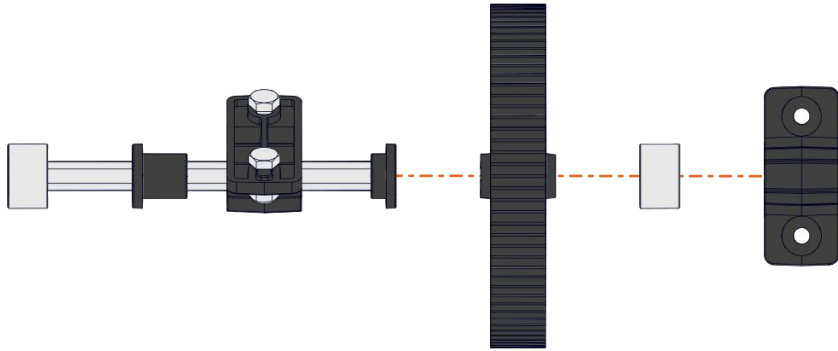
Cut a 90mm by 125mm piece of corrugated plastic. The ridges of the plastic should be horizontal with the 90mm side of the plastic cutout. Once the cutout is made fold along the ridges making the plastic more compliant.



Get:

- 2 - Bearing Pillow Blocks
- 4 - M3 Locknuts
- 4 - 8mm M3 Bolts

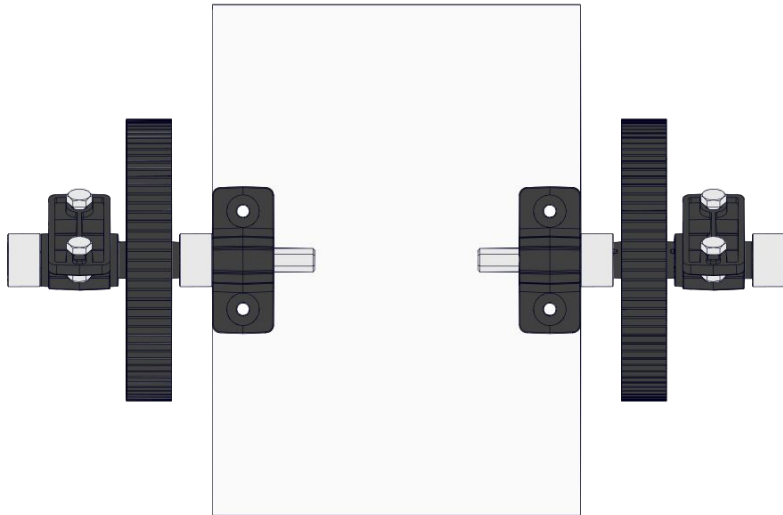
Pre-load the Pillow Blocks with 2 8mm, M3 bolts with locknuts. Only thread a few threads; don't tighten down the bolts yet



Get: 2

- 2 - Shaft Collars
- 1 - Through Bore Bearing- Long
- 1 - Pre-loaded Bearing Pillow Block
- 1 - Through Bore Bearing - Short
- 1 - 90 Tooth Plastic Gear
- 1- Hex Pillow Block
- 1- 75 mm Hex Shaft

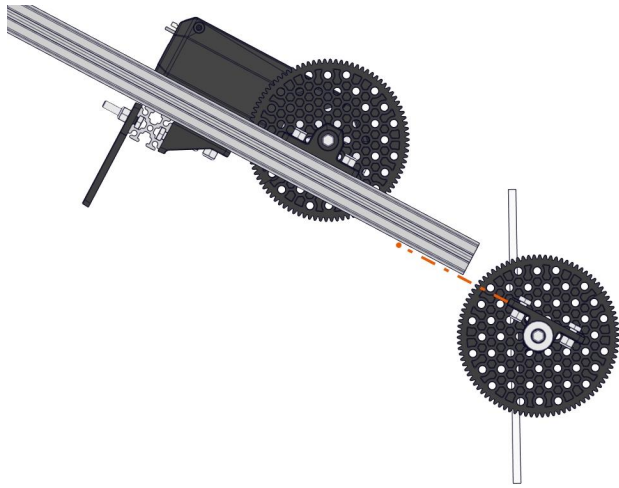
Slide the components on to the Hex Shaft in the order and orientation shown. Use the Shaft collar set screws to lock them in place. Repeat the steps to another shaft assembly.



