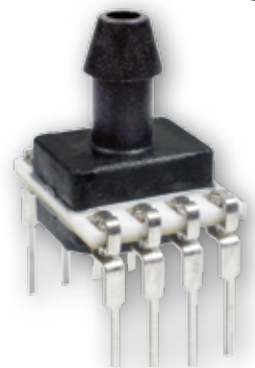




TruStability® Board Mount Pressure Sensors

HSC Series—High Accuracy, Compensated/Amplified

±1.6 mbar to ±10 bar | ±160 Pa to ±1 MPa | ±0.5 inH₂O to ±150 psi
Digital or Analog Output



TruStability® Board Mount Pressure Sensors

The TruStability® High Accuracy Silicon Ceramic (HSC) Series is a piezoresistive silicon pressure sensor offering a ratiometric analog or digital output for reading pressure over the specified full scale pressure span and temperature range.

The HSC Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz for analog and 2 kHz for digital.

The HSC Series is calibrated over the temperature range of 0 °C to 50 °C [32 °F to 122 °F]. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc.

These sensors measure absolute, gage, or differential pressures. The absolute versions have an internal vacuum reference and an output value proportional to absolute pressure. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. Differential versions allow measurement of pressure between the two pressure ports.

The TruStability® pressure sensors are intended for use with non-corrosive, non-ionic gases, such as air and other dry gases. Available options extend the performance of these sensors to non-corrosive, non-ionic liquids for pressure ranges above 40 mbar | 4 kPa | 20 inH₂O.

All products are designed and manufactured according to ISO 9001 standards.

Table of Contents

Features and Benefits	3-5
Potential Applications	6
General Specifications	7-8
Analog Operating Specifications	9
Digital Operating Specifications	10
Transfer Function Limits	11
Total Error Band Values	12
Nomenclature and Order Guide	13
Pressure Range Specifications	
±1.6 mbar to ±10 bar	14
±160 Pa to ±1 MPa	15
±0.5 inH ₂ O to ±150 psi	16
Available Standard Configurations	17-18
Dimensional Drawings	
DIP Packages	19-21
SMT Packages	21-24
SIP Packages	24-29
Pinouts, PCB Layouts	30
TruStability® Board Mount Pressure Sensors	
Portfolio Overview	31
Additional Information	32

What makes our sensors better?

- Stability and reliability
- Industry-leading accuracy of ±0.25 %FSS BFSL
- Port and housing options simplify integration
- Wide pressure range, from ±1.6 mbar to ±10 bar | ±160 Pa to ±1 MPa | ±0.5 inH₂O to ±150 psi
- Small package size
- Extremely low power consumption

STABILITY • ACCURACY • FLEXIBILITY • SMALL SIZE

Features and Benefits

PROPRIETARY HONEYWELL TECHNOLOGY

Combines high sensitivity with high overpressure and burst pressure while providing industry leading stability—performance factors that are difficult to achieve in the same product; this gives the customer more flexibility in sensor implementation and reduces the customer design requirements for protecting the sensor without sacrificing the ability to sense very small changes in pressure.

PROTECTED BY MULTIPLE GLOBAL PATENTS

INDUSTRY-LEADING LONG-TERM STABILITY

Even after long-term use and thermal extremes, the sensor's stability remains best in class:

- Minimizes system calibration needs.
- Improves system performance.
- Helps support system uptime by minimizing the need to service or replace the sensor during its application life.

TOTAL ERROR BAND (TEB)

Honeywell specifies TEB—the most comprehensive, clear, and meaningful measurement—that provides the sensor's true performance over a compensated range of 0 °C to 50 °C [32 °F to 122 °F] (see Figure 1):

- Minimizes individually testing and calibrating every sensor, decreasing manufacturing time and process costs.
- Improves system accuracy.
- Provides enhanced sensor interchangeability—there is minimal part-to-part variation in accuracy.

