MrBaddeley
MKIII Foot Drives instructions
Version 0.1 (Draft)

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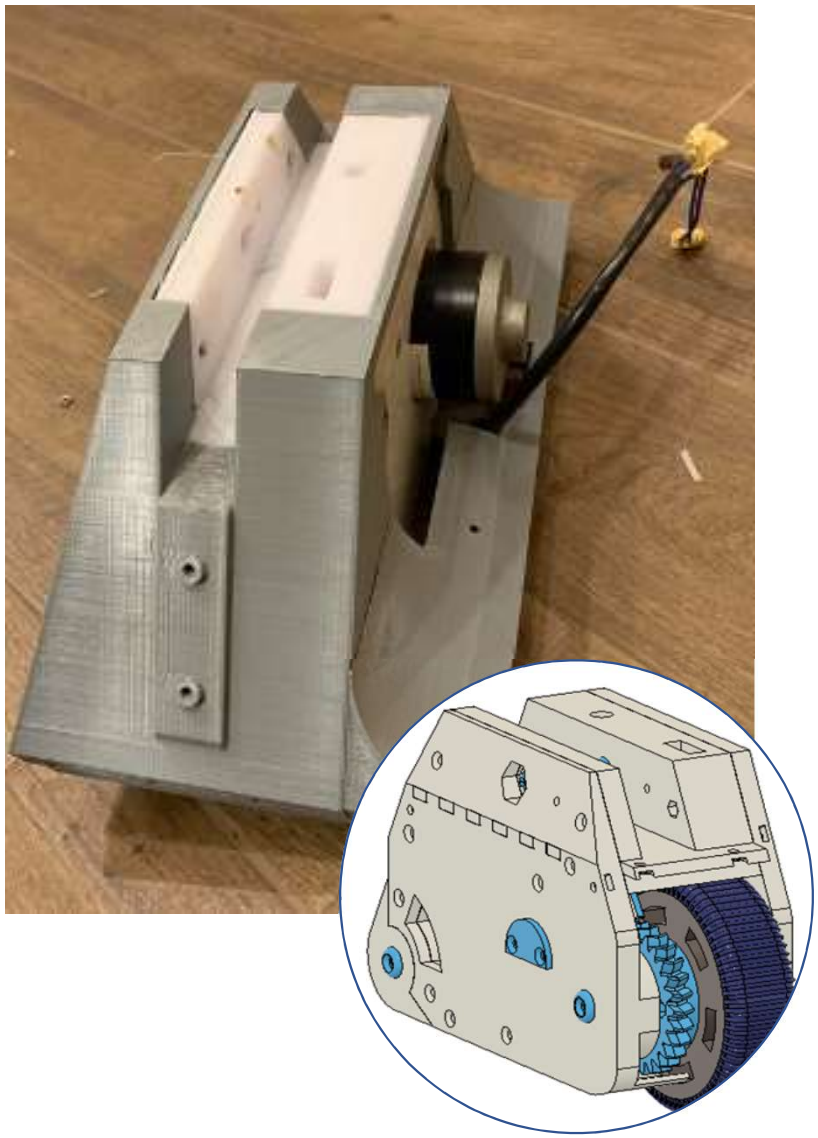
for other parts and instructions



The MKIII Feet & Drives - Features

- Direct Herringbone Gear Drive for reliability & noise reduction
- Built in cable management
- Aligned Tyres and Omniwheels for stability
- Improved drive Ratio for better torque
- Improved Shell Mounts for easy fixing / build
- Standard M4 Bolt & Nuts
- New Omniwheel design, flex tyres for reduced noise
- Standard Omniwheels across all feet
- Tighter tolerances to reduce noise
- Uses standard e-100 12v or 24v scooter drive motor
- Full printed, only needs standard hardware
- All bolted design (no glue) for strength & PETG assembly
- Virtually no supports needed
- All prints are aligned for the print bed
- Lower plate cover to reduce debris to the gearing
- Flex tyres & omniwheels for traction & smooth running
- Single Shell Print & design to eliminate support on details
- Compatible with v2 and MKIII legs / bodies / domes

Hardware & Materials

Hardware Summary (per drive, double for both feet)

