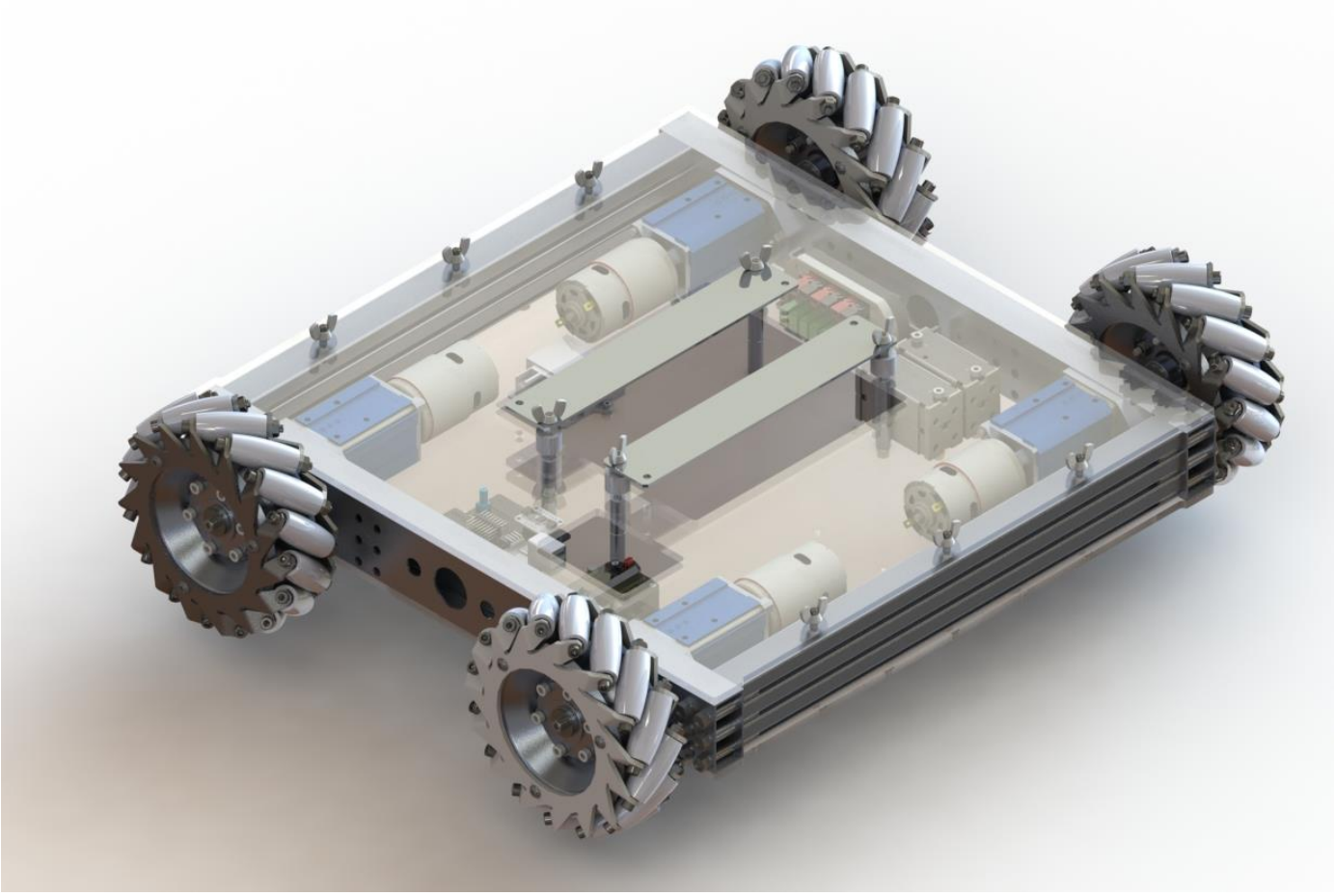
AndyMark®

User Guide

Rover 6" Mecanum Drive (am-4100a_MK6)



Additional Instructions Available

We encourage customers to seek product information at **AndyMark.com.** Contact us via e-mail at **support@andymark.com**, or call Toll-Free **877-868-4770** with questions about any of our products.

Update History:

10-17-19: Initial Release

12-27-19: Revised Electrical Layout

03-20-20: Updated BoM and relevant parts in various steps

07-15-21: Updated BoM, added clarification to gearbox and wheel assembly steps

10-21-22: Updated BoM, revised electrical layout, altered instructions.

Rover Chassis Recommended Hand Tool List (not included)

Component	Part Number	QTY	Part Photo
3/16" Allen Driver	am-2752	1	
Fold Up 12 Set Hex	am-3864	1	
5.5mm Nut Driver	am-1287	1	
3/8 in Nut Driver	am-3877	1	
7mm Combination Wrench	am-4140	1	
3/8"-7/16" Open End Wrench	am-2745	1	
DarkSoul #25 Chain Break	am-4024	1	
Retaining Ring Pliers	am-4013	1	
PowerPle Crimper	am-4202	1	
Hand Rivet Tool	am-2834	1	
Ferrule Crimp Tool	am-3739	1	
¼ Inch Drill Bit	am-4048	1	

6” Mecanum Wheel Assembly Bill of Materials (am-4100a mMK6)

Component	Part Number	QTY	Part Photo
RedLine Motor with 16 Tooth Pinion Gear Installed	am-3775a_16t	4	
57 Sport 3 Inch Shaft	am-3791	4	
57 Sport Gearbox, 64:1, SD	am-3973_064	4	
57 Sport Motor Block	am-3765	**4**	
57 Sport Flange Mount	am-4132	4	
10-32 x 0.5 Inch Button Head Cap Screw	am-1512	4	
Red Tacky Grease, 14.2 gram	am-2768	1	
6" SR Mecanum Left	am-3479La	2	
6" SR Mecanum Right	am-3479Ra	2	
1/2 Inch Extruded Hex Hub	am-2568	4	
10-32 x 0.75 Inch Socket Head Cap Screw	am-1047	24	
10-32 Nylock Jam Nut	am-1063	4	
Rover Drive Rail	am-4094	2	
1/2 Inch Hex Bore Bearing, Flanged	am-2986	4	
1/2 Inch Hex Spacer x 1.0 Inch	am-3948-1000	4	
10-32 x 0.625 Inch Socket Head Cap Screw	am-1007	4	

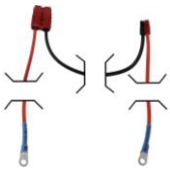
Rover End Rail	am-4131	2	
#10 x 0.75 Inch Fender Washer	am-1523	2	
#10 Flat Washer	am-1026	4	
Rover Chassis Bottom Plate, Polycarbonate	am-4100a_bottom	1	
Rover Chassis Top Plate, Polycarbonate	am-4100a_top	1	

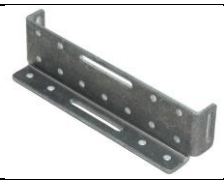
Shared Mechanical Hardware Bill of Materials (am-4100a_mh)

Component	Part Number	QTY	Part Photo
3/16 Inch Rivet, 0.376-0.5 Inch Range	am-1340	8	
1/4-20 x 1.75 Inch Self Tapping Screw	am-1372	24	
10-32 Nylock Jam Nut	am-1063	28	
#10 x 0.75 Inch Fender Washer	am-1523	2	
10-32 x 0.375 Inch Socket Head Cap Screw	am-1359	4	
0.375 in. OD x 0.257 in. ID x 0.875 in. Aluminum Spacer	am-1513	16	
10-32 x 0.625 Inch Socket Head Cap Screw	am-1007	4	
10-32 Wing Nut	am-1483	10	
10-32 x 2.75 Inch Socket Head Cap Screw	am-1397	6	
10-32 0.375IN OD x 1.000IN Long Aluminum Spacer	am-3876	8	
10-32 0.5IN Aluminum Spacer	am-3720	8	