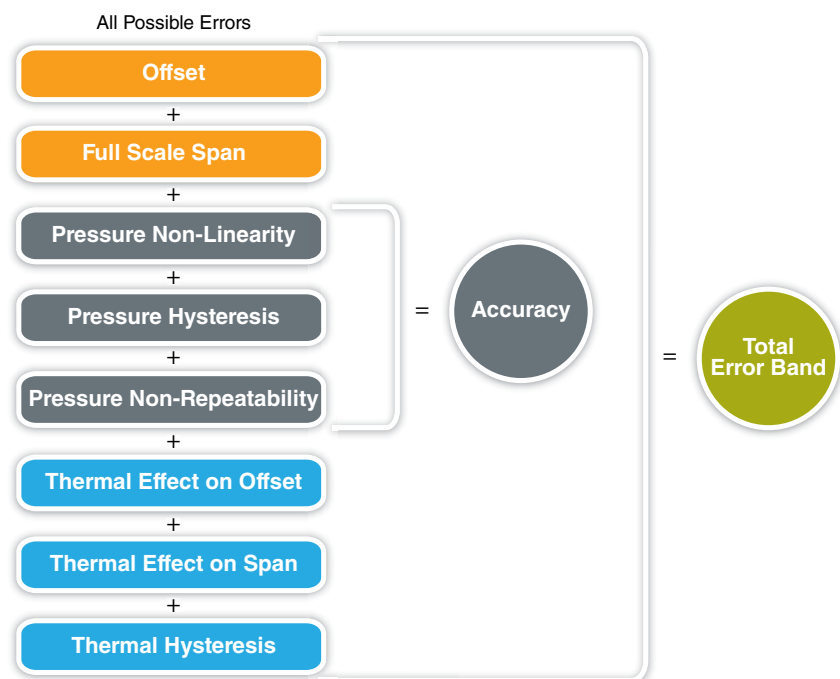


Figure 1. TEB Components for TruStability® Board Mount Pressure Sensors

Features and Benefits

INDUSTRY-LEADING ACCURACY

Extremely tight accuracy of ± 0.25 %FSS BFSL (Full Scale Span Best Fit Straight Line) reduces software needed to correct system inaccuracies, minimizing system design time:

- Avoids additional customer calibration.
- Helps to improve system efficiency.
- Often simplifies software development.

HIGH BURST PRESSURES

- Promotes system reliability and reduces potential system downtime.
- Can simplify the design process.

HIGH WORKING PRESSURE RANGES

Allows ultra-low pressure sensors to be used continuously well above the calibrated pressure range.

INDUSTRY-LEADING FLEXIBILITY

Modular, flexible design with many package styles (with the same industry-leading stability), pressure ports, and options simplify integration into the device manufacturer's application.

WIDE VARIETY OF PRESSURE RANGES

From ± 1.6 mbar to ± 10 bar | ± 160 Pa to ± 1 MPa | ± 0.5 inH₂O to 150 psi provide support for many unique applications.

MEETS IPC/JEDEC J-STD-020D.1 MOISTURE SENSITIVITY LEVEL 1 REQUIREMENTS

- Allows the customer to avoid the thermal and mechanical damage during solder reflow attachment and/or repair that lesser rated products would incur.
- Allows unlimited floor life when stored as specified (≤ 30 °C/85 %RH), simplifying storage and reducing scrap.
- Never requires lengthy bakes prior to reflow.
- Stable and usable shortly after reflow process allows for lean manufacturing.

OPTIONAL INTERNAL DIAGNOSTIC FUNCTIONS

- May reduce the need for redundant sensors in the system.
- Detects most internal failures including burst sensors.

ENERGY EFFICIENT

Extremely low power consumption (less than 10 mW, typ.):

- Reduces system power requirements.
- Enables extended battery life.
- Optional sleep mode available upon special request.

Features and Benefits

OUTPUT: RATIOMETRIC ANALOG; I²C- OR SPI-COMPATIBLE 14-BIT DIGITAL OUTPUT (MIN. 12-BIT SENSOR RESOLUTION)

Accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors.

SMALL SIZE

Miniature 10 mm x 10 mm [0.39 in x 0.39 in] package is very small when compared to many board mount pressure sensors:

- Occupies less area on the PCB.
- Typically allows for easy placement on crowded PCBs or in small devices.

REACH AND ROHS COMPLIANT

LIQUID MEDIA OPTION

- Provides robustness in environments with condensing humidity.
- Compatible with a variety of non-ionic fluids.
- Available for pressure ranges above 40 mbar | 4 kPa | 20 inH₂O.