Get:

- Corrugated Plastic
- Shaft Assemblies
- Zip Ties

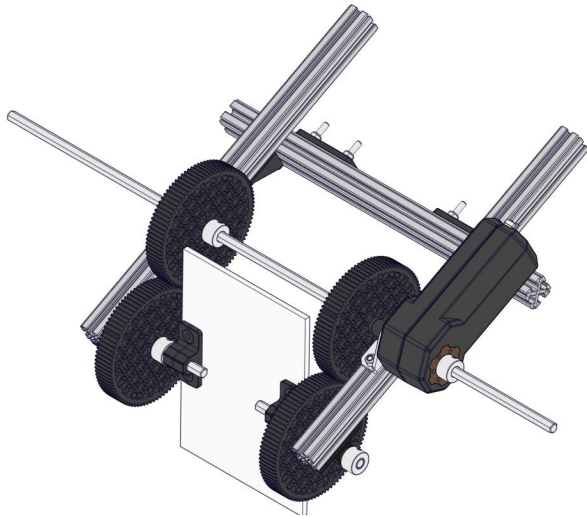
Attach the shaft assemblies from the previous step to the corrugated plastic by using zip ties to fix the Hex Pillow Blocks to the corrugated plastic. Use the Hex Pillow blocks as guides to poke holes in the corrugated plastic



Get:

- Flapper Assembly
- Intake Assembly

Slide the Flapper Assembly on the Intake Assembly. The Bearing Pillow Blocks are flush with the end of the Extrusion. Tighten the lock nuts to secure in place.

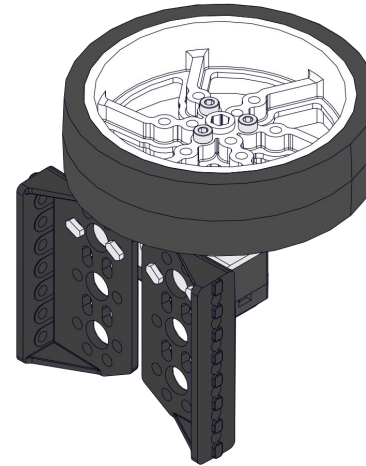


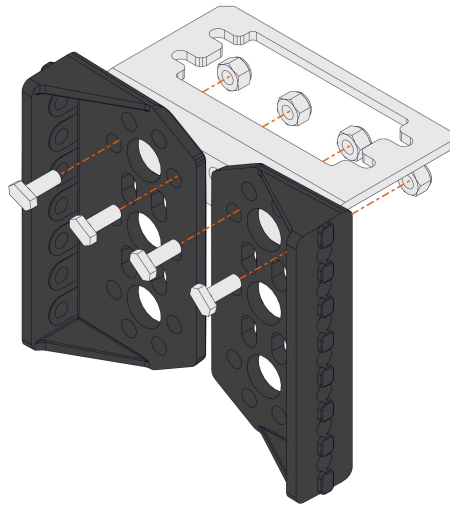
Intake Assembly Complete

Adjust the upper shaft assembly on the intake so that the gears of both shaft assemblies mesh. Assembly is complete set aside for now.

