

## 8XH SERIES PRESSURE SENSOR

High Accuracy Integrated Media Isolated Pressure Sensor

### SPECIFICATIONS

- **316L Stainless Steel Media Isolated Pressure Sensor**
- **High Accuracy Pressure/Temperature Read-out**
- **Integrated and Compact Package**
- **Absolute, Gage and Vacuum Gage**
- **Digital I<sup>2</sup>C and Analog Output**
- **13 mm, 16 mm and 19 mm Module Diameter**

The 8XH Series pressure sensor integrates a MEMS die, an ASIC Chip and passive components within isolated oil cavity. Leveraging the MEMS die bridge resistance for both temperature and pressure measuring in the same oil temperature environment, it can provide the accurate on-site temperature signal required for compensation, achieve outstanding initial accuracy and excellent EMC performance. The 8XH Series can provide pressure and temperature dual output in digital output mode.

The 8XH Series is ISO packaged, factory calibrated pressure sensor. It offers gage, vacuum gage and absolute pressure measurements spanning from 5 psi ~ 1500 psi.

The 8XH Series pressure sensor can offer amplified analog output or digital output signal with update mode through the I<sup>2</sup>C protocol.

### Features

- **Weldable or O-ring Mount**
- **-20 °C To +85 °C Compensated Temperature Range**
- **±0.1% Span Pressure Accuracy**
- **±0.3% Span Total Error Band**
- **Low Power Consumption**
- **Low and Medium Pressure**

### Applications

- **Semiconductor Equipment**
- **Process Automation**
- **Medical Devices**
- **OEM IoT System**
- **Analytical Equipment**

## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

### Standard Pressure Ranges & Types Related to Model Series

Pressure Range	Model Series	Gage (G)	Absolute (A)	Pressure Range	Model Series	Vacuum Gage (V)
0 to 5 psi	85H/85FH/86H/82H	•				
0 to 15 psi	85H/85FH/86H/82H	•	•	-14.5 psi to 15 psi	85FH/82H	•
0 to 30 psi	85H/85FH/86H/82H	•	•	-14.5 psi to 30 psi	85FH/82H	•
0 to 50 psi	85H/85FH/86H/82H	•	•	-14.5 psi to 50 psi	85FH/82H	•
0 to 100 psi	85H/85FH/86H/82H	•	•	-14.5 psi to 100 psi	85FH/82H	•
0 to 300 psi	85H/85FH/86H/82H	•	•			
0 to 500 psi	85H/85FH/86H/82H	•	•			
0 to 1000 psi	85H/85FH/86H/82H		•			
0 to 1500 psi	85H/85FH/86H/82H		•			
0 to 1 bar	82H	•	•			
0 to 2 bar	82H	•	•			
0 to 3 bar	82H	•	•			
0 to 4 bar	82H	•	•			
0 to 5 bar	82H	•	•			
0 to 6 bar	82H	•	•			
0 to 7 bar	82H	•	•			
0 to 20 bar	82H	•	•			
0 to 30 bar	82H	•	•			
0 to 70 bar	82H		•			
0 to 100 bar	82H		•			

Note: Other specific pressure ranges are available upon order

### Performance Specifications

Ambient Temperature: 25°C (Unless otherwise specified)

Parameters	Min.	Typ.	Max.	Unit	Notes
Pressure Accuracy	-0.1		0.1	% Span	1
Total Error Band	-0.3		0.3	% Span	2
Temperature Accuracy	-1		1	°C	3
Long Term Stability (Offset & Span)		±0.1		% Span/Year	4
Supply Voltage (Digital output)	2.7	3.3	3.6	VDC	
Supply Voltage (Analog output)	4.75	5.0	5.25	VDC	
Maximum Current Consumption			3	mA	
Insulation Resistance (500 VDC)	100			MΩ	5
Dielectric Strength (500VAC, 1min.)			1	mA	5

## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

ESD	±4 KV (HBM: C = 100 pF / R = 1.5 kΩ)			
Compensated Temperature	-20	85	°C	6
Start-up Time (Supply on)		20	ms	7
Conversion Time		2	ms	7
Operating Temperature	-40	125	°C	8
Storage Temperature	-40	125	°C	8
Over Pressure		3X	Rated	9
Burst Pressure		4X	Rated	10
Vibration Resistance	20g, 5 Hz to 2000 Hz			
Mechanical Shock Resistance	Half sine, 50g for 11 ms			
Media Compatibility	Liquids and gases compatible with 316L Stainless Steel			

### Notes

1. Combined linearity, pressure hysteresis and repeatability.
2. ±0.5% Span for 5 psi, includes calibration errors and temperature effects over the compensated temperature range.
3. Measured over the compensated temperature range, can only be read out by the digital output product.
4. ±0.2% Span/year for 5 psi
5. Between case and pins
6. Compensated temperature range is 0 °C to 50 °C for 5 psi.
7. Start-up time (supply on) is the time from power-on to being able to receive the first command, Conversion time is the time interval from conversion command received to the output.
8. Maximum temperature range for 85FH series product with pins is -20 °C to 125 °C, maximum temperature range for all series product with standard cable is -20 °C to 105 °C, maximum temperature range for all series product with standard connector is -25 °C to 85 °C.
9. 3x or 2000 psi, whichever is less.
10. 4x or 3000 psi, whichever is less.

