

**TEESING**

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Capacitance-Based  
**PRESSURE  
TRANSDUCER  
HANDBOOK**

Understanding,  
Specifying and Applying  
*Capacitive Pressure Transducers*

T E C H N I C A L     D A T A

**T**he sensing and measurement of physical quantities through small changes in electrical capacitance is scarcely a new concept. The natural benefits of this approach were recognized for many years. But it was not until Setra engineers introduced new materials, new designs, and innovative, dedicated circuitry that the techniques full potential was realized in the practical, real world of pressure measurement.

Today, capacitive pressure transducers are widely used in both highly-specialized and general equipment applications that call for thoroughly dependable accuracy and/or long-term stability. They are especially in demand wherever a job involves adverse operating conditions, such as shock, vibration, temperature extremes, etc. Designers and engineers find that the electrical simplicity and inherently rugged mechanical structure of the typical capacitive sensor result in relative freedom from the problems to which more glamorous technique are usually susceptible.

The specific facts and data on the following pages will help to introduce you to capacitive pressure transducers (if you are not already familiar with them) and will assist you in evaluating their applicability to pressure measurement problems that call for more than offhand solutions.

## H I S T O R Y O F S E T R A

### **ABOUT SETRA**

Founded in 1967, Setra Systems, Inc. is a leading designer and manufacturer of pressure, acceleration, and weight sensing devices. Setra has devoted its engineering and research efforts to the development of transducers and systems based on highly accurate variable capacitive transduction principle. The dead ended sensor design eliminates the risk of sensor contamination, prevalent with the flow through the sensor designs used to many competitors. The integrity of the ventilation control system is at the heart of a contaminant free environment which is why Setra's capacitive sensor design is the preferred solution for Critical Environments.

### **SETRA CREATES SOLUTIONS**

- Over 40 years of expertise in sensing and sensing applications
- R&D and Design Engineering focused providing application solutions
- Sensors cover a wide range of pressure ranges with unique expertise in low pressures



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## AN INTRODUCTION TO CAPACITANCE BASED PRESSURE TRANSDUCERS

# Capacitive Transducers

functional simplicity & structural sophistication

Equipment designers today can choose from an impressive array of commercially available pressure transducers. Sensing devices range from modern versions of the venerable manometer and Bourdon tube, through bonded strain gauges to sophisticated units using, deposited or ion-implanted piezoresistive semiconductor elements on silicon or sapphire substrates.

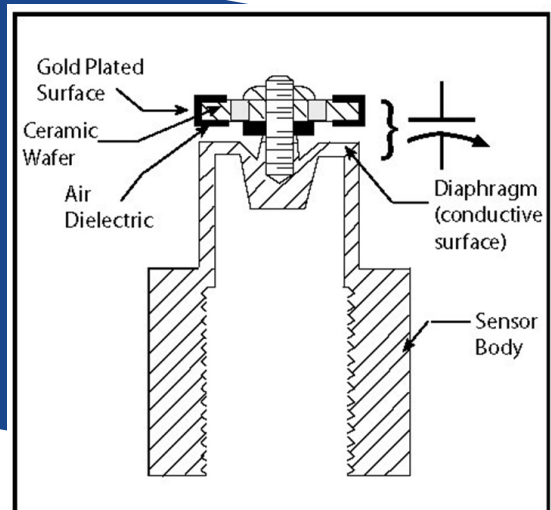
And the list goes on, to include such special-purpose types such as LVDT, variable reluctance, Hall effect, inductive and potentiometric devices.

Although most of these transducers perform acceptably in specific applications, virtually all have inherent operating and performance limitations. Selection of a particular transducer type is usually a trade-off in which certain acknowledged disadvantages are tolerated in order to achieve a desired result. Lower cost, for example, is often bought at the expense of long-term stability...or accuracy...or reliability.

In this somewhat overcrowded pressure transducers field, **Setra capacitive devices** stand out as perhaps the closest thing to a universal pressure transducer style. They have generally broader application, greater overall reliability and physical ruggedness, and in most cases, require fewer trade-offs than other types. Costs, while often thought to be higher, are actually extremely competitive in quantity.

Setra's capacitive pressure transducers are expertly designed adaptations of a simple, durable and fundamentally stable device...the electrical capacitor.

In typical Setra configuration, a compact housing contains two closely spaced, parallel, electrically-isolated metallic surfaces, one of which is essentially a diaphragm capable of slight flexing under applied pressure. The diaphragm is constructed of a low-hysteresis material such as 17-4 PH SS or a proprietary compound of fused glass and ceramic (Setraceram™). These firmly secured surfaces, or plates are mounted so that a slight mechanical flexing of the assembly, caused by a minute change in applied pressure, alters the gap between them, creating, in effect, a variable capacitor.



