

Production Test Fixture for Sensor Ring Test

Concept Generation
Group 5

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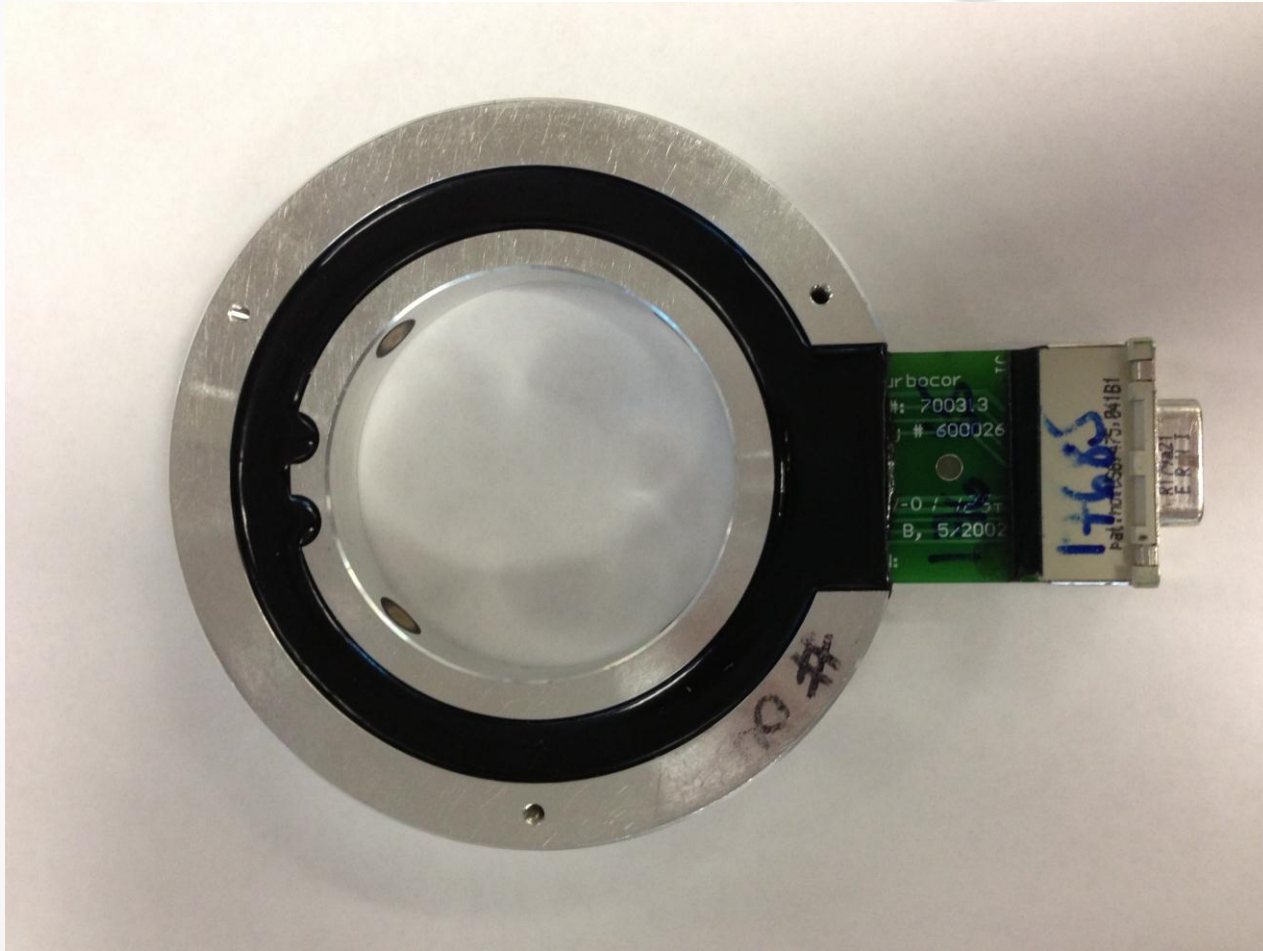
Overview