### Additional Notes

Direct mechanical contact with diaphragm is prohibited. Diaphragm surface must remain free of defects (scratches, punctures, dents, fingerprints, etc.) for device to operate properly. Caution is advised when handling parts with exposed diaphragms. Use protective cap whenever devices are not in use.

## Output

Possible outputs	Digital output	Analog output
	I <sup>2</sup> C, DC 3.3 V, four-wire (Addr. 0x74, other address requirement contacts factory)	DC 0.5 to 4.5 V, three-wire, radiometric 10% to 90% of the supply voltage
Load	-	R <sub>L</sub> ≥ 5 kΩ
Pull-up resistor	R <sub>Pull-up</sub> 1 to 10 kΩ	-
A/D Resolution	24 Bit	-

## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

### I<sup>2</sup>C Interface Specification

#### Application Circuit

Bi-directional bus lines are implemented by the devices (master and slave) using open-drain output stages and a pull-up resistor connected to the positive supply voltage. The recommended pull-up resistor value depends on the system setup (capacitance of the circuit or cable and bus clock frequency). In most cases, 4.7kΩ is a reasonable choice. The capacitive loads on SDA and SCL line must be the same. It is important to avoid asymmetric capacitive loads.

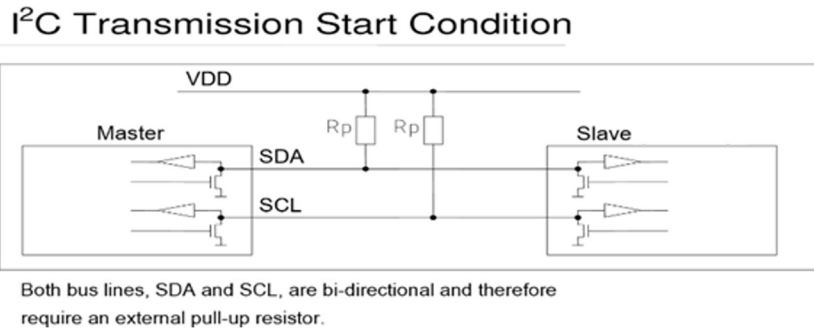


Figure 1: Typical application circuit

#### I<sup>2</sup>C Address

The I<sup>2</sup>C address consists of a 7-digit binary value. The factory setting for the I<sup>2</sup>C slave address is 0x74. The address is always followed by a write bit (0) or read bit (1). The default hexadecimal I<sup>2</sup>C header for read access to the sensor is therefore 0XE9.

#### Communication Interface

##### General

It consists of a piezoresistive sensor and a sensor interface IC. The main function of the sensor interface IC is to convert the uncompensated analogue output voltage from the piezoresistive pressure sensor to a 24-bit digital value, as well as providing a 24-bit digital value for the temperature of the sensor.

##### I<sup>2</sup>C Interface

It is built with I<sup>2</sup>C serial interface, the external microcontroller clocks in the data through the input SCL (Serial Clock) and SDA (Serial Data). The sensor responds on the same pin SDA.

Mode	Pins used
I <sup>2</sup> C	SDA, SCL

Table 1: Pin definition

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High Accuracy Integrated Media Isolated Pressure Sensor

### Pressure and temperature calculation

$$Pressure = \frac{(P_{value} - 4,194,304)}{8,388,607} * (P_{max} - P_{min}) + P_{min}$$

$$Temperature = \frac{(T_{value} - 4,194,304)}{8,388,607} * (T_{max} - T_{min}) + T_{min}$$

Notes:

$$T_{max} = +130^{\circ}\text{C}$$

$$T_{min} = -50^{\circ}\text{C}$$

$P_{max}$ : The maximum pressure of the pressure range

$P_{min}$ : The minimum pressure of the pressure range

$P_{value}$ : The digital value of pressure

$T_{value}$ : The digital value of temperature

### Operation Commands

It has only three basic commands:

1. Reset
2. Read ADC of P&T result (24 bits pressure / temperature)
3. Read Diagnostic Register

Each I<sup>2</sup>C communication message starts with the start condition, and it ends with the stop condition. The device address is 1110100x (write: x=0, read: x=1).

The size of each command is 1 byte (8 bits) as described in Table 1 below.

The device will return to 24-bit pressure value after ADC read command with T=0; P=1.

The device will return to 24-bit temperature value after ADC read command with P=0; T=1.

Commands	Bit [7]	Bit [6]	Bit [5]	Bit [4]	Bit [3]	Bit [2]	Bit [1]	Bit [0]
Reset	0	0	0	1	0	0	0	0
Read ADC	0	1	0	1	0	T	P	0
Read Diagnostic Register 0	0	1	1	1	1	0	0	0
Read Diagnostic Register 2	0	1	1	1	1	1	0	0

Table 2: User commands

### Status bits and Diagnostic Features

The table below summarizes the status bits conditions for checking if the ADC conversion is completed and the issue related to sensor bridge.

