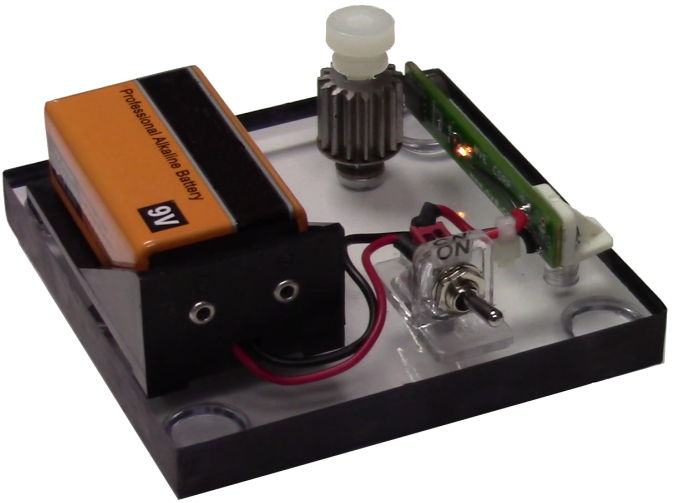
NVE CORPORATION

AG921-07E
Digital Gear-Tooth Sensor Demonstrator



GT sensor

SN12454

NVE Corporation (800) 467-7141 sensor-apps@nve.com www.nve.com

About This Demonstrator

GT Sensors™ are designed for detection of gear teeth and magnetic encoder wheels in industrial speed sensing.

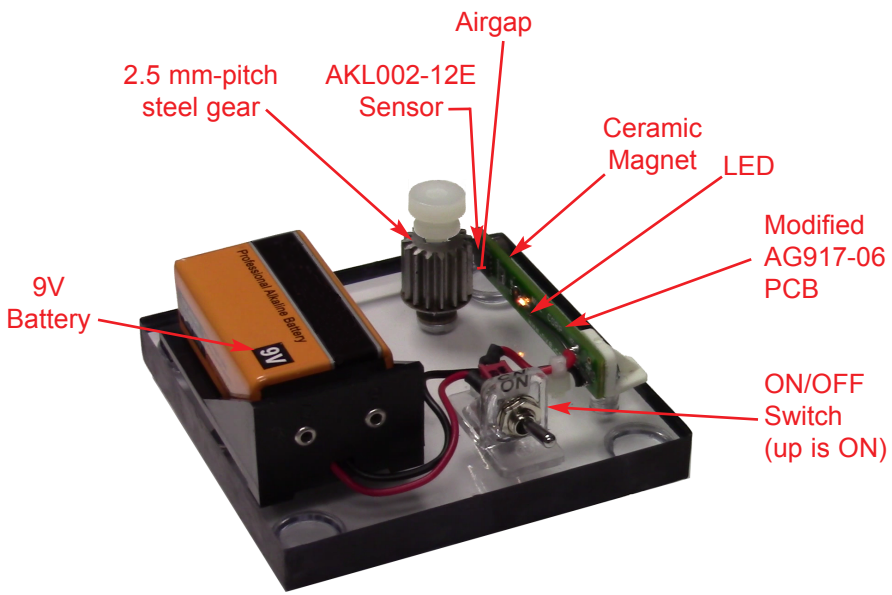
This demonstrator is based on an AKL-Series GT Sensor, which provides a 50% duty cycle digital current-modulated output.

The demonstrator also includes a circuit board with an LED and a transistor driver; a small gear that can be rotated; and a battery to power the circuit.

GT Sensors are based on Giant Mangetoresistance (GMR), providing the sensitivity to detect small gear teeth and wide air gaps. GT Sensors can operate to DC, and can therefore detect a wide range of speeds, including very slow speeds.

In addition to AKL-Series digital sensors, NVE offers ABL-Series analog gear-tooth sensors, which provide sinusoidal outputs. Single- or dual-bridge analog sensors are available. The dual-bridge versions have two out-of-phase outputs for determining direction.

Quick Start



Quick Start

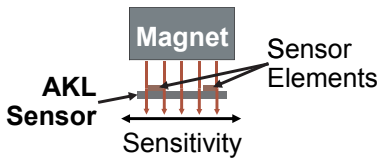
- Install 9 volt battery.
- Turn the demonstrator ON (switch in the up position).
- Adjust the airgap between the sensor and the gear if necessary.
- Turn the gear slowly and observe the LED tuning ON and OFF.
- Turn the demonstrator OFF when not in use to preserve battery life.

Note:

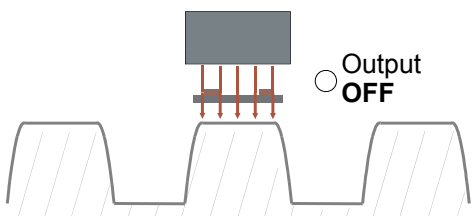
Style may vary from the above image.

Magnetic Operation

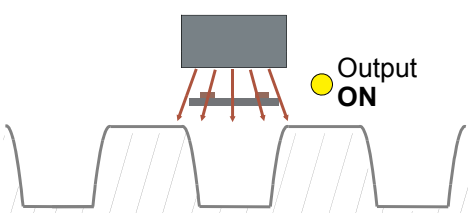
As shown in the diagrams at right, the direction of sensitivity is parallel to the plane of the AKL sensor. A biasing magnet provides magnetic field.