M4 Countersunk hex bolt M4 Countersunk Hex Bolts

18x	*10mm*
6x	*12mm*
5x	*15mm*
13x	*18mm*
7x	*20mm*
5x	*25mm*

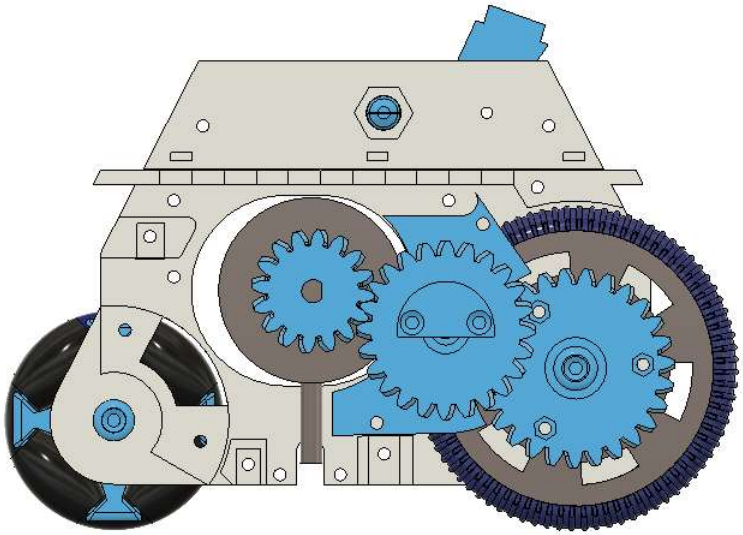
23x	M4 Hex Nuts
21x	M4 square Nuts

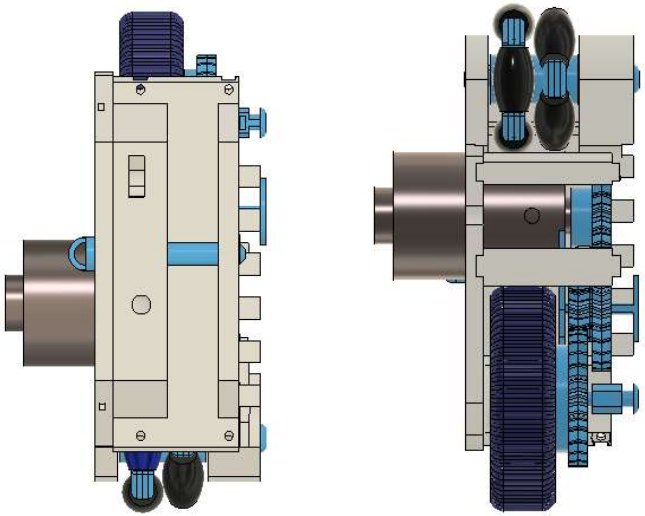
E100 scooter motor (12v or 24v)
XT60 connector (2 pairs)
3x cable ties

4x	608ZZ Bearings
2x	606ZZ Bearings
16x	683ZZ bearings (3x7x3)
8x	3mm Stainless Steel Rods (40.5mm)

4 x 10mmx5mm Super Strong Magnets (get them from ebay)

Super Glue
Loctite
Araldite (fast curing)





Printing the parts is fairly straightforward. I would recommend printing all the parts in PETG if possible (PLA or PLA+ would probably work but hasn't been tested).

Strengthwise, I'd print 4 outer layers (or more if you're cautious), 1.6mm wall for Cura and minimum 20% infill or upwards, but no higher than 50% as you'll get no real extra strength. The only exceptions are the centre spindles, I'd up the walls to 5 or 6 and infill to 35% upwards. Also the Gear Train, similar, I'd print 5 or 6 walls, 35% upwards.

For the flex (tyres and omniwheels) I printed in Ninjatek Cheetah, but I guess most semi-flex would work (or even flex, just not tested it).

The files are split into "FootA" and "FootB" folder, these are simply left and right feet, I stopped using left and right as I got confused between left from the front, or left from R2's perspective, so I thought A&B would be easier ☺

All parts are to be printed once, with the exception of any with (x8) for example, which means we need 8.

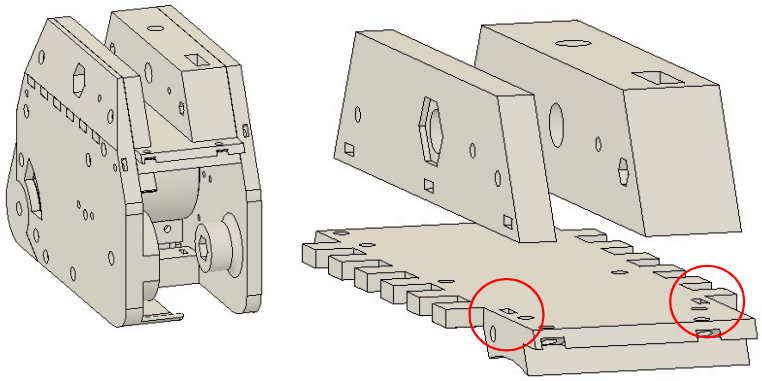
The Omniwheels will make you very familiar with this ☺

MotorFrameB will need support, I did try to put built in support but found it's better on this model to use the slicer generated support.

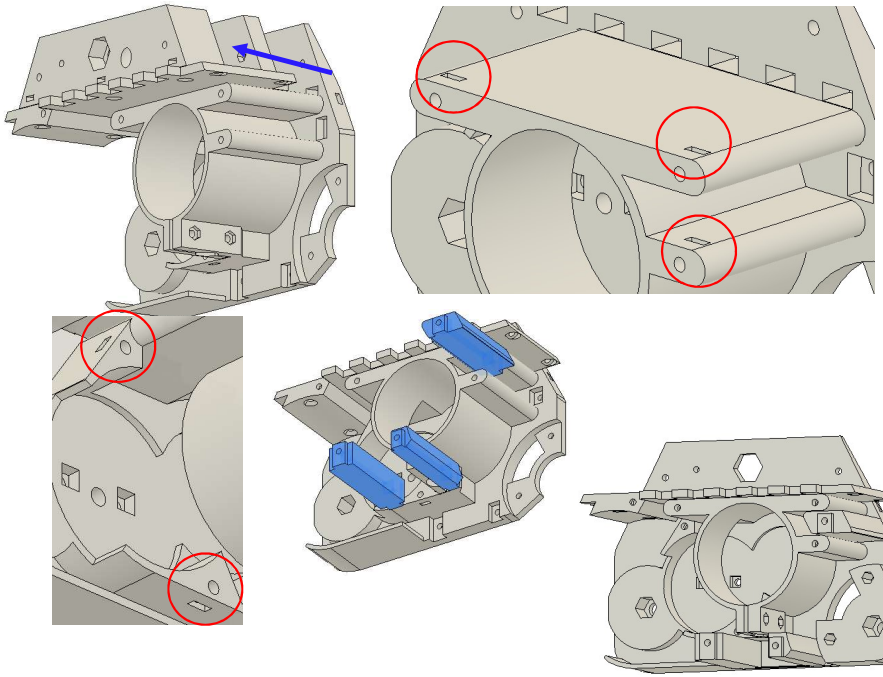
The main shell is printed "upside down" and the smaller shell the right way up.

