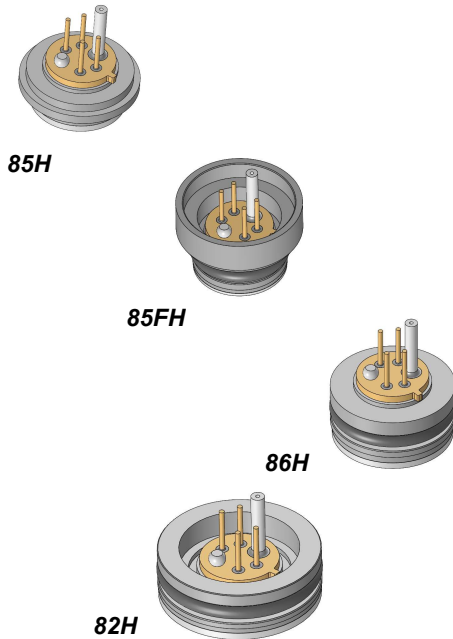




H SERIES PRESSURE SENSOR

High Accuracy Integrated 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 I²C and Analog Output**
- **13mm, 16mm and 19mm Module Diameter**

The H 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 H Series can provide pressure and temperature dual output in digital output mode.

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

The H Series pressure sensor provides both amplified analogy output and digital output signals through the I²C protocol.

Features

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

Applications

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

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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

Supply Voltage: 2.7 VDC to 5.5 VDC

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
Pressure Resolution	5X10 ⁻⁵			%Span	
Temperature Accuracy	-1		1	°C	3
Temperature Resolution			1X10 ⁻⁴	°C	
Long Term Stability (Offset & Span)		±0.1		%Span/Year	

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Supply Voltage	2.7	5.0	5.5	VDC	
Supply Current		3		mA	
Insulation Resistance (500 VDC)	100			MΩ	4
Dielectric Strength (500VAC)			1	mA	
ESD	±4KV (HBM: C = 100 pF / R = 1.5 kΩ)				
Compensated Temperature	-20		85	°C	5
Operating Temperature	-40		125	°C	6
Storage Temperature	-40		125		
Over Pressure			3X	Rated	7
Burst Pressure			4X	Rated	8
Vibration Resistance	20g, 5 Hz to 2000 Hz				
Mechanical Shock Resistance	Half sine, 50g for 11ms				
Media Compatibility	Liquids and gases compatible with 316L Stainless Steel				

Notes

1. Combined linearity, pressure hysteresis and repeatability.
2. Includes calibration errors and temperature effects over the compensated range.
3. Measured over the compensated temperature range, can only be read out by the digital output product.
4. Between case and sensing element.
5. Compensated temperature range is 0°C to 50°C for 5psi.
6. Maximum temperature range for 85FH series product is -20°C to 125°C, Maximum temperature range for all series product with connector is -20°C to 85°C.
7. 3x or 2000psi, whichever is less.
8. 4x or 3000psi, 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

Output	Digital output (2.7V to 3.6V)	Analog output (4.75V to 5.25V)
	I ² C (Addr. 0x74, other address requirement contacts factory)	DC 0.5 to 4.5V radiometric 10% to 90% of the supply voltage
Load	-	R _L ≥ 5 kΩ
Pull-up resistor	R _{Pull-up} 1 to 10 kΩ	-
Bit rate	24bit	-

I²C INTERFACE

The transaction on the bus is started through a start condition (START) signal. START condition is defined as a HIGH to LOW transition on the data line while the SCL line is held HIGH. After START has been transmitted by the host, the bus is considered busy. The next byte of data transmitted after START contains the client address in the first 7 bits, and the eighth bit tells whether the host is receiving data from the client or transmitting data to the client. When an address is sent, each device in the system compares the first 7 bits after a start condition with its address. If they match, the device considers itself addressed by the host. The ninth clock pulse, following the client address byte (and each subsequent byte) is the acknowledge (ACK). The transmitter must release the SDA line during the ACK period. The receiver must then pull the data line low so that it remains stable low during the high period of the acknowledge clock period. The number of bytes per transfer is unlimited. If the host cannot receive another complete byte of data until it has performed some other function, it can hold the clock line, SCL low to force the transmitter into a wait state. Data transfer only continues when the host is ready for another byte and releases the clock line. A low to high transition on the SDA line while the SCL line is high is defined as a stop condition (STOP). A data transfer is always terminated by a STOP. A host may also issue a repeated START during a data transfer. Device expects repeated STARTs to be used to randomly read from specific registers.