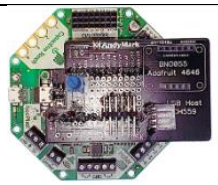
1032 x 3.5IN Long Socket Head Cap Screw	am-1402	4	
AM14U Family Horizontal Battery Mount Strap Plate	am-2940	2	
10-32 x 0.5IN Button Head Cap Screw	am-1512	4	

Electronics Bill of Materials (am-4100a_elec)

Component	Part Number	QTY	Part Photo
PowerPole Distribution Board	am-3699a_NF	1	
Victor SPX Motor Controller	am-3748	4	
120A Circuit Breaker	am-0282	1	
20 AWG White Ferrule Crimp	am-3738_20	4	
30 Amp Resettable Fuses	am-4112	4	
5 Amp Resettable Fuse	am-4822	1	
Rover Chassis Power Cable	am-4113	1	
12 Guage Red Black Bonded Wire	am-0904-5	5 ft	
Powerpole Kit, 8 Pack	am-2198	2	

Female Spade Connector, 12-10 AWG, Yellow, 10 Pack	am-2211	1	
S3 Battery Mount	am-3687	1	

Universal Drive Control System Bill of Materials (am-4708)

Component	Part Number	QTY	Part Photo
Logitech F710 Gamepad	am-4049	1	
USB Host Module	am-3040	1	
Universal Drive Control System	am-4706	1	

Electrical Hardware Bill of Materials (am-4100a_mh)

Component	Part Number	QTY	Part Photo
4-40 x 0.5IN Socket Head Cap Screw	am-1136	6	
4-40 Nylock Nut	am-1139	6	
M4-0.7 DIN 985 Nylock Nut	am-1435	4	
M4-0.7 x 50mm Socket Head Cap Screw	am-1401	4	
1/4-20 Nylock Nut	am-1015	2	
1/4-20 x 1IN Socket Head Cap Screw	am-1341	2	
6-32 x 0.5IN Hex Head Cap Screw	am-1563	2	
6-32 Nylock Jam Nut	am-1419	2	

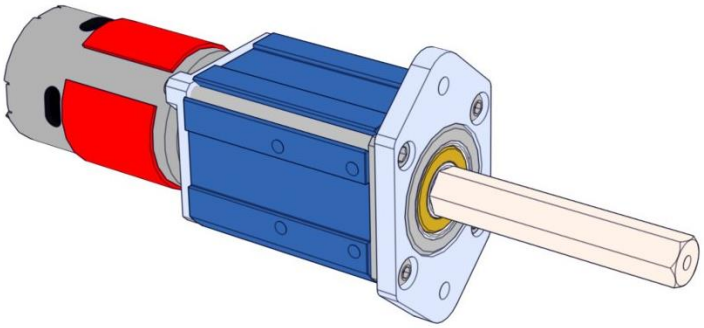
Gearbox Assembly Instructions (QTY 4)

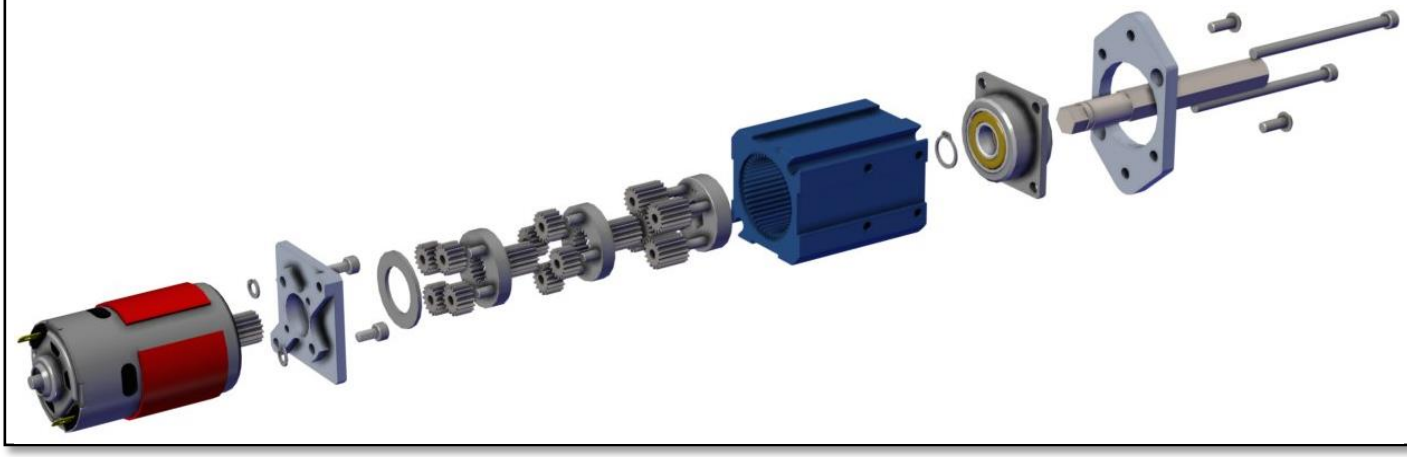
Each Rover 6” Mecanum Chassis includes four (4) AndyMark 57 Sport Gearboxes in a 64:1 ratio (am-4006_064). Four (4) AndyMark 775a RedLine Motors with 16t Pinions (am-3775a_16T) are also included along with the hardware necessary to mount the motors to the gearboxes. Additionally, a 57 Sport 3 inch Shaft (am-3791) is included for each gearbox to allow for the cantilevered wheel setup utilized in the Rover Chassis.

The 64:1 ratio has been chosen specifically for use with the 6 inch mecanum wheels to provide a fast and agile platform to build upon. Other ratios or wheel sizes (sold separately) can be used with the Rover chassis to suit your specific needs.

57 Sport									
Part #	Ratio	Weight	Length	Rated Torque	Redline				
					Stall Torque	Free Speed	Wheel Speed		
							4in.	6in.	8in.
am-4005_004	4:1 SD	0.76 lb	2.92 in.	120 ft-lbs	2.80 ft-lbs	5255.00 rpm	91.72 ft/sec	137.58 ft/sec	183.43 ft/sec
am-4005_012	12:1 SD	0.97 lb	3.42 in.	135 ft-lbs	8.40 ft-lbs	1751.67 rpm	30.57 ft/sec	45.86 ft/sec	61.14 ft/sec
am-4006_012	12:1 HD	1.06 lb	3.67 in.	170 ft-lbs	8.40 ft-lbs	1751.67 rpm	30.57 ft/sec	45.86 ft/sec	61.14 ft/sec
am-4005_016	16:1 SD	0.98 lb	3.42 in.	120 ft-lbs	11.20 ft-lbs	1313.75 rpm	22.93 ft/sec	34.39 ft/sec	45.86 ft/sec
am-4006_016	16:1 HD	1.07 lb	3.67 in.	160 ft-lbs	11.20 ft-lbs	1313.75 rpm	22.93 ft/sec	34.39 ft/sec	45.86 ft/sec
am-4005_020	20:1 SD	0.98 lb	3.42 in.	110 ft-lbs	14.00 ft-lbs	1051.00 rpm	18.34 ft/sec	27.52 ft/sec	36.69 ft/sec
am-4006_020	20:1 HD	1.08 lb	3.67 in.	140 ft-lbs	14.00 ft-lbs	1051.00 rpm	18.34 ft/sec	27.52 ft/sec	36.69 ft/sec
am-4006_036	36:1 HD	1.27 lb	4.17 in.	170 ft-lbs	25.20 ft-lbs	583.89 rpm	10.19 ft/sec	15.29 ft/sec	20.38 ft/sec
am-4006_048	48:1 HD	1.30 lb	4.17 in.	170 ft-lbs	33.60 ft-lbs	437.92 rpm	7.64 ft/sec	11.46 ft/sec	15.29 ft/sec
am-4006_064	64:1 HD	1.28 lb	4.17 in.	160 ft-lbs	44.80 ft-lbs	328.44 rpm	5.73 ft/sec	8.60 ft/sec	11.46 ft/sec
am-4006_080	80:1 HD	1.30 lb	4.17 in.	140 ft-lbs	56.00 ft-lbs	262.75 rpm	4.59 ft/sec	6.88 ft/sec	9.17 ft/sec
am-4006_100	100:1 HD	1.30 lb	4.17 in.	140 ft-lbs	70.00 ft-lbs	210.20 rpm	3.67 ft/sec	5.50 ft/sec	7.34 ft/sec

