



Operations Manual
Axial Flux Permanent
Magnet Bi-directional Rotary Actuator



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Table of Contents

1	Safety Precautions	1
2	Introduction	2
3	List of components	3
4	Actuator Assembly	4
5	Operation	8

1 Safety Precautions

The equipment selected for our system has the potential to cause bodily injury. Injuries can occur because of electrical shock and the following precautions should be taken while operating the system:

1. Make sure the power supply is disconnected from the system and is turned off before connecting it to the actuator.
2. Make sure that your hands are dry when handling the electrical components of the system.
3. Wear shoes with rubber soles in order to avoid grounding of current as it only take 0.3 mA to stop the human heart.
4. Get instructions for any power supply that you are not familiar with.
5. Immediately clean up any spilled water from work area as it will short the power supply and corrode the steel parts of the actuator.
6. Do not leave actuator on for longer than 5 minutes as it may begin to heat up.
7. Do not place actuator near any sensitive electronics equipment as it generates a strong magnetic field when activated.

2 Introduction

This manual gives systematic guidelines for assembling the bi-directional rotary actuator and properly operating it. Figure 1 shows the actuator in its testing setup, the upper stator has been removed to allow for ease of access to the rotor assembly.

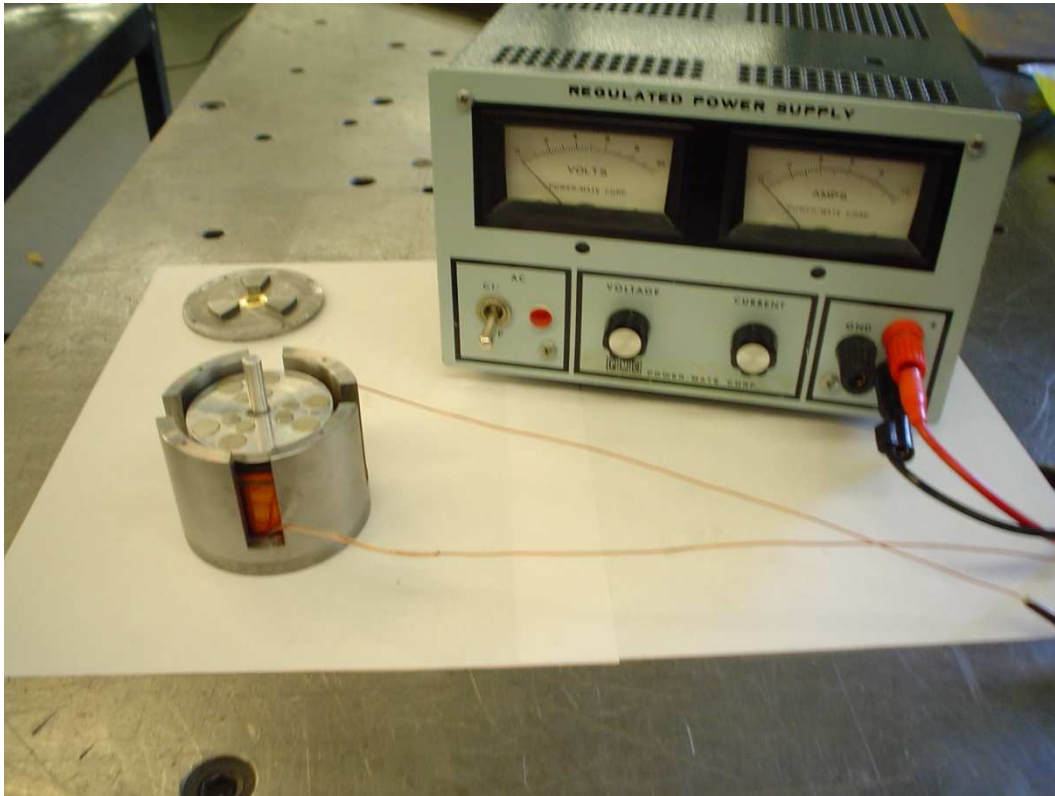


Figure 2.1 - Complete experimental setup

3 List of components

- Power Source
 - Capable of 10V and 2.5A
- Power connector cables
 - Alligator clips required
 - Positive (red) and Negative (black)
- Completed Actuator Assembly (see section 4 for instructions)
 - Base Plate
 - Coil Core
 - Coil Assembly
 - Lower Stator Assembly
 - Housing
 - Rotor Assembly
 - Upper Stator Assembly
 - 1-64 Flat Head Screws (0.25in and 0.375in)



Figure 3.1 - Parts required for actuator assembly

4 Actuator Assembly

1. Begin by gathering all of the parts needed to assemble the actuator (see section 3)
2. Secure the Coil Core to the Base Plate using 3 1-64 Flat Head Screws (0.375in in length)



Figure 4.1 - Base plate and Coil core

3. Slide the magnetic Coil assembly over the core, no adhesive or fasteners are required to hold it in place, the Lower Stator will secure it.

