

## Technical Note

### Pressure Sensor Glossary of Terms

#### A

**Absolute Pressure (a)** – Pressure measured relative to a perfect vacuum (zero pressure) reference.

**Absolute Pressure Sensor** – Product whose output is proportional to the difference between applied pressure and a built-in fixed reference to vacuum (zero pressure). Typically the Minimum Operating Pressure ( $P_{min.}$ ) is set to absolute zero pressure (perfect vacuum).

**Absolute Maximum Ratings** – The extreme limits that a product can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade product reliability.

**Accuracy** – The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to output measured over the Compensated Pressure Range at Reference Temperature. Includes all errors due to: Pressure Non-Linearity, Pressure Hysteresis and Non-Repeatability.

**Auto-Zero** – A compensation technique based on sampling output at a known reference condition, within the Compensated Temperature and Compensated Pressure Range of the product. Typically, a zero pressure reference such as atmospheric pressure (or equal pressures on both pressure ports for a differential product) is employed to allow the external correction of Offset Error.

#### B

**Best Fit Straight Line (BFSL)** – The straight line fitted through a set of points which minimizes the sum of the square of the deviations of each of the points from the straight line ('least-squares' method). See also **Pressure Non-Linearity**.

**Bridge Resistance** – The Input Impedance of an uncompensated unamplified analog output product.

**Burst Pressure** – The maximum pressure that may be applied to any port of the product without causing escape of pressure media. The product should not be expected to function after exposure to any pressure beyond the burst pressure. See also **Overpressure**.

#### C

**Clipping Limits** – The maximum and minimum limits of signal that the product will output under normal operating conditions. See also **Diagnostic Range**.

**Common Mode Pressure** – The applied 'line' pressure which is common to both ports of a Differential Pressure Sensor. See also **Maximum Common Mode Pressure**.

**Common Mode Voltage** – The voltage between each of the output terminals of a differential output product and electrical ground.

**Compensation** – The signal conditioning used to provide a calibrated product whose output closely matches the Ideal Transfer Function. Deviation from the Ideal Transfer Function results in errors which are described by the Total Error Band.

**Compensated Temperature Range** – The temperature range (or ranges) over which the product will produce an output proportional to pressure within the specified performance limits.

**Compound Range Pressure Sensor** – Product for measuring Gage pressures both above and below atmospheric pressure. Typically the Minimum Operating Pressure ( $P_{min.}$ ) is set to -1 bar below atmospheric pressure.

#### D

**Dead Volume** – The open volume inside the product which is occupied by fluids being sensed. Does not include the flow channel for flow-through pressure products.

**Diagnostic Range** – Under normal operating conditions the product will provide outputs following the Transfer Function and/or remaining within the Clipping Limits. Detection of a signal outside these limits indicates a fault condition which allows for automated detection of a sensor failure.

**Differential Pressure (d)** – Pressure difference measured between two pressure sources.

**Differential Pressure Sensor** – Product whose output is proportional to the difference between pressure applied to each of the pressure ports.

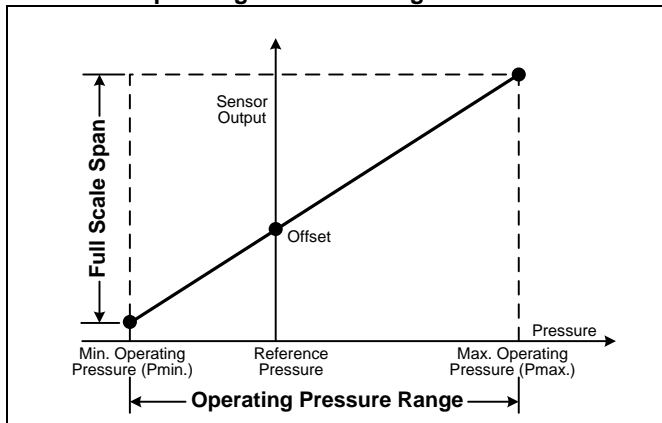
**Drift** – instability; the opposite of Stability which is the ability of a sensor to retain its performance characteristics with time. Note that the term 'Drift' should only be used to describe temporal (time-based) changes; for changes due to temperature. See also **Thermal Effects**.

#### F

**Full Scale Span (FSS)** – The algebraic difference between output signal measured at the upper and lower limits of the Operating Pressure Range. Also known as 'Span' or ambiguously as 'Full Scale Output'. (See Figure 1.)

# Pressure Sensor Glossary of Terms

Figure 1. Illustration of Key Pressure Sensor Terms Relative to Operating Pressure Range



## G

**Gage Pressure (g)** – Pressure measured relative to the local ambient (atmospheric/barometric) pressure. Also known as ‘Gauge’.

**Gage Pressure Sensor** – Product whose output is proportional to difference between applied pressure and local ambient (atmospheric) pressure. Typically the Minimum Operating Pressure ( $P_{min.}$ ) is set to atmospheric pressure.

