

## HIGH ACCURACY ANGLE MEASURING DEVICE FOR INDUSTRIAL, MEDICAL, SCIENTIFIC, OR RECREATIONAL USE

### Background

The ability to accurately measure movement of rotating components is crucial in many industrial, medical, and recreational applications. Devices used to measure such movement are called rotary position encoders (RPE), which represent a North American market worth \$500m. An absolute encoder (a RPE subtype), is desirable because it is able to determine present position angle, even if the device has been turned off and on again. However, a strong limitation to using these encoders is cost, with a high-end ( $\pm 0.4$  arc seconds accuracy) absolute RPE costing as much as \$20k. In addition, systems currently in use suffer from large, bulky components and they often experience measurement errors resulting from mechanical imperfections.

### Technology

A UW-Stout researcher has developed a high-accuracy angle measurement system that addresses the problems inherent to existing RPE systems. In this device, a high accuracy optical RPE, controlled by a microprocessor, consists of rotating optical disks and sensors precisely formed and placed to read angles with 0.001 arc second sensitivity (average) and better than  $\pm 0.1$  arc second accuracy (single readings), which is comparable to the accuracy of the high-end encoders currently on the market. This accuracy is made possible by a compact, novel design that combats mechanical sources of error which are problematic in other devices. Beyond high accuracy and portability, the cost of this improved system is much lower than a high-end commercial system because it is easily constructed from readily available industrial grade components, bringing the production cost to roughly \$2,000. Strikingly, this cost is comparable to the advertised price of other rotary position encoders that are less than one tenth as accurate. Its high accuracy, low cost, and portability make this new angle measurement system a strong option for use in virtually any of the current applications for absolute rotary encoders.

### Research and Development Status and Commercialization Needs

Prototypes have been developed and tested for principle of operation, accuracy, and sensitivity. Further refinement through mechanical and electrical engineering would be needed to take this product to market. Additional software development may be needed to interface the device to other equipment depending on desired end-use. Both engineering and development would benefit from industry collaborations and WiSys is currently seeking a strategic partner to further develop, manufacture, market, and distribute this device.

### Applications and Key Benefits

- Astronomical telescope mounts, land surveying, industrial inspection and calibration, machine tools, magnetic resonance imaging (MRI) and computerized tomography (CT) machines, robotics;
- High single reading accuracy of  $\pm 0.1$  arc seconds with high average reading sensitivity of 0.001 arc seconds;
- Excellent inherent accuracy obviates need for calibration in most applications;
- Small angular changes can be measured with high accuracy because residual error is a slowly varying function of angle;
- Low production cost; easily constructed from readily available standard industrial level components and;
- Compact and portable design.

### Intellectual Property

A U.S. Provisional Patent Application has been filed for this technology. For more information, please contact Jennifer Cook at [jennifer@wisys.org](mailto:jennifer@wisys.org) or by phone at 608-316-4131.