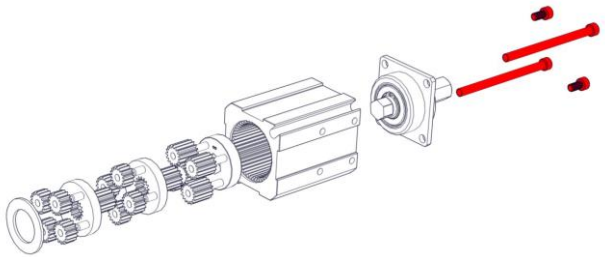
*Stall Torque and Free Speed are calculated using the unmodified specs of a pair of AndyMark 775a RedLine Motors



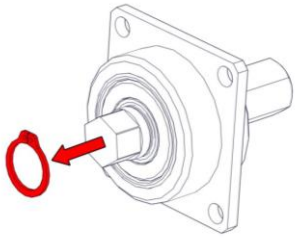


Gearbox Assembly Instructions (QTY 4)

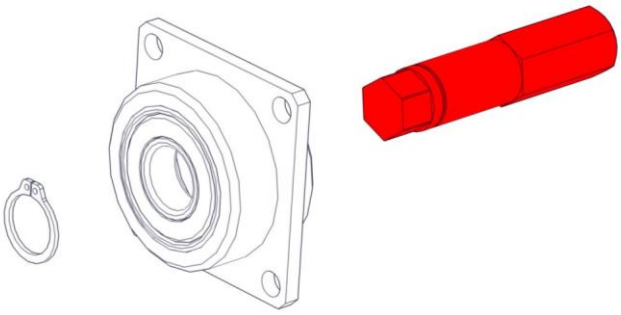
Step 1: The 57 Sport gearbox is pre-assembled with a plastic cap on the back. Remove the four (4) #10-32 Socket Head Cap Screws from the front of the gearbox and carefully remove all components, being careful to keep them together. The plastic cap can be discarded.



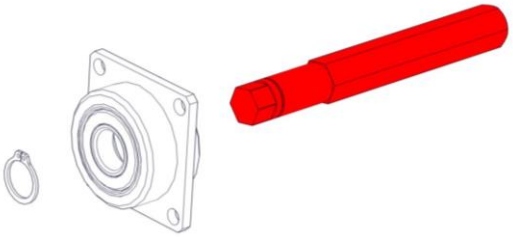
Step 2: The short output shaft needs to be replaced with the longer 3 inch output shaft. Using a pair of snap ring pliers, remove the snap ring from the backside of the face plate. Be careful not to permanently deform the snap ring by opening it too wide.



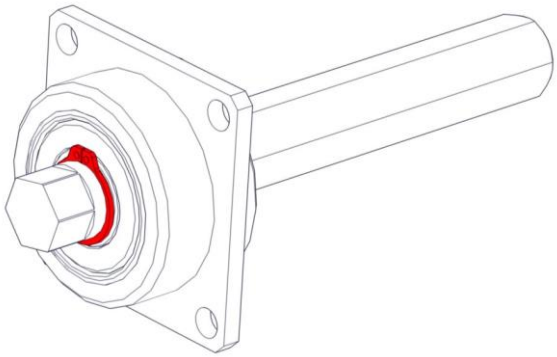
Step 3: Remove the output shaft by pulling it through the front of the face plate and bearings.



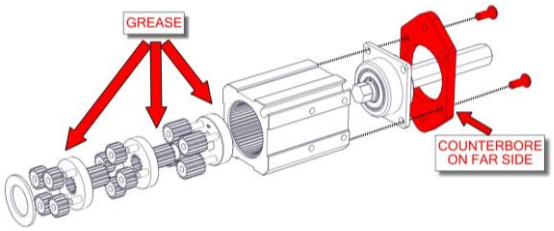
Step 4: Insert the new 57 Sport 3 inch Shaft (am-3791) into the faceplate. Be sure to push the shaft all the way in until the shoulder rests against the outer bearing and make sure the inner bearing remains seated in the faceplate.



Step 5: Replace the snap ring on the new shaft. Be careful to not permanently deform the snap ring by opening it too wide. It should snap into the groove on the output shaft around the full circumference.

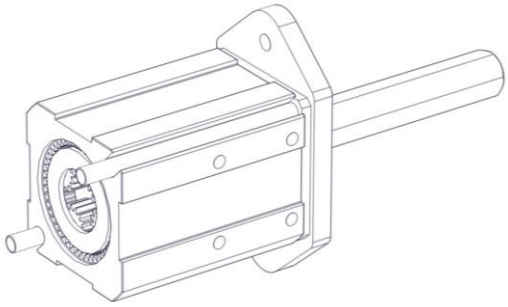


Step 6: Reassemble the 57 Sport Gearbox using two (2) #10-32 x 0.5 inch long Button Head Cap Screws (am-1512) in place of the 0.375 inch long Socket Head Cap Screws. Add the 57 Sport Flange Mount (am-4132) to the front face of the gearbox – the screws will be used in the pair of counter-bored holes on the flange plate. Add a pea-sized amount of Red Tacky Grease (am-2768) to each planet gear and the carrier plate surfaces. Enough grease should be used so that all internal surfaces get a coating of grease; however, too much grease can cause the gearbox to drag.

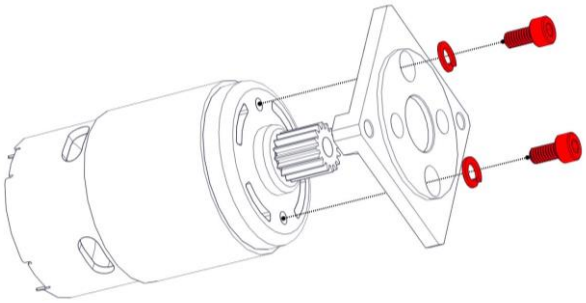


Gearbox Assembly Instructions (QTY 4)

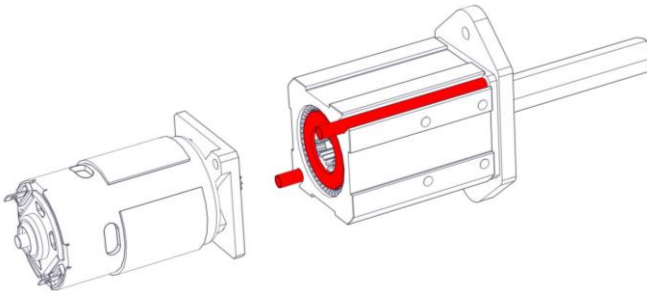
Step 7: The 57 Sport Gearbox Assembly is now complete. The Motor and Motor Plate will be assembled next. The long Socket Head Cap Screws will remain loose for now.



