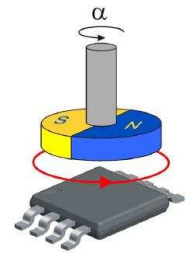


THROUGH SHAFT 360° MAGNETIC ROTARY POSITION SENSOR

INTRODUCTION

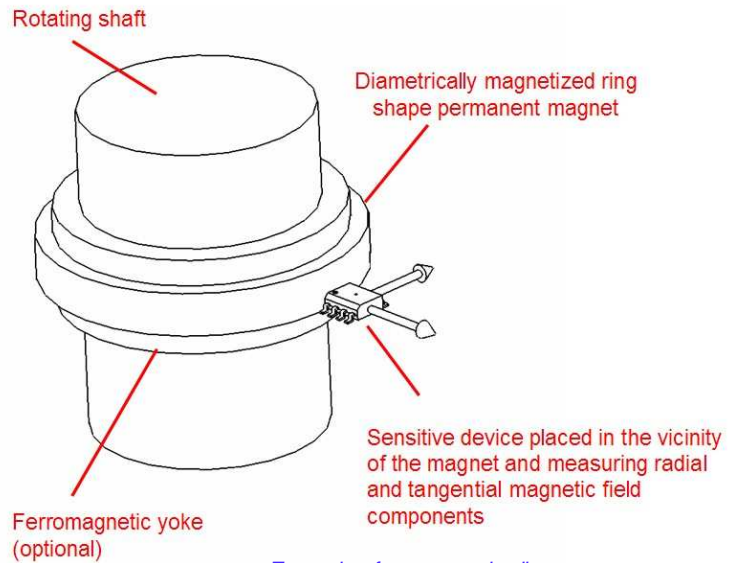
Measurement of angular position using variation of magnetic field amplitude induced by the displacement of a moving magnet has been intensively developed over the last fifteen years. However, these solutions have limits in terms of angular range and temperature influence. Recently, new solutions based on the determination of the angle of a rotating magnetic field have been developed. They allow for a measurement of angles up to 360° with limited temperature influence using sine and cosine signals generated in a plane by a rotating magnet. Typical set-up of these solutions is to use a permanent magnet with a bipolar magnetization placed at one end of a shaft and facing a dedicated Hall ASIC.

However, several applications require a through shaft, which prevents from using the basic principle described hereabove. Therefore, MMT has developed and patented innovative solutions for through shaft magnetic position sensors using measurement of the angle of a rotating magnetic field.

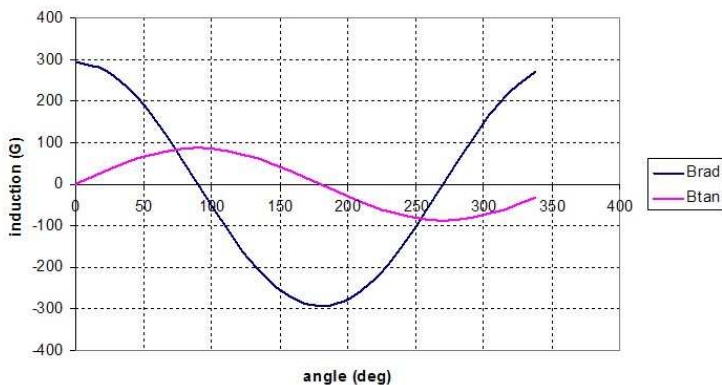


MMT 360° THROUGH SHAFT POSITION SENSOR SOLUTION

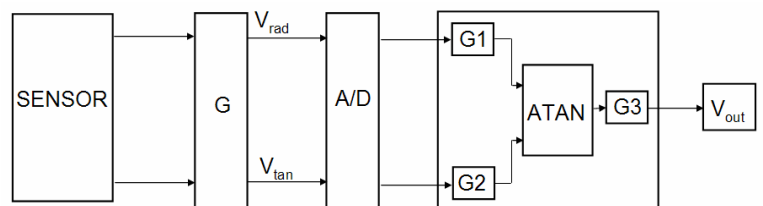
MMT patented sensor solution is using a ring magnet that can be for example magnetized diametrically. This ring magnet is linked to a rotating shaft, either directly or using a ferromagnetic yoke as an interface. Hall cells placed in the vicinity of the ring magnet measure the tangential and either the radial or the axial component of the magnetic field generated by the magnet. These components are in quadrature and generally have different amplitudes. However, a pre-calibrated signal processing unit can adjust both amplitudes which then allow to calculate the angle using an Arctangent function.



