



Enhancing the Operational Reliability of Material Handling Equipment

Using Non-Contacting Rotary Position Sensors

APPLICATION NOTE

BACKGROUND

Various types of equipment are used for material handling such as forklifts, pallet jacks, scissor lifts and other types of robotic machinery. Typically, this equipment integrates a variable control device, which is used for adjusting the speed of the lift. It is important that these control devices be of high quality and reliability, be able to operate in rugged or harsh environmental conditions and offer a long deployment life to ensure the safety of the operator as well as the materials being handled.

Traditionally, variable control models used for speed controls were devices based on contacting technology. In general, contacting technology components are rated for 10 million shaft revolutions and operate over a wide temperature range: -40°C to $+125^{\circ}\text{C}$. However, as designs evolved to newer platforms, concern for safety of the operator became a major design objective.

Newer platforms began migrating to redundant output potentiometer designs to ensure a fail-safe mode, but concern remained about possible broken or damaged contacts resulting from normal use. Other speed control platforms found a solution in non-contacting technology utilizing optical encoder designs. Unfortunately, the operating temperature range can affect the performance of optical encoders. Optical encoders traditionally do not perform reliably at very low temperatures, such as those encountered in refrigerated warehouses and freezers.

Another disadvantage of utilizing optical technology in these particular applications is reduced cycle life due to exposure to dirty environments such as dust, oils, and moisture. Optical encoders are better suited for use in clean environments where the user will get the maximum performance from this technology.



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NON-CONTACTING MAGNETIC SENSORS: A VIABLE TECHNOLOGY SOLUTION

Non-contacting magnetic (also known as “Hall effect”) technology offers a reliable and high quality solution for material handling equipment applications. Discovered by Edwin Hall in 1879, “Hall effect” refers to the potential difference on opposite sides of a bar-shaped conducting or semi-conducting material (Hall element). This potential difference (voltage) is produced by a magnetic field applied perpendicular to the Hall element through which an electric current flows. Figure 1 is provided to demonstrate this concept by illustration.

Hall effect technology produces an analog output similar to contacting potentiometers without the aid of a physical wiper contact. No internal contacting parts are subject to mechanical failure, making this technology ideal for use in harsh environments where extreme levels of shock, vibration, temperature, moisture and particles may be present. Figure 2 demonstrates the typical configuration for the Hall effect sensor where a magnet is rotated over a preprogrammed Application Specific Standard Product (ASSP), thereby producing an analog signal output.



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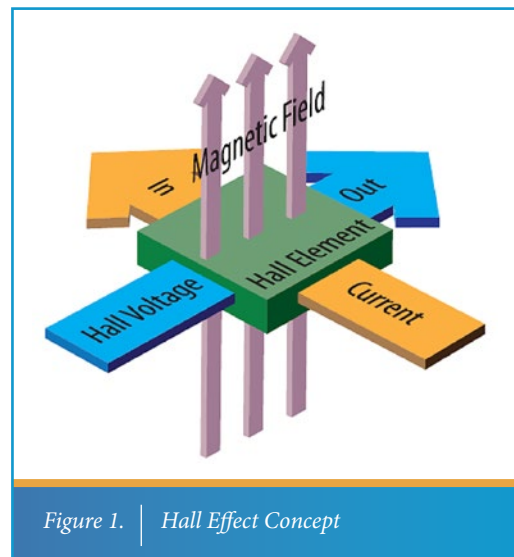


Figure 1. | Hall Effect Concept

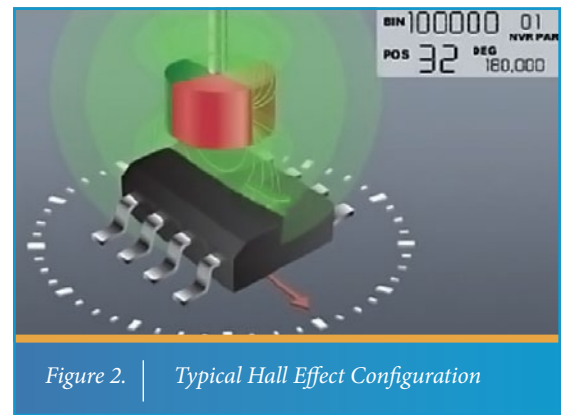


Figure 2. | Typical Hall Effect Configuration

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BOURNS® MODEL AMS22 SERIES NON-CONTACTING ROTARY SENSORS

The Bourns® Model AMS22 Series of non-contacting rotary sensors are magnetic “Hall effect” non-contacting rotary position sensors. Both models are available in 5.0 VDC supply voltage with low speed and high speed processing options. Offering superior side load performance, Bourns® Models AMS22B and AMS22S have sintered bronze sleeve bushings with a rotational life of up to 50 million shaft revolutions with a 250 gram side load capacity, while Bourns® Model AMS22U with ball bearings boasts a rotational life of up to 100 million shaft revolutions and a 250 gram side load capacity. Environmental ratings for these models include excellent performance in 98 % relative humidity and a wide operating temperature range of -40 °C to +125 °C.

Unlike their contacting rotary position counterparts, the Bourns® Model AMS22 Series of non-contacting rotary sensors offer stable independent linearity over the rotational life of the unit at $\pm 0.5\%$ standard, and $\pm 0.3\%$ optional upon request. The models also offer exceptional hysteresis of 0.2 % V_{DD} maximum, and factory programmable electrical angles from 10 ° to 360 ° with 12-bit resolution. These models are sealed to IP50 and are RoHS compliant*.

Other custom capabilities available on request include PWM or SPI output and dual output for systems requiring redundant output. Value-added options include flying leads or cable and connector for ease of connection to circuit boards.



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TECHNOLOGY BENEFITS PROVIDE TANGIBLE RELIABILITY RESULTS

The Bourns® Model AMS22 family of non-contacting rotary sensors offer the high quality, reliability and value required by OEMs designing equipment for the material handling industry. Non-contacting magnetic technology offers improved reliability and rotational life by as much as 40 % over contacting technology as there are no internal contacting parts subject to mechanical stress or failure. This translates into reduced calibration, maintenance and service cost for systems in the field. The redundant output option addresses optimum reliability in systems where safety is a concern.

In summary, Models AMS22B, AMS22S and AMS22U with magnetic non-contacting technology provide highly reliable rotary sensor solutions optimally-suited for use in harsh environments typically encountered in material handling applications where shock, vibration, humidity, temperature and particulates are frequently encountered.

Other Bourns® products available for material handling equipment include automotive brake wear sensors, steering sensors, pedal position sensors, resistor networks, trimming potentiometers, and the industry's broadest selection of circuit protection solutions.



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ADDITIONAL RESOURCES

For more information on Bourns® Sensors and Controls, visit Bourns online at:

www.bourns.com

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