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Introduction

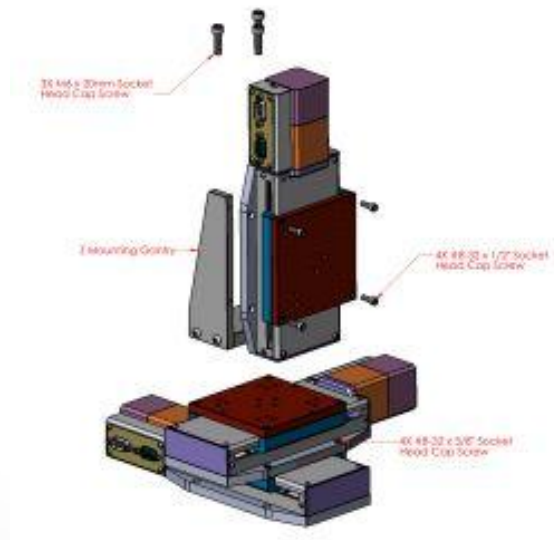
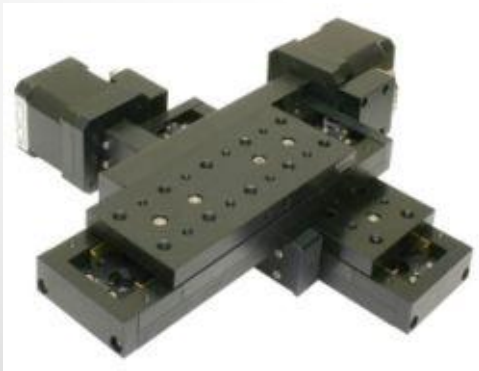
- Problem Statement
 - The current sensor test rig does not allow for reliable accurate measurements
- Proposed Solution
 - Design and build a sensor test rig using an X-Y-Z platform with zero backlash
 - Repeatable

Sensor Ring



Existing Technology

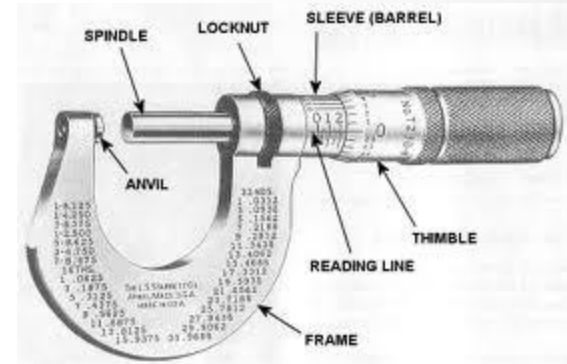
- Turbocor's current sensor test rig
 - Off-center shaft
 - Assumption of contact between shaft and ring
 - Back lash of stepper motor
- X-Y-Z Platforms



Displacement Measuring Devices

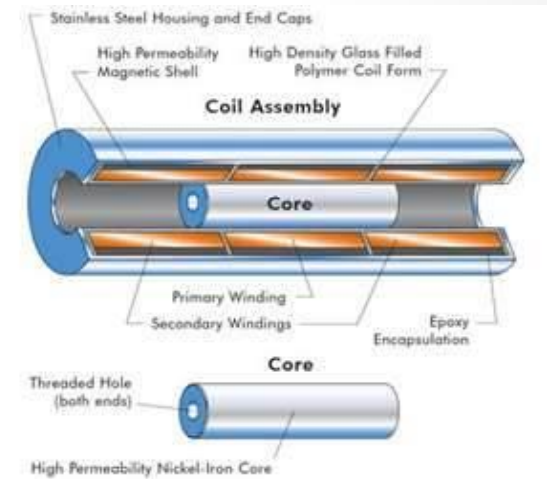
- **Micrometer**

- Uses finely threaded screw to create and measure linear displacement
- Accurately measures to the order of 10^{-6} meters