Potential Applications



MEDICAL

- AIRFLOW MONITORS
- ANESTHESIA MACHINES
- BLOOD ANALYSIS MACHINES
- GAS CHROMATOGRAPHY
- GAS FLOW INSTRUMENTATION
- KIDNEY DIALYSIS MACHINES
- OXYGEN CONCENTRATORS
- PNEUMATIC CONTROLS
- RESPIRATORY MACHINES
- SLEEP APNEA EQUIPMENT
- VENTILATORS
- SPIROMETERS
- NEBULIZERS
- HOSPITAL ROOM AIR PRESSURE



INDUSTRIAL

- BAROMETRY
- FLOW CALIBRATORS
- GAS CHROMATOGRAPHY
- GAS FLOW INSTRUMENTATION
- HVAC
- LIFE SCIENCES
- PNEUMATIC CONTROL
- VAV (VARIABLE AIR VOLUME) CONTROL
- CLOGGED HVAC FILTER DETECTION
- HVAC TRANSMITTERS
- INDOOR AIR QUALITY



General Specifications

Table 1. Absolute Maximum Ratings¹

Characteristic	Min.	Max.	Unit
Supply voltage (V_{supply})	-0.3	6.0	Vdc
Voltage on any pin	-0.3	$V_{\text{supply}} + 0.3$	V
Digital interface clock frequency:			
I ² C	100	400	kHz
SPI	50	800	
ESD susceptibility (human body model)	3	—	kV
Storage temperature	-40 [-40]	85 [185]	°C [°F]
Soldering time and temperature:			
lead solder temperature (SIP, DIP)	4 s max. at 250 °C [482 °F]		
peak reflow temperature (SMT)	15 s max. at 250 °C [482 °F]		

¹Absolute maximum ratings are the extreme limits the device will withstand without damage.

Table 2. Environmental Specifications

Characteristic	Parameter
Humidity:	
gases only (See “Options N and D” in Figure 4.)	0% to 95% RH, non-condensing
liquid media (See “Options T and V” in Figure 4.)	100% condensing or direct liquid media on Port 1
Vibration	MIL-STD-202G, Method 204D, Condition B (15 g, 10 Hz to 2 Hz)
Shock	MIL-STD-202G, Method 213B, Condition C (100 g, 6 ms duration)
Life ¹	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at ≤ 30 °C/85 % RH)

¹Life may vary depending on specific application in which the sensor is utilized.

General Specifications

Table 3. Wetted Materials¹

Component	Port 1 (Pressure Port)	Port 2 (Reference Port)
Ports and covers	high temperature polyamide	high temperature polyamide
Substrate	alumina ceramic	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone
Electronic components	ceramic, silicon, glass, solder	silicon, glass, gold

¹Contact Honeywell Customer Service for detailed material information.

CAUTION

PRODUCT DAMAGE FOR SENSORS WITH LIQUID MEDIA OPTION (ONLY AVAILABLE 60 MBAR | 6 KPA | 1 PSI AND ABOVE)

- Ensure liquid media is applied to Port 1 only; Port 2 is not compatible with liquids.
- Ensure liquid media contains no particulates. All TruStability® sensors are dead-ended devices. Particulates can accumulate inside the sensor, causing damage or affecting sensor output.
- Recommend that the sensor be positioned with Port 1 facing downwards; any particulates in the system are less likely to enter and settle within the pressure sensor if it is in this position.
- Ensure liquid media does not create a residue when dried; build-up inside the sensor may affect sensor output. Rinsing of a dead-ended sensor is difficult and has limited effectiveness for removing residue.
- Ensure liquid media are compatible with wetted materials. Non-compatible liquid media will degrade sensor performance and may lead to sensor failure.

Failure to comply with these instructions may result in product damage.

Table 4. Sensor Pressure Types

Pressure Type	Description
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 – Port 2).
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.

Analog Operating Specifications

Table 5. Analog Operating Specifications

Characteristic	Min.	Typ.	Max.	Unit
Supply voltage (V_{supply}) ^{1, 2, 3} pressure ranges ≥ 60 mbar 4 kPa 1 psi: 3.3 Vdc 5.0 Vdc pressure ranges ≤ 40 mbar 4 kPa 20 inH ₂ O: 3.3 Vdc 5.0 Vdc	3.0 4.75 3.27 4.95	3.3 5.0 3.3 5.0	3.6 5.25 3.33 5.05	Vdc
Supply current: 3.3 Vdc 5.0 Vdc	— —	2.1 2.7	2.8 3.5	mA
Operating temperature range ⁴	-20 [-4]	—	85 [185]	°C [°F]
Compensated temperature range ⁵	0 [-32]	—	50 [122]	°C [°F]
Startup time (power up to data ready)	—	—	5	ms
Response time	—	1	—	ms
Clipping limit: upper lower	— 2.5	— —	97.5 —	%Vsupply
Accuracy ⁶	—	—	± 0.25	%FSS BFSL ⁸
Output resolution	0.03	—	—	%FSS
Orientation sensitivity (± 1 g) ^{7, 9} pressure ranges ≤ 40 mbar 4 kPa 20 inH ₂ O pressure ranges ≤ 2.5 mbar 250 Pa 1 inH ₂ O	— —	± 0.1 ± 0.2	— —	%FSS ⁸

¹Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.

²Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified operating voltage.

³The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

⁴Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.

⁵Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

⁶Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25 °C [77 °F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

⁷Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

⁸Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range. (See Figure 4 for ranges.)

⁹Insignificant for pressure ranges above 40 mbar | 4 kPa | 20 inH₂O.

Digital Operating Specifications

Table 6. Digital Operating Specifications

Characteristic	Min.	Typ.	Max.	Unit
Supply voltage (V_{supply}): ^{1, 2, 3} pressure ranges ≥ 60 mbar 6 kPa 1 psi: 3.3 Vdc 5.0 Vdc pressure ranges ≤ 40 mbar 4 kPa 20 inH ₂ O: 3.3 Vdc 5.0 Vdc	3.0 4.75 3.27 4.95	3.3 5.0 3.3 5.0	3.6 5.25 3.33 5.05	Vdc
Supply current: 3.3 Vdc 5.0 Vdc	— —	3.1 3.7	3.9 4.6	mA
Operating temperature range ⁴	-20 [-4]	—	85 [185]	°C [°F]
Compensated temperature range ⁵	0 [-32]	—	50 [122]	°C [°F]
Startup time (power up to data ready)	—	—	3	ms
Response time	—	0.46	—	ms
SPI/I ² C voltage level: low high	— 80	— —	20 —	%Vsupply
Pull up on SDA/MISO, SCL/SCLK, SS	1	—	—	kOhm
Accuracy ⁶	—	—	± 0.25	%FSS BFSL ⁸
Output resolution	12	—	—	bits
Orientation sensitivity (± 1 g): ^{7, 9} pressure ranges ≤ 40 mbar 4 kPa 20 inH ₂ O pressure ranges ≤ 2.5 mbar 250 Pa 1 inH ₂ O	— —	± 0.1 ± 0.2	— —	%FSS ⁸

¹Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.

²Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified operating voltage.

³The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

⁴Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.

⁵Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

⁶Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25 °C [77 °F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

⁷Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

⁸Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range. (See Figure 4 for ranges.)

⁹Insignificant for pressure ranges above 40 mbar | 4 kPa | 20 inH₂O.

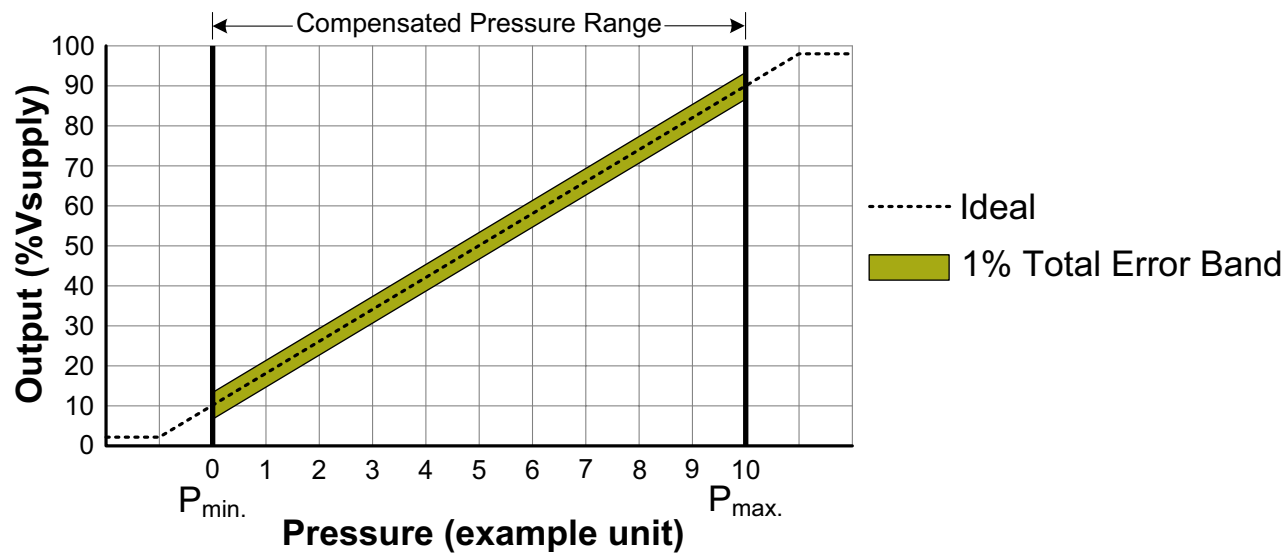
Table 7. Sensor Output at Significant Percentages (Digital Versions Only)