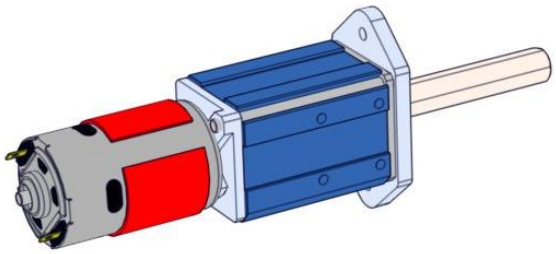
Step 8: Attach the Redline Motor with 16 Tooth Pinion (am-3775a_16t) to the 57 Sport Back Plate (am-3765) using M4 x 8mm screws and lock washers included with the motor.



Step 9: Join the 57 Sport Gearbox and the motor together using the #10-32 x 3.0 inch Socket Head Cap Screws. Make sure the thrust washer is seated in the ring gear flush against the planet gears before mating the two housings.

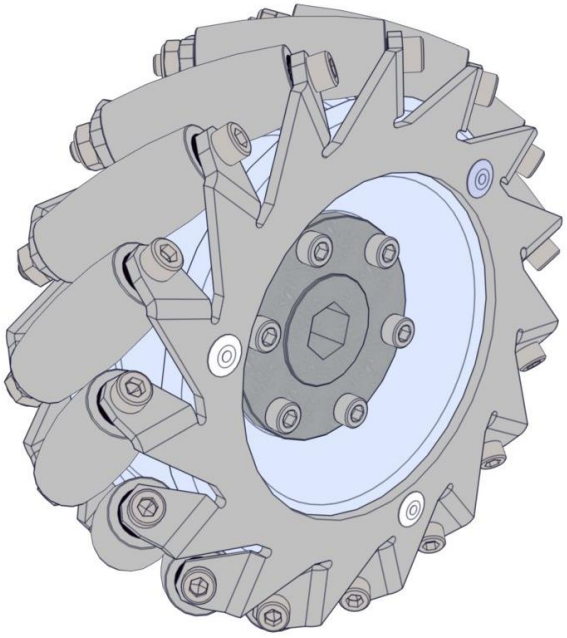


Step 10: Congratulations, you now have a completed gearbox assembly. Repeat Steps 1 – 9 to complete three additional identical gearboxes.

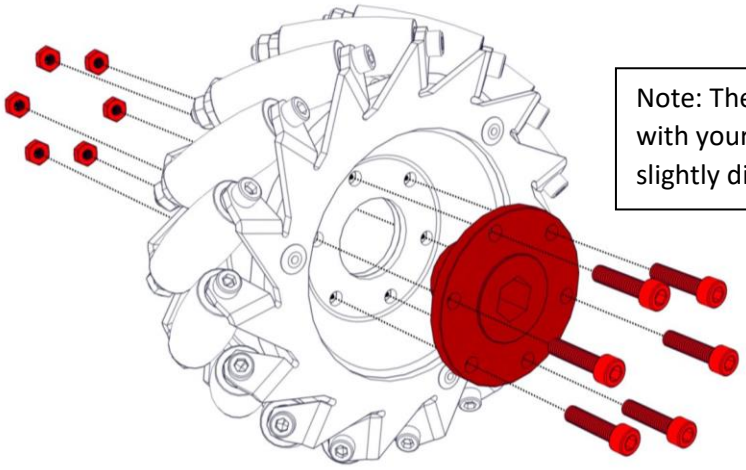


Wheel Assembly Instructions (QTY 4)

The Rover 6” Mecanum Chassis includes a complete set of SR Mecanum wheels, two Left and two Right. Mecanum wheels will give your robot the ability to move in any direction while maintaining the simplicity of a traditional four wheel drive configuration. These wheels have heavy duty features and increased smoothness while rolling. The gaps between the rollers are minimized, enabling this wheel to be our "smooth rolling" (SR) Mecanum Wheel. These wheels will be assembled together with a ½ Inch Hex Hub to be driven by the output shafts of the previously assembled gearboxes.



Step 1: Using six (6) #10-32 x 0.750 inch Socket Head Cap Screws (am-1047) and six (6) #10-32 Nylock Jam Nuts (am-1063), attach a ½ Inch Hex Hub (am-2568) to the wheel. The hub will protrude partially through the center of the wheel.

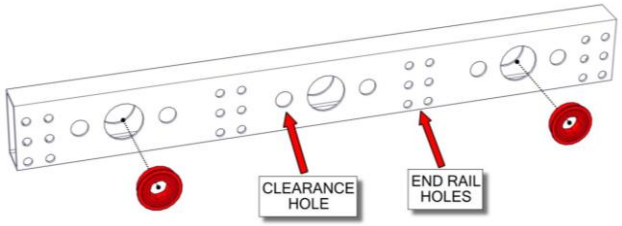


Note: The hub included with your Rover may look slightly different.

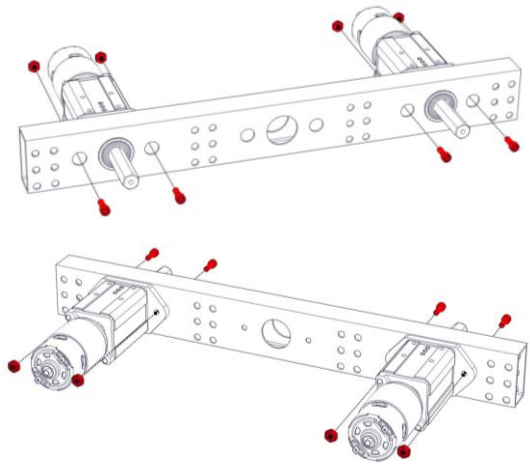
Step 2: Congratulations, you now have a completed wheel assembly. Repeat Step 1 three (3) more times to complete a total of four (4) wheels. Note that two wheels will have the rollers oriented opposite from the wheel depicted above and the hub may be installed on either side of any of the wheels

Chassis Assembly Instructions

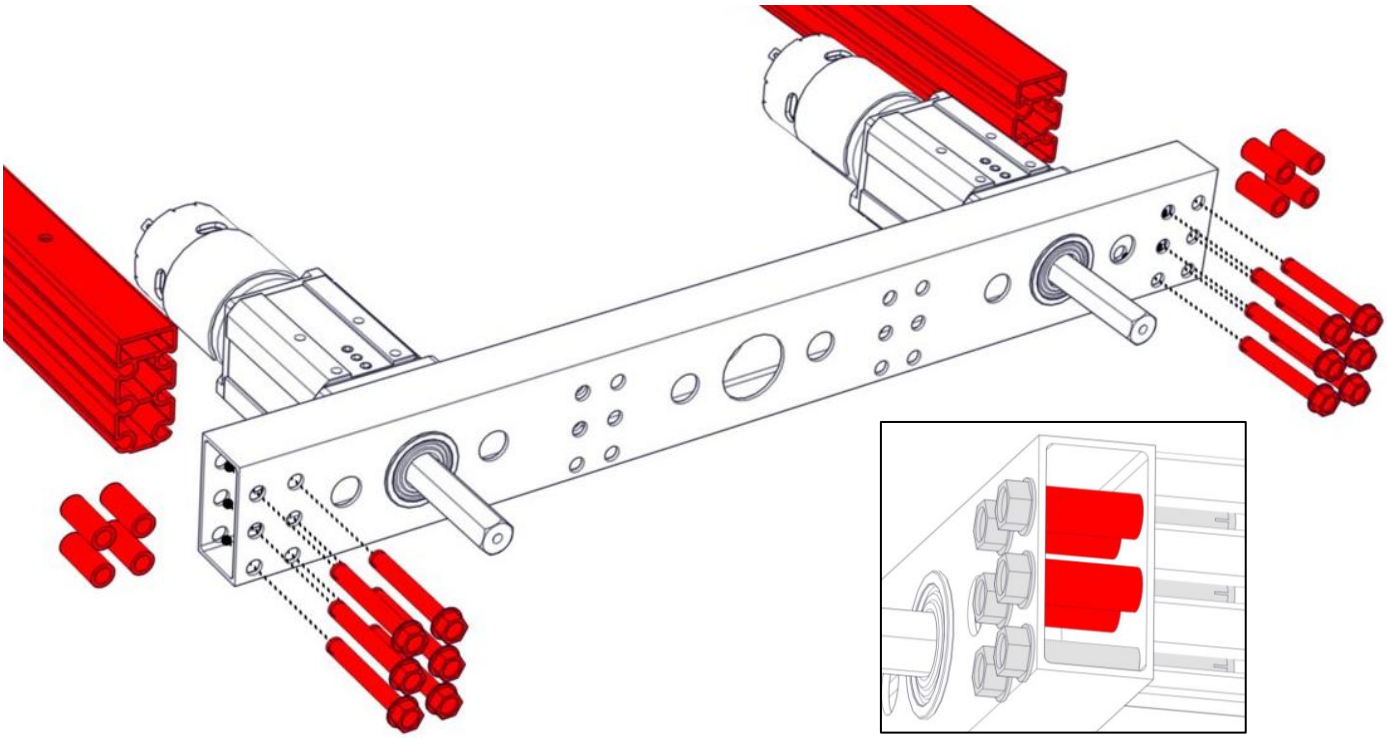
Step 1: Into one of the Rover Drive Rails (am-4094), press two ½ Inch Flanged Hex Bearings (am-2986) into the face with the large clearance holes adjacent to the bearing holes. Both bearings should be placed into the end holes leaving the middle hole remaining open. **Note:** The twenty-four (24) End Rail holes are not centered vertically on the tube and should be biased toward the bottom of the tube.



