Terminology and Testing

Resolution

The smallest increment of position change that can be detected by the transducer. The resolution of Micropulse transducers depends on the output type chosen.

Digital Pulse Output (all housings)
For digital pulse-output systems (i.e. Start/Stop or PWM) resolution is determined by the clock frequency of the customer interface which measures the time interval between the Start pulse and the Stop pulse (or the rising and falling edges of the PWM signal). Resolution can be determined as follows:

Resolution (in inches) =
1 ÷ (Gradient x Clock Frequency)

The gradient value is printed on the label of each transducer and is expressed in microseconds per inch (µsec/inch).

The Clock Frequency is the frequency of the counter in the customer supplied interface and is usually expressed in megahertz (MHz).

Example - assuming a gradient value of 9.000 µs/inch and a clock frequency of 56 MHz

Resolution (in inches)
= 1 ÷ (9 x 56)
= 1 ÷ 504
= 0.00198”

Digital Serial Systems (SSI, Canbus, etc.)
Resolution is a defined value, stated in inches.

Digitally-Derived Analog (Z housing, rod-style only)
Output resolution is expressed as 16-bits. The digital position information is converted into an analog signal internally through a digital-to-analog converter.

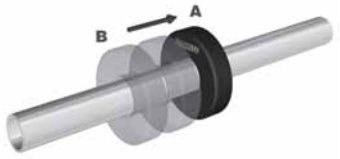
True Analog (all other housing styles)
The analog output is derived without using a digital-to-analog converter. Resolution for this type of system is virtually infinite. Attainable resolution is determined primarily by electrical noise inherent to the application, and input resolution of the control system.

Temperature Coefficient
Expressed as ppm/°C or °F, TC is the degree to which the output signal (and therefore the indicated position) is affected by ambient temperature changes.

Non-Linearity
The degree to which the output value from the Micropulse transducer system is not perfectly proportional to travel distance. Standard transducers show a non-linearity of max. ±0.02% full scale. Example: a 24-inch stroke BTL5 with analog output may output a position value which is 0.0048" greater or less than the true, absolute position. This value is repeatable, however, to within 0.0002" (see “resolution” and “repeatability”). For higher accuracy requirements, Micropulse transducers with Synchronous Serial Interface (SSI) can be used.

Hysteresis
The difference in indicated position when the same point is reached from two different directions. Repeatability refers to travel from one direction only, hysteresis from two directions.

Repeatability
The degree to which the indicated position point B as represented by the output value is reproduced when moving in one direction from point A and back to point B. In the case of a BTL5 system, position repeat accuracy is always the same as the stated resolution + hysteresis.



Dead Zone
The end of the Micropulse transducer rod, from end of stroke to the end of the rod. This is usually the last 2.3 inches of the rod. If the magnet enters the dead zone the output will be unpredictable.

Null Space
The distance from the head of the transducer to the start of the electrical stroke.

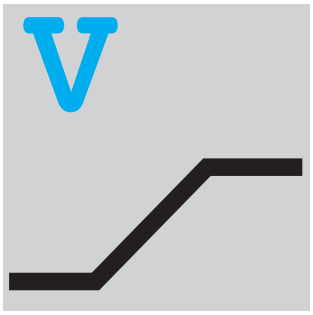
Null Position
The position of the magnet on the transducer rod which reads a zero or minimum output.

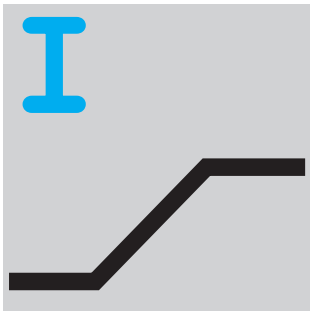
Stroke
The active electrical portion or the sensing portion of the Micropulse transducer.

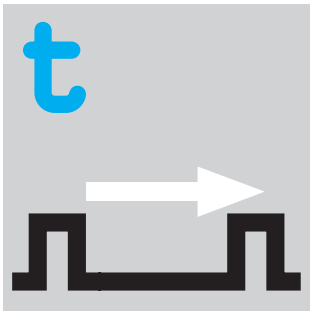
Analog
The output of the transducer is an analog voltage (0 to 10 Vdc, -10 to +10 Vdc, or -5 to 5 Vdc) or an analog current (0 to 20 mA, 4-20 mA) and is proportional to the position of the magnet.

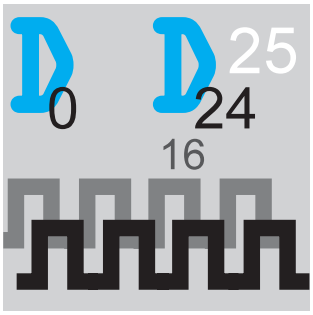
Digital Pulse Output
The output of the transducer is a digital Start/Stop pulse or a Pulse Width Modulated (PWM) signal. Magnet position is directly proportional to the time interval between the Start pulse and the Stop pulse (or the rising and falling edges of the PWM signal). An external counter is required to measure this time interval.
A wide variety of processor cards, PLC plug-in cards, and stand-alone controllers designed around this interface are available.

Digital Serial Output
The output of the transducer is in the form of a serial data word or string in SSI (binary or Gray code) or CANbus format.









Analog voltage output

The output voltage is directly proportional to the position of the magnet along the waveguide.