% Output	Digital Counts (decimal)	Digital Counts (hex)
0	0	0x0000
10	1638	0x0666
50	8192	0x2000
90	14746	0x399A
100	16383	0x3FFF

Transfer Function Limits

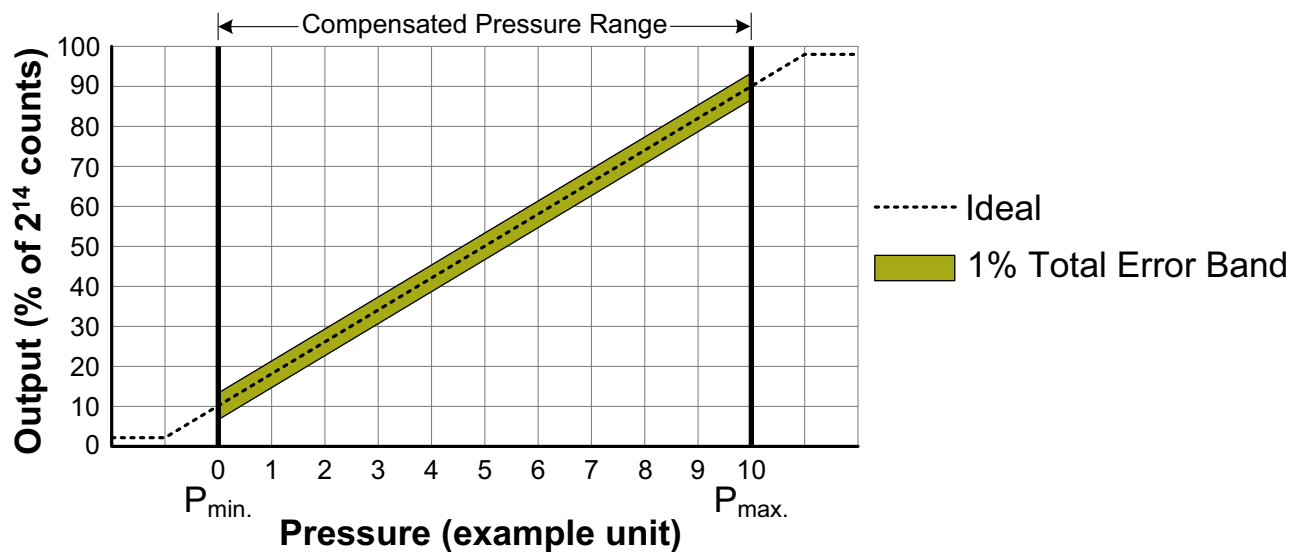
Figure 2. Transfer Function Limits¹

Analog Versions



$$\text{Output (V)} = \frac{0.8 \times V_{\text{supply}}}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 0.10 \times V_{\text{supply}}$$