I'd also get some white grease for the gear train, this will reduce noise and wear.

Whilst you may worry about the printed spindles or the printed gears, they are both very robust when fitted and whilst I've not done years of running them, they have lasted extremely well without any sign of wear.



Hint, use Hot Glue Gun to hold in the Square Nuts



Frame Assembly

First we'll assemble the main frame. Starting with the top frame (TopFrameA, B,C). Print these parts, firstly fit two square nuts in the slots which sit underneath parts A&C and then assemble as shown in the diagram. 4x M4 Countersunk Hex Bolts with 4 x M4 Square nuts are fitted first (note the square nuts are on the outer side). Then you need two slightly longer M4 18mm Bolts for the thicker parts, again with 2 square nuts. Align and tighten, This is the Top Frame Complete.

Next we're going to add the MotorFrameB to the topframe assembly. Firstly, there's three M4 Square Nuts to add to the frame (marked in Red), put these in and fill the top of the square hole with Hot Glue Gun to hold the square nuts in place. Then take the top frame assembly and push the slotted tabs into the MotorframeB. Secure this with a M4 18mm Bolt. Then two hex nuts and two 18mm bolts which go through the upper part of the MotorframeB through to the two inner hex holes in the top frame (marked in blue)

Next add Post1, 2 and 3. First, add two square M4 nuts to the slots either side of the gear opening (circular part to one side as marked in the red circles) and hot glue tag them. The Posts will cover one of these holes. Then fix the posts into place. In all cases, add the square nuts to the posts, hot glue to tag and use 3xM4 18mm Bolt to hold these in place.

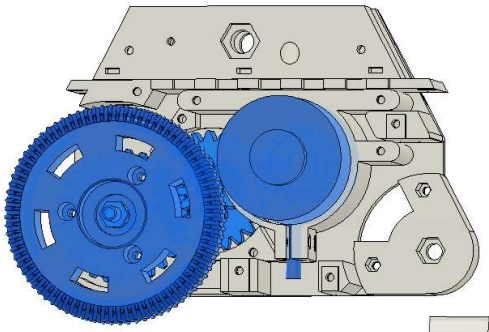
Finally fit the RearOminB (the thicker one) to the MotorFrameB, this is fixed with 2x M4 hex nuts and 2x M4 18mm Bolts.

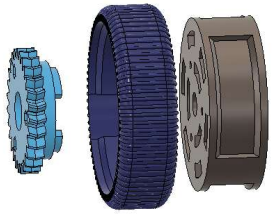
This is your core frame assembly, ready to put fit the gearing into place.

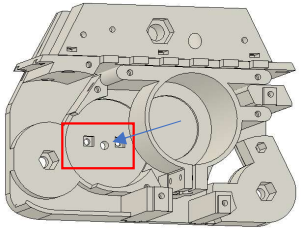
Hardware Summary

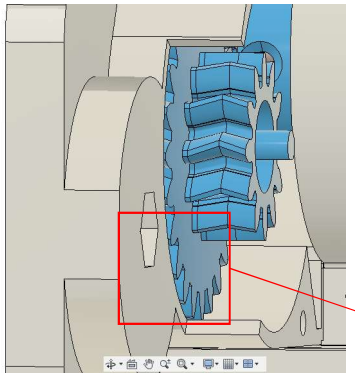
M4 Countersunk Bolts (4x12mm, 10x18mm)

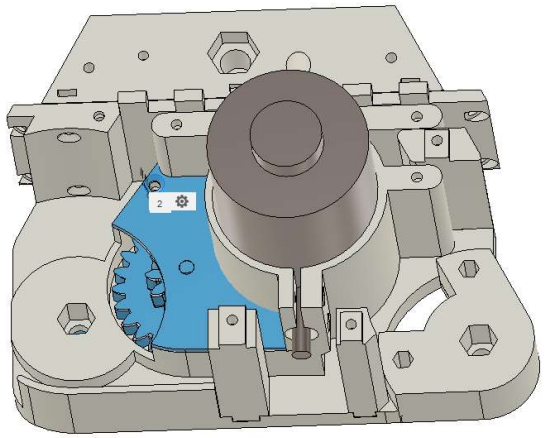
M4 square nuts (x13), M4 hex nuts (x4)











Drive Train

Now onto the Drive Train. Firstly let's assemble the drive wheel. First job is to put the tyre onto the main wheel. You can leverage this on this flay headed screw drivers (my approach, brute force), put it in hot water first, there's a few techniques but you want to make sure the inner tabs line up on the wheel. Secondly then bolt the wheelgear onto the wheel with 3x 25mm Bolts and 3x hex nuts. Finally push in two 608 ZZ bearings (8mmx22mmx7mm) into either side of the wheel / gear assembly. Then take the Middlegear and push two 6mm bearings into either side. These are 606ZZ (6mm x17mm x6mm).

First part of the assembly is to put the Middlegear in, firstly put two M4 square nuts in the two holes either side of the circular hole of the Main Frame, and tag with hot glue gun. Next, drop the Middlegear into the Motor hole and move this across to the circular hole (marked in Blue). This is the easiest way to get the gear in. Then, take the GearBoxPin and push this in from the outerside through the Middlegear securing this into place. This will be extremely tight (you can lightly sand the pin, but you want a tight fit). Secure the Gearboxpin in place with two M4 10mm bolts bolted into the square nuts . The trick is then to adjust the gear so the larger gear is flush with the frame surface, pushing it down until it is flush.