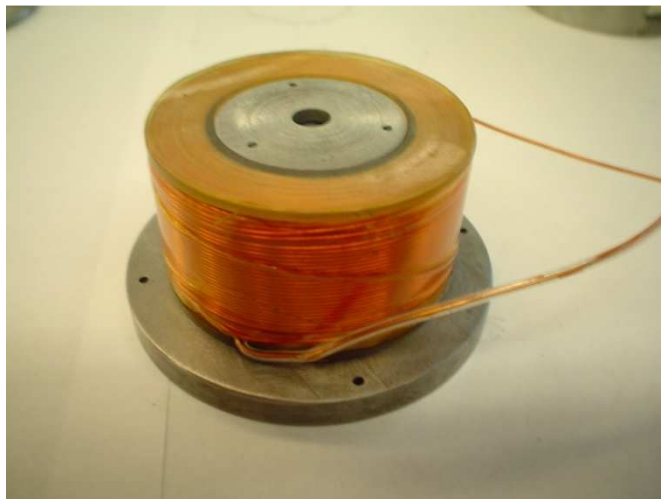


Figure 4.2 - Coil added

4. Press fit the Ball Bearing into the hole in the center of the Lower Stator. The shoulder of the bearing must be on the top.
5. Fasten the Lower Stator to the top of the Coil Core using 3 1-64 Flat Head Screws (0.25in in length)

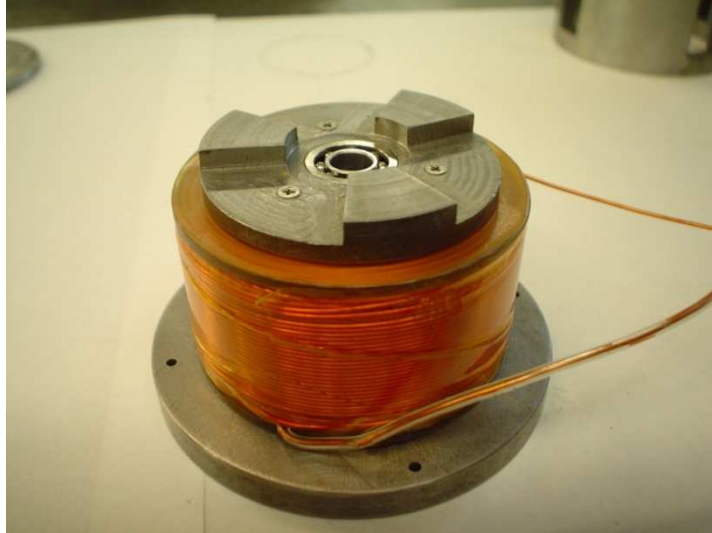


Figure 4.3 - Lower Stator fastened in place

6. The outer housing may now be added, carefully lower the Housing making sure that the Coil leads are passed through it and come out from the top.
7. Rotate the Housing so that the slots on its side line up with where the leads come off the Coil, this will provide easy access to the leads for running the apparatus.

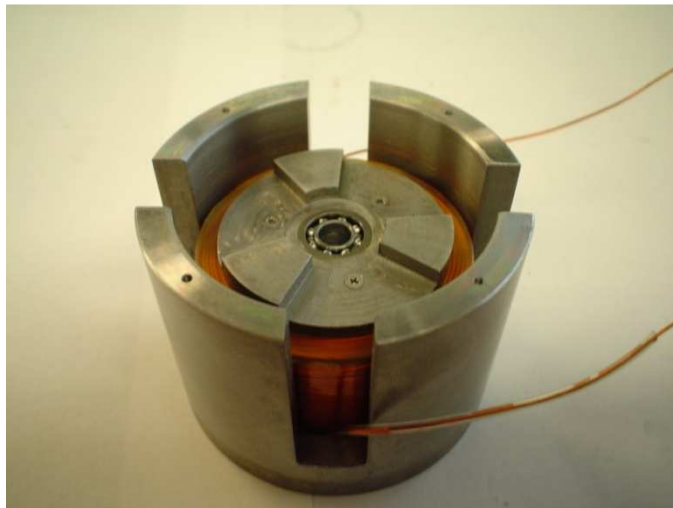


Figure 4.4 - Outer Housing in place

8. Fasten Outer Housing using 4 1-64 Flat Head Screws (0.375in in length)
9. Rotor assembly
 - a. Make sure that the rotor is dry and clean of any oils or solvents used during machining
 - b. Using “Super Glue” or any instant adhesive begin placing the magnet in the rotor beginning with the inside track and alternating polarities as you go.
 - c. Once inside track is complete proceed to the outside track and once again alternate polarities as you go (make sure the polarity of the inside and outside magnet match in a given line).
 - d. Support the rotor evenly with both hands and push the shaft through the center hole until the sholder of the shaft butts up against the lower surface of the rotor.
 - e. Using a Snap Ring installation tool, lower the Snap Ring into the groove on the shaft