Example of sensor embodiment



Magnetic field components before signal processing



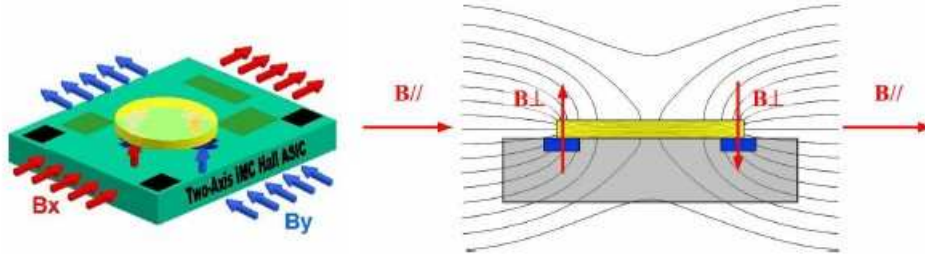
Example of signal processing principle

MMT / MELEXIS PRELIMINARY DEVELOPMENT NOTE

MELEXIS Triaxis™ TECHNOLOGY

Of course, this kind of sensor requires an adequate measurement and signal processing unit. In this scope, the Triaxis™ technology developed by MELEXIS offers an ideal solution, with an efficient and optimized implementation of magnetic field measurement and integrated signal processing capabilities offered by the MLX 90316 ASIC.

Therefore, MMT and MELEXIS have decided to be partners in this development.

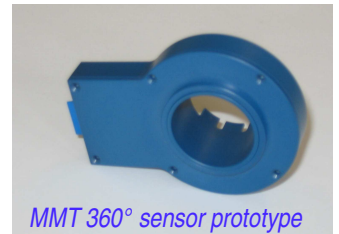


General principle of Triaxis™ solution

APPLICATION EXAMPLE : STEERING COLUMN POSITION SENSOR

One direct application of this principle is the steering column position sensor that can be used for automotive Electronic Stability Program (ESP) or Electric Power Steering (EPS) solutions.

Therefore, MMT is currently developing adapted solutions and some preliminar data are to be found hereafter :



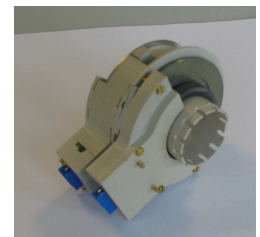
MMT 360° sensor prototype

PRELIMINARY DATASHEET 360° STEERING COLUMN POSITION SENSOR

Sensor type	Absolute, True Power-On	
Temperature range	-40° C/+125° C (a)	(a) : can be extended to 150° C
Stroke	360° (b)	(b) : multi-turn possible if associated with a geartrain
Accuracy at 25° C	+/- 1° (c)	(c) : can be improved by post-processing
Accuracy over temp. range and lifetime	+/- [2°.. 3°] (d)	(d) : depends on signal processing solutions
Resolution	0.1°	
Refresh rate	1...10 ms	
Dynamic range	2000°/s	
Output signal type	Analog, PWM or SPI (preferred)	

This sensor can provide either single or redundant output. Several possibilities exist for signal output type and signal processing or post-processing that will allow for the customer to get a solution adapted to its application requirements.

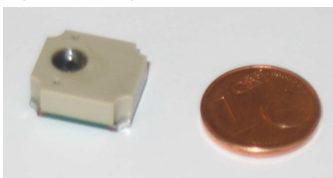
It can also be easily combined in a single package with MMT patented torque sensor technology or used as a multi-turn sensor using for example a planetary geartrain, with the advantage of measuring the position before the gear reduction.



Combined torque and angle sensor

CONCLUSIONS – OTHER APPLICATIONS

MMT has developed a simple and economic solution for through shaft steering column 360° position sensor. Close partnership with MELEXIS will allow our customers to have access to measurement and signal processing solutions adapted to their requirements. Of course this technology can also be adapted to various application ranges as for example miniature through shaft contactless potentiometers, valve position sensors, wiper sensors etc...



Miniature through shaft potentiometer

Also, using adapted magnetization patterns and optimized permanent magnet shapes, MMT has patented solutions adapted to short stroke angular measurement or very large stroke (up to 200 mm) linear position measurement.

FOR MORE INFORMATION, PLEASE CONTACT :

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- About MMT sensor technologies : Stephan Biwersi – sbiwersi@movingmagnet.com – 00.33.3.81.41.42.00