Velocity and Acceleration Calculations

There can be multiple ways to determine the angular velocity and acceleration of a Quadrature Encoder. One way is to count the number of Quadrature Encoder pulses in a fixed time interval to estimate the velocity and acceleration of the encoder, Fig. 6 demonstrates this procedure. This method is appropriate for high speed applications.

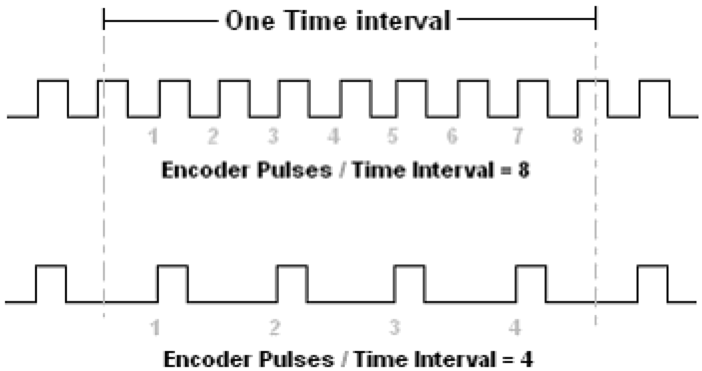

Fig. 6 Velocity Estimation

Once the number of pulses in a fixed time interval is measured the angular velocity of the Quadrature Encoder can be calculated using the following formula:

$$Velocity = \frac{\dfrac{Encoder\,Pulses}{Pulses\ per\ Revolution} \times \dfrac{60\,\text{sec}}{1\,\text{min}}}{Sampling\ Time\,(\text{sec})}\,(\text{rpm}) \tag{14}$$

Where, "Encoder Pulses" is the number of quadrature encoder pulses received in the Fixed Time Interval.

Acceleration is the rate of change of velocity. The following formula can be used to estimate acceleration of the Quadrature Encoder:

$$Acceleration = \frac{\left(\dfrac{Encoder\,Pulses_n - Encoder\,Pulses_{n-1}}{Pulses\ per\ Revolution}\right) \times \left(\dfrac{60\,\text{sec}}{1\,\text{min}}\right)^2}{(Sampling\,Time)^2\ (\text{sec})^2}\,(\text{rpm})^2 \tag{15}$$

Where, the numerator divided by one Sampling Time represents the change in velocity. Dividing the change in velocity by one Sampling Time gives the acceleration.