Read Register	Status Bits	Definition
Diagnostic Register 0	Bit [0]	is set to 1 if the ADC conversion has finished
	Bit [0]	is set to 1 if svdd open
Diagnostic Register 2	Bit [1]	is set to 1 if sgnd open
	Bit [2]	is set to 1 if inn short sgnd
	Bit [3]	is set to 1 if inp short sgnd
	Bit [4]	is set to 1 if inn short svdd
	Bit [5]	is set to 1 if inp short svdd
	Bit [6]	is set to 1 if inn open
	Bit [7]	is set to 1 if inp open

Table 3: Status bits



## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

---

```
#define RXBUFFERSIZE    9
#define BufferSize      1
uint8_t aRxBuffer[RXBUFFERSIZE];
uint8_t WriteBuffer[BufferSize];
void Read_HIDC(uint8_t PT)
{
    WriteBuffer[0]=Conversion;
    if (HAL_I2C_Master_Transmit(&hi2c2, ADDR_HIDC, WriteBuffer, I2C_MEMADD_SIZE_8BIT, 10000) != HAL_OK)
    {
        /* Transfer error in reception process */
        Error_Handler();
    }
    HAL_Delay(4);//4ms for OSR=5
    if (HAL_I2C_Mem_Read(&hi2c2, ADDR_HIDC, PT, I2C_MEMADD_SIZE_8BIT,aRxBuffer,RXBUFFERSIZE, 10000) != HAL_OK)
    {
        /* Transfer error in reception process */
        Error_Handler();
    }
}

void Reset_HIDC(void)
{
    WriteBuffer[0]=Reset;
    if (HAL_I2C_Master_Transmit(&hi2c2, ADDR_HIDC, WriteBuffer, I2C_MEMADD_SIZE_8BIT, 10000) != HAL_OK)
    {
        /* Transfer error in reception process */
        Error_Handler();
    }
}

void Read_INT_HIDC(uint8_t Diagnostic)
{
    uint8_t ReadSize=0x02;
    if (HAL_I2C_Mem_Read(&hi2c2, ADDR_HIDC, Diagnostic, I2C_MEMADD_SIZE_8BIT, aRxBuffer, ReadSize, 10000) != HAL_OK)
    {
        /* Transfer error in reception process */
        Error_Handler();
    }
}

void All_Fun_HIDC(void)
{
    uint16_t DIAG0,DIAG1,DIAG2;
    uint32_t Pressure;
    uint32_t Temperature;

    Reset_HIDC(); //Reset (0X10)
    printf("\n\r Reset \n\r");

    Read_HIDC(Read_PT); //Read P&T1 (0X56)
    Pressure=(aRxBuffer[0]*256+aRxBuffer[1]*256+aRxBuffer[2]);
    Temperature=(aRxBuffer[3]*256+aRxBuffer[4]*256+aRxBuffer[5]);
    printf("Pressure = %lX\n", Pressure);
    printf("Temperature = %lX\n", Temperature);

    Read_INT_HIDC(Read_Diagnostic0_Reg); //Read INT0 (0X78)
    DIAG0 = (aRxBuffer[0] << 8) | aRxBuffer[1];
    printf("IN0 = %04X\n", DIAG0);
    Read_INT_HIDC(Read_Diagnostic2_Reg); //Read INT2 (0X7C)
    DIAG2 = (aRxBuffer[0] << 8) | aRxBuffer[1];
    printf("IN2 = %04X\n", DIAG2);
}
```

## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

---

```
/* USER CODE BEGIN Header */
/**
 * *****
 * @file   HIDC.h
 * @brief  This file contains all the function prototypes for
 *         the HIDC.c file
 * *****
 * @attention
 *
 * Copyright (c) 2024 STMicroelectronics.
 * All rights reserved.
 *
 * This software is licensed under terms that can be found in the LICENSE file
 * in the root directory of this software component.
 * If no LICENSE file comes with this software, it is provided AS-IS.
 * *****
 */
/* USER CODE END Header */
/* Define to prevent recursive inclusion -----*/
#ifndef HIDC_H
#define HIDC_H

#ifdef __cplusplus
extern "C" {
#endif

/* Includes -----*/
#include "main.h"

#define ADDR_HIDC           0XE8
#define Reset              0X10
#define Read_PT            0X56
#define Read_P             0X52
#define Read_T             0X54
#define Read_Diagnostic0_Reg 0X78
#define Read_Diagnostic2_Reg 0X7C

void Read_HIDC(uint8_t PT);
void Reset_HIDC(void);
void Read_INT_HIDC(uint8_t Diagnostic);
void All_Fun_HIDC(void);

#endif /* __HIDC_H__ */
```