The gear should run smoothly, but be firm on the post. You can add washers either side, I didn't as friction holds it firmly and it should run on the bearing.

Next take you motor (you need to remove the chain sprocket it comes with, there's different types of holding this on, so unscrew the bolt, or circlip, or use a gear remove depending on the type you've got.). Then fit the MotorDrivegear, again a square M4 nut and a 15mm M4 Bolt to fit securely on the shaft.

Next, push the motor into place, line up the drive gear with the smaller Middlegear and ensure the cable fits in the gap. Finally secure with two M4 18mm bolts and 2x M4 hex nuts, tighten so the Motor is firmly in place. Check the gears run smoothly and are meshed correctly. Finally fit the MotorBracketCover covering the Middle gear with 2x M4 15mm Bolts. (The captive nuts you added in the previous section.

Hardware Summary

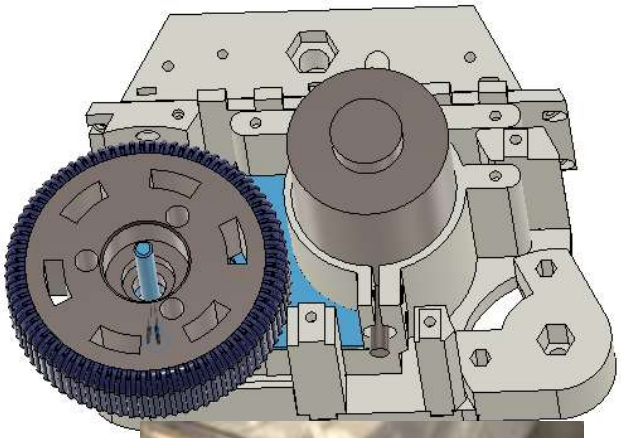
2x 608ZZ Bearings

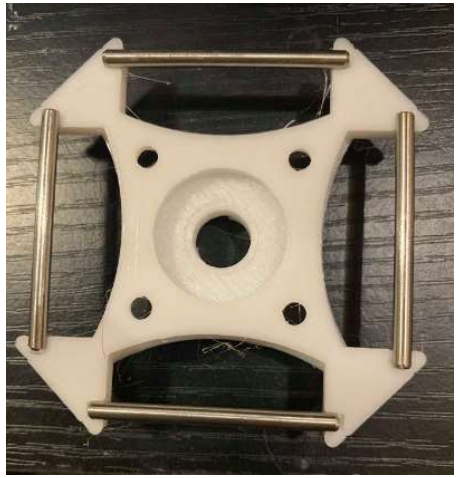
2x 606ZZ Bearings

M4 Countersunk Hex Bolts (3x25mm 2x10mm, 3x15mm, 2x18mm)

M4 Nuts (3x Square, 5x Hex)

E100 scooter motor (12v or 24v)





Drive Train – Continued

Next take the WheelPin and WheelCap, place a M4 Square nut into the WheelPin, and slot this into the inner hex hole at the wheel section on the Frame Assembly. (It can be easier to get this into place with the wheel already fitted, again the wheel fits on tightly and is held on securely with friction. Gentle sanding may possibly be needed but keep it tight). Once the pin is in place, a M4 18mm Bolt goes through the Wheel Cap and bolts the pin in place. At this point, if you've not already, slide on the Wheel assembly, tight as mentioned until it meshes perfectly with the Middle Gear.

Next it's time to build the Omniwheels. You'll need 8 Wheelcore / Wheeltyre assemblies first. To assemble these there are a couple of techniques, firstly I use a clamp method. Note there's a chamfer on the Core and Tyre which needs to match up, see the next page for pics and visuals (Thanks Larry for the pic!). Oven method, put the tyres in a 200 degree oven, boiling water or grease them first. See what works for you.

Once you've got 8 cores and tyres together, then you need two bearings per wheel. These are 683ZZ (3mmx7mmx3mm), you'll need a lot of these… so 16 per drive unit, 32 for both outer feet and a further 48 for the middle foot!!

Once you've got 8 omniwheel assembly, the next task is to make the 3mm pins the wheels run on.

For these I used RC Spindles, stainless 3mm rods and cut to size with a demel.

The technique I used was to place the bar against the omniframe print, marked the cut with masking tape. Them I cut with a Dremel. Finally I ground both ends slightly, rotating them against a spinning grinding wheel to give a nice chamfered edge.

Then I used the pin (once I'd checked it) to cut the other 7 pins, giving 8 in total

Place the pins in the Omniwheels cores and you're ready to assemble the Omniwheels.