The most important parameter for analog outputs is the refresh rate and the ripple of the output signal. Many transducers on the market attain the specified values for output ripple only by means of low-pass filtering. This always carries with it an undesirable time delay of the output signal.

Micropulse transducers attain the specified signal quality without extensive low-pass filters, instead using improved circuit design. This means fast update times with low levels of ripple and noise on the output signal. Micropulse transducers with voltage output have 2 outputs, one increasing and one decreasing.

Available versions include:

0...10 V (10...0 V)

-10...10 V (10...-10 V) and

-5...5 V (5 V...-5 V)

Analog current output

The output signal is directly proportional to the magnet position along the waveguide. Analog current interfaces of 0...20 mA and 4...20 mA are standard in numerous applications and in many industries. Current interfaces are significantly less sensitive to induced noise than are analog voltage interfaces. A 500 Ohm resistor can be used to easily convert the 0..20 mA signal into a voltage of 0...10 V. The 4...20 mA signal provides a simple form of cable break monitoring, since even at the nullpoint of the stroke a current of 4 mA must flow. Micropulse transducers with current output are available with increasing or decreasing signals.

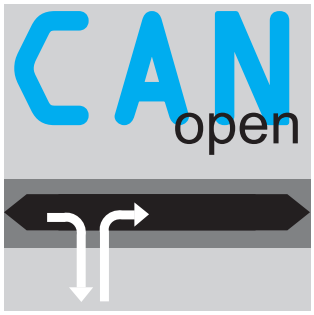
Pulse interface

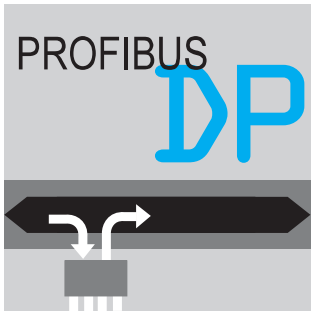
The time between an interrogation and the reply signal is directly proportional to the position of the magnet along the waveguide. These pulses are transmitted using RS485/422 differential line drivers, guaranteeing noise-free signal transmission over distances of up to 500 m (1640 ft.). The great advantage of these interfaces is the noise-immune signal transmission with a simple and economical interface. Interfaces with tristate outputs allow multiplexing of several Micropulse transducers. Appropriate control cards are available.

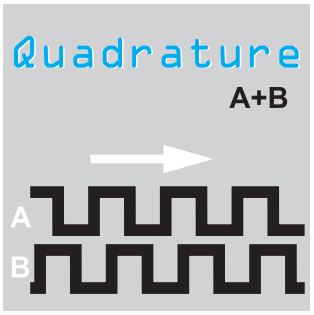
SSI synchronous serial interface

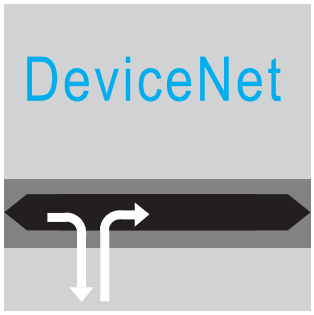
The position of the magnet along the waveguide is sent to the control serially in the form of a data word.

Micropulse transducers with SSI interface can be connected directly to controls or closed-loop control cards with SSI interfaces designed for absolute encoders. The data transmission from the sensor to the control is synchronized by means of a clock pulse from the control. Depending on the required resolution, transducers with 24 or 25-bit data words are available. The maximum non-linearity of the SSI Micropulse transducer of ±30 µm over the entire stroke, the update frequency of 2 kHz and a resolution of 5 µm make the SSI Micropulse transducers an ideal feedback sensor, even in the most demanding applications.









CAN*open*

The position of the magnet along the waveguide is sent over the CAN-Bus to the control in so-called Process Data Objects, PDOs. Micropulse transducers work with standard CAN*open* protocols per CiA DS 301 and with the standard device profile per DS 406. CAN*open* offers greater flexibility because of the large number of configuration options for the transducer. For example, the resolution is programmable for 5, 10, 20 or 100 µm, depending on your application. Or you can select whether only position or also velocity information shall be sent to your control; cyclically, or on-demand. And there's more: Up to 4 so-called software cams can be defined in the active stroke range. Each time the status of one of these cams changes, high-priority Emergency messages are sent to the control (check factory for availability).

– Consult factory for technical data

PROFIBUS

This interface provides an efficient connection to machines using Profibus. Features of this interface include:

– Single telegram message for fast updates even with 4 magnets
– Operates at 12 Mbps
– GSD file provided to configure telegram message
– Sync and Freeze functions available for coordination between other devices

Quadrature

The quadrature output interfaces directly to standard encoder inputs (90° out of phase, A & B). This configuration gives you more interface options for connecting to motion based systems. Operating modes can be either free-running or synchronous (switch selectable) depending on the control system's requirements.

DeviceNet™

DeviceNet is a manufacturer-independent, open standard fieldbus used to interconnect control devices and sensors for data exchange. It uses **Controller Area Network** (CAN) as the backbone technology.

The Micropulse® linear position transducer with DeviceNet interface is compatible with the CIP Common Specification Object Library “Position Sensor Object”.

Micropulse DeviceNet transducers feature:

– Selectable position resolution to 5 µm
– Selectable velocity resolution to 0.1 mm/s
– MAC-ID and baud rate can be preset using DIP switches, and can also be changed via software
– On-board status LED shows network/device status