Carousel Mechanism - Bill of Materials

PART NUMBER	DESCRIPTION	QTY
REV-41-1167	M3 x 8mm T-Slot Screw	10
REV-41-1361	M3 Nyloc Nuts	10
REV-41-1267	90mm Grip Wheel	1
REV-41-1828	Aluminum Servo Horn V2	1
REV-41-1609	M3 x 20mm Socket Head Screw	3
REV-41-1485	15mm Metal Bent Servo Bracket V2	1
REV-41-1097	Smart Robot Servo	1
REV-41-1315	15mm Gearbox Motion Bracket	2
REV-41-1359	M3 x 8mm Hex Cap Screws	1

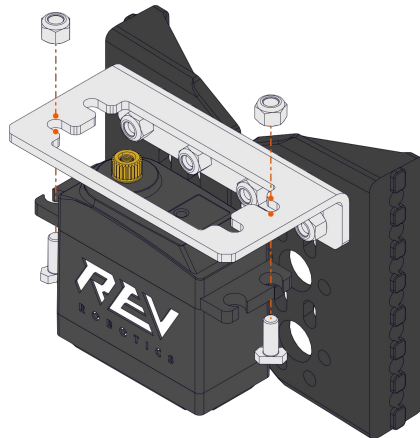




Get:

- M3 x 8mm T-Slot Screw x 4
- M3 Nyloc Nuts x 4
- 15mm Metal Bent Servo Bracket V2 x 1
- 15mm Gearbox Motion Bracket x 2

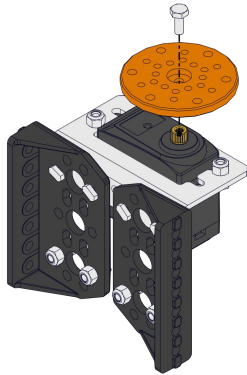
Attach both Gearbox Motion Brackets to the Bent Servo Bracket using the T-Slot Screws and Nyloc Nuts in the orientation shown.



Get:

- M3 x 8mm T-Slot Screw x 2
- M3 Nyloc Nuts x 2
- Smart Robot Servo x 1

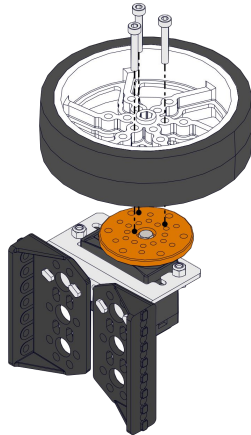
Attach the Robot Servo to the Servo Bracket using the T-Slot screws and Nyloc Nuts in the orientation shown.



Get:

- Aluminum Servo Horn V2 x 1
- M3 x 8mm Hex Cap Screws x 1

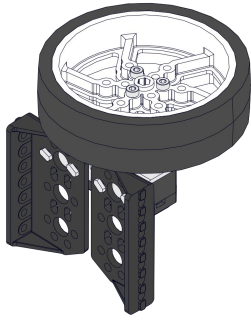
Attach Servo Horn to the Robot Servo using the T-Slot Screw in the orientation shown.



Get:

- 90mm Grip Wheel
- M3 x 20mm Socket Head Screw x 3

Attach the Grip Wheel to the Servo Horn using the Socket Head screws in the orientation shown. Note: The Socket Head Screws are part of the Ultrplanetary Gearbox Kit