Step 2: Insert four (4) #10-32 x 0.625 inch Socket Head Cap Screws (am-1007) through the clearance holes and use four (4) #10-32 Nylock Jam Nuts (am-1063) to attach two gearbox assemblies to the tube. Align the hex bearings with the output shafts to allow them to slide through.

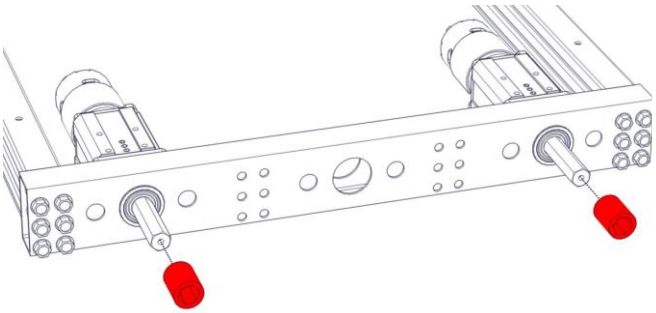


Step 3: Using twelve (12) ¼-20 x 1.75 inch Self-Tapping Screws (am-1372), join the Rover Drive Rail Assembly from Step 2 to two Rover End Rails (am-4131). The Rover End Rails will have the rounded face towards the bottom to ensure the top and bottom faces of all three rails are flush. Use eight (8) 0.375 inch OD x 0.875 inch long Aluminum Spacers (am-1513) inside the Rover Side Rail with the screws that are not adjacent to the bottom wall to prevent crushing the tube.

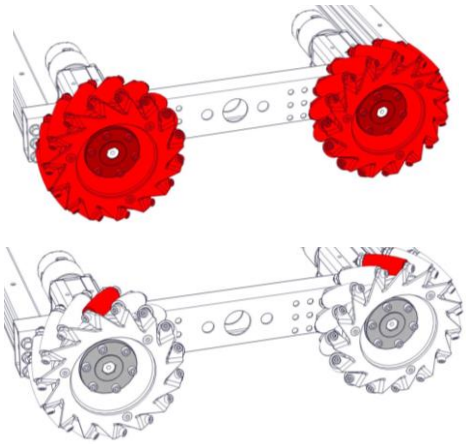


Chassis Assembly Instructions

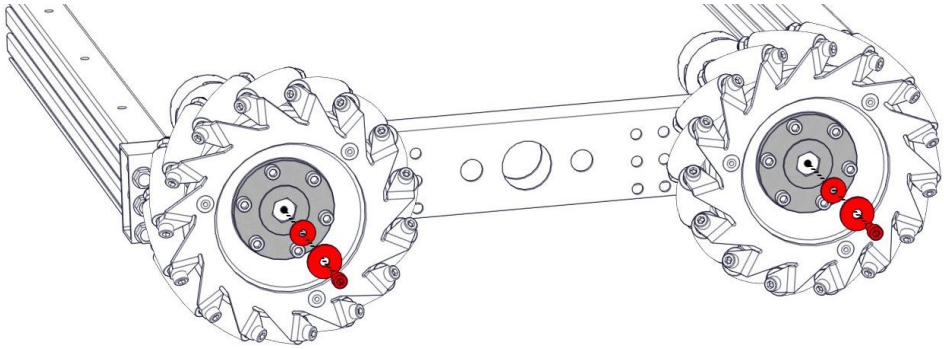
Step 4: Place a 1.0 inch long Hex Spacer (am-3948-1000) onto each of the two output shafts.



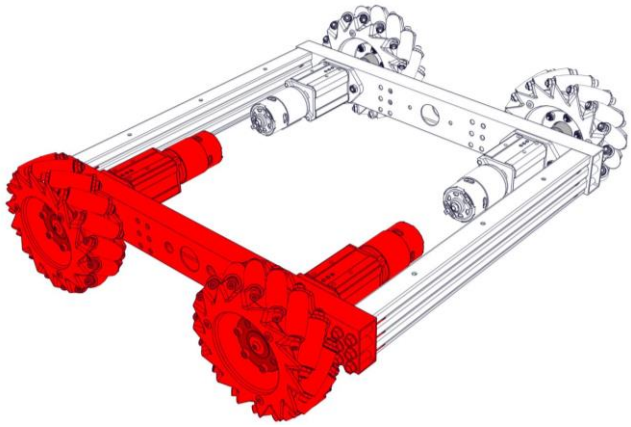
Step 5: Place one of each completed wheel assembly (left and right) onto the two drive shafts. The hub flange should be to the outside of the assembly. The roller axles at the top of the wheels should point towards the middle of the chassis.



Step 6: Capture the wheels on the gearbox output shafts with a #10-32 x 0.375 inch long Socket Head Cap Screw (am-1359), a #10 Fender Washer (am-1523), and a #10 Flat Washer (am-1026) for each wheel.

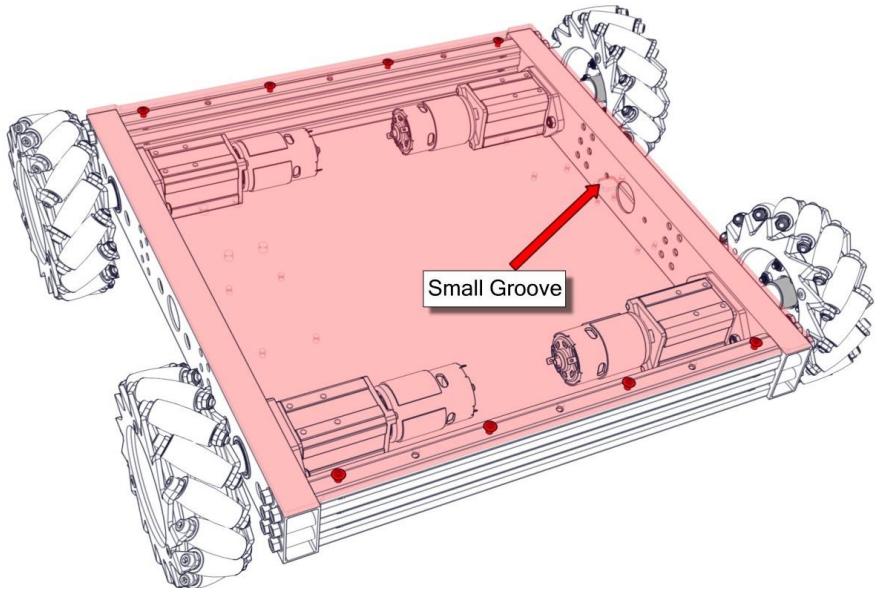


Step 7: Repeat Steps 1-6 to build the other half of the chassis. Be sure to mirror the assembly left-to-right and orient the Rover Side Rail such that the 24 End Rail holes are in the same vertical orientation as the previous assembly. The wheels should be put on the same way so that the rollers form an X on top (diamond on bottom).

