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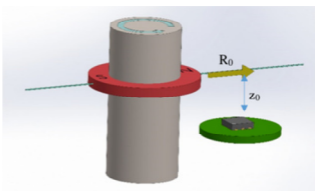
Off-Axis Angle Sensing

NVE TMR angle sensors are used in a variety of applications including encoders, robotics, motor controls, and automotive applications. But what happens when you can't center the magnet over the sensor?

Fortunately, these sensors are especially robust in off-axis configurations. There are two off-axis configurations: parallel-plane off-axis or perpendicular-plane off-axis.

Parallel-Plane Off-Axis

The parallel-plane off-axis configuration often uses a diametrically-magnetized ring magnet mounted on a shaft. The angle sensor is displaced vertically and radially to detect the rotating field:



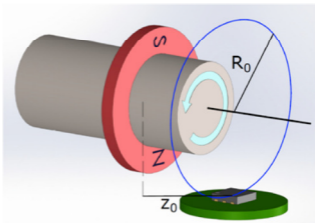
Sensor out-of-plane with a ring magnet with the sensor plane and magnet planes parallel. Distances are measured center-to-center.

For the best accuracy, the sensor should be placed where the rotating magnetic flux is a constant magnitude. This is achieved by choosing R_0 and z_0 so that:

$$R_0 = \sqrt{2} \cdot z_0$$

Perpendicular-Plane Off-Axis

The configuration with the magnet plane perpendicular to the plane of the sensor is shown below:



The second off-axis configuration, with the sensor plane perpendicular to the magnet plane. The plane of the sensor should be tangential to the blue circle, as shown.

Accuracy in this configuration is optimized at one of two locations:

$$R_0 = \sqrt{\frac{7-3\sqrt{5}}{2}} \cdot z_0 \quad \text{or} \quad R_0 = \sqrt{\frac{7+3\sqrt{5}}{2}} \cdot z_0$$

A Web App

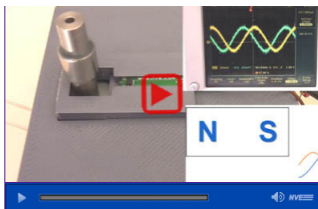
To make these calculations easy, we have a free [Web application](#) to calculate the ideal spacings for both off-axis configurations and any size magnet.

The Sensitivity Advantage

The magnetic field for off-axis geometries is significantly smaller than on-axis, which requires sensitive sensors. NVE offers high accuracy angle sensors that operate in as little as 1.5 mT, significantly less than other technologies. Our high-sensitivity sensors make off-axis angle sensing possible with small, inexpensive magnets.

Live Demonstration

Here's an off-axis angle sensing live demonstration:



A Range of Angle Sensors

NVE offers a range of [TMR angle sensors](#) including [analog angle sensors](#), and [Smart Angle Sensors](#), which include integrated digital signal processing and SPI interfaces. All of our angle sensors offer a unique combination of speed and accuracy.

More Information:

[Application Note \(.pdf\) »](#)

[Off-Axis-Angle-Sensing Web App »](#)

[TMR angle sensors »](#)

[Smart Angle Sensor Demo Board »](#)

Upcoming Exhibitions

NVE distributor K.K. Rocky will be exhibiting sensors, isolators, and the popular smart-sensor based xylophone at **Embedded Technology & IoT Technology**, November 20 to 22 in Yokohama, Japan.