Typical capacitive pressure sensor, showing rugged construction. Material are carefully selected for compatibility to minimize environmental effects. (Capacitance gap is accentuated for illustration)

The resulting change in capacitance is detected by a sensitive linear comparator circuit (employing proprietary, custom designed ASICs), which amplifies and outputs a proportional, high-level signal.

The inherent simplicity and ruggedness of this physical configuration, the fact that all wettable parts are of stainless steel or low-hysteresis ceramic, and a careful marriage of the mechanical assembly to the electronic circuitry, all combine to create a transducer that exhibits uniformly superior performance and reliability.

## Comparative Operating Features

### High Accuracies

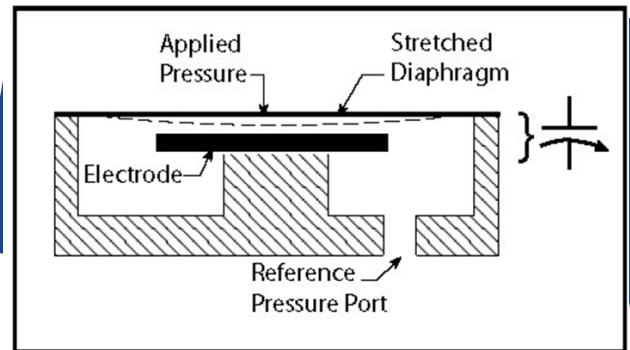
Depending on application requirements, Setra transducers can provide accuracies as high as  $\pm 0.02\%$  FS. Such precision, not attainable by many other transducer types, is particularly useful in test-and-measurement applications, barometric standards transfer, altimetry, etc.

### Minimal Mechanical Motion

A measurable voltage change is produced by a very slight change in capacitor plate gap. The extremely small deflection of Setra sensor diaphragms helps to minimize hysteresis and repeatability errors and to provide very fast response times.

### Broad Range Capabilities

Setra transducers provide an unusually broad selection of pressure ranges. Pressure from 0.05 in. W.C. to 10,000 psig can be measured accurately and consistently.



Cross-section of Setra's Model 239 — a high accuracy, low differential pressure transducer. Its unique, thermal-stretched diaphragm combines high sensitivity with optimum accuracy (0.14% FS) and thermal characteristics (Operating from 30°F to 150°F with  $<\pm 1\%$  FS/ 100°F thermal effect). (Capacitor gap and deflection accentuated for illustration.)

### Long Term Stability

All Setra transducers are designed and specified to maintain accuracy settings longer than competitive units. Unlike sensors such as bonded strain gauges, capacitive transducers exhibit extremely low creep, aging effects, humidity effects and other common enemies of output stability. Setra transducers provide long-term zero stabilities as low as 0.05% FS/yr.

# TYPICAL PRESSURE TRANSDUCER TYPES



**MODEL 204**  
High Accuracy/Broad Range  
Test & Measurement



**MODEL 730**  
Capacitance Manometer  
Absolute Pressure Transducer  
Test & Measurement



**MODEL 206**  
Industrial/OEM



**MODEL 209**  
Industrial/OEM



**MODEL 270**  
High Accuracy/Low Medium Pressure  
Setraceram™ - Barometric Use



**MODEL 239**  
High Accuracy/Low Differential Pressure  
HVAC - R & E - Environmental



**MODEL 230 w/ 3-Valve Manifold**  
Wet/Wet  
Process Control - HVAC - Etc.



**MODEL 230**  
Wet/Wet  
Process Control - HVAC - Etc.



**MODEL 264**  
Low Differential Pressure  
HVAC



**MODEL C290**  
Flush Diaphragm/3A Sanitary  
Beverage/Dairy/Food Processing



**MODEL 224**  
Flow-Through  
Ultra-High Purity Applications



**AccuSense™ MODEL ASL**  
High Accuracy/Low Differential Pressure  
Test & Measurement/Industrial



**Micro-Cal MODEL 869**  
Ultra-Low Pressure Generating and Documenting  
Calibrator



**AccuSense™ MODEL ASM**  
High Accuracy/Gauge Pressure  
Test & Measurement/Industrial



**MODELS 370 & 470**  
Environmental Monitoring  
Test & Measurement

### High-Level Output

Setra transducers need no signal amplification. As a result, they avoid problems common to low-level output devices, such as piezoresistive (thin film and IC) types. Such problems normally include poor long-term stability, thermal stability, high RFI susceptibility and humidity effects.

### Broad Media Compatibility

All wetted parts of Setra sensors are either of stainless steel or tough ceramic material. As a result, they can handle a wide range of difficult fluids, including acids, salt solutions, corrosive gases and liquids with high particulate content.

### High Electromagnetic Compatibility (EMC)

Setra's sturdy metal cases, shielded cables and careful construction, together with the high-level

output characteristic of capacitive sensing, ensure high immunity to external radio frequency and electrostatic discharge interference. Similarly, they are essentially immune to radio frequency interferences emissions.