User commands are intended for regular user access, whereas service commands are utilized during fabrication for module calibration purposes. The commands are explained in the next table.

Concerning commands using paging addressing (P1, P0), the address field should only consider the 5 LSB, ie 32 addresses. The 3 MSB of the address field can be ignored.

Table 1: User commands								
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	CRC
Conversion **	0	1	0	0	1	1	1	CRC
Read ADC **	0	1	0	1	T2	T1	P	CRC

** Read ADC with all T2, T1 and P = 0 are invalid commands and will not be accepted by the controller.

Reset

During a reset the NVM data is transferred to the RAM. Using a reset command during an ongoing NVM erase or write operation is not allowed!

Bit 8 of the command is sensitive and not fully covered by the CRC check. If bit 8 is corrupted, the following cases can appear:

1. 1 becoming 0 => reset will be executed immediately. The master will get wrong CRC and therefore knows that something went wrong. The chip configuration will be overridden by the content of NVM.
2. 0 becoming 1 => the reset will not be executed since clocks should be given by the master to check CRC. Neither the slave nor the master will know that the reset was not executed. The only way to monitor the internal busy state is to raise CSB up and down again.

To allow the slave to compute the CRC right before the 8th rising edge, the data from the master must be well setup and guaranteed.

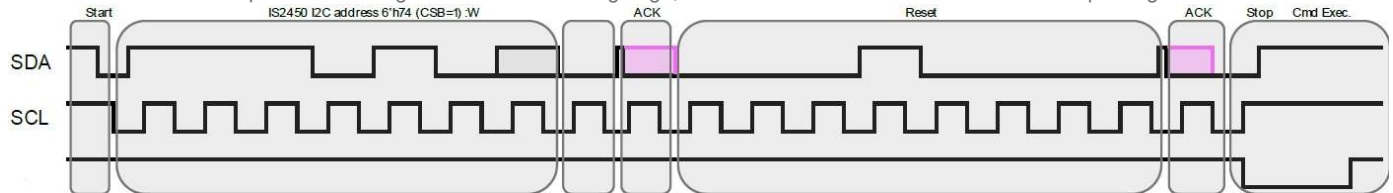


Figure 1: I2C Reset Command

Conversion

An ADC conversion is started using a conversion command. The conversions time is depending on the conversion type bits P_off, T1_off or T2_off set within the config register and OSR.

The result of the conversion is transferred to the data register after the conversion. This command is not accepted during an ongoing conversion.

When P_off, T1_off, or T2_off are set to "1" in the memory, the corresponding conversion will not start.

It is not allowed to invoke the conversion command with all P_off, T1_off, or T2_off set to "1" as it is an illegal operation and should be avoided.

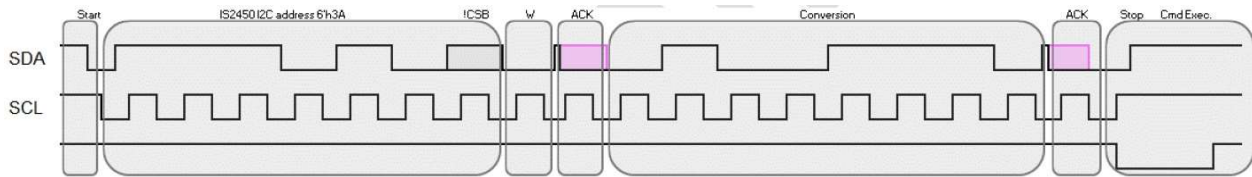


Figure 2: I2C conversion command

Read ADC

The ADC read command retrieves the result of a conversion command, and its behavior is influenced by several configuration bits:

1. The settings of the T2, T1, and P flags within the command itself.
2. The data read length can be configured in the operating register using t2_resol, t1_resol, and p_resol.