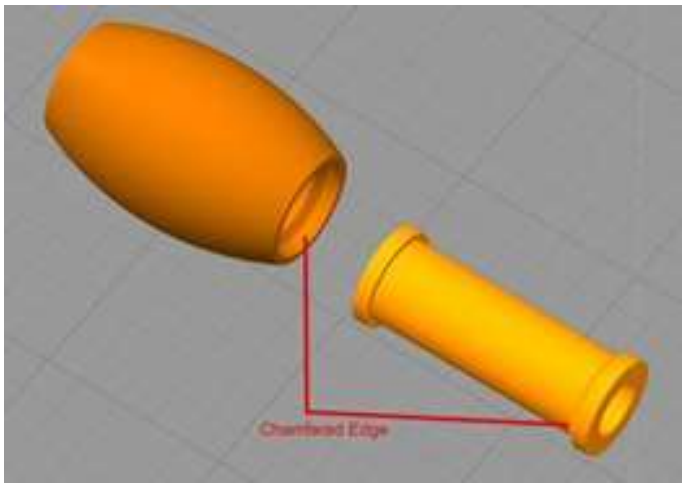
Hardware Summary

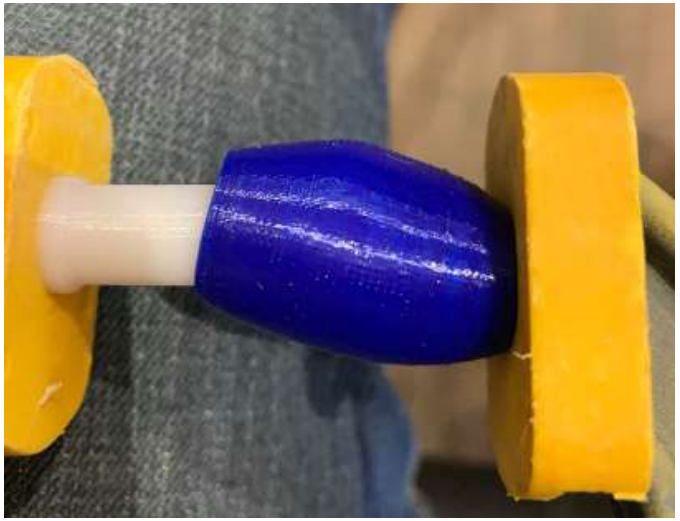
M4 Countersunk Hex Bolt (18mm)

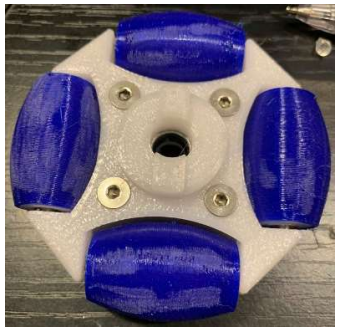
M4 Square Nut

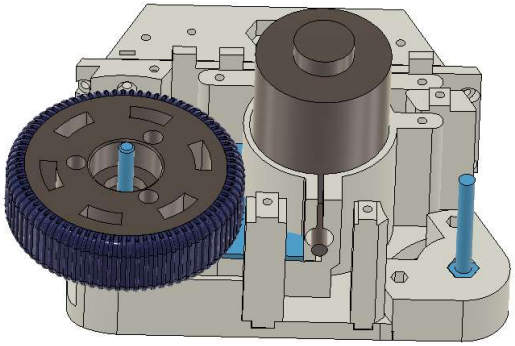
16 683ZZ bearings (3x7x3)

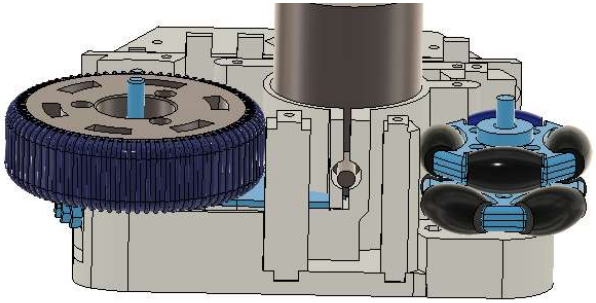
3mm Stainless Steel Rods (cut) x8


Chamfered Edge









Drive Train – Continued 2

Next we're going to assemble the OmniWheels. You'll need OmniFrameA, B, C & D.

This makes two pairs of Omniwheels, A&B and C&D. The assembly is exactly the same for both, so I'll describe one and I'm sure you can make both.

Firstly, remove any support from the frames, and push in a bearing into the centre hole. These are 8mm 608ZZ Bearings as before.

Next, rest the 4 assembled Omniwheels in the slots and push the top frame on. (A&B or C&D), holding them tightly. Next use 4x M4 10mm bolts and 4x M4 Hex nuts to tightly screw together. This gives you the assembled Omniwheel. Repeat this for the next wheel.

(Note the pic is from the centre wheel, but it's virtually the same). The two wheels should slot together with the 4 pin / holes printed in on the frames.

This is you Omniwheel assembly. Next we're going to fit this to the main frame using the OmniPin and OmniCap. Take a M4 Square nut and place it in the OmniPin hole and slot this into the hex hole at the back of the main frame, securing into place with the Omnicap, through the frame and into the pin, similar to how you secured the Tyre / Wheel pin.

Next, take the two wheels, hold together with the pins meshed and push onto the pin firmly. You want the Omniwheels to fit via friction, tightly again, around central on the frame.

This is pretty much the drive unit assembled. The last part is to fit the last frame piece, make sure all the square nuts are in place, the Hot Glue Gun is a godsend otherwise you'll have a million square nuts all over the floor!. Firstly take the SideFrameA and fit the remaining OmniBracket with 2x M4 12mm Bolts and 2x M4 Hex Bolts. Then you should have two printed Hex Nut shaped pieces (Omninut & Wheelnut), these fit into the hex holes on the SideFrameA.