### Resistant to Harsh Environments

Setra's transducers are tough! Those models designed for industrial use are specified to withstand a minimum of 10 million full scale cycles with specified accuracy and thermal performance. When they are installed per ANSI B40.2 applying a maximum of 75% F.S. pressure, they will exhibit unlimited cycle life. What's more, all industrial units are certified to between 100 G and 200 G shock loading, and can withstand vibration at minimum peak amplitudes from 10 G to 20 G.

## Capacitance-Based Pressure Transducers SUMMARY OF CHARACTERISTICS

Transducer Characteristic	In use, this translates to:
High-Level Output	Better Accuracy High Stability Lower RFI Vulnerability
Rugged, Shielded Construction	Broad Media Compatibility High Shock & Vibration Tolerance High Electromagnetic Compatibility High Resistance to Harsh Conditions
Proprietary, Linear Circuitry	Highest Accuracy
Carefully Selected, Compatible Materials	Excellent Temperature Stability Minimum Humidity Effects
Minimum Mechanical Motion	Low Hysteresis High Repeatability
Capacitive Sensing	High Sensitivity Accuracy Low-Pressure Sensing

# COMPARATIVE CHARACTERISTICS CAPACITANCE VS. STRAIN GAUGE TRANSDUCERS

	STRAIN GAUGE TRANSDUCERS			 <b>setra</b> CAPACITIVE TRANSDUCERS
	BONDED	THIN FILM	IC	
<b>MEASUREMENT ACCURACY</b>	AVERAGE	AVERAGE	AVERAGE	HIGH
<b>LONG-TERM STABILITY</b>	LOW	AVERAGE	AVERAGE	HIGH
<b>OUTPUT LEVEL</b>	HIGH	LOW	LOW	HIGH
<b>HYSTERESIS</b>	AVERAGE	AVERAGE	AVERAGE	LOW
<b>CREEP</b>	HIGH	LOW	LOW	NONE
<b>FREQUENCY RESPONSE</b>	FAST	LIMITED	AVERAGE	FAST
<b>MEDIA COMPATIBILITY</b>	LIMITED	LIMITED	LIMITED	HIGH
<b>AGING EFFECTS</b>	AVERAGE	AVERAGE	AVERAGE	VIRTUALLY NONE
<b>PRESSURE RANGE</b>	LIMITED	LIMITED	LIMITED	BROAD
<b>TEMPERATURE COMPENSATION</b>	EXTENSIVE	EXTENSIVE	EXTENSIVE	MINIMAL
<b>EMI/RFI SUSCEPTIBILITY</b>	AVERAGE	HIGH	HIGH	MINIMAL
<b>RUGGEDNESS &amp; RELIABILITY</b>	FAIR-LOW	FAIR-LOW	FAIR-LOW	HIGH



# Capacitive Pressure Transducers APPLICATIONS

Because they have earned a reputation for **consistently high accuracy** and **unmatched long-term stability**, Setra pressure sensors find broad application in areas where characteristics rate from important to vital.

A few of these include:

## Test & Measurement

- Turbo-jet/Turbo-fan aircraft engine test stands- internal pressure measurements at multiple points.
- Engine test stands for Airbus- Europe
- Wind tunnels
- Dynamometers
- Stack gas monitoring & analysis
- Medical instrumentation
- Hydraulic and Pitot static aircraft test systems
- A broad range of instruments, including laser interferometers, porosimetry instruments, particle measuring systems, automated sorption analyzers, etc.
- General R & D and Metrology Laboratory applications

## Industrial & Military

- High-speed compressors
- Process control systems
- Canning/bottling systems

- Off-road vehicles
- Dairies - breweries
- Tank level measurement systems
- Helicopter missile-launch control systems
- Military surveillance equipment
- Semiconductor processing equipment
- Pharmaceutical and biotechnology processing
- Natural gas lines
- Off-shore drilling equipment
- Freeze drying equipment

## Heating, Ventilating, Air Conditioning (HVAC)

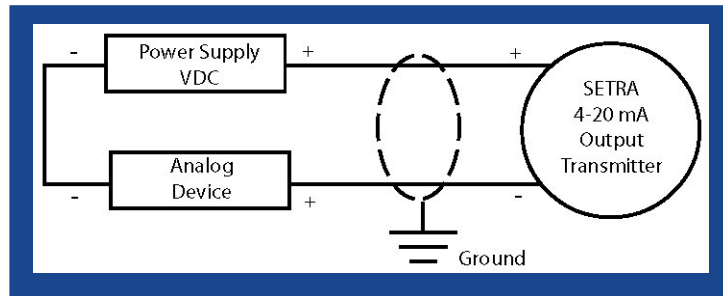
- HVAC and VAV control systems
- Energy management systems
- Clean room control
- Filter condition monitoring
- Fume hood control
- Pump speed control
- Hospital isolation wards