## I

**Ideal Transfer Function** – Mathematically, the Ideal Transfer Function is a straight line, which is independent of temperature, passing through the ideal Offset with a slope equal to the ideal Full Scale Span over the Operating Pressure Range. See also Transfer Function.

**Input Impedance** – The electrical impedance measured across the input terminals of the product (as presented to the excitation source, with the output terminals open-circuited).

## L

**Linearity** – See **Pressure Non-Linearity**.

## M

**Maximum Common Mode Pressure** – The maximum pressure that can be applied simultaneously to both ports of a Differential Pressure Sensor without causing changes in specified performance.

**Maximum Operating Pressure ( $P_{max.}$ )** – The upper limit of the Operating Pressure Range. (See Figure 1.)

**Minimum Operating Pressure ( $P_{min.}$ )** – The lower limit of the Operating Pressure Range. (See Figure 1.)

**Maximum Power Consumption** – The maximum electrical power consumed in normal operation of the product, dependent upon the Supply Voltage and any internal power saving modes of the product.

## O

**Offset** – The output signal obtained when the Reference Pressure is applied to all available pressure ports. Also known as ‘null’ or ‘zero’. (See Figure 1.)

**Offset Error** – The maximum deviation in measured Offset at Reference Temperature relative to the ideal (or target) Offset as determined from the Ideal Transfer Function. See also **Thermal Effect on Offset**.

**Operating Pressure Range** – The pressure range (or ranges) over which the product will produce an output proportional to pressure within the specified performance limits. (See Figure 1.)

**Operating Temperature Range** – The temperature range over which the product will produce an output proportional to pressure but may not remain within the specified performance limits. See also **Compensated Temperature Range**.

**Orientation Sensitivity** – The maximum change in Offset of the product due to a change in position or orientation relative to the Earth's gravitational field (g).

**Output Impedance** – The electrical impedance measured across the output terminals of the product (as presented to an external circuit).

**Output Resolution** – The smallest difference between output signal readings which can be meaningfully distinguished or resolved.

**Overpressure** – The Absolute Maximum Rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the Operating Pressure Range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified, this applies to all available pressure ports at any temperature within the Operating Temperature Range. Also known as ‘Proof Pressure’. See also **Working Pressure**.

# Pressure Sensor Glossary of Terms

## P

**Position Sensitivity** – See **Orientation Sensitivity**.

**Pressure Hysteresis** – The maximum difference between output readings when the same pressure is applied consecutively, under the same operating conditions, with pressure approaching from opposite directions within the specified Operating Pressure Range.

**Pressure Non-Linearity** – The maximum deviation of product output from a straight line fitted to the output measured over the specified Operating Pressure Range. Standard methods of straight line fit specified for this calculation are either BFSL or TSL.

**Pressure Response Time** – Time taken for output of the product to change from 10% to 90% of Full Scale Span in response to a step change in input pressure from the specified Minimum to Maximum Operating Pressure.

**Proof Pressure** – See **Overpressure**.

## R

**Ratiometricity** – See **Supply Voltage Ratiometricity**.

**Reference Pressure** – The pressure used as a reference (zero) in measuring product performance. Unless otherwise specified, this is vacuum (0 psi a) for an Absolute Pressure Sensor and local ambient atmospheric pressure (0 psi g) for Gage, Compound and Differential Pressure Sensors.

**Reference Supply Voltage** – The voltage excitation used as a reference in measuring product performance, typically  $5.00 \pm 0.01$  Vdc.

**Reference Temperature** – The temperature used as a reference in measuring product performance, typically  $25 \pm 3$  °C.

**Repeatability** – The maximum difference between output readings when the same pressure is applied consecutively, under the same operating conditions, with pressure approaching from the same direction within the specified Operating Pressure Range. See also **Pressure Hysteresis** and **Thermal Hysteresis**.

**Resolution** – See **Output Resolution**.

## S

**Sensitivity** – The ratio of output signal change to the corresponding input pressure change. Sensitivity is determined by computing the ratio of Full Scale Span to the specified Operating Pressure Range. Also known as “Slope”.

**Shift** – An ambiguous term sometimes used to describe a permanent change in output of a sensor. The terms 'Offset Shift' and 'Span Shift' are also sometimes used to describe output changes due to temperature. To avoid confusion, these should be replaced by Thermal Effect on Offset and Thermal Effect on Span. See also **Drift**.

**Sink Current** – The maximum current an amplified circuit can accept ('sink') on its output pin and still remain within the specified performance limits.

**Source Current** – The maximum current an amplified circuit can supply ('source') on its output pin and still remain within the specified performance limits.

**Span Error** – The maximum deviation in measured Full Scale Span at Reference Temperature relative to the ideal (or target) Full Scale Span as determined from the Ideal Transfer Function. See also **Thermal Effect on Span**.

**Stability** – The ability of a sensor to retain its performance characteristics with time.

**Storage Temperature Range** – The temperature range over which the product may safely be exposed without excitation or pressure applied. Under these conditions the product will remain in specification after excursion to any temperatures within this range. Exposure to temperatures outside this range may cause permanent damage to the product.