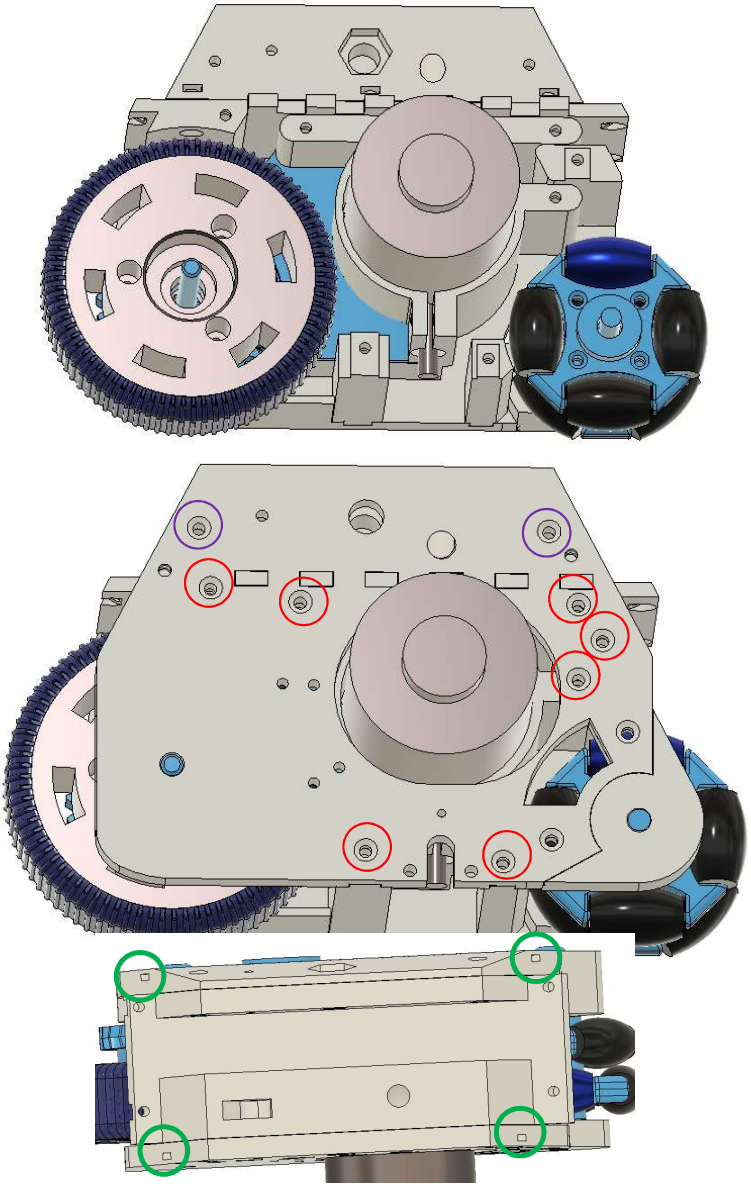
Then, push the whole assembly onto the main frame, finally it's just bolting the frame into the posts, frame and top frame, we'll cover that on the next page.

Hardware Summary

2x 608ZZ Bearings (8mmx22mmx7mm)

M4 Countersunk Hex Bolts (8x10mm, 2x12mm)

M4 Hex Nuts (x10)



Drive Train – Final Assembly

The last assembly for the drive unit. Take the assembled frame and push onto the main assembly, the tabs should fit in and all the M4 square nuts should be fixed in ready, so it's just a matter of bolting (7 x M4 20mm) into the frame and top frame. (Marked on red).

Next, (and finally) we bolt the two top holes into the top frame. This is done with 2x M4 25mm bolts and two M4 Hex nuts. You can use another M4 Bolt to get the hex but into the deep hole, just screw the nut on at the end, slide in into the hex hole and unscrew to leave the nut in place whilst screwing in from the actual bolt side.

Tighten all bolts and you've completed the whole assembly. The cable follows the cable tie holes but you can fix the cable when you're ready to move forward. I also put a new connector on the motors for easy testing / removal etc. (Soldered XT60 connects on).

Finally add four M4 square nuts into the slots – Marked in green – and use hot glue gun to secure these into place. These are to secure the shell onto the drive unit.

Hardware Summary

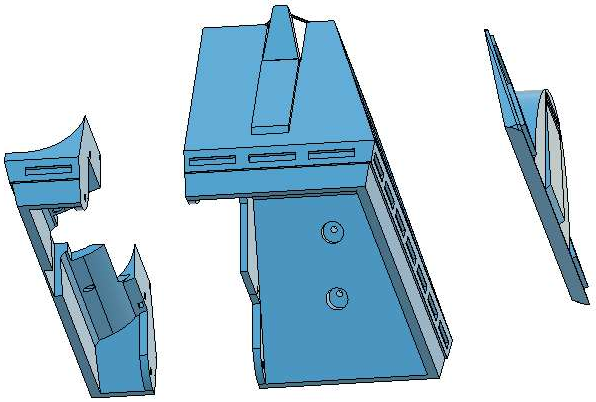
M4 Countersunk Hex Bolt (7x20mm, 2x25mm)

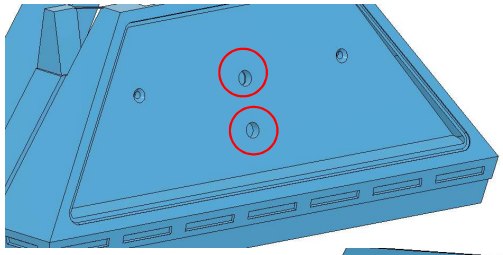
M4 Square Nut (4)

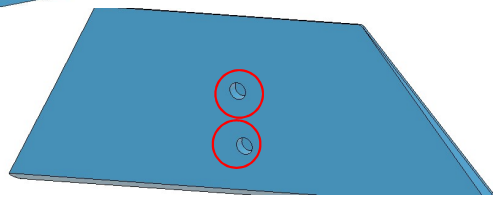
M4 Hex Nut (2)

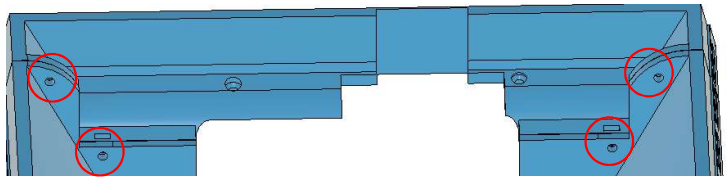
XT60 connector (2 pairs)

3 cable ties









Building the shells

The shells are printed in three parts, the main shell is printed upside down, with built in supports which snap off. The second part of the shell prints stood up correctly. Finally the side details print flat. I would suggest .2 layer height for the two main shells and .1 for the side details as it does have some slight inclines so would need more sanding if printed .2.

