Lower Cost Magnetic Encoders Solve Encoder Problems for Motor Manufacturers

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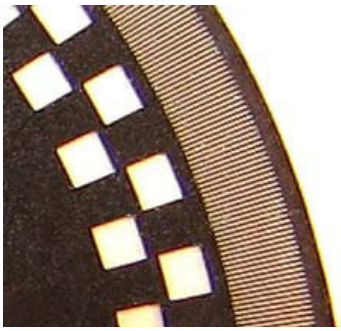
Magnetic encoders have been typically reserved for heavy duty industrial applications: Large and costly, they have long been the kings of encoders, not the foot soldiers used to fit common applications. These applications have been reserved for optical encoders due to price considerations. Recent technological developments have brought magnetic encoders to unprecedented price points, but not all designs share the high reliability and high performance of their high-quality ancestors.

Motor manufacturers install thousands of encoders on their motors every year. Typically, these are low-cost optical encoders. Manufacturers have reported high failure rates of these optical encoders.



Optical Encoder Disk

Why are Magnetic Encoders Superior to Optical Encoders?
Optical encoders are vulnerable to three kinds of damage:

- Seal failures which permit the entry of contaminants (oil, dirt, water, etc.)
- The optical disk may shatter during vibration or impact
- Bearing failures

Magnetic encoder designs effectively eliminate the first two failure modes and offer an opportunity to reduce bearing failures as well.

Why do contaminants (dirt, oil, water…) cause optical encoder failure and not magnetic encoder failure?

Optical encoders shine a light through a disk and detect variations in the amount of light cast on a sensor on the opposite side. Optical encoders need to see tiny lines on the disk accurately; they make errors when there is any type of contamination on the disk or sensor.

Magnetic encoders do not make errors due to contamination. Their sensors detect variations in magnetic fields imbedded in the rotor. Oil, dirt, and water do not affect these magnetic fields.
Nidec-Avtron has created higher-reliability optical encoders by improving the seals and sensor technology with shatter-proof disks. However, magnetic encoders offer yet a higher level of durability. Customers experiencing high optical encoder failure rates believe that a completely different approach is required.

Magnetic Encoder Technology: A Quick Primer
A magnetic encoder consists of two parts: a rotor and a sensor. The rotor turns with the shaft being measured, with alternating north and south poles around the circumference of the rotor. The sensor detects these magnets. There are many methods of detecting magnetic field changes, but the two primary sensor types used in encoders are:

- Hall Effect
- Magnetoresistive (MR)

Hall Effect sensors work by detecting a change in voltage caused by magnetic deflection of electrons. Magnetoresistive (MR) sensors detect a change in resistance caused by a magnetic field.

In practical usage today, Hall Effect sensors are generally lower cost, and less precise than MR sensors. This means that Hall Effect sensors, when used in an encoder, produce more “jitter” or error in the signal caused by sensor variations.

The Inputs:
Customers, especially motor manufacturers, have been frustrated by the high failure rate of small hollow shaft optical encoders. Several manufacturers reported huge warranty losses per year, and some suffered 100% encoder failure rates on key applications in the field!

Failures fell into broad categories:

- Wiring errors and electrical output failures
- Contamination (seal) failures
- Bearing failures (with shaft current issues)
- Optical disk failures

Magnetic (MR) technology has decreased in cost and increased in accuracy.

Nidec-Avtron has a long history of successful heavy-duty magnetic encoder designs.

The Results:
Nidec-Avtron has created the HS35M, a small, low-cost magnetic hollow shaft encoder for motor or shaft mounting. This product addresses each of the failure modes in existing small optical and magnetic encoders.

Nidec-Avtron HS35M Magnetic Encoder

Reliance Electric now offers their brand version of this encoder: the “RAHS35M” as an available product option for their variable speed stock and production motors.

Other key US motor manufacturers added the HS35M to their motor options.

High-Precision Control: The HS35M uses MR sensors to produce extremely accurate output, including PPRs from 1 to 2048. Jitter and signal variations are exceptionally low.

Shock and Vibration Resistance: The solid metal rotor eliminates shattered encoder disk problems.

Eliminating Output Failures: All of the HS35M output options feature full protection from short circuits of any kind, cross wiring, reverse polarity, and transients from external sources.

Long-Lasting Bearings: The HS35M features an insulated housing. This removes the possibility of motor and encoder bearing damage from shaft currents. Synthetic grease protects the oversize bearings and the bearings are placed farther apart to withstand greater forces.

Making Wiring Simpler: The North American standard for encoder wiring is the MS connector. The HS35M offers this option for compatibility and retrofits. However, the HS35M also offers a no-solder EPIC® style connector with a fully enclosed, full size terminal strip for easy wiring.

Conclusion:
Lower-cost magnetic technology and a design aimed squarely at elimination of encoder failures resulted in the Nidec-Avtron HS35M, a great product success that greatly reduces encoder problems for motor manufacturers and other customers as well.

For more information about this article or encoders & tachometers in general, contact:

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