**Supply Current** – Corresponds to the current drain on the supply terminal, dependent upon the Supply Voltage.

**Supply Voltage Operating Limits** – The range of voltage excitation which can be supplied to the product to produce an output which is proportional to pressure but due to Supply Voltage Ratiometricity errors may not remain within the specified performance limits.

**Supply Voltage Ratiometric Limits** – The range of voltage excitation required by the product to remain within the specified performance limits for Supply Voltage Ratiometricity.

**Supply Voltage Ratiometricity** – The maximum deviation in ratiometric output of the product (Output divided by Supply Voltage) resulting from a voltage excitation which is different from the Reference Supply Voltage but remaining within the Supply Voltage Ratiometric Limits.

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## T

**Thermal Coefficient of Offset (TCO)** – The Thermal Effect on Offset expressed as an amount of Offset change occurring over a specified temperature change (e.g. TCO in %FSS/25 °C gives the amount of Offset change which occurs for a 25 °C change in temperature).

**Thermal Coefficient of Resistance (TCR)** – The deviation in Input Impedance due to changes in temperature over the specified temperature range, typically expressed as a ratio of the Input Impedance at Reference Temperature.

**Thermal Coefficient of Span (TCS)** – The Thermal Effect on Span expressed as an amount of Span change occurring over a specified temperature change (e.g. TCS in %FSS/25 °C gives the amount of Span change which occurs for a 25 °C change in temperature).

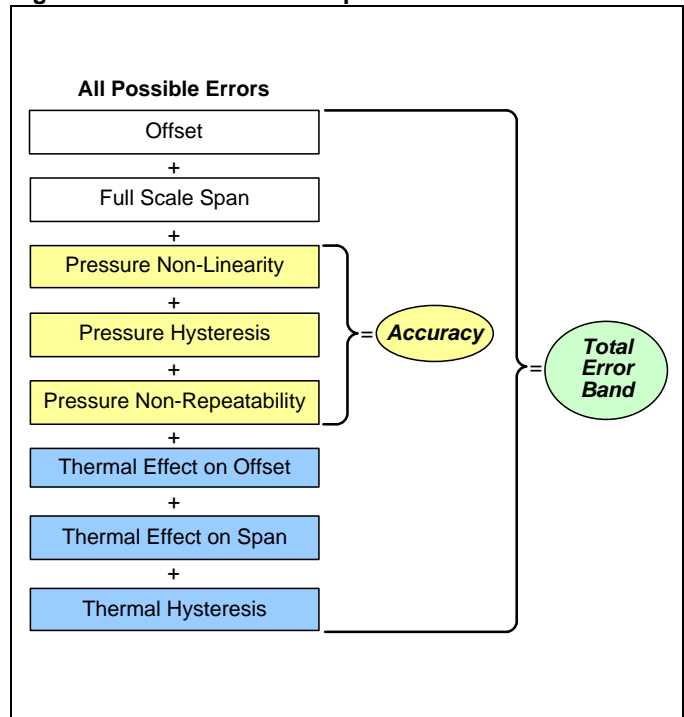
**Thermal Effect on Offset** – The maximum deviation in Offset due to changes in temperature over the Compensated Temperature Range, relative to Offset measured at Reference Temperature.

**Thermal Effect on Span** – The maximum deviation in Full Scale Span due to changes in temperature over the Compensated Temperature Range, relative to Full Scale Span measured at Reference Temperature.

**Thermal Hysteresis** – The maximum difference between output readings when the same temperature is reached consecutively, under the same operating conditions, with temperature approaching from opposite directions within the specified temperature range.

**Total Error Band (TEB)** – The maximum deviation in output from the Ideal Transfer Function over the entire Compensated Temperature and Pressure Range. Includes all errors due to: Offset, Full Scale Span, Pressure Non-Linearity, Pressure Hysteresis, Non-Repeatability, Thermal Effect on Offset, Thermal Effect on Span and Thermal Hysteresis. (See Figure 2.)

Figure 2. Total Error Band Explanation



**Transfer Function** – The equation which defines the output of the product as a function of pressure over the Operating Pressure and Temperature Ranges. See also **Ideal Transfer Function**.

**Terminal Straight Line (TSL)** – The straight line fitted through the end points of a set of data points. See also **Pressure Non-Linearity**.

## W

**Wetted Materials** – Materials used in the product which may come into direct contact with measured fluids (media) applied to the pressure port(s).

**Working Pressure** – The maximum pressure that may be applied to the product in continuous use. This pressure may be outside the Operating Pressure Range in which case the product may not provide a valid output until pressure is returned to within the Operating Pressure Range. Unless otherwise specified this applies to all available pressure ports at any temperature with the Operating Temperature Range. Note that the product may be operated continuously at pressures up to the Working Pressure, as compared with Overpressure which is an Absolute Maximum Rating.



# Pressure Sensor Glossary of Terms

## **WARNING**

### **PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop products or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

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Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

## **WARNING**

### **MISUSE OF DOCUMENTATION**

- The information presented in this technical note is for reference only. DO NOT USE this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

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