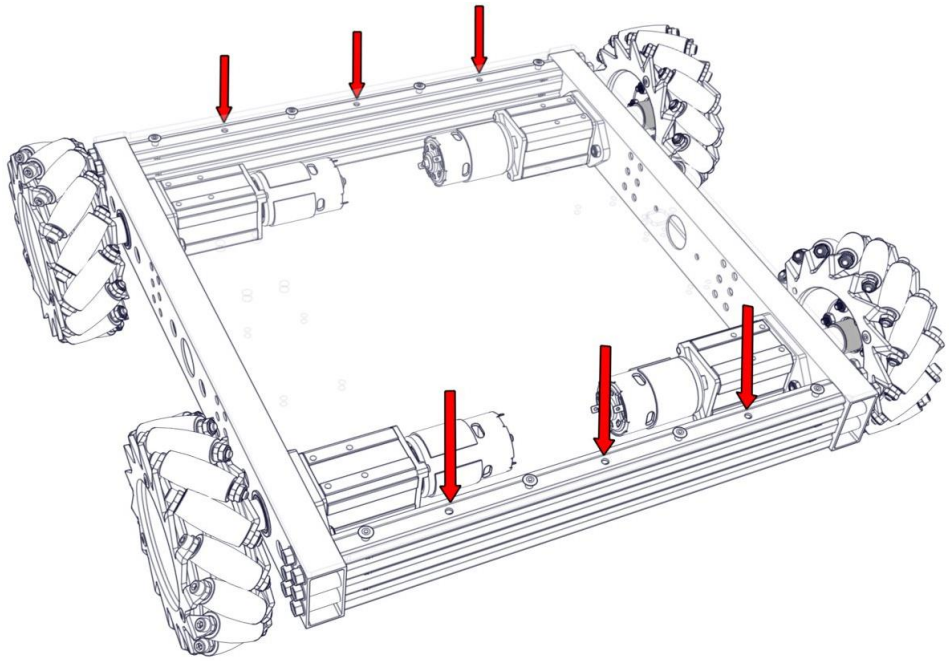


Chassis Assembly Instructions

Step 8: Flip the chassis over so the rounded edges of the End Rails are on top and place the Rover Chassis Bottom Plate (am-4100a_bottom) on top of the four rails oriented as shown below (the small groove should be on the bottom face on the right, as seen below). Rivet the Bottom Plate in place using eight (8) 3/16 inch Rivets (am-1340) in the four corner holes and every alternate hole in-between.



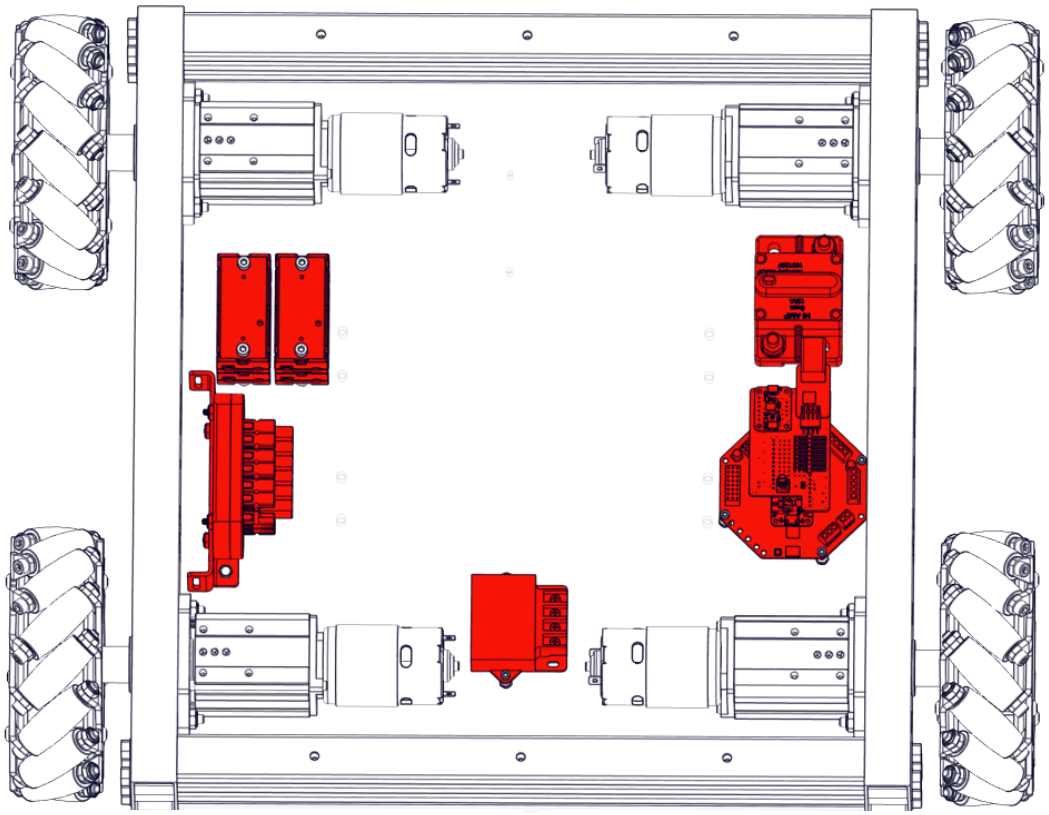
Step 9: The six (6) remaining holes along the End Rails should align with the through-holes in the End Rails but may need to be drilled out using a ¼ inch bit to ensure a bolt may pass through.



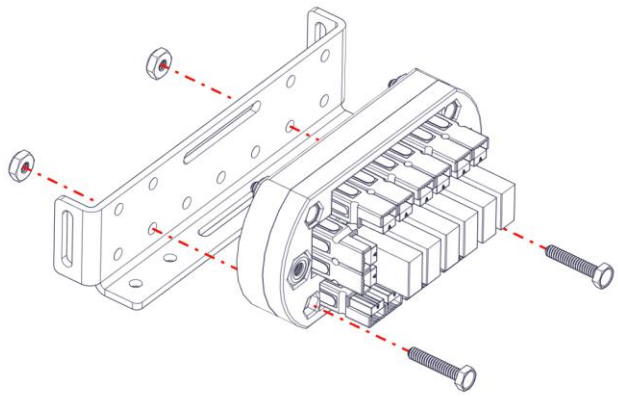
Step 10: Flip your chassis over and you have completed the assembly of the Rover 6" Mecanum Chassis. Electronics will be added in the following section. You may skip to **Step 19** of the Electronics Assembly when assembling only the mechanical portion of the chassis or using a custom electronics package.