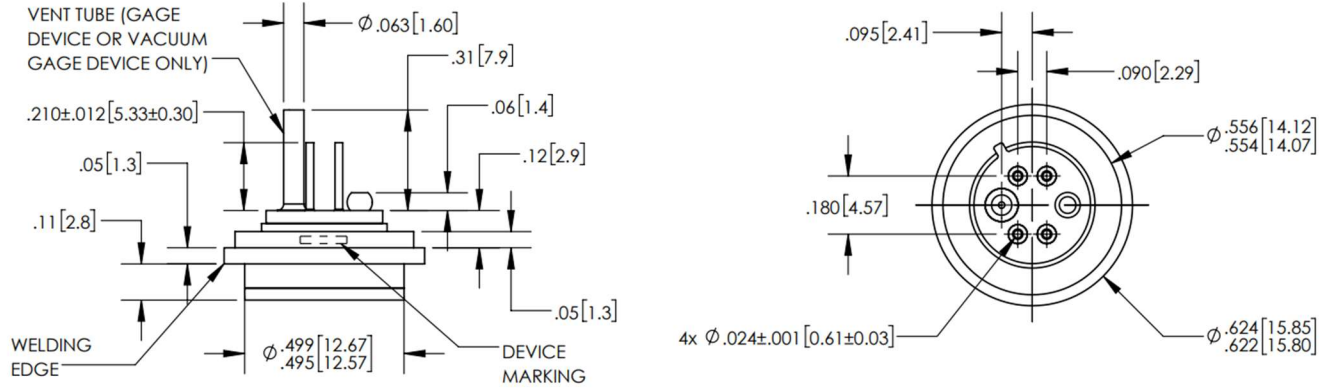
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High Accuracy Integrated Media Isolated Pressure Sensor