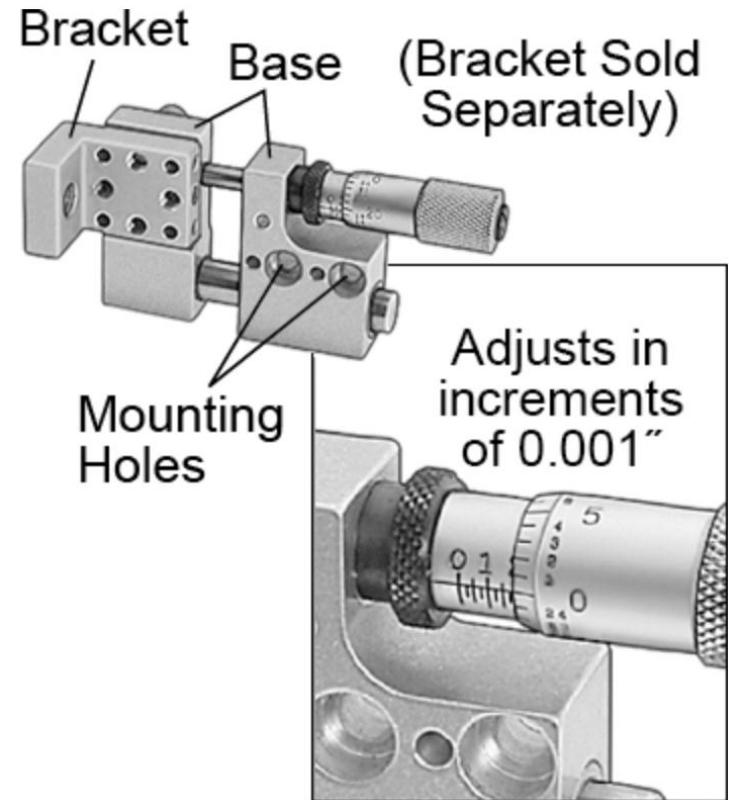
- **Linear Variable Differential Transformer (LVDT)**

- Utilizes motion of a magnet to create voltage differential in coils
- Voltage difference is linearly proportional to displacement of the magnet
- Extremely accurate



Displacement Methods

- **Linear Micro Positioner**
 - Utilizes a micrometer head and bracket
 - Creates and measures displacement in a continuous fashion
 - Minimal backlash
 - Relatively slow motion



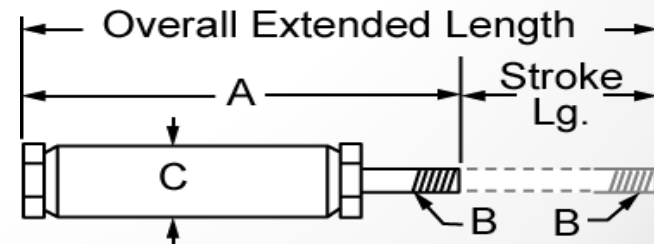
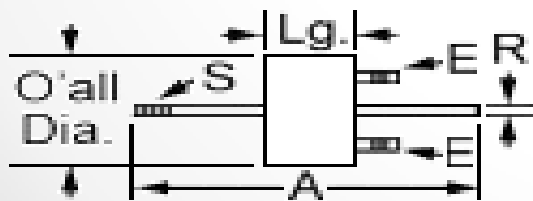
- **Solenoid Actuator**

- Uses electric current to create magnetic force via a coil
- “Clapper” solenoid can be used for three position linear movement
- 2 two-position solenoids facing each other can create the same three-position effect

- **Hydraulic Actuator**

- Uses air pressure and a piston cylinder apparatus to create linear motion
- Turbocor already has air lines run to testing station

- ❖ Both systems require independent displacement measurement such as an LVDT
- ❖ Both systems require physical “stops” to limit displacement