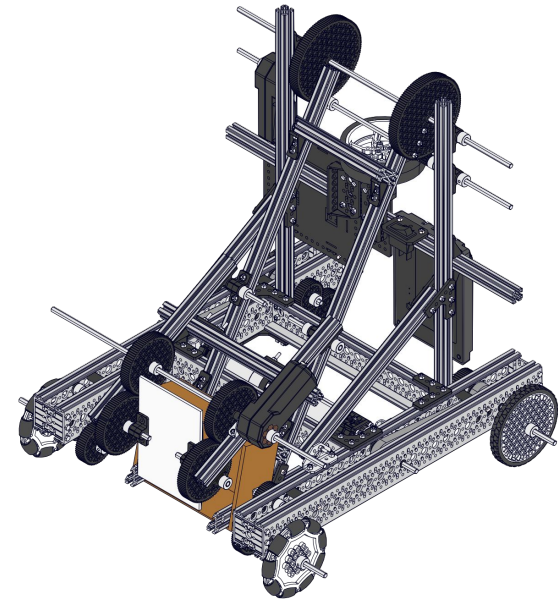


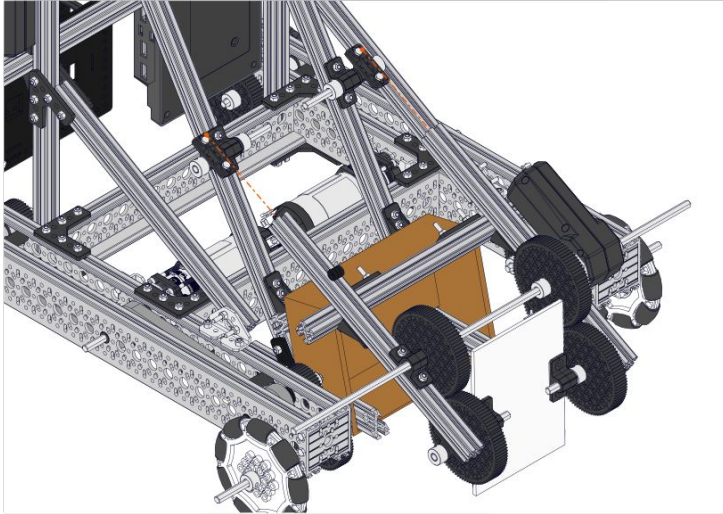
Carousel Mechanism complete - Set aside for now

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Final Assembly - Bill of Materials

PART NUMBER	DESCRIPTION	QTY.
N/A	Drivetrain, Tower, and Arm Assembly	1
N/A	Intake Assembly	1
REV-41-1907	M3 x 8mm T-Slot Screws	8
REV-41-1492	M3 Standoff - 40mm	4
REV-31-1387	Switch Cable and Bracket	1
REV-31-1595	Control Hub	1
REV-41-1163	Surgical Tubing	1
REV-41-1166	Battery Holder Plate	2

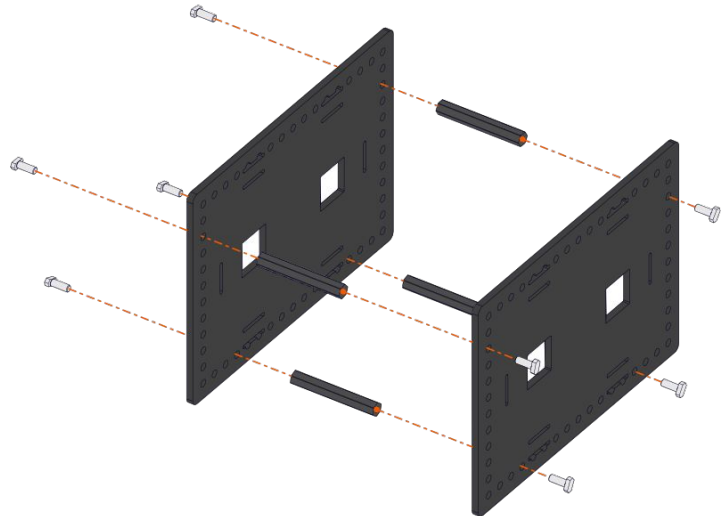




Get:

- Intake Assembly

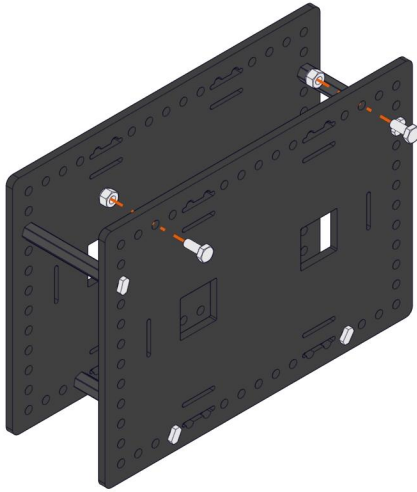
Slide the Roller Intake onto the arm using the Pillow Blocks. The edge of the Intake Extrusion should align with the outer edge of the pillow block. Tighten the Nylock Nuts to secure the intake in place.