## Dimensions (Unit: inch[mm])

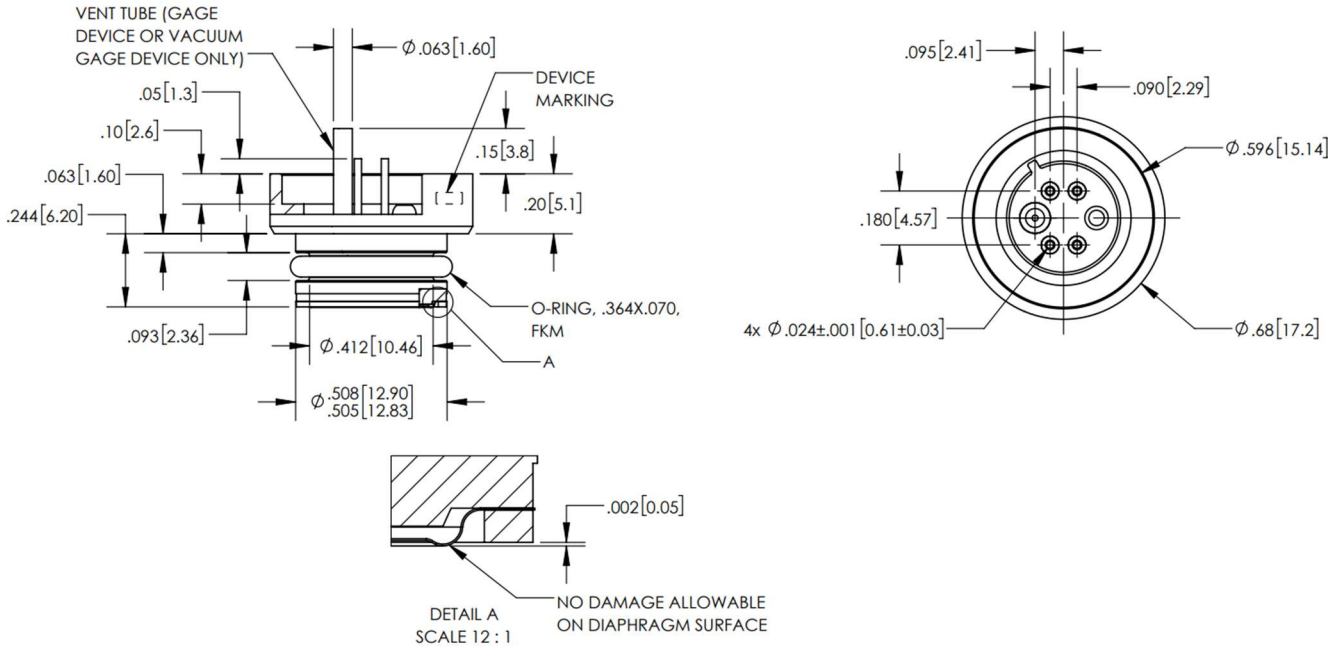
### 85H Series with Pins

**ø13mm** Module diameter pressure capsule, standard recessed diaphragm, **weldable**



### 85FH Series with Pins

**ø13mm** Module diameter pressure capsule, flush diaphragm, **O-ring mount**

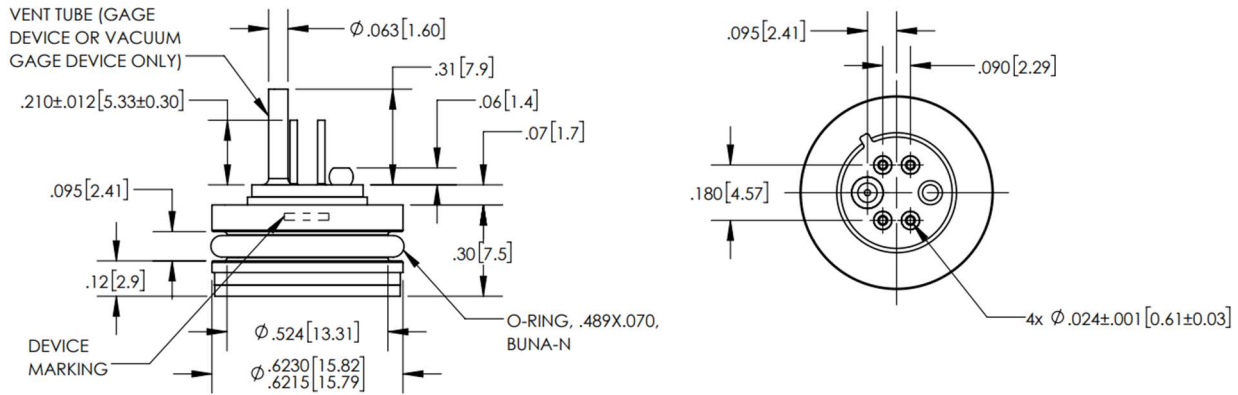


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High Accuracy Integrated Media Isolated Pressure Sensor

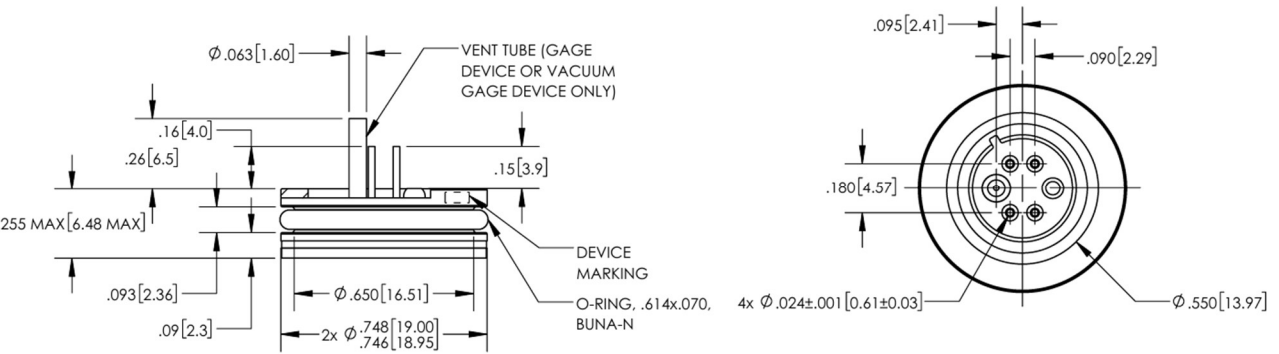
## 86H Series with Pins

**ø16mm** Module diameter pressure capsule, standard recessed diaphragm, **O-ring mount**



## 82H Series with Pins

**ø19mm** Module diameter pressure capsule, standard recessed diaphragm, **O-ring mount**



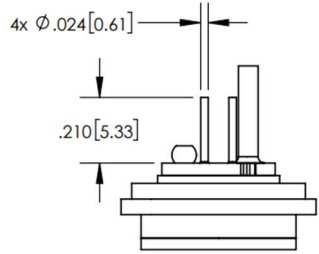
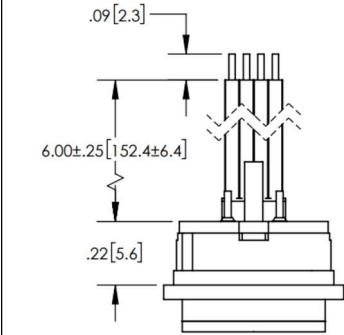
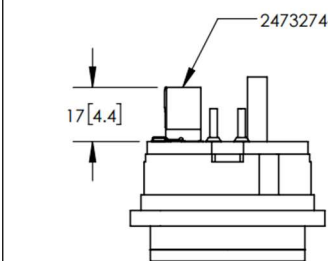
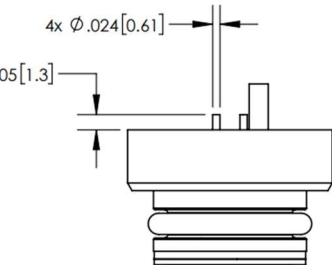
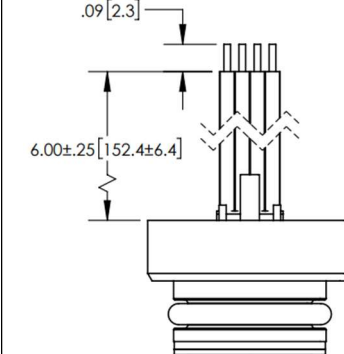
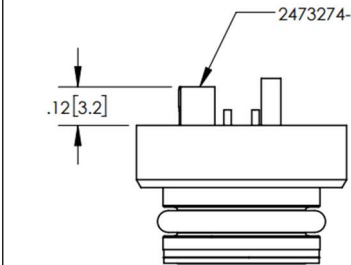
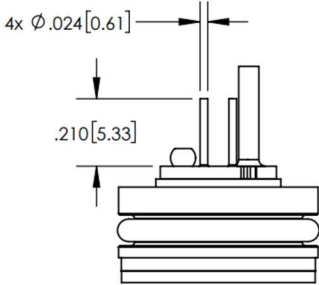
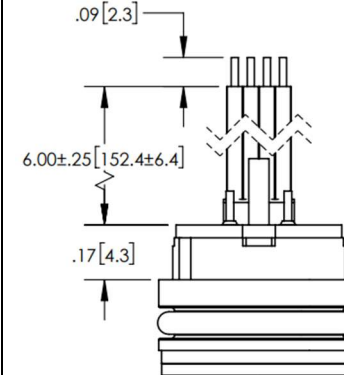
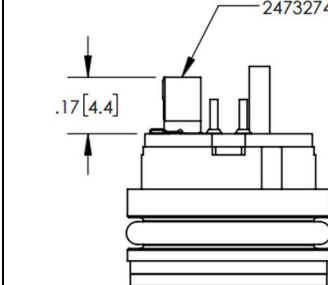
## Process Connections (Only for 85H Series)