## Barometric applications

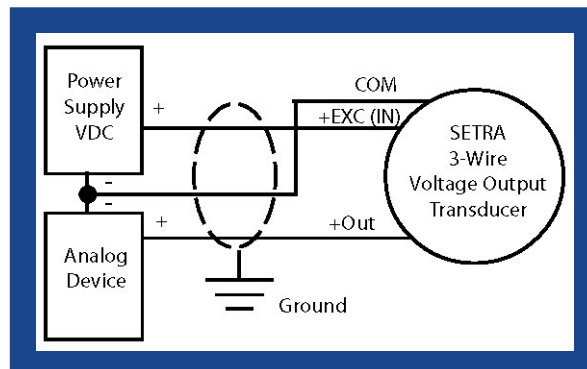
- Presently in use at over 400 remote Land & Sea Weather Stations
- In use at over 500 airports as part of AWOS (Automated Weather Observing Systems) and ASOS (Automated Surface Observation Systems), for automatic barometric pressure reporting
- Used in weather stations throughout the U.S. and Canada
- In use by major weather systems manufacturers in Europe
- Widely used as transfer pressure standards
- Used by many airports and avionics shops for altimeter recertification

# ELECTRICAL CONNECTIONS

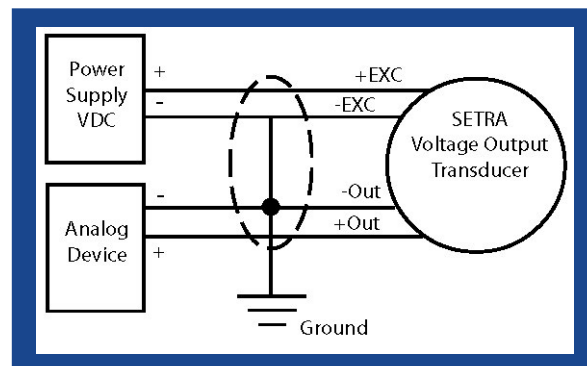
## 2 Terminal Transmitter Wiring FOR USE WITH ALL SETRA CURRENT OUTPUT (4-20mA) MODELS



## 3 Terminal Transducer Wiring FOR USE WITH SETRA MODELS 207, 264, and 280E

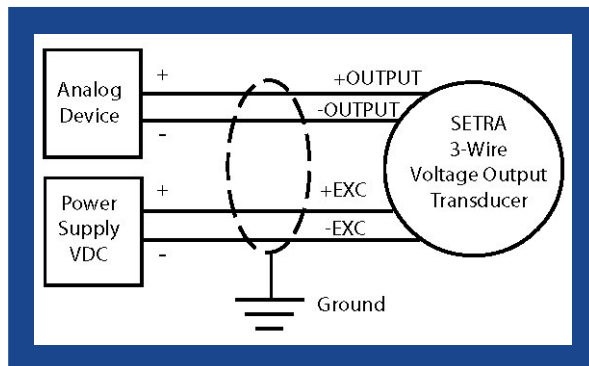


## 3 Terminal Transducer Wiring FOR USE WITH SETRA MODELS 206, 209, 212FT, and 276



# 4 Terminal Transducer Wiring

FOR USE WITH ALL SETRA MODELS 204, 204D, 205-2, 206\*, 212FT\*, 239, and 270

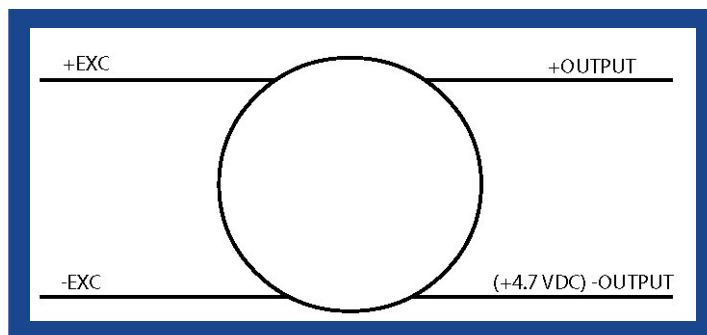


\*Models 206, 212FT can be wired as 3-wire devices by connecting -Output, -EXC and shield to a common ground.  
 4-wire transducers can only be grounded at either -EXC or on the -Output because a common mode voltage exists.  
 (See Common Mode Voltage, below)

## Common Mode Voltage

### 4 WIRE MODELS ONLY

MODELS 204, 204D, 205-2, 228-1, 239, and 270



Typically -- OUTPUT is approximately 4.7 VDC above the -EXCITATION.  
 Rule: You can only common or ground at one location - either -EXC or -Output.