Get:

- 4 - M3 Standoffs
- 8 - M3 T-Slot Screws
- 2 - Battery Holder Plates

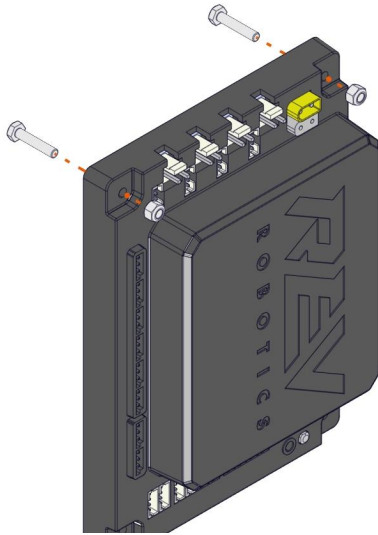
Create a box for the battery by sandwiching the M3 standoffs between the battery plates and using the t-slots screws to tighten them into place.



Get:

- 2 - 8mm M3 Hex Cap Screws
- 2- M3 Nylock Nuts

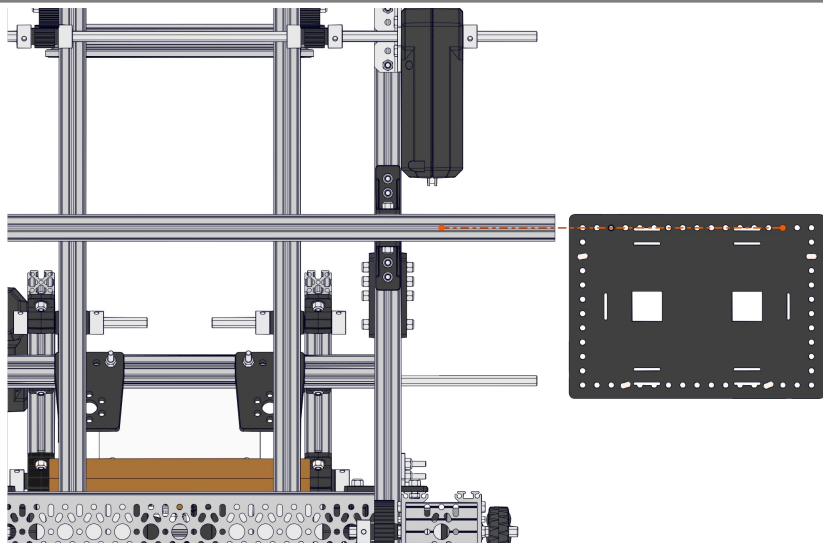
Pre-load one of the battery holder plates with two M3 8mm Hex Cap Screws. The Screws should be on the the 3rd hole from the edge of bracket, facing outwards. Do not tighten.



Get:

- 1 - Control Hub
- 2 – 16mm M3 Bolts
- 2 – M3 Locknuts

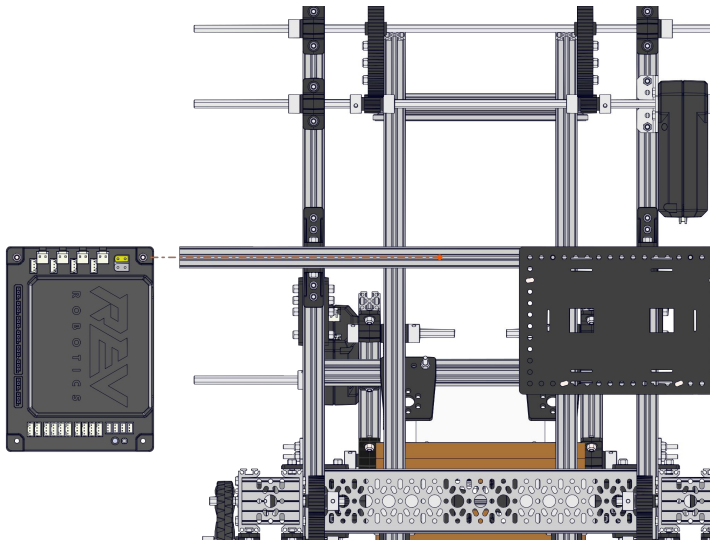
Pre-load the 16mm M3 Bolts into one side of the Control Hub.