After power up and in FIFO "off" mode, attempting to read the ADC without any prior conversion will yield all zeros. However, after a conversion is completed, the last conversion result will be read.

When FIFO is empty, reading will yield all zeros regardless of whether FIFO update mode or FIFO full mode is activated.

The reading can be stopped in I2C by NAK.

If a conversion of temperature (T1) and pressure (P) is requested by a conversion command (t2_off=1, t1_off=0 and p_off=0), the temperature conversion will be executed first, followed by the pressure conversion. As soon as both conversions are done, the computation engine is triggered (if t1_raw=0 and p_raw=0). Both compensated data are then available and can be read out by a read ADC command.

Reading data while the commanded conversion session is still ongoing will return previous values for all requested data. This precaution is taken to prevent the possibility of returning corrupt data resulting from concurrent write and read operations. The host should only read data after the conversion process has fully completed.

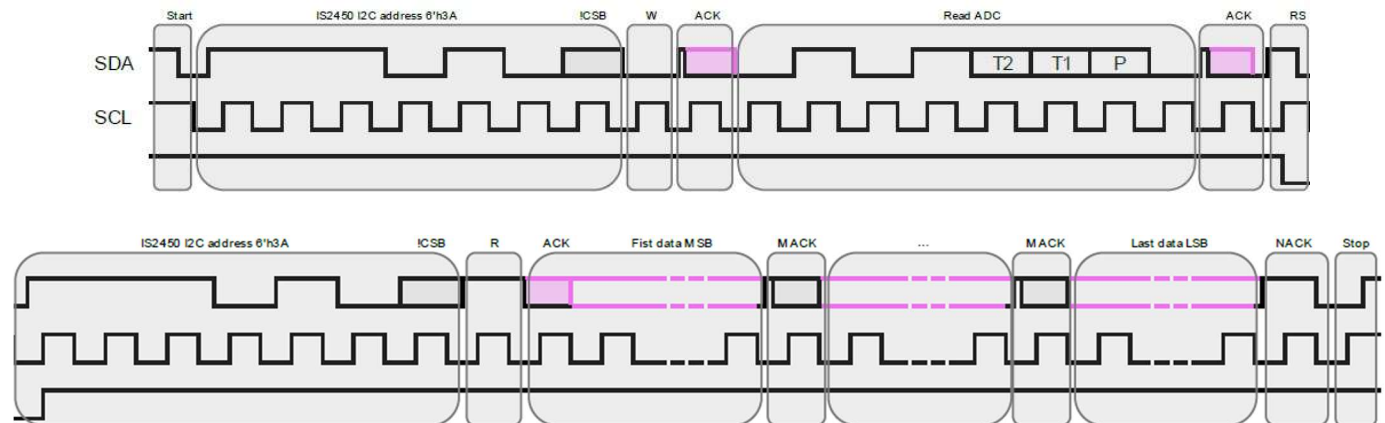


Figure 3: I2C read ADC

Data channel signal	Data class	8-bit Value Address	16-bit Value Address	24-bit Value Address	Number of values
Error code	Signaling	249 .. 255	65529 .. 65535	16777209 .. 16777215	7
High clamp	Pressure / temperature data	248	65528	16777208	1
Pressure temperature valid range		2 .. 247	2 .. 65527	2 .. 16777207	$2^{nb_bit} - 10$
Low clamp		1	1	1	1
Initialisation	Signaling	0	0	0	1