Digital Versions

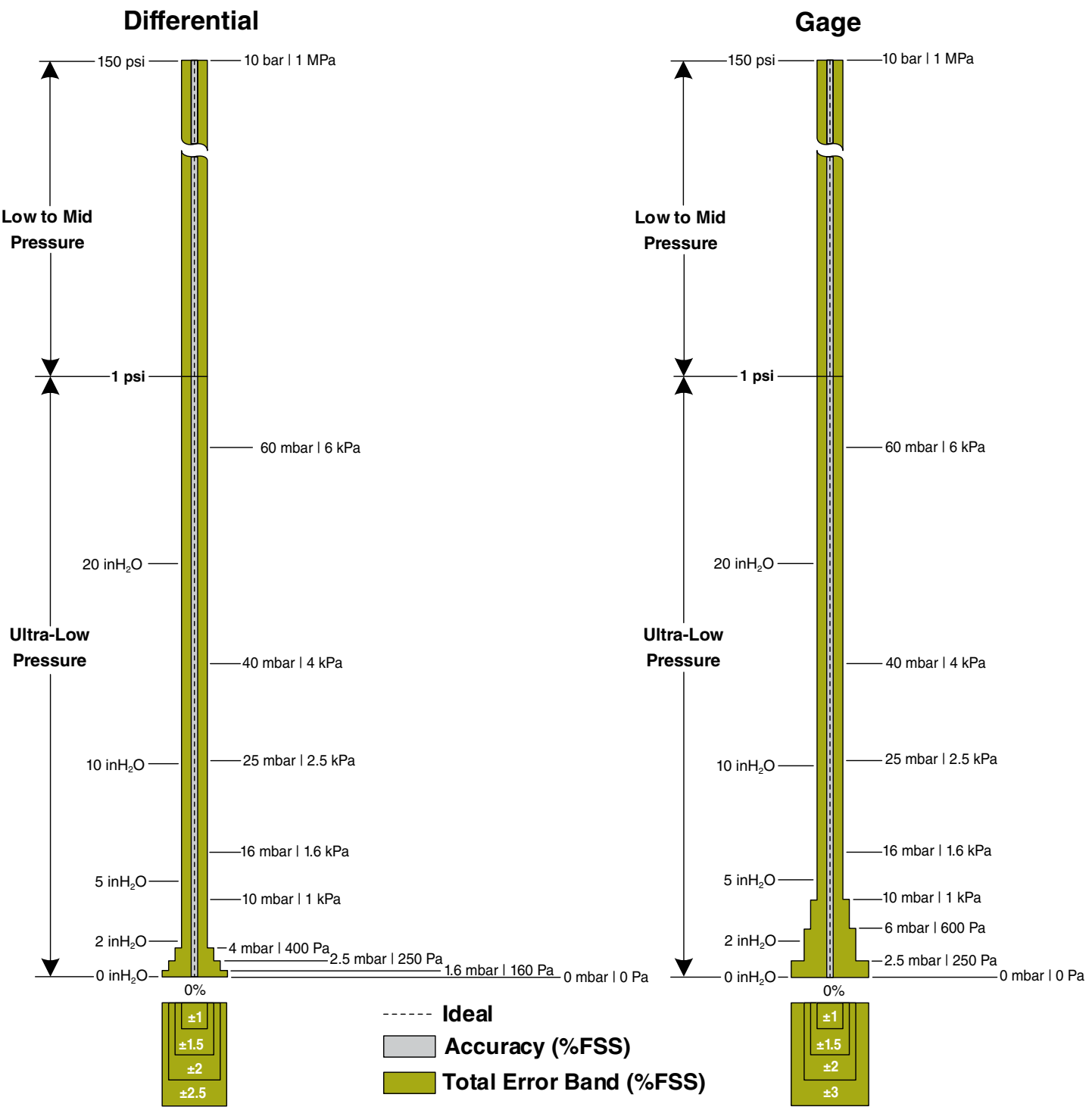


$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{P_{\text{max.}} - P_{\text{min.}}} \times (\text{Pressure}_{\text{applied}} - P_{\text{min.}}) + 10\%$$

¹Transfer Function "A" is shown. See Figure 4 for other available transfer function options.

Total Error Band Values

Figure 3. Total Error Band Values for Full Scale Span Pressure Ranges



Nomenclature and Order Guide

Figure 4. Nomenclature and Order Guide

For example, **HSCDNNN150PGAA3** defines an HSC Series TruStability® Pressure Sensor, DIP package, NN pressure port, no special options, 150 psi gage pressure range, analog output type, 10% to 90% of Vsupply transfer function, 3.3 Vdc supply voltage.