Process Connections	Type Code: 4 1/4 – 18 NPT, ANSI B1.20.1, 5/8 Hex	Type Code: 5 1/4 – 19 BSP, BS21, 3/4 Hex	Type Code: 8 1/8 – 27 NPT, ANSI B1.20.1, 5/8 Hex
Examples	<p>5/8 HEX .625 [15.88]</p> <p>.33 [8.4]</p> <p>.45 [11.4]</p> <p>1/4-18 NPT</p>	<p>3/4 HEX .748 [19.00]</p> <p>.36 [9.1]</p> <p>.45 [11.4]</p> <p>1/4-19 BSP</p>	<p>5/8 HEX .625 [15.88]</p> <p>.33 [8.4]</p> <p>.32 [8.1]</p> <p>1/8-27 NPT</p>
Notes: Other process connections are available upon order			

# 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

## Electrical Connections

Electrical Connections	Type Code: P w/ Pins	Type Code: R w/ Standard Ribbon Cables	Type Code: C w/ TE Connector (2473274-4)
<p><b>85H Series</b></p> 			
<p><b>85FH Series</b></p> 			
<p><b>86H Series</b></p> 			

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High Accuracy Integrated Media Isolated Pressure Sensor

<p><b>82H Series</b></p>			
<p>Notes:</p> <ol style="list-style-type: none"> <li>1. Wire ends of standard Ribbon cables are tin-plated</li> <li>2. Ribbon cable size: 26AWG</li> <li>3. Other cable lengths and sizes can be available upon order</li> </ol>			

## Connection Diagram

Digital output device			
Electrical Diagrams	Type Code: P w/ Pins	Type Code: R w/ Standard Ribbon Cables	Type Code: C w/ TE Connector (2473274-4)
<p><b>All Series</b></p>			
SCL	1	2	2
SDA	2	1	1
VDD	3	4	4
GND	4	3	3

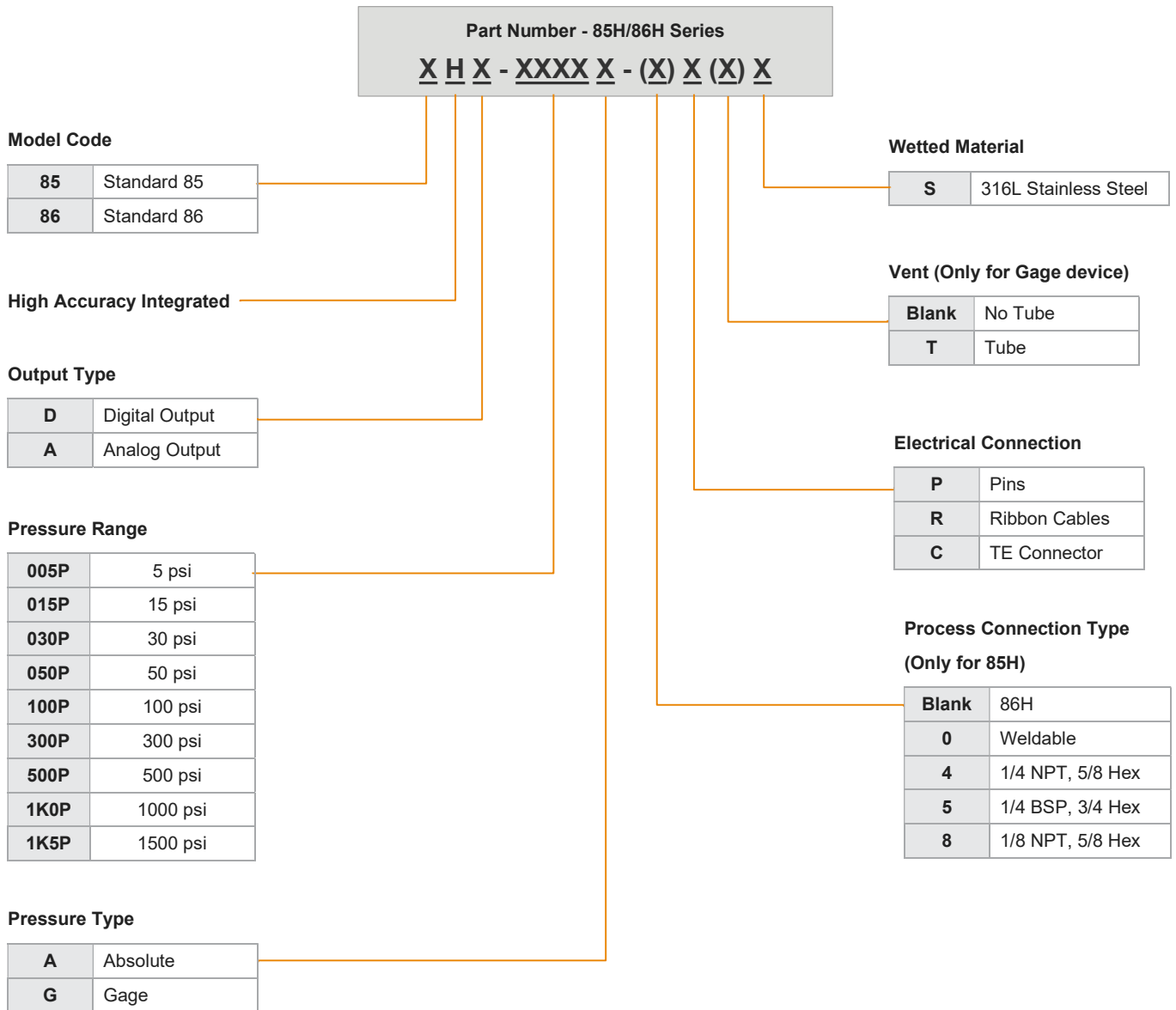
Analog output device			
Electrical Diagrams	Type Code: P w/ Pins	Type Code: R w/ Standard Ribbon Cables	Type Code: C w/ TE Connector (2473274-4)
<p><b>All Series</b></p>			
Aout	2	1	1
GND	4	3	3
VDD	3	4	4



