VIATRAN

TECHNICAL NOTE

ACCURACY

There are many aspects that affect a pressure transmitter's accuracy, and each one is relevant to different types of instrumentation and applications. The three most important aspects that apply to pressure transmitters are linearity, hysteresis, and repeatability. Of the three, linearity is the greatest contributor to a transmitter's inaccuracy.

Many transmitter manufacturers combine linearity, hysteresis, and repeatability characteristics together, specifying one value as representative of the overall accuracy. Viatran, however, separates linearity from the other two. To specify accuracy in a Viatran transmitter, there is a value for linearity and a second value that represents a combination of hysteresis and repeatability.

Linearity

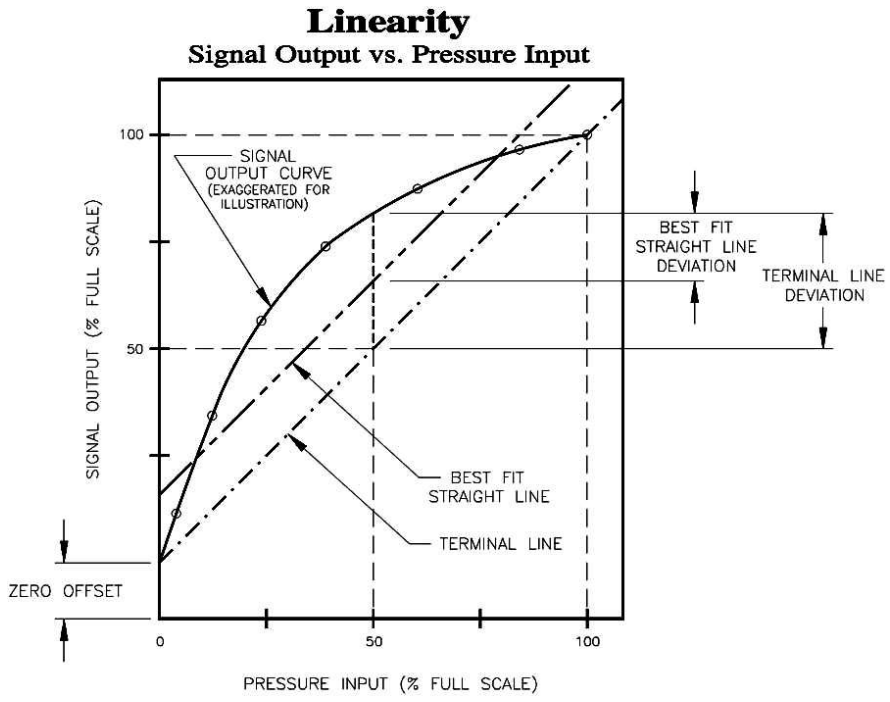
Ideally, a graph of the electrical output from a transmitter would form a straight line over the range from zero pressure to full scale pressure. In reality, that is rarely the case. Transmitter output plots have slight curvatures over the full range of inputs. This effect is the result of the transmitter diaphragm geometry, the sensing technology used, and general inconsistencies in the sensor's material. Linearity performance is defined as the closeness to which the actual transmitter output curve resembles a straight line. Linearity is quantified as the maximum deviation of the output curve from some straight line of reference.

One way to quantify the linearity error of a transmitter is to employ the Terminal Line method. A terminal line connects the value of the zero output signal to the value of the full scale output signal (see figure). Linearity is defined as the maximum deviation of the transmitter output from the terminal reference line and is reported as a percentage of the unit's full scale range.

Another method of quantifying linearity, the Best Fit Straight Line (BFSL) method, has become popular in the pressure transmitter industry. The BFSL method uses a mathematical technique known as linear regression to fit a straight line through the transmitter output data points. This technique equally weights the points above and below the BFSL. In the BFSL method, linearity is defined as the maximum deviation of the transmitter output curve from the reference BFSL.

For the same transmitter, the linearity performance using the BFSL method appears to be about twice as good as that obtained from the Terminal Line method (see figure). This is simply a result of the BFSL method using a line midway between the two parallel straight lines closest together and enclosing all output vs. measurement values on a calibration curve. The Terminal Line method using a line connecting the extremes of output response.

Viatran has standardized on the BFSL method because it is the most commonly used in the pressure industry. With this method, our customers can compare Viatran products to any others on an equal basis.



Viatran
38 Forge Parkway
Franklin, MA 02038 USA

Hotline: 1-800-688-0030
Phone: 1-716-629-3800
Fax: 1-716-693-9162
Email: solutions@viatran.com
Web: www.viatran.com

VIATRAN

To minimize the effect of nonlinear performance, Viatran's engineers employ linear compensating analog correction techniques and engineered diaphragm geometries that compensate for nonlinear performance. Sensor materials and technologies are selected that best suit the ranges and applications of each model.