Firstly glue 2x 10mm x5mm magnets (flatter disc) into the side detail and 2x 10mmx5mm magnets into the main shell. I used two part epoxy glue (Araldite) as these are strong magnets. Make sure you get the polarity correct so they attract to hold these on.

Next, once the glue has set (and leave it at least 24 hours before leaving the details in place for any length of time), bolt the two shells together. I would recommend gluing first and then holding with bolts, either superglue or Epoxy two part glue. The bolts will hold it, but if you're filling and sanding glue will prevent cracking later on.

Apply glue and then there's two M4 10mm bolts used with two M4 square nuts for the upper holes and two M4 15mm bolts used with two M4 hex nuts for the lower bolt. You can also use locktite to ensure the nuts don't loosen over time.

Once glued and bolted, you're pretty much completed the assembly of the shell.

The slide detail will just hold on via the magnets.

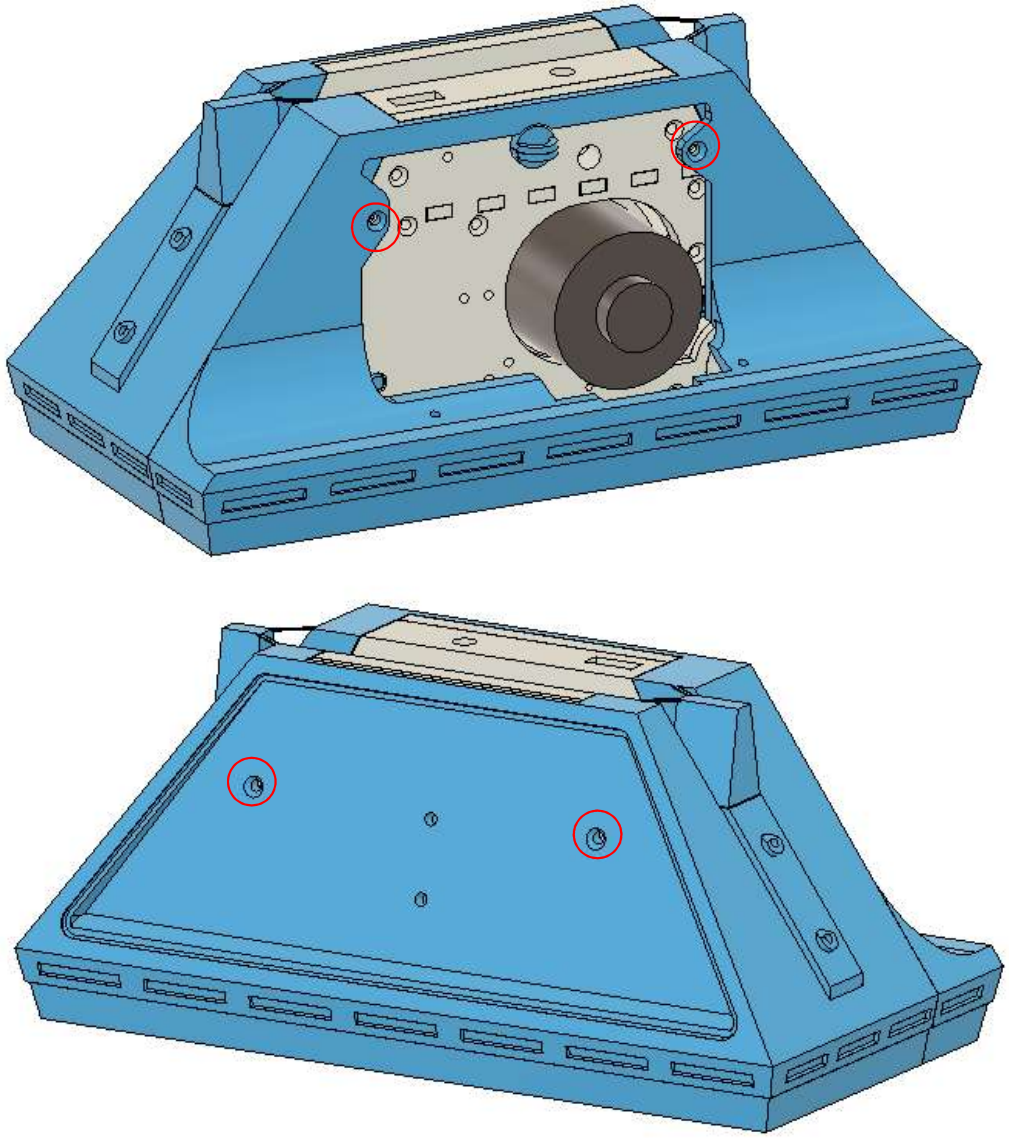
The shell should fit snugly over the drive units and is secured in place with 4 M4 bolts (M4 10mm) which go through the shell. Two under the slide detail and two which are behind the batter box hole. Congratulations! All done, now repeat for side "B".