Electronics Assembly Instructions

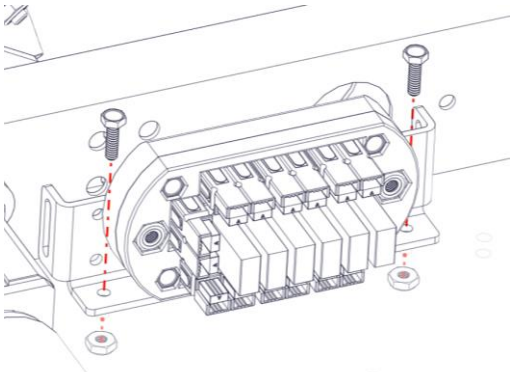
Step 1: The Rover 6” Mecanum Chassis is designed to use four (4) Victor SPX (am-3748) speed controllers and a Universal Drive Control System (am-4706). The Rover Chassis Bottom Plate (am-4100a_bottom) has mounting holes for all pre-selected components. The following steps cover how and where to install the components but wires have been removed from the images for clarity. A full wiring diagram can be found at the end of this section.



Step 2: Mount the PowerPole Distribution Board (am-3699) to the S3 Battery Mount (am-3687) using the 6-32 Socket Head Cap Screwsand 6-32 Nylock Nuts included with the Distribution Board Kit, as shown below.



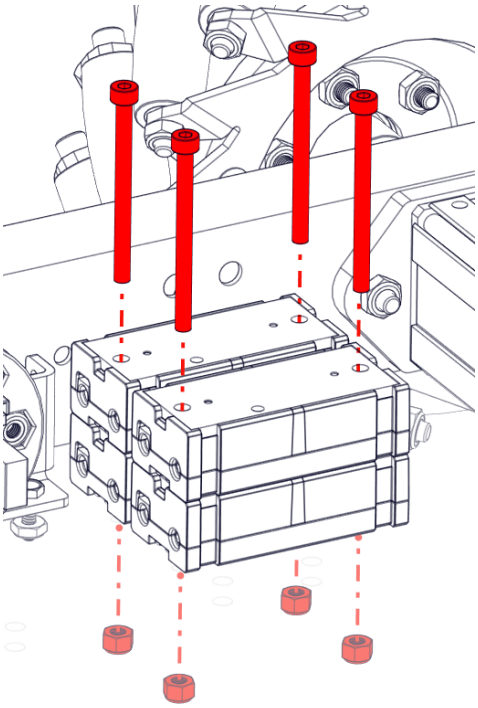
Step 3: Mount the PowerPole Distribution Board assembly to the top of the Bottom Plate using four (2) 0.5IN 6-32 Socket Head Cap Screws (am-1563) and 6-32 Nylock Nuts (am-1419) on the underside of the Bottom Plate.



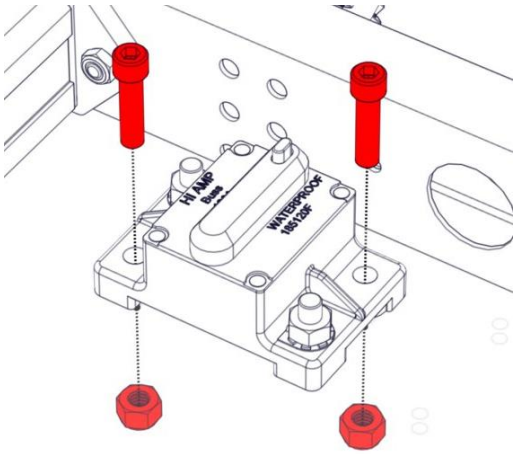
Electronics Assembly Instructions

Step 4: Add PowerPoles (am-2198) to the four power leads on each Victor SPX. Red PowerPoles should be added to the Red and White leads and black PowerPoles should be added to the Black and Green leads. A PowerPole Crimp Tool (am-4202) (sold separately) should be used to ensure a proper crimp.

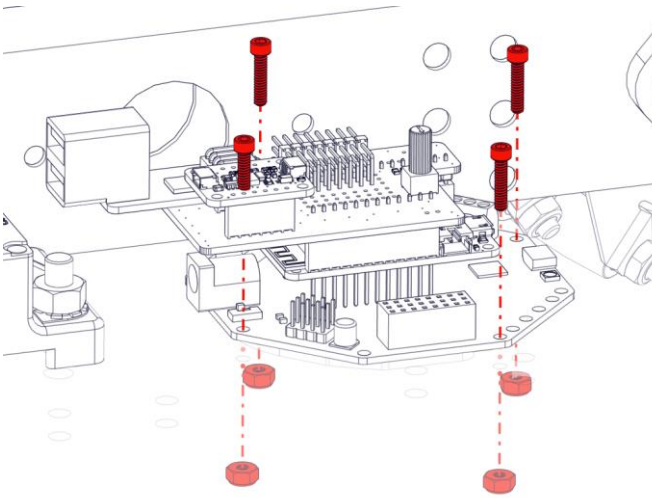
Step 5: Add four (4) Victor SPX Speed Controllers (am-3748) in two stacks of two with the CAN wires oriented facing towards the CAN Connector. Use four (4) M4x50 Socket Head Cap Screws (am-1401) and M4 Nylock Nuts (am-1435) to secure the controllers to the top of the Bottom Plate.



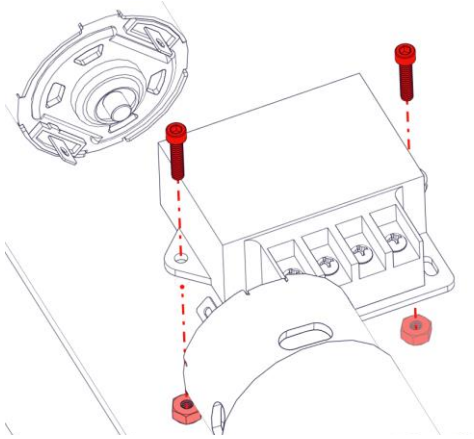
Step 6: Attach the 120A Circuit Breaker (am-0282) on the other side of the robot from the previous components using two (2) ¼-20 x 1.0 inch long Socket Head Cap Screws (am-1341) and ¼-20 Nylock Nuts (am-1015) on the underside of the Bottom Plate.



Step 7: Place the UDCS board (am-4707) on top of the standoffs with the USB-A ports toward the main breaker. Secure the UDCS using four (4) 4-40 Socket Head Cap Screws (am-1136) and 4-40 nuts (am-1139).

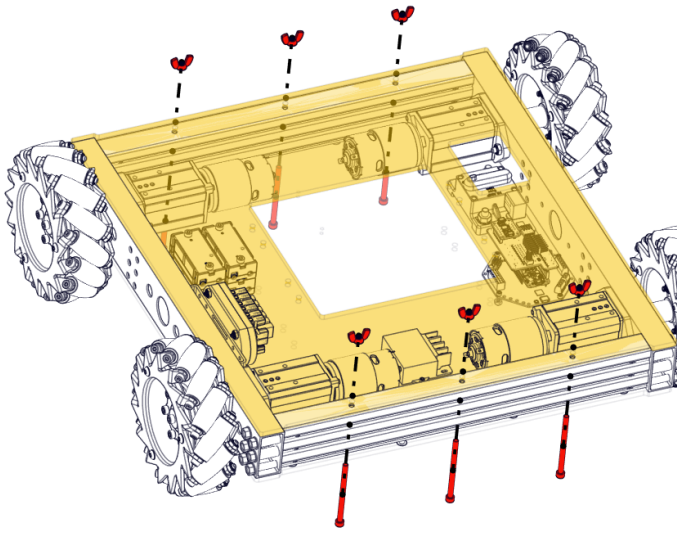


Step 8: Attach the DC 12V to 5V converter to the bottom plate via (2) 4-40 0.5IN socket head cap screws (am-1136) and (2) 4-40 nuts (am-1139). Point the wire inserts towards the UDCS board.