# 8XH SERIES

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## Ordering Information – 85H/86H Series



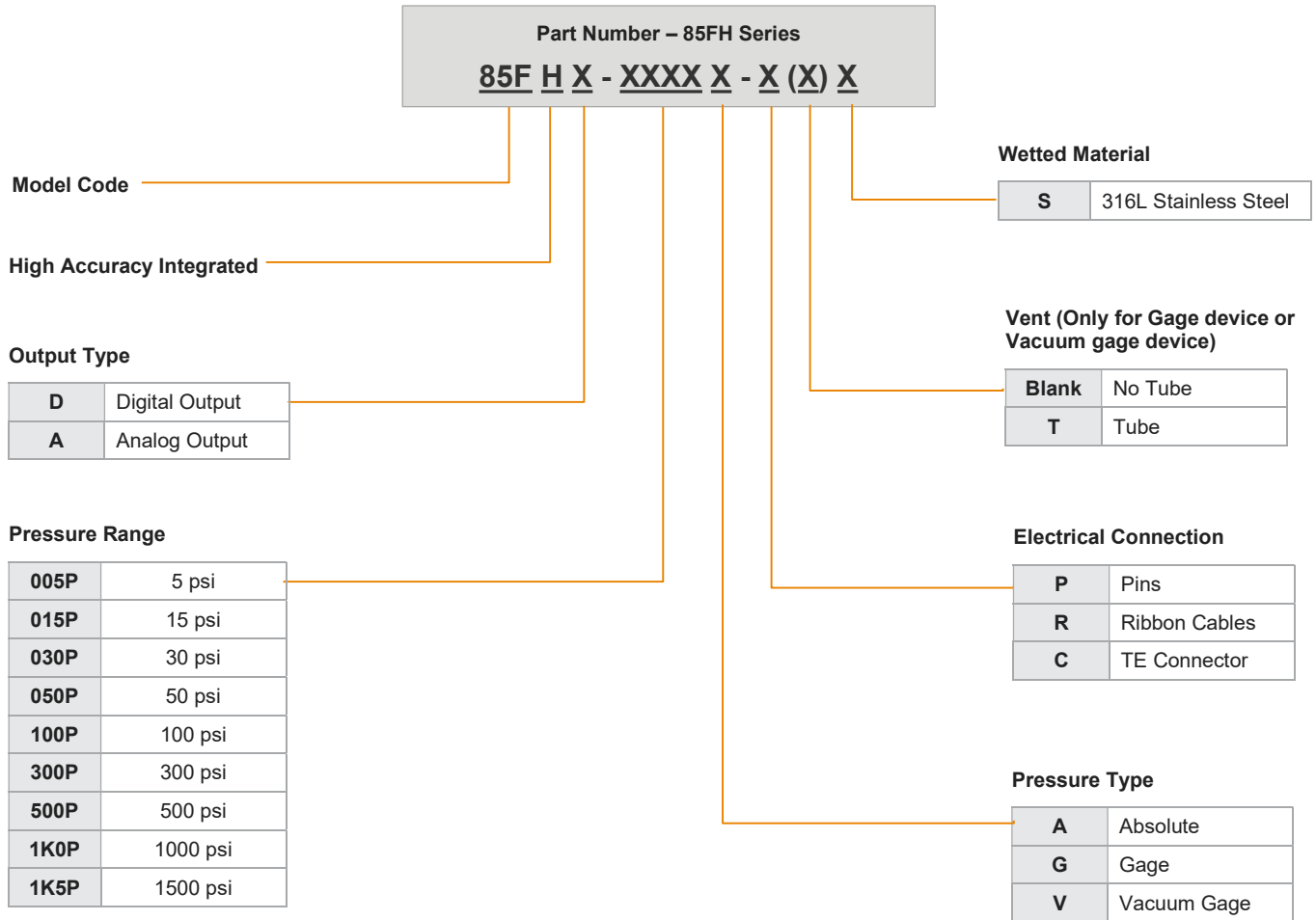
**Notes:**

1. Refer to standard pressure ranges & types related to model series in Page 2.
2. Other specific pressure ranges are available upon order.