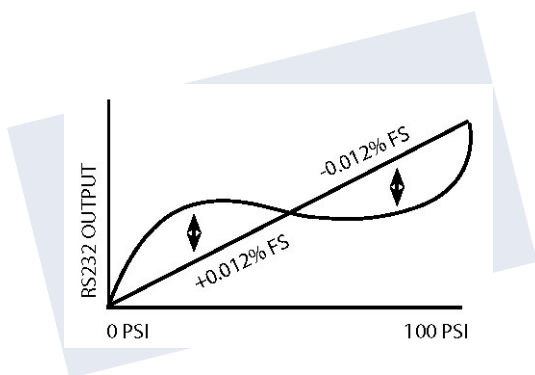


## NON-LINEARITY

Relationship of a calibration curve to a specified straight line with end points at zero and full scale.

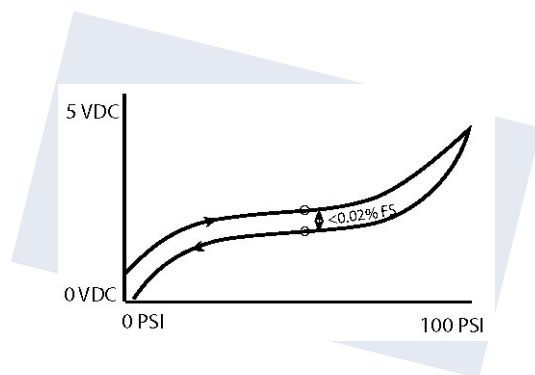
### Terminal Method

Example:  $\pm 0.012\%$  FS



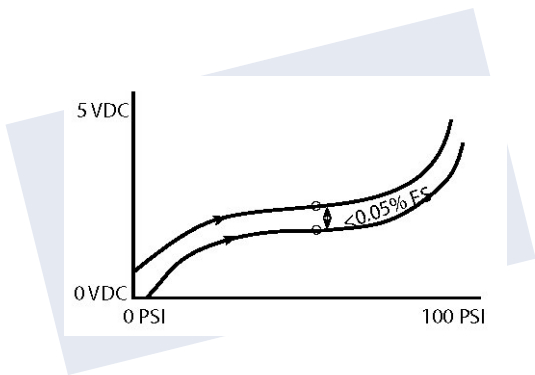
## HYSTERESIS

The maximum difference in output at any pressure value within the specified range, **when the value is approached with increasing and decreasing pressure.**



## NON-REPEATABILITY

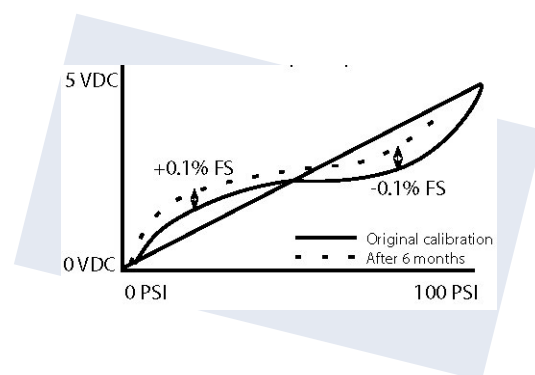
The ability of a transducer to reproduce output readings **when the same pressure value is applied to it consecutively, under the same conditions, and from the same direction.**



## LONG TERM STABILITY

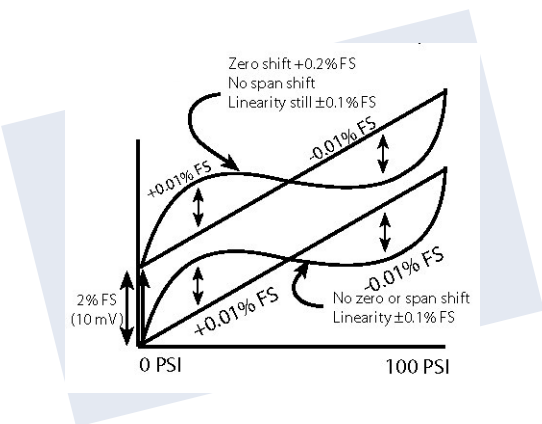
The ability of a transducer to reproduce output readings obtained during its original calibration **at room conditions for a specified period of time.**

Example: Model 270  
 $\pm 0.1\%$  FS over 6 months  
 at 70°F (21°C)



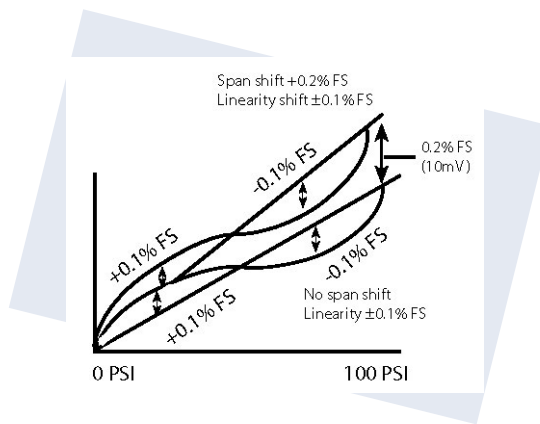
## ZERO OFFSET

Zero output is factory set to within a certain % of full scale. Results in a shift up or down of the calibration curve. **Does not affect linearity or accuracy.**



## SPAN OFFSET

Span output is factory set to within a certain % of full scale. Results in a change in the slope of the curve. **Does not affect linearity or accuracy.**



## THERMAL EFFECTS

The change in the zero and span output that occurs due to temperature changes.

