Printing the frame

The frame is best printed with the axle holes vertical, the bearing housings need to be as round as possible. Print on your normal settings. Once printed it needs to be cleaned up of any flash. The important areas are:-

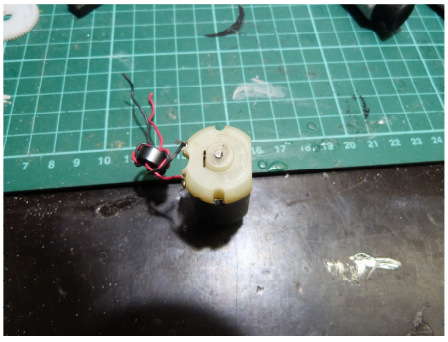
1. The bearing housings:- use a 6mm end mill to ensure the holes are clean.
2. The axle holes:- run a 3.5mm drill through these, turn by hand.
3. The register for the motor:- this is 6.25mm diameter so a ¼" round file is ideal.
4. The recess and slot in front of the motor:- Needs a gentle file, the motor shaft has to go down this slot.
5. The motor bolts:- These have to be recessed so that the heads of the bolts do not catch the gear wheel. Use a 6mm drill to do this turned by hand.

The Motors

These are obtained from EBay:- **DC 12V 4000RPM Mabuchi FC280SA High Precision Carbon Brush Motor Metal Gear DIY**. £3 each

The motors need to have the axles shortened and the brush housing reduced in height.

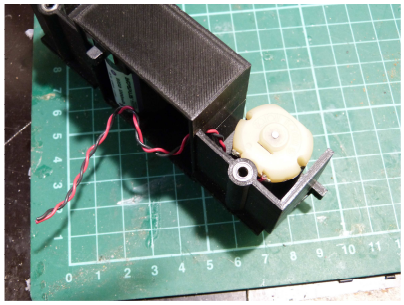
1. File or grind off the shaft protruding beyond the pinion. Ensure you remove all the shaft and 0.25mm of the pinion.
2. Cut through the shaft protruding from the non-driven end of the motor. This needs filing right back to the plastic housing.
3. The plastic housing at the rear of the motor needs an 8mm dia recess filing in it as shown. The recess needs to be as deep as the metal casing on the motor. It is to allow the motor to sit on the bearing housing.



Fitting the bearings.

The bearings are MR63ZZ. They should be a press fit into the housings, if not retain with a dab of superglue. Push in gently using a small vice. The bearings must sit flush with the body of the frame, if not you need to remove them and clean the holes out again with the 6mm end mill. Check the axle goes through both bearings and runs smoothly.

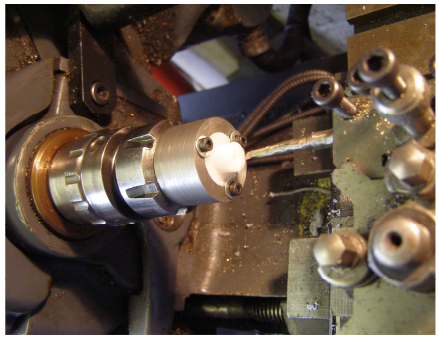
Fitting the motors



You can use the wires that come with the motors. Cut the connector off the end, remove the ferrite core and untwist the first 15mm or so nearest the motor. Push the wires through the hole in the frame. Slide the motor axle down the slot in the frames until the register lines up with the hole. Make sure the connections are underneath. One wire has to go across the axle so make sure it does so at a recessed area. Push the motor register through the hole and secure the motor with 2 M2.5 x 4mm countersunk Allen screws. The heads MUST be below the side of the frame otherwise they will foul the gear wheel. You can obtain screws of this length but I

have found that shortening a 6mm screw is the better option as they tend to be made from high tensile steel. The screws must not foul the windings inside the motor. Gently turn the motor by hand to check this is not the case. The top of the motor should line up with the top of the frame, if it does not you probably need to remove some more of the brush housing or adjust the wire that runs under the motor.

The Gearwheel



The gearwheel is a 0.5 Mod 42 tooth gear, 3mm tooth width in Hostaform. I got mine from bearingboys.co.uk. I obtained the ball races from the same source. The boss needs removing so you need a fixture for the lathe to do this. All the boss has to be removed so you end up with a 0.5mm recess in one side of the gear. See the drawings for information on the fixture.

Turned Parts

There are a number of turned parts. These can be done in brass or steel, it does not matter. Note the axle needs an M3 thread on the end. One wheel needs reaming out to 3mm, the other to 4mm. Again you can make a fixture for the lathe to do this. Alternatively if you have a decent 3 jaw put it in the chuck, square it up using the tail stock and ream it through. It worked for me.

Assembly

NOTE you can check the final back to back distance between the wheels before fixing any parts together. Put the shaft through the bearings in the frame. Place the two brass bushes and the M3 nut on the shaft as shown in the exploded drawing. The distance from the outside of the driven side bush to the outside of the non-driven bush should be 46 mm, that is the 40 mm back to back plus the 6mm depth of the non-driven bush. If it is not then you need to adjust the bushes to suit.

Non Driven Side

Fit the treaded bush to one of the wheels with the 4mm reamed hole. Mine were a press fit but you can use superglue. Drill a 1mm hole through the hub of the wheel and the bush parallel to the CL of the axle. You can then put a piece of 1mm round rod in as a key to ensure the wheel and bush are fixed. Superglue will hold this in place.

Driven Side

The metal bush goes through the gear wheel such that the large flange sits in the recess. This should leave 0.5mm of the bush protruding through the gear. Superglue can be used to hold this in place. Thread a piece of 3mm dia axle through the bush and put a 3mm reamed wheel on this such that it is up against the gear wheel and bush. Drill a 1mm hole through the hub of the wheel and the bush parallel to the CL of the axle. You can then put a piece of 1mm round rod in as a key to ensure the wheel and bush are fixed. Superglue will hold this assembly in place. Ensure it does not adhere to the axle as it has to be removed once the adhesive has set.

Place an M3 nut on the threaded end of the axle, the nut should be 2.5mm thick. Screw it down until it is at the end of the threaded section. Follow this up with the non-driven bush and wheel. These can then be lock nutted in place. Push the axle through the bearings from the non-driven side.

On the other end of the axle place the gear wheel assembly. This should mesh with the gear on the motor. Use Loctite retainer to fix the driven end bush onto the axle.