# 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

## Ordering Information – 85FH Series



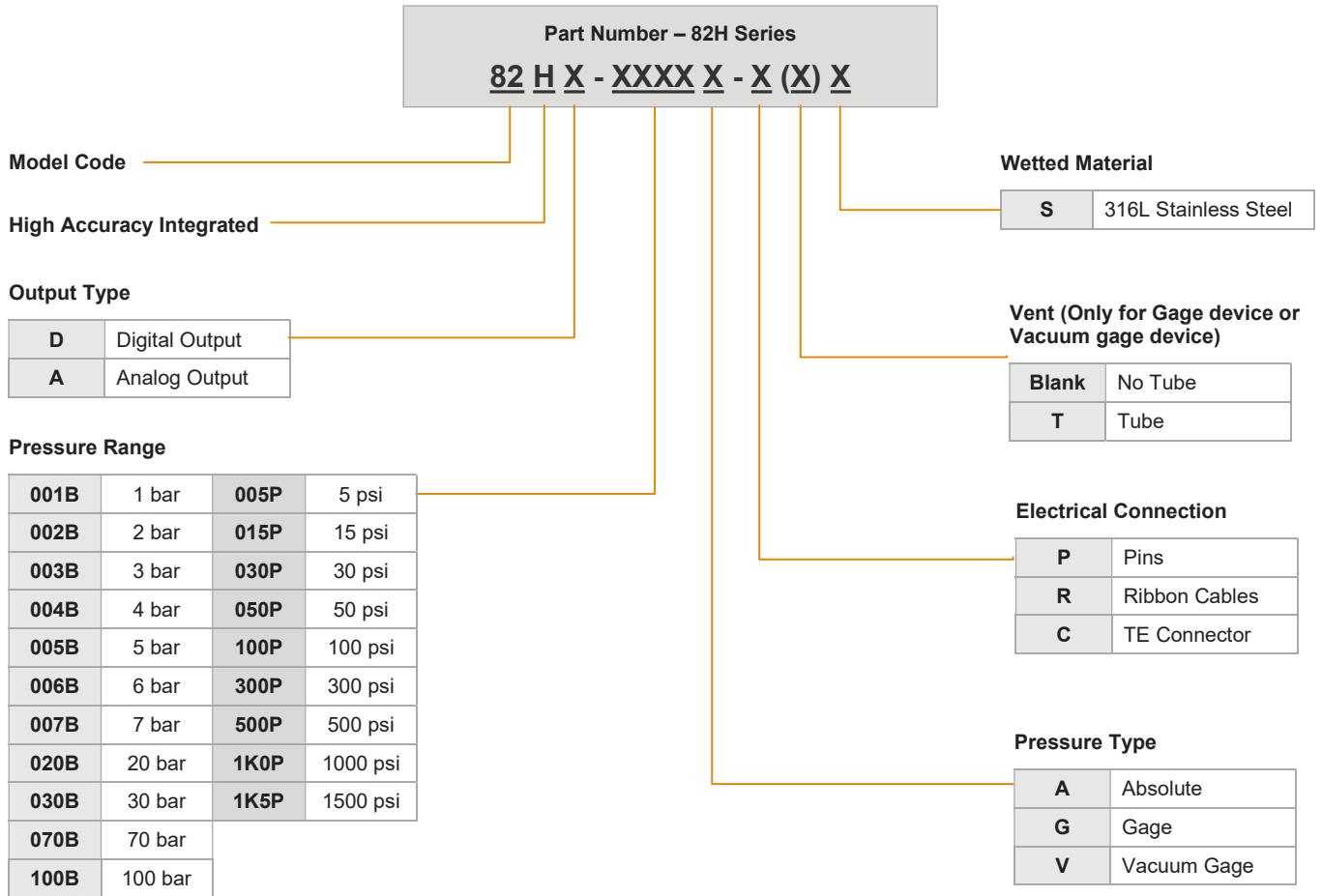
**Notes:**

1. Refer to standard pressure ranges & types related to model series in Page 2.
2. Other specific pressure ranges are available upon order.

## 8XH SERIES

High Accuracy Integrated Media Isolated Pressure Sensor

### Ordering Information – 82H Series



**Notes:**

1. Refer to standard pressure ranges & types related to model series in Page 2.
2. Other specific pressure ranges are available upon order.

**NORTH AMERICA**

Tel +1 800 522 6752

**EUROPE**

Tel +31 73 624 6999

**ASIA**

Tel +86 0400 820 6015

**te.com/sensors**

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