As the gear turns, the magnetic flux lines are deflected into the direction of sensitivity by passing steel gear teeth.



The sensor produces a digital output with one cycle per tooth.



Magnetic Design Considerations

The Right Sensor for the Application

AKL-Series sensors have two sensor elements with various spacings. The following table shows popular models:

Part Number	Element Spacing (Microns)
AKL001-12	1000
AKL002-12*	500
AKL003-12	300

*Included in the demonstrator

Optimal spacing depends on the geometry of the gear and the sensor system. As a starting point, the sensor element spacing can be one-fourth of the gear pitch. In this demonstrator, the gear pitch is approximately 0.1 inch (2.5 mm), so the 500-micron sensor (AKL002) was selected.

Sensor-to-Magnet Spacing

This demonstrator has the sensor and magnet on opposite sides of a circuit board, providing approximately 1.5 millimeter spacing between the sensor and magnet. Spacing in this range typically keeps flux-lines “flexible” and able to follow gear teeth.

Magnet Selection

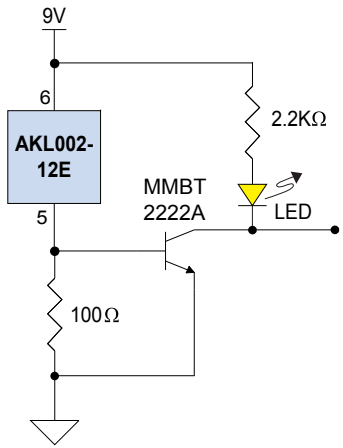
Ceramic-8 magnets, like the NVE number 12216 disk magnet used in this demonstrator, are recommended for most gear-tooth applications because of their low cost and good field properties. Alnico-8 magnets can be used for high-temperature applications. Rare-earth magnets are not recommended because they saturate the sensors too easily.

Schematic and Electrical Operation

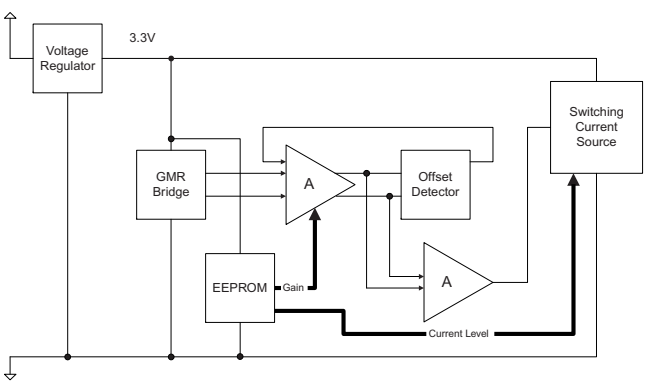
Demonstrator Circuitry

AKL-Series Gear-Tooth Sensors have 4-to-8 mA two-wire interfaces. This demonstrator provides a circuit board with an LED and driver.

When the sensor current is 4 mA, the voltage across the 100 ohm resistor is 0.4 V, which is not enough to turn on the transistor. With 8 mA the transistor turns on, illuminating the LED.



Demonstrator Schematic

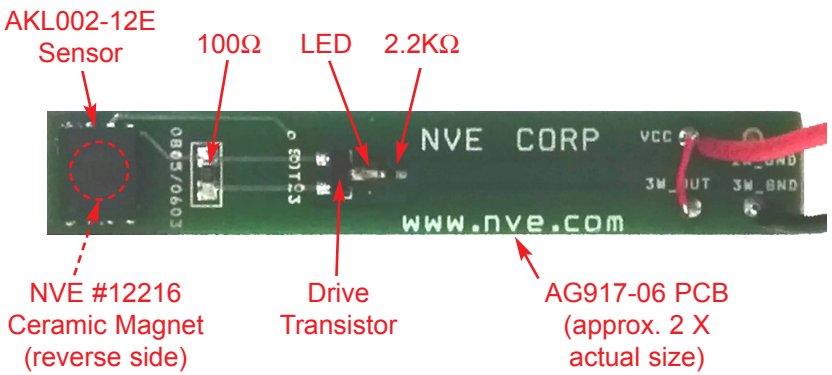


AKL-Series Sensor Block Diagram

AKL Operation

AKL-Series sensors include a GMR bridge consisting of two GMR sensor elements, a voltage regulator to allow a wide range of supply voltages, a factory-programmable EEPROM for calibration, and an output current driver.

Circuit Board



The circuit board in this demonstrator is designed for an AKL sensor in a TDFN-8 package. The standard AG917-06 PCB has connections for converting to a three-wire output by adding a 100 ohm resistor (0805 package) and an NPN output transistor (SOT-23 package). The demonstrator circuit board has been modified to add an LED and series resistor to indicate an output.

A board is also available with the sensor rotated 90 degrees (the AG916-06) for sensitivity parallel to the short axis of the board.

For more information: *http://www.nve.com/Downloads/gtsensor_catalog.pdf*

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