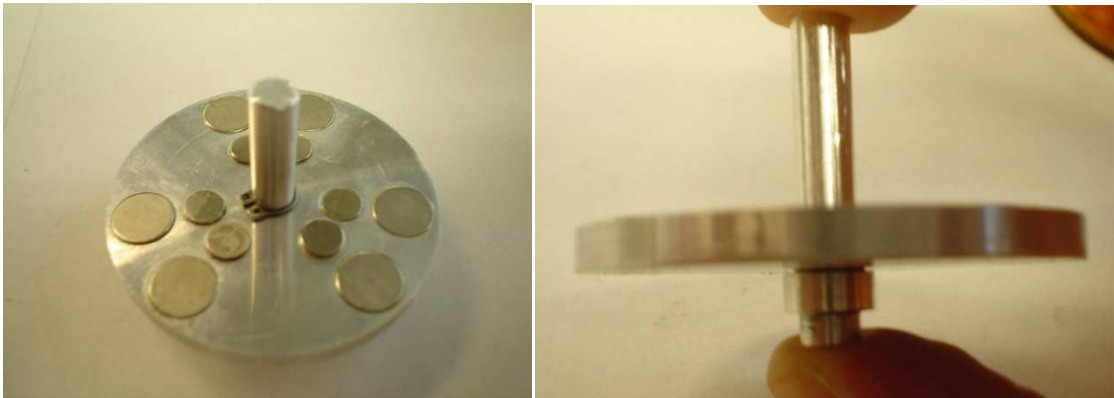


Figure 4.5 - Completed Rotor sub-assembly

10. Place the Rotor assembly on the Ball Bearing and GENTLY using a small rubber mallet tap the assembly down until the shoulder of the shaft is resting on the top surface of the bearing.

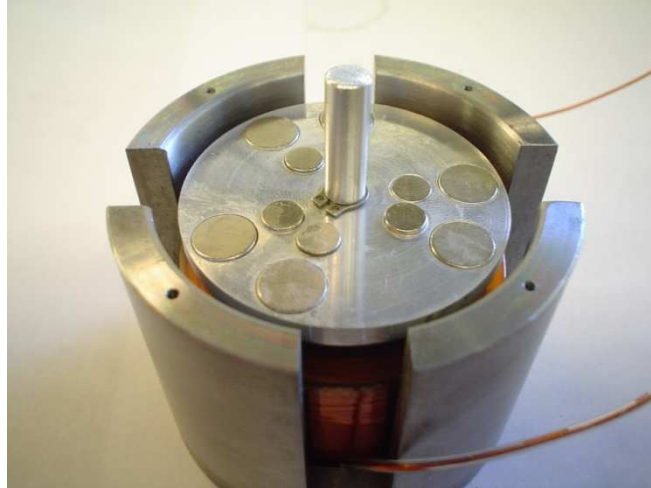


Figure 4.6 - Rotor assembly added

11. Press fit the Brass Bushing into the hole in the center of the Upper Stator. Make sure the Bushing shoulder is on top
12. Place the Upper Stator on top of the Outer Housing and rotate until the Upper and Lower Stators are aligned.
13. Fasten down the Upper Stator using 4 1-64 Flat Head Screws (0.25in in length)

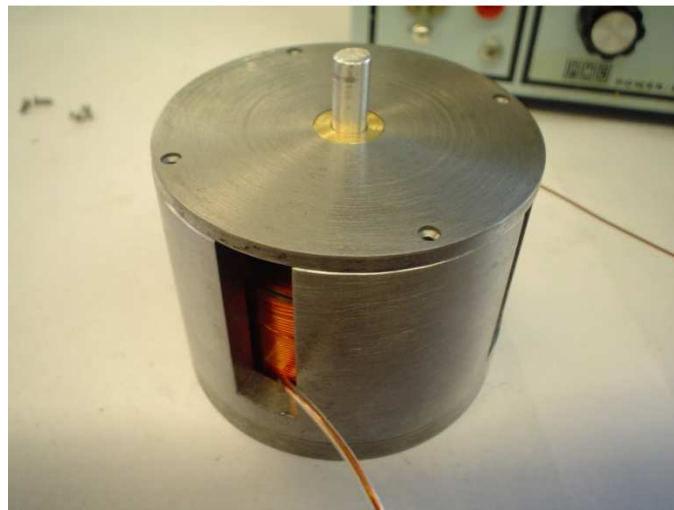


Figure 4.7 - Fully assembled actuator

5 Operation

1. Connect the Power connector cables to the two leads coming from the actuator coil using the alligator clip ends.
2. Connect the other ends of the connector cables to the power supply; red to red (positive) and black to black (negative). Do not connect the black cable to the ground port.



Figure 5.1 - Show connection of cables to power supply

3. Make sure that the power supply is switched off, and then plug it into a wall socket.
4. Check to make sure that voltage and current knobs are turned all the way down. (counter-clockwise)
5. Turn on the power supply.
6. Slowly turn the voltage knob until it reaches 10 V.
7. Slowly turn the current knob until it reaches 2.5 A.
8. Turn switch on and off to make actuator turn clockwise and then return to neutral position
9. To make actuator turn count-clockwise repeat steps 2-9 but instead connector the power connector cables red to black and black to red.