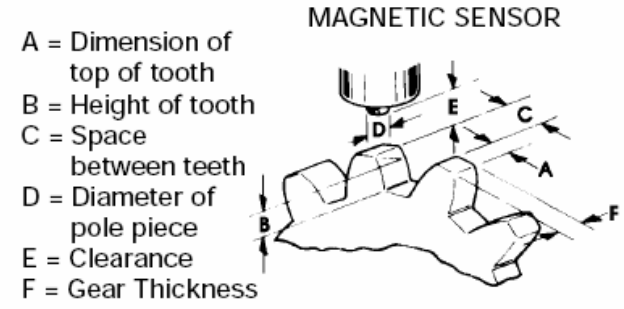
VRS Output Voltage Calculations

For every gear tooth configuration, there is an optimum pole piece size and shape to achieve maximum output voltage from the sensor. This relationship is as follows:
The optimum dimension of A, B, and C are given as they relate to D the diameter of the pole piece of the VRS sensor being used.

A is equal to or greater than **D**
B is equal to or greater than **C**
C is equal to or greater than three times **D**
E is as close as possible
F is equal to or greater than **D**



The above configuration is usually not available in a stock gear, but it is seldom necessary to have the maximum output. Very close to the maximum output may be generated by conventional stock gears if the tooth width **A** is equal to or greater then the pole piece diameter and **C** is 1.5 times **D**.
For ease of alignment, gear thickness should be 2 or 3 times the pole piece diameter.

A. Gear pitch =
$\frac{\text{\# of Teeth + 2}}{\text{Gear Diameter}}$

B. Minimum Surface Speed =
$\frac{\text{Min RPM x Gear Dia. x 3.14}}{60}$

C. Frequency =
$\frac{\text{\# of Teeth x RPM}}{60}$

D. Gear Diameter =
$\frac{\text{Total \# of teeth +2}}{\text{Gear Pitch}}$

E. Actual Voltage =
$\frac{\text{Ref Voltage Out}}{\text{1000 IPS}} = \frac{\text{Unknown Voltage Out}}{\text{Actual Speed}}$

Calculating Actual Output Voltage for a Given Application

Application Example:
Minimum speed of Interest: 100 rpm
Maximum speed of Interest: 1000 rpm
Actuator: 20 pitch 60 tooth gear
Air Gap: .010”
Load impedance: 10k Ohms
Output Required: 1 V P-P minimum

Using our example:
We first need to calculate the Gear Diameter: Ex (“D”)
60 + 2 = $\frac{62}{\text{Pitch} = 20}$ Gear diameter = 3.1 inches
Then, Min Surface Speed: Ex (“B”)
$\frac{100 \times 3.1 \times 3.14}{60}$ = 16.2 IPS

Then, actual voltage using the unit’ specifications: Ex (“E”)
(We will use the 3030 series spec for this example)
$\frac{190 \text{ V p-p}}{1000 \text{ IPS}} \times \frac{\text{“x” V p-p}}{16.2 \text{ ips}} = 3.078$

Solution: 1000x= 3078 x = 3.078