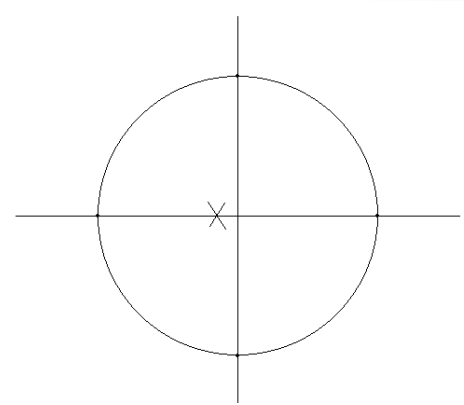
Solenoid / Hydraulic Actuator



- Air valve controls solenoid movement using compressed air and user activation
- Guide tracks act to maintain linear displacement while eliminating possibility of unwanted misdirection
- Stoppers positioned on guide tracks limit movement

Rotary Table

- Existing testing rig used by Turbocor
- Implements stepper motor and belt-driven shaft to perform tests
- Off-center shaft creates measurable spacing difference
- Z – direction testing



- Motor and belt-drive introduce backlash
- Inconsistency in locating the off-center rotation center between shafts

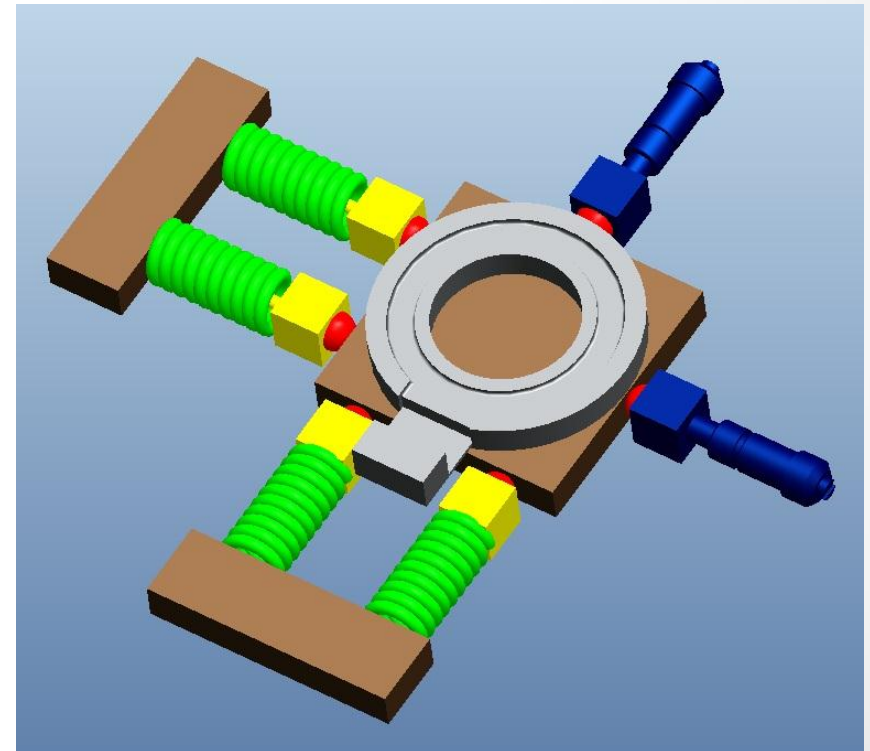
Concept 1: XY Displacement Table

- Pros
 - Independent movements
 - Very precise
 - No vibration (backlash)
- Cons
 - Low load capacity (5kg)
 - Additional components for Z-displacement



Concept 2: Spring Loaded Displacement Table

- Similar to XY Displacement Table
- Controls are manual
- Micrometer heads for displacement
- Spring loaded to prevent backlash
- Ball bearings allows smooth movements
- Z-Displacement use similar method



Conclusion

- Existing technology is beneficial in development of project
- Because of the required precision and accuracy, it is difficult to machine the XYZ platform
- Utilizing existing platforms, a base can be created for the sensor ring.

References

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