Get:

- Battery Box Assembly
- M3 Wrench

Use the screw heads to slide the Battery Box onto the Extrusion cross member for the uprights. Tighten the nylock nuts into place using a M3 wrench.



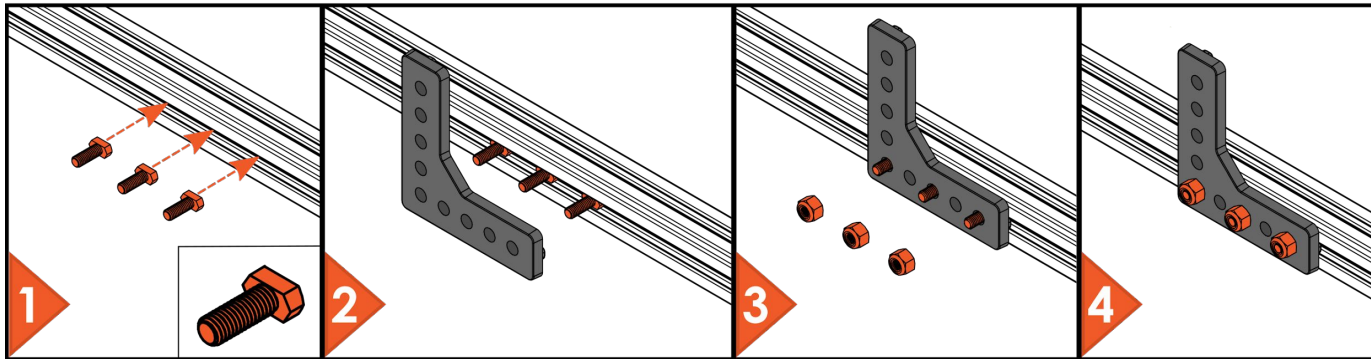
Get:

- Pre-loaded Control Hub
- Robot Assembly

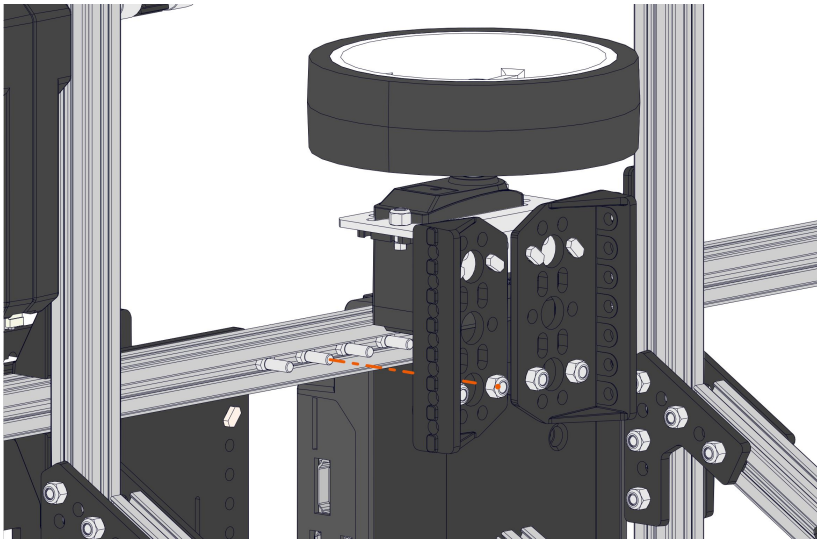
Slide the Control Hub onto the extrusion opposite of the Battery Box. Tighten the nylock nuts to secure it in place.

