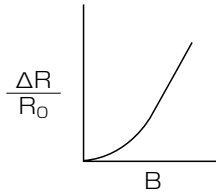
BASIC PRINCIPLES

Basic principles

The semiconductor magnetoresistive element is a magneto-electric transducer which utilize the magnetoresistance effect.
When a magnetic field is applied in a direction perpendicular to the InSb plate surface, the resistance will be raised.

(Resistance change ratio) $\frac{\Delta R}{R_0} = \frac{R_B - R_0}{R_0}$



Resistance in a magnetic field (B ≠ 0)

Resistance in the absence in a magnetic field (B=0)

Magnetoresistance effect depends on the electron mobility μH of the material.
InSb is used for the magnetoresistive elements because of high electron mobility.

磁気抵抗効果の磁束密度依存性

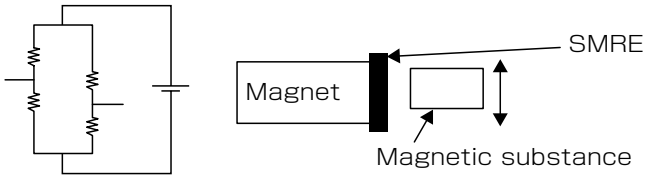
Low magnetic field $\frac{\Delta R}{R_0} \propto (\mu_H B)^2$

High magnetic field $\frac{\Delta R}{R_0} \propto (\mu_H B)$

Sensor structure

The sensor circuit has a bridge-type.
The sensor is configured with a combination of SMRE and a permanent magnet、and can be used to detect magnetic media movement.

Bridge-type circuit

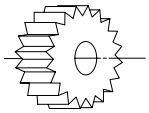


APPLICATION GUIDE

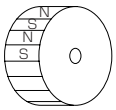
Operation

Targets
A gear type,where projections and indentations are formed on a magnetic substance or a magnetic drum type.
The specifications are determined by the face width, bottom width and depth in case of a gear In case of a magnetic drum,the specifications are determined by the magnetization pitch, and material.

Soft magnetic geartooth

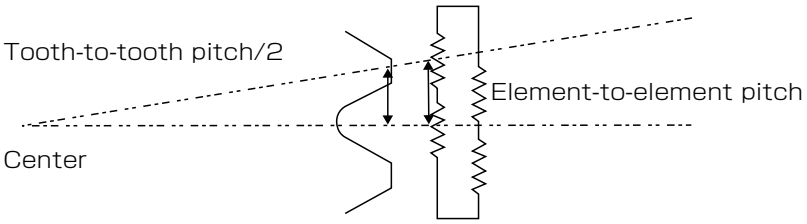


Magnetic drum



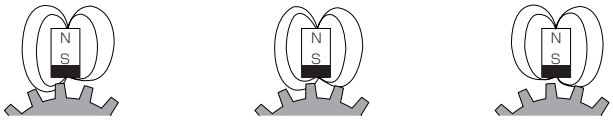
Relationship between geartooth and SMRE

The SMRE detects the difference between the projections and indentations of the gear.
The gear is designed so that the sensor's element-to-element pitch is one-half the tooth-to-tooth pitch as standard.
the magnetores



Detection mode

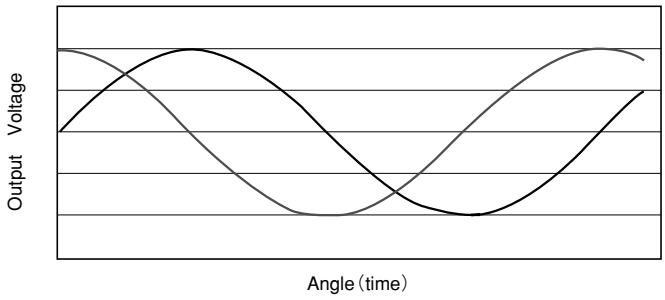
When the gear rotates, the SMRE detects the change in magnetic flux density caused by projections and indentations of the gear and the permanent magnet built into the sensor.



R(MR1)>R(MR2) R(MR1)=R(MR2) R(MR1)<R(MR2)

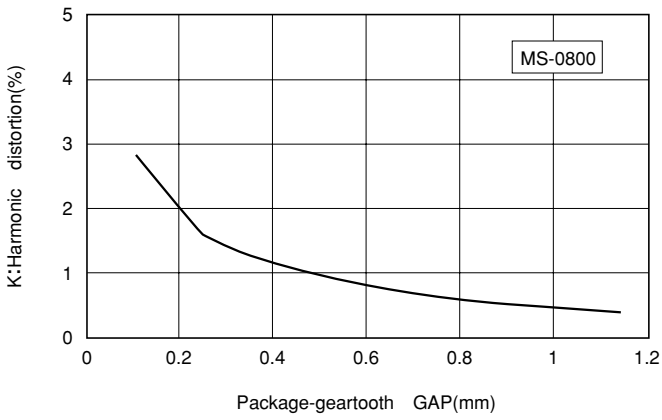
Output signal

The output is multi-phase(A,B-phase).
The phase difference between phases A and B is 90°of the electrical angle.



Harmonic distortion of output

The output waveform is close to an ideal sine wave.



K:Harmonic distortion

$$K=\frac{\sqrt{E_2^2+E_3^2+E_4^2+\cdots}}{E_1}$$

E1:Amplitude of fundamental wave
E2:Amplitude of the second harmonic wave
E3:Amplitude of the third harmonic wave