Whitepaper

Electromagnetic encoder with Wiegand Technology

Dr. Bruno Basler | Head of R&D Predevelopment
Dunkermotoren GmbH

dunkermotoren | AMETEK® ADVANCED MOTION SOLUTIONS

For accurate positioning, it is essential to store the absolute path information during one or more motor revolutions. Integrated electronics versions with optional absolute encoder are offered for the basic motors of the BG family. For this purpose, the rotary encoder supplies signals via a communication interface, which at any time allow an absolute positioning without the teaching-in or over-travel of a reference point. Due to the absence of a homing run, it is necessary to assign an absolute position value to each angular position over several revolutions.

The optional AE 38 is an electromagnetic multiturn encoder. The exact position information is retrieved via an internally galvanically isolated transmission interface. The absolute position value is available to the control pcb of the drive immediately after the drive is switched on. The control pcb accepts the master functionality and communicates with the absolute encoder via the Synchronous Serial Interface (SSI). The single-turn resolution of the encoder is 16 bits, the multi-turn resolution is 20 bits with a resolution and accuracy of 16 bits with respect to one mechanical revolution. Due to the additionally protected housing in the mounting part, the rotary encoder is insensitive to external interference fields, in particular caused by magnetic fields of the permanent magnets of the rotor or magnetic brakes. The advantage of the electromagnetic encoder lies in the detection of the position without mechanical onnection of the encoder to the shaft of the drive. Thus, the non-contact position detection does not require any further bearing and no mounted reduction gear for position detection. In addition, manufacturing tolerances can be better compensated for by eliminating the mechanical connection between the drive and the encoder. Another crucial advantage is the omission of the battery for storing the position. The Wiegand principle is used to notice the change in position during a rotation in the de-energized state or during a voltage drop. The centerpiece of this technology is a high-quality wire (Wiegand wire) consisting of a hard magnetic shell and a soft magnetic core. The Wiegand effect is due to the sudden reversal of magnetism in the wire. A prerequisite is a rotating magnetic field generated by the rotational movement of the drive shaft. Because of the magnetic field of a diametrically polarized permanent magnet, the soft magnetic core of the copper wire is directed by the magnetic field. The rotational movement of the magnet causes a change in the field intensity up to the polarity reversal of the wire shell. When the field strength is sufficiently large, the magnetic moments of the Weiss regions flip over one after the other and produce a sudden change in the polarization. Irrespective of the rotational speed of the outer rotating field or of the drive rotational speed, the change in the state by the Barkhausen effect is always equally fast. Thus, a sufficiently large magnetic field can be generated even at a very low rotational speed. If the Wiegand wire is in the middle of a coil, a positive or a negative voltage pulse is induced by this change in state per mechanical revolution. This short voltage pulse is sufficient for the power supply of the electronic counting system. By means of an amplifier circuit and a buffer capacitor, an electronics evaluates the direction of rotation and saves permanently the number of revolutions. This process takes a maximum of 100 µs. Thus, the Wiegand sensor serves not only as a pulse sensor, but also as a source of energy for storing the position in the de-energized state.

Sources:

https://www.posital.com/media/posital_media/documents/Spannungsautarke_Drehgeber.pdf
http://www.k-magazin.de/index.cfm?pid=1651&pk=166775&p=1#.V-p5sY9OJaQ

Your Contact For Public Relations:

Janina Dietsche | janina.dietsche@ametek.com
Phone.: +49 (0)7703/930-546

Author: Dr. Bruno Basler
Date: 08.25.2017