Introduction to T-Screws

In the FTC Starter Kit V3 there are T-Slot Screws. These screws have a T-shaped head allowing them to drop in the slots of the Extrusion or Channel. This allows for modification of an existing design by adding in brackets, structure, or mechanisms without needing access to the end of a slot.



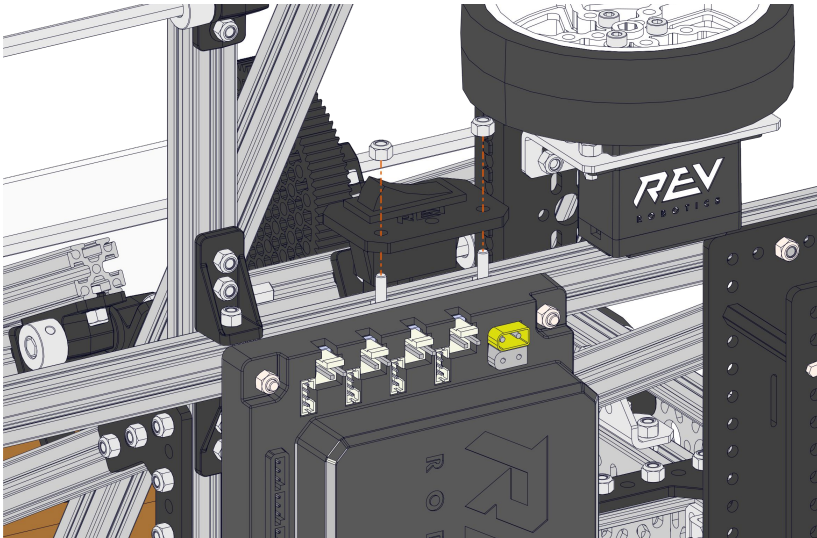
To use T-Screws, drop them into a slot on the extrusion, place the bracket over the screw head, finger start the nuts, then start to tighten down the nut with a nut driver. Wait until you feel the “T” of the screw catch the ends of the slot and continue to tighten. Repeat this process whenever using T-Screws in slots!



Get:

- T-Slot Screws - 4
- Carousel Mechanism
- M3 Locknuts - 2

Use the t-slot screws to attach the Carousel Mechanism to the middle of the extrusion uprights. Note the servo should go over the top of the extrusion towards the back of the robot.



Get:

- Switch Cable and Bracket
- T-Slot Screws - 2
- M3 Locknuts - 2

Use the t-slot screws to attach the Carousel Mechanism to the middle of the extrusion uprights. Note the switch is located on the inside of the robot.

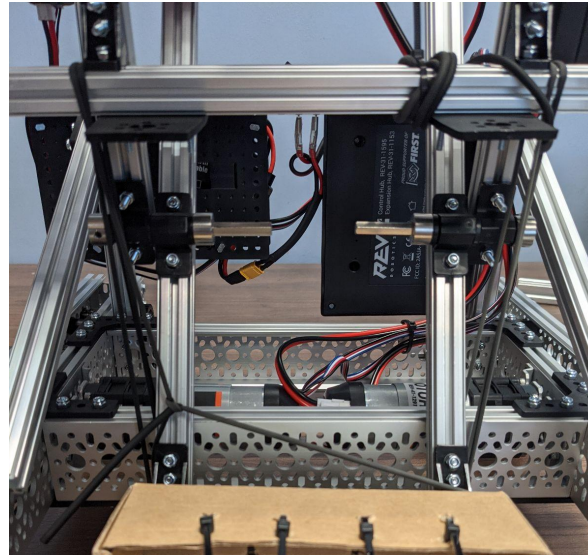


Get:

- Surgical Tubing
- Zipties

Wrap tubing around the intake support and the bottom of the arm. Adjust the amount of wrap and tension based on compliance and testing with game objects.

Use zipties to hold tubing secure in place.





Starter Bot Build Complete