H S C D N N N 1 5 0 P G A A 3										Supply Voltage	
Product Series										3	3.3 Vdc
HSC High Accuracy, Compensated/Amplified										5	5.0 Vdc
Package										Transfer Function¹	
D DIP (Dual Inline Pin)										A	10% to 90% of Vsupply (analog), 2 ¹⁴ counts (digital)
M SMT (Surface Mount Technology)										B	5% to 95% of Vsupply (analog), 2 ¹⁴ counts (digital)
S SIP (Single Inline Pin)										C	5% to 85% of Vsupply (analog), 2 ¹⁴ counts (digital)
Pressure Port										F	4% to 94% of Vsupply (analog), 2 ¹⁴ counts (digital)
DIP										Output Type²	
NN No ports										A	Analog
AN Single axial barbed port										S	SPI
LN Single axial barbless port										2	I ² C, Address 0x28
FF Fastener mount, dual axial barbed ports, opposite sides										3	I ² C, Address 0x38
FN Fastener mount, single axial barbed port										4	I ² C, Address 0x48
GN Ribbed fastener mount, single axial barbed port										5	I ² C, Address 0x58
NB Fastener mount, dual axial ports, same side										6	I ² C, Address 0x68
RR Dual radial barbed ports, same side										7	I ² C, Address 0x78
DR Dual radial barbed ports, opposite sides										Pressure Range^{3, 4}	
JN Single radial barbless port										±1.6 mbar to ±10 bar	
JJ Dual radial barbless ports, same side										±160 Pa to ±1 MPa	
HH Fastener mount, dual radial barbed ports, same side										±0.5 inH₂O to ±150 psi	
HN Fastener mount, single radial barbed port										Absolute	
MN Manifold mount, outer diameter seal										001BA 0 bar to 1 bar	
SN Manifold mount, inner diameter seal										1.6BA 0 bar to 1.6 bar	
										2.5BA 0 bar to 2.5 bar	
										004BA 0 bar to 4 bar	
										006BA 0 bar to 6 bar	
										010BA 0 bar to 10 bar	
										100KA 0 kPa to 100 kPa	
										160KA 0 kPa to 160 kPa	
										250KA 0 kPa to 250 kPa	
										400KA 0 kPa to 400 kPa	
										600KA 0 kPa to 600 kPa	
										001GA 0 kPa to 1 MPa	
										Differential	
										1.6MD ±1.6 mbar	
										2.5MD ±2.5 mbar	
										004MD ±4 mbar	
										006MD ±6 mbar	
										010MD ±10 mbar	
										016MD ±16 mbar	
										025MD ±25 mbar	
										040MD ±40 mbar	
										060MD ±60 mbar	
										100MD ±100 mbar	
										160MD ±160 mbar	
										250MD ±250 mbar	
										400MD ±400 mbar	
										600MD ±600 mbar	
										001BD ±1 bar	
										100KD ±100 kPa	
										1.6BD ±1.6 bar	
										160KD ±160 kPa	
										2.5BD ±2.5 bar	
										250KD ±250 kPa	
										004BD ±4 bar	
										400KD ±400 kPa	
										Gage	
										2.5MG 0 mbar to 2.5 mbar	
										004MG 0 mbar to 4 mbar	
										006MG 0 mbar to 6 mbar	
										010MG 0 mbar to 10 mbar	
										016MG 0 mbar to 16 mbar	
										025MG 0 mbar to 25 mbar	
										040MG 0 mbar to 40 mbar	
										060MG 0 mbar to 60 mbar	
										100MG 0 mbar to 100 mbar	
										160MG 0 mbar to 160 mbar	
										250MG 0 mbar to 250 mbar	
										400MG 0 mbar to 400 mbar	
										600MG 0 mbar to 600 mbar	
										001BG 0 bar to 1 bar	
										1.6BG 0 bar to 1.6 bar	
										2.5BG 0 bar to 2.5 bar	
										004BG 0 bar to 4 bar	
										006BG 0 bar to 6 bar	
										010BG 0 bar to 10 bar	
										100KG 0 kPa to 100 kPa	
										160KG 0 kPa to 160 kPa	
										250KG 0 kPa to 250 kPa	
										400KG 0 kPa to 400 kPa	
										600KG 0 kPa to 600 kPa	
										001GG 0 kPa to 1 MPa	
Options^{5, 6}											
N Dry gases only, no diagnostics											
D Dry gases only, diagnostics on											
T Liquid media on Port 1, no diagnostics											
V Liquid media on Port 1, diagnostics on											

¹The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact Honeywell Customer Service.

²SPI output function is not available in SIP package.

³Custom pressure ranges are available. Contact Honeywell Customer Service for more information.

⁴See the explanation of sensor pressure types in Table 4.

⁵See the CAUTION in this document.

⁶Options T and V are only available on pressure ranges ±60 mbar to ±10 bar | ±6 kPa to ±1 MPa | ±1 psi to ±150 psi.