Thermal Zero Shift:  $<\pm 0.4\% \text{ FS}/100^\circ\text{F}$

Thermal Span Shift:  $<\pm 0.3\% \text{ FS}/100^\circ\text{F}$

Example Temp. Range:  $-10^\circ\text{F}$  to  $\pm 130^\circ\text{F}$

Max. temp change from  $70^\circ\text{F} = 80^\circ\text{F}$

$80^\circ\text{F} \times 0.4\% = 0.32\% \text{ FS DZ/DT}$

$80^\circ\text{F} \times 0.3\% = 0.24\% \text{ FS DZ/DT}$

Zero shift:  $<\pm 0.32\% \text{ FS}$

Span shift:  $<\pm 0.24\% \text{ FS}$

## TOTAL ERROR BAND

(Worst Case) Over a Temperature Range of  $-10^\circ\text{F}$  to  $130^\circ\text{F}$

Non-Linearity:  $\pm 0.1\% \text{ FS}$

Hysteresis:  $\pm 0.05\% \text{ FS}$

Non-Repeatability:  $\pm 0.02\% \text{ FS}$

Thermal Zero Shift:  $<\pm 0.32\% \text{ FS}$

Thermal Span Shift:  $<\pm 0.24\% \text{ FS}$

Zero Offset:  $\pm 0.2\% \text{ FS}$

Span Offset:  $\pm 0.2\% \text{ FS}$

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$\pm 1.13\% \text{ FS}$

*Long-term stability error not included.*

# GLOSSARY OF PRESSURE TERMS

**ABSOLUTE PRESSURE** - Pressure measured relative to a full vacuum. Referred to as pounds per square inch absolute (PSIA).

**ACCURACY** - Combined error of linearity, hysteresis & repeatability (Setra uses the root sum of the squares (RSS) method)

**AMBIENT CONDITIONS** - The conditions (pressure, temperature, etc.) of the medium surrounding the case of the transducer.

**ATMOSPHERIC PRESSURE** - Pressure of the atmosphere at the earth's surface NIST standard atmospheric pressure = 1.01325 bar.

**BAR** — Unit of pressure (or stress). 1 bar = 750.07 mm of mercury at 0°C, lat. 45°

**BAROMETRIC PRESSURE** — Atmospheric pressure; often measured in millibars, in. Hg (inches of mercury), or hectopascals.

**BOURDON TUBE** — An early, mechanical pressure gauge consisting of a flattened tube that tends to straighten under internal pressure; today usually used with a potentiometer to produce an electrical output.

**BURST PRESSURE** — The maximum pressure that may be applied to the positive pressure port without rupturing the sensing element.

**CAPACITIVE SENSING**— Detection and measurement of pressure through the change in voltage across a capacitor, one plate of which is a diaphragm which deflects slightly with changes in applied pressure.

**COMPOUND PRESSURE** — Pressure measured from full vacuum (-14.7 PSIV) to gauge pressure, referencing atmosphere.

**DIFFERENTIAL PRESSURE** — Pressure measured relative to a reference pressure. Referred to as pounds per square inch differential (PSID).

**EXCITATION** - The external electrical voltage and/or current applied to a transducer for its proper orientation.

**FS (FULL SPAN/FULL SCALE)** — The range of mea-

sured values over which a transducer is intended to measure, specified by the upper and lower limits. Ex: 0 to 100 PSIG, FS is 100 PSIG/ 0 to 5 VDC, FS is 5 VDC, 800-1100 MB, FS is 300 MB.

**GAUGE PRESSURE** — Pressure measured relative to ambient atmospheric pressure. Quantified in pounds per square inch gauge (PSIG).

**HYSTERESIS** - The maximum deviation of any calibration point on a specified straight line, during any one calibration cycle. (Setra uses the best straight line method.)

**LINEARITY** - The maximum difference in output, at any measured value within the specified range, when the value is approached first when increasing and then decreasing pressure.

**MANOMETER** - An early instrument for measuring pressure; originally a U-shaped tube containing liquid (water, oil or mercury), one limb opening to the gas volume to be measured, the other closed or connected to a registering or recording instrument. Modern versions utilize diaphragms, bellows or other devices for sensing relative pressures.

**MILLIBAR (mBAR)**— Unit of pressure generally used in barometric measurements; 1 mbar = 100 N/m<sup>2</sup>, or 1~ dyn/cm<sup>2</sup>

**NEWTON (N)** — The unit of force in the International System of Units (SI); the force required to impart an acceleration of 1 m/sec<sup>2</sup> to a mass of 1 kg.

**PASCAL (PA)**—The standard unit of pressure (or stress) in the SI system: equal to 1 newton per square meter (1 N/m<sup>2</sup>).

**PI**— Term common to process industries meaning pressure-in/current-out. (3-15 PSIG Input to 4-20 mADC Output.).



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**PRESSURE TRANSDUCER** - An electromechanical device for translating pressure values into voltages across a high-impedance (5k ohms or greater) load.

**PRESSURE TRANSMITTER** - An electromechanical device for translating pressure values into currents (generally 4-20 mA) into a low-impedance load.

**PROOF PRESSURE** — The maximum pressure that may be applied without changing performance beyond specifications (typically, 0.5% FS zero shift).

**PSIA**— Pounds per square inch absolute.

**PSIV** — Pounds per square inch vacuum.

**RANGE** — The spread between the maximum and minimum pressures between which the transducer has been designed to operate.

**SETRACERAM™**— A patented, ceramic/ glass sensing element, used by Setra in barometric transducers and instruments requiring the highest degree of measurement precision and stability.

**SPAN**— The algebraic difference between the limits of the range. EX: 0.1 to 5.1 Volts DC; span is 5 VDC. Sometimes used to designate full scale output; i.e. 5 VDC.

**REPEATABILITY** - The ability to reproduce output readings when the same pressure value is applied consecutively, under the same conditions, and in the same direction.

**RESPONSE TIME** - The length of time required for the output to rise to a specified percentage of its final value as a result of a step change in pressure.

**THERMAL ERROR** - The maximum change in output, at any pressure value within the specified range, when the temperature is changed from room temperature to specified temperature extremes.

**THERMAL ZERO SHIFT** - The zero shift due to changed in ambient temperature from room temperature to the specified limits of the operating temperature range.

**TORR**— A unit of low pressure equal to a head of 1 mm of mercury, or 133.3 N/m<sup>2</sup>.

**VACUUM**— Generally refers to pressures between 0 and atmospheric; often measured in 0-30 in. Hg Vacuum. Referred to as pounds per square inch vacuum (PSIV).

### GAUGE/ABSOLUTE PRESSURE

1 atmosphere



### VACUUM PRESSURE

14.7 psiv



0 psia

14.7 psia  
1 atmosphere



TYPICAL APPLICATION	SETRA TRANSDUCER MODEL													
	Model 204 High Acc. - T&M	AccuSense™ Model ASL High Acc. Low Diff. Pressure	Model 206/207 Industrial/OEM	Model 209 Industrial/OEM	Model 270/370/470 Barometric/Med. Pressure	Model 280E High Press./GP Processing	Model 240D High Diff. Pressure	Model 230 Wet/Wet Diff. Pressure	Model 239 High Acc. Low Diff. Pressure	Model 264/265/260 Low. Diff. Pressure (HVAC)	Model 212FT Flow-Thru-UHP	AccuSense™ Model ASM T&M / Industrial	Model C290 Flush Diaph-3A Sanitary	Model 276/278 OEM Barometric
Altimeter Setting Barometric Measurements					●									
Chillers Clean Room Control			●	●						●				
Compressor Control Dynamometers			●	●										●
Energy Management Engine Test Cells	●					●	●			●		●		
Filter Condition Monitors Food & Beverage Process							●		●	●			●	
Fume Hood Control Gas Bottle Filling Equipment		●						●	●		●			
General Purpose/Industrial Hazardous Locations			●			●	●					●		
High Acc. Test & Measurement HPLC	●	●			●	●	●		●					
HVAC/VAV Control HVAC Equipment		●		●				●	●	●				
Hydraulic/Pneumatic System Intrinsically Safe Duty			●	●		●								
Industrial Engine Laster Interferometers				●	●									●
Leak Detection Level Measurement		●			●	●		●					●	
Medical Instrumentation Natural Gas Lines				●										
OEM Applications Off Road Vehicles			●	●	●			●		●	●		●	●
Off Shore Drilling Paper Converting System				●				●						
P/I Range Pharmaceutical Process						●					●		●	
Pressure Transfer Stds. Process Control					●			●				●		
Pump Speed Control Refrigeration Equipment			●	●				●						
R&D Scientific Sanitary Filtration System	●	●			●			●	●			●	●	
Sanitary Pressure Lines Semicon Equipment		●			●				●		●		●	●
Specialty Gas Handling Test & Measurement	●	●			●		●		●		●			
Weather Data Systems Vacuum Systems	●				●	●								●

## PRESSURE CONVERSION CHART

MULTIPLICATION FACTORS

<b>FROM</b>	<b>PSI (lb/in<sup>2</sup>)</b>	<b>BAR</b>	<b>MILLIBAR Hectopascal</b>	<b>IN.HG (at 0°C)</b>	<b>IN.H<sub>2</sub>O (at 4°C)</b>	<b>MM HG (at 0°C)</b>	<b>MM H<sub>2</sub>O (at 4°C)</b>	<b>PASCAL (N.m<sup>2</sup>)</b>	<b>ATM</b>	<b>TORR</b>
<b>TO</b>										
<b>PSI (lb/in<sup>2</sup>)</b>	1	14.5039	1.4504 x 10 <sup>-2</sup>	.491159	3.6127 x 10 <sup>-2</sup>	1.93368 x 10 <sup>-2</sup>	1.4223 x 10 <sup>-3</sup>	1.45038 x 10 <sup>-4</sup>	14.6960	1.9337 x 10 <sup>-2</sup>
<b>BAR</b>	6.8947 x 10 <sup>-2</sup>	1	1 x 10 <sup>-3</sup>	3.3865 x 10 <sup>-1</sup>	2.4908 x 10 <sup>-3</sup>	1.3332 x 10 <sup>-4</sup>	9.8068 x 10 <sup>-5</sup>	1 x 10 <sup>-5</sup>	1.0132	1.3332 x 10 <sup>-3</sup>
<b>MILLIBAR Hectopascal</b>	68.947	1 x 10 <sup>3</sup>	1	33.865	2.4908	1.3332	9.8068 x 10 <sup>-2</sup>	1 x 10 <sup>-2</sup>	1.0132	1.3332
<b>IN.HG (at 0°C)</b>	2.0360	29.529	2.9529 x 10 <sup>-2</sup>	1	7.3552 x 10 <sup>-2</sup>	3.9368 x 10 <sup>-2</sup>	2.8959 x 10 <sup>-3</sup>	2.9529 x 10 <sup>-4</sup>	1.0132 x 10 <sup>3</sup>	3.9368 x 10 <sup>-2</sup>
<b>IN.H<sub>2</sub>O (at 4°C)</b>	27.680	401.47	.40147	13.596	1	.53525	3.9372 x 10 <sup>-2</sup>	4.0147 x 10 <sup>-3</sup>	29.920	.53525
<b>MM HG (at 0°C)</b>	51.7149	750.06	.75006	25.401	1.8683	1	7.3558 x 10 <sup>-2</sup>	7.5006 x 10 <sup>-3</sup>	406.78	1
<b>MM H<sub>2</sub>O (at 4°C)</b>	703.08	1.0197 x 10 <sup>4</sup>	10.197	345.32	25.399	13.595	1	.10197	760.00	13.595
<b>PASCAL (N.m<sup>2</sup>)</b>	6894.76	1 x 10 <sup>5</sup>	100	3.3865 x 10 <sup>3</sup>	249.08	133.32	9.8068	1	1.0332 x 10 <sup>5</sup>	133.32
<b>ATM</b>	6.8046 x 10 <sup>-2</sup>	.98692	9.8692 x 10 <sup>-4</sup>	3.3422 x 10 <sup>-3</sup>	2.4583 x 10 <sup>-3</sup>	1.3158 x 10 <sup>-3</sup>	9.6788 x 10 <sup>-5</sup>	9.8692 x 10 <sup>-6</sup>	1	1.3158 x 10 <sup>-3</sup>
<b>TORR</b>	51.7149	750.06	.75006	25.401	1.8683	1	7.3558 x 10 <sup>-2</sup>	7.5006 x 10 <sup>-3</sup>	760.00	1

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## SETRA'S CRITICAL CARE PRODUCT FAMILY

The integrity of the ventilation control system is essential in maintaining a contaminant free environment. Whether a room is to be maintained at a negative pressure to prevent contaminants from escaping into adjacent areas or a positive pressure to protect patients from outside non-sterile air, the proper pressurization of a room is essential.



**SRCM**  
Room Condition Monitor

The SRCM provides a high resolution, flush mount touch screen user interface for easy setup & maintenance, while fitting into a standard electrical box for easy installation. The SRCM offers best in class low-differential pressure sensing technology for stability and accuracy.



**MRMS**  
Multi-Room Monitoring Station

The MRMS is BACnet enabled with Auto-Discover to automatically search & connect to Setra devices to ensure immediate room status feedback. Built-in configurable audible & visual alarms alert users to changes in room status or condition.



**SRIM**  
Room Isolation Monitor

In critical environments, proper room pressurization is essential to guarantee that the space is safe and/or sterile, depending on application requirements. The SRIM offers local audible and visual alarms to alert personnel when the pressure differential is compromised.



**SRMD**  
Remote Measurement Display

The SRMD is sensor agnostic and can be used with any analog 0-5 or 0-10 VDC output, making it the perfect solution for retrofit construction where sensors are already installed.



**SRPM**  
Room Pressure Monitor

The SRPM is a complete system that includes a convenient back-lit RGB LCD screen with an intuitive graphic interface for pressure, calibration, alarm, and password setup.



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