Hysteresis

Hysteresis error results when a transmitter gives different outputs at a particular applied pressure, depending on whether the pressure has risen or fallen to that point. For example, when pressure increases from 0 to 50 psi, a transmitter experiencing hysteresis error has a higher output than when the pressure decreases from 100 to 50 psi (see figure). Hysteresis error is the difference between the two varying signal outputs. Viatran specifies hysteresis error as a percentage of full scale pressure.

Repeatability

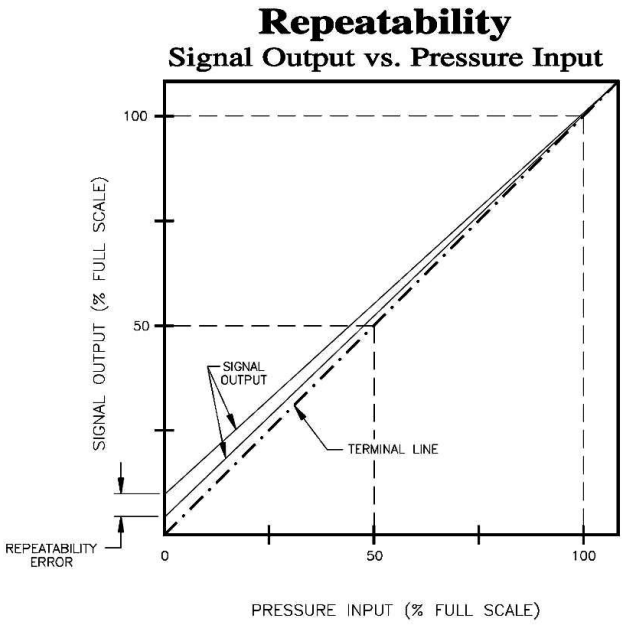
Repeatability refers to a transmitter's ability to give the same output signal on repeated but independent applications of the same input pressure.

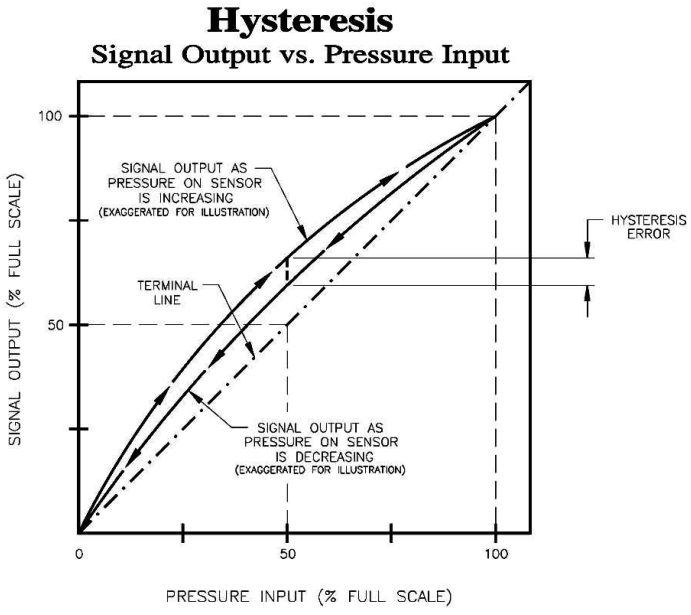
The zero repeatability performance of a pressure transmitter is tested by measuring the output at zero pressure after each of two independent full scale pressure applications (see figure). The transmitter output signal at zero pressure should be the same for both trials. Due to mechanical and electrical effects, sometimes there is a very slight difference between the two output signals, called zero repeatability error.

Repeatability error is quantified as the difference between the two varying signal outputs. The error value is then specified as a percentage of the full scale pressure.

Repeatability and hysteresis both involve differing output signals that occur for a single pressure value. For this reason, Viatran specifies these two values as one quantity, and lists the specification in product bulletins as "Hysteresis & Repeatability."

The mechanical properties of a transmitter's sensor and diaphragm material are the major factors in hysteresis and repeatability effects. Viatran chooses sensor and diaphragm materials with minimal susceptibility to these effects in order to minimize sensor hysteresis and repeatability error.





Viatran
38 Forge Parkway
Franklin, MA 02038 USA

Hotline: 1-800-688-0030
Phone: 1-716-629-3800
Fax: 1-716-693-9162
Email: solutions@viatran.com
Web: www.viatran.com

VIATRAN