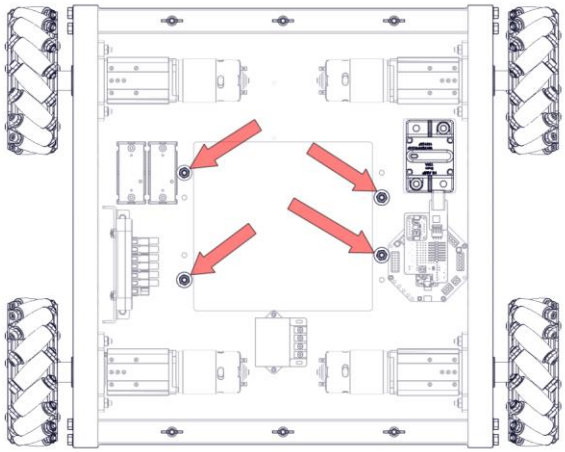


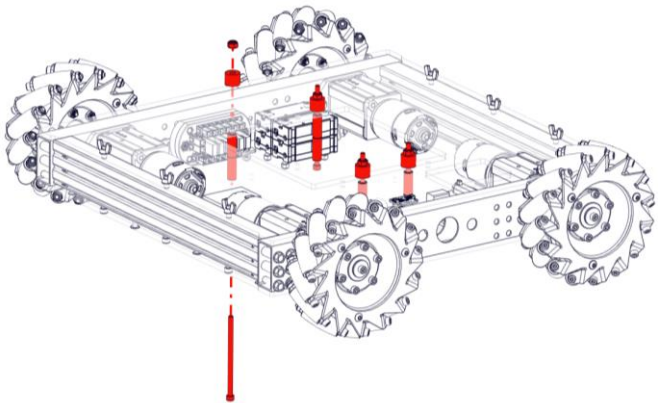
Now that all the electronics have been mounted properly, pause and carefully wire each component according to the wiring guide on **Page 19**. Make sure none of your wires cross through the center of the Rover where the battery will be positioned.

Step 9: With all of the wiring complete, the Rover Top Sheet (am-4100_top) can be attached using (6) 10-32 2.75IN socket head cap screws (am-1397) and (6) 10-32 wing nuts (am-1483).

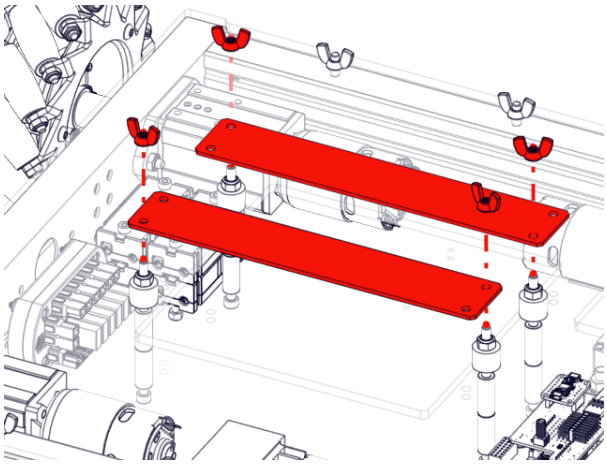


Step 10: Run (4) 3.5IN 10-32 socket head cap screws through the center of the rover in the pattern shown. Place (8) 1IN 10-32 spacers between the top and bottom plates along the screws. Above the top plate, put (1) 0.5IN spacer on each screw and hold the assemblies together with (1) 10-32 nylock nut each.



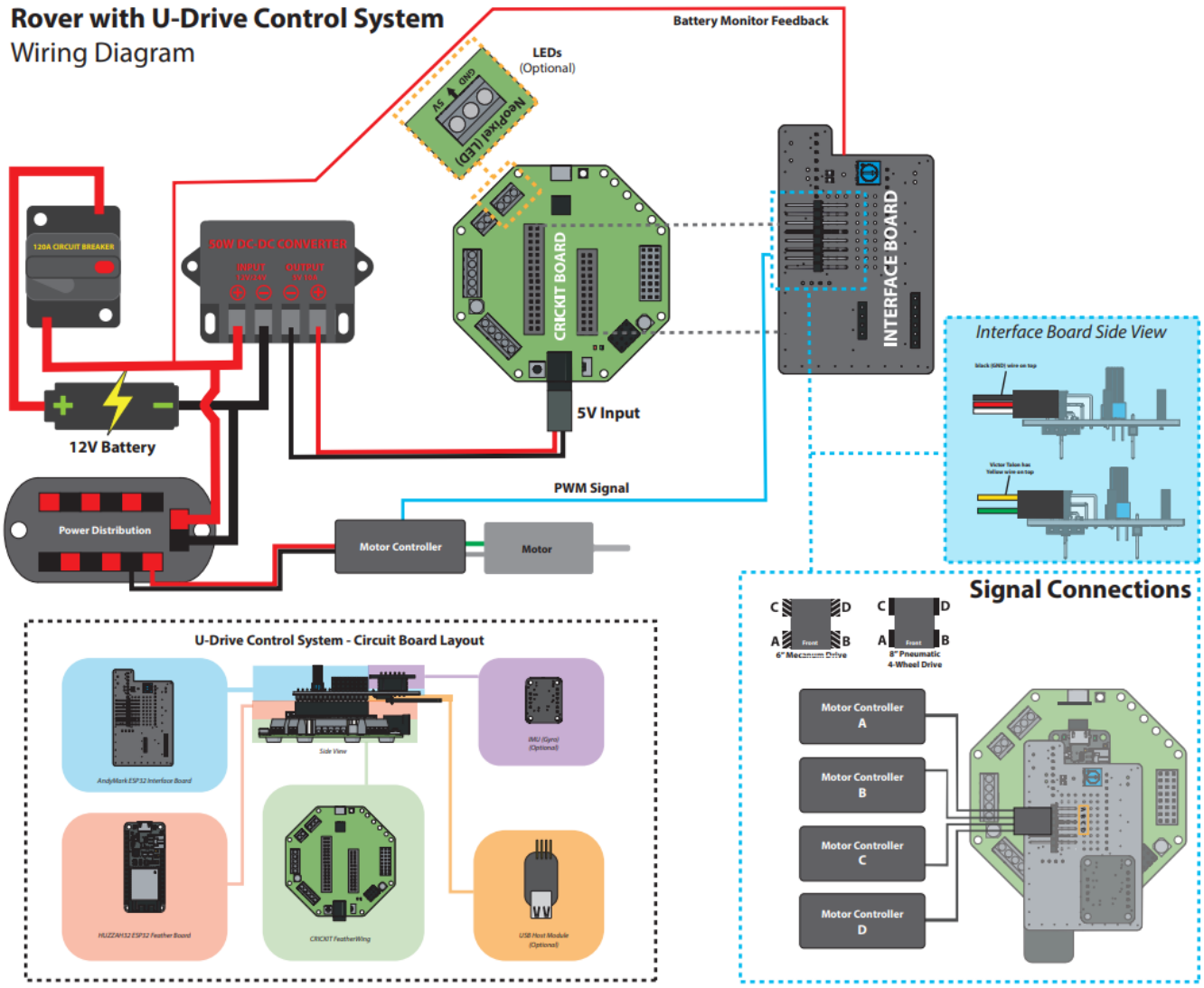


Step 11: When taking the battery in and out of the Rover, use (4) 10-32 wingnuts (am-1483) placed on the standoffs created in step 10 to hold down the (2) battery straps (am-2940) as shown.



Wiring Diagram

The following schematic shows where each wire should be connected and generally how the wires should be laid out in the Rover Chassis.



RedLine Motor: The back of the RedLine motor has a positive and negative terminal. The positive terminal is in the black plastic housing with a notch: