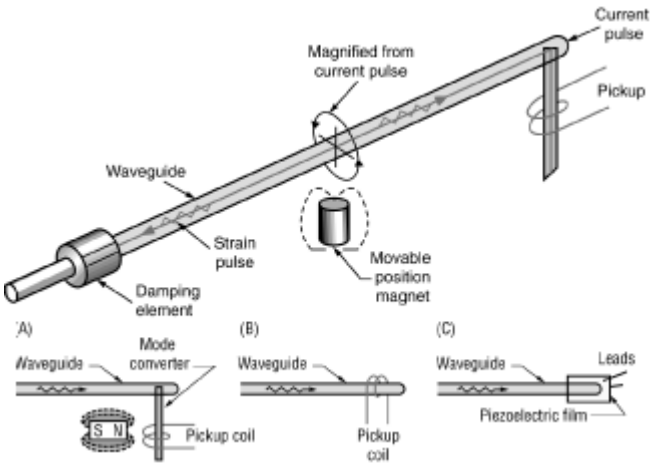
Principles and Advantages of Magnetostrictive Position Transducers

How Magnetostrictive Sensors Work

A magnetostrictive position transducer is a non-contact device that detects the position of a magnet. The magnet moves along the length of the sensing element and is attached to the object whose position is to be determined.



The magnetostrictive linear displacement transducer (MLDT) relies on the basic principle of magnetostriction, which causes some ferromagnetic materials to change dimension when subjected to magnetic fields. The construction of a typical MLDT includes an electronic sensing head and a conducting wire coaxially mounted in a waveguide. The waveguide is made of a magnetostrictive material that is mounted within a protective housing made of a non-magnetic material. The waveguide is spring mounted on one end for damping. An external magnet moves along the exterior of the housing.

A current pulse is launched along the conducting wire in the waveguide. This generates a circumferential magnetic field around the waveguides as the current pulse travels down the conducting wire. When the magnetic field from the current pulse intersects with the field of the external magnet, the interaction of the fields forms a third field. This causes the waveguide to experience a minute torsional strain or twist. The strain pulse travels at ultrasonic speeds along the waveguide and into a pickup mounted in the head of the instrument.

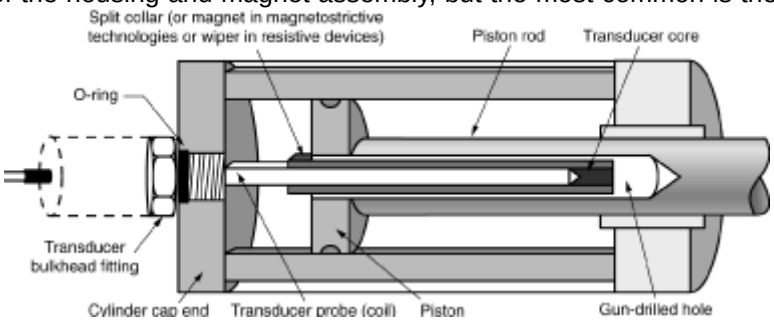
There are different methods of sensing the torsional strain pulse. Each of the variations of strain pulse sensing detects the dynamic strain induced in the waveguide and produces a signal that is sent to the conditioning electronics for amplification and shaping.

The precise position of the magnet is determined from the time interval between the initiation of the current pulse and the arrival of the torsional strain pulse in the head. This time interval multiplied by the travel speed, of the strain pulse along the waveguide, indicates the position.

The output is digital in nature. The most common are start-stop pulse width modulated (PWM). These electronic circuits are either self-contained or available as a separate module. An

analog conversion is readily available that generally provides 0 to10-V DC or 4 to 20 mA as an output interface. Most units use DC excitation.

MLDTs are generally available in external- and internal-mounting configurations. The external mounts usually consist of an extruded aluminum housing to protect the waveguide assembly. There are many variations of the housing and magnet assembly, but the most common is the rod and cylinder style. The rod and cylinder type has an internal magnet assembly attached to the rod and is moved as the rod is stroked. This style resembles a pneumatic cylinder and is often mistaken for one. MLDTs mount inside cylinders in a manner similar to that of the inductive transducer.



Magnetostrictive Position Transducers' Functional Advantages

Frictionless Measurement

One of the most important features of a magnetostrictive transducer is its friction-free operation. In normal use, there is no mechanical contact between the magnetostrictive transducer's ring (or float) and rod, so there is no rubbing, dragging or other source of friction.

High Resolution

Since a magnetostrictive transducer operates in a friction-free structure, it can measure very small changes in ring position. These same factors also give a magnetostrictive transducer its outstanding repeatability.

Unlimited Mechanical Life

Because there is normally no contact between the magnetostrictive transducer's ring and rod structure, no parts can rub together or wear out. This means that a magnetostrictive transducer features unlimited mechanical life.

Absolute Output

A magnetostrictive transducer is an absolute output device, as opposed to an incremental output device. This means that in the event of loss of power, the position data being sent from the magnetostrictive transducer will not be lost. When the measuring system is restarted, the magnetostrictive transducer's output value will be the same as it was before the power failure occurred.

(Digested from *Position Sensors and Hydraulic)*