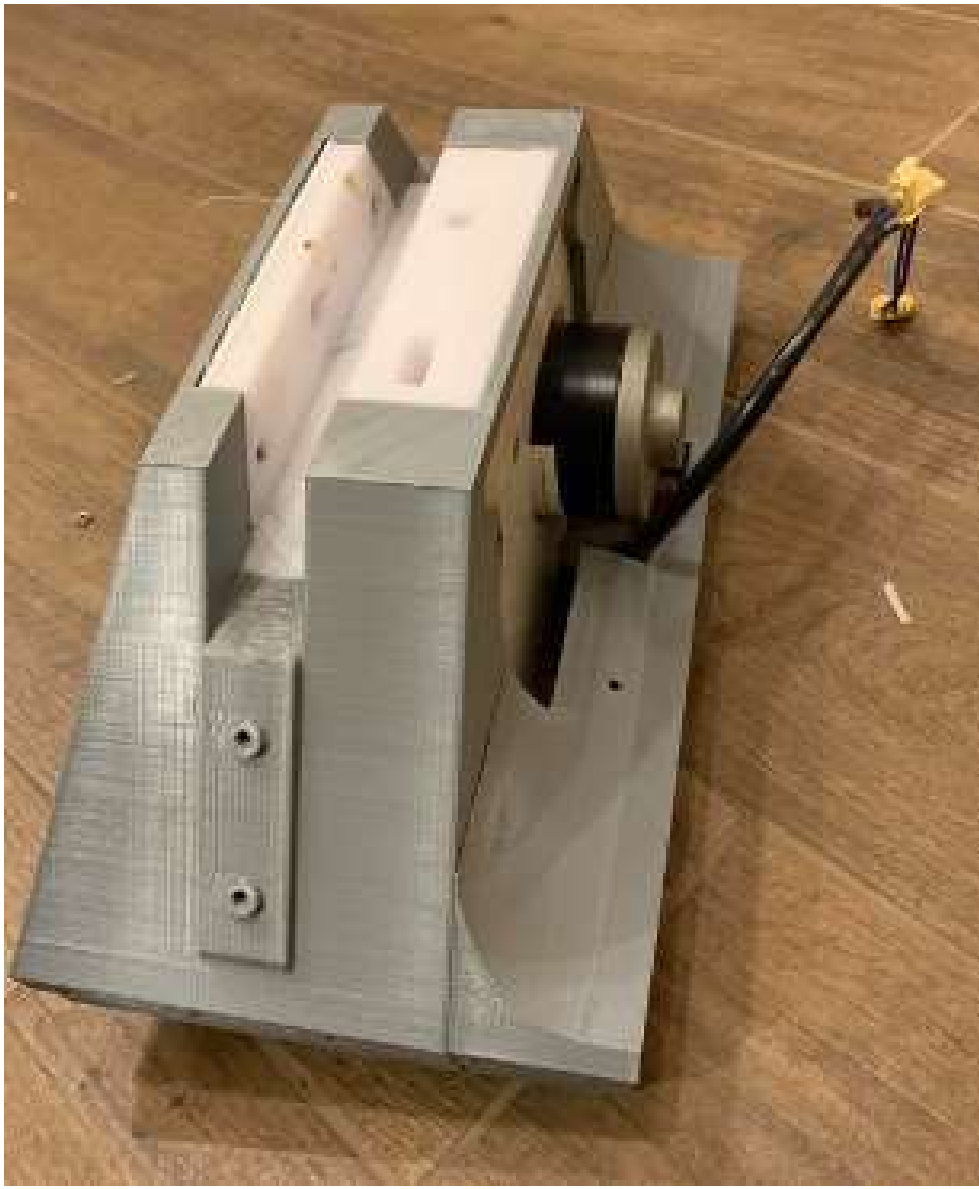
Hardware Summary

4 x 10mmx5mm Super Strong Magnets (get them from ebay)

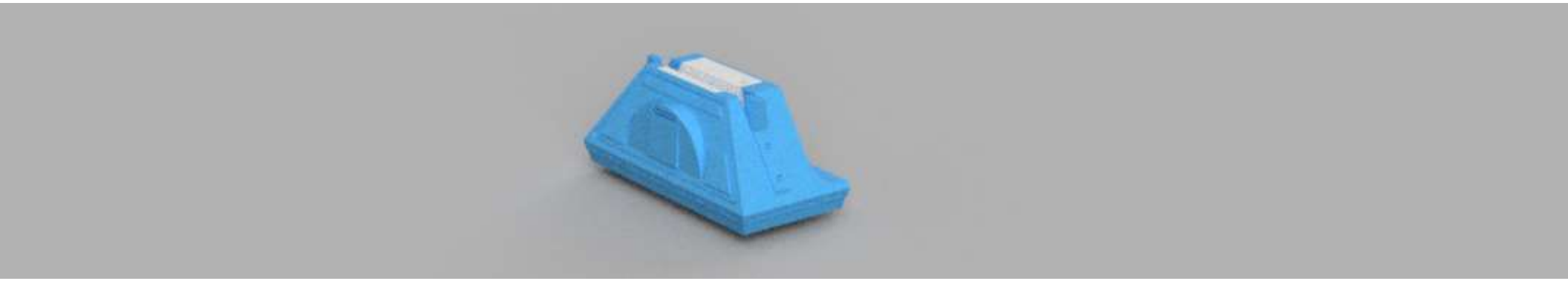
M4 Countersunk hex bolt (6x10mm 2x15mm)

M4 hex nut (x2)





Amazing

Supporters!

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