Table 2: Read ADC formatting for compensated data

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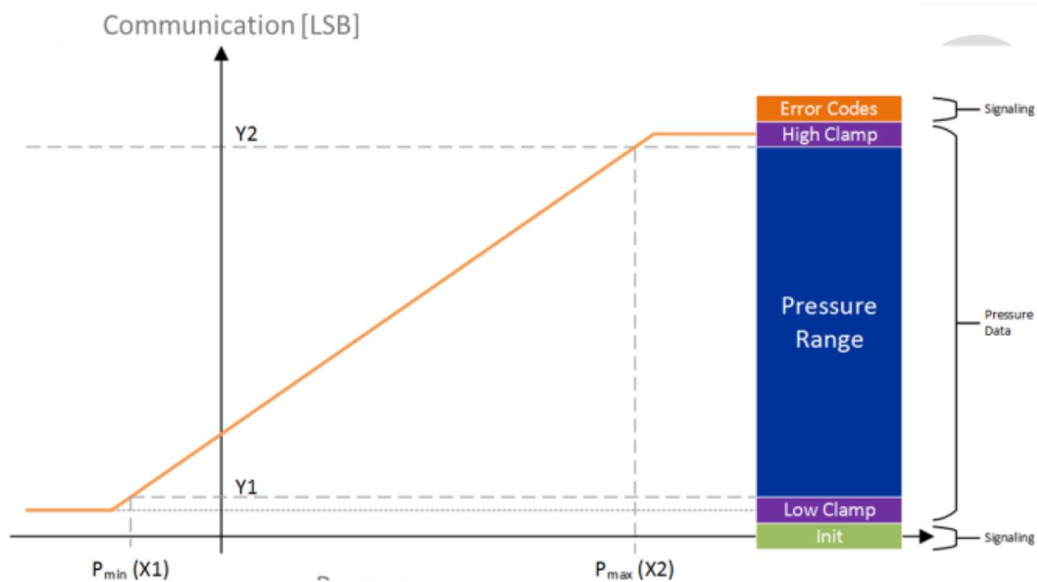


Figure 4: Output format for read ADC

Including the following error codes:

Error Description	8-bit Value	16-bit Value	24-bit Value
Init	0	0	0
Sensor diagnostic error	d249 / 0xF9	d65529 / 0xFFFF9	d16777209 / 0xFFFFF9
Sensor ADC saturation	0xFA	0xFFFA	0xFFFFFA
Register CRC	0xFB	0xFFFB	0xFFFFFB
Sensor computation error	0xFC	0xFFFC	0xFFFFFC
DAC error	0xFD	0xFFFD	0xFFFFFD

Table 3: Read ADC error coding

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 pressure range

P_{min} : The minimum pressure of pressure range

P_{value} : The digital value of pressure

T_{value} : The digital value of temperature

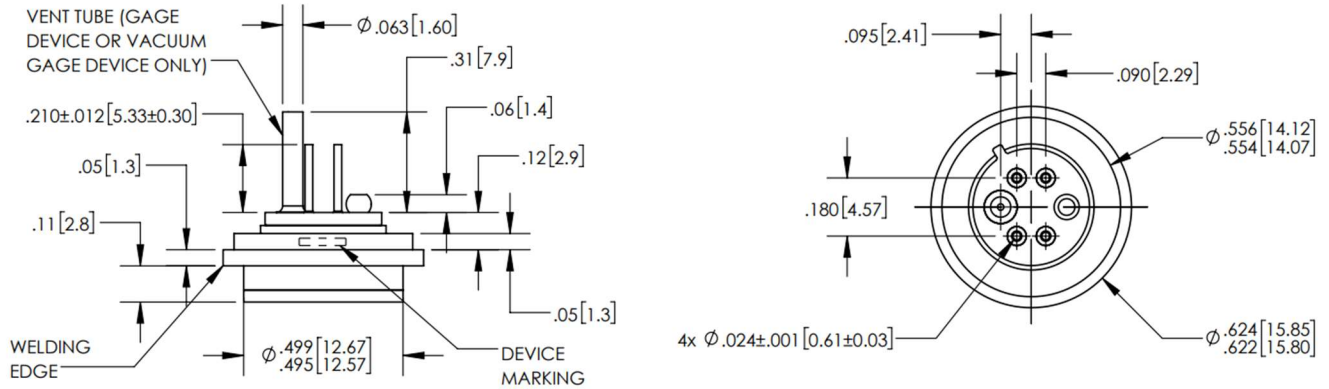
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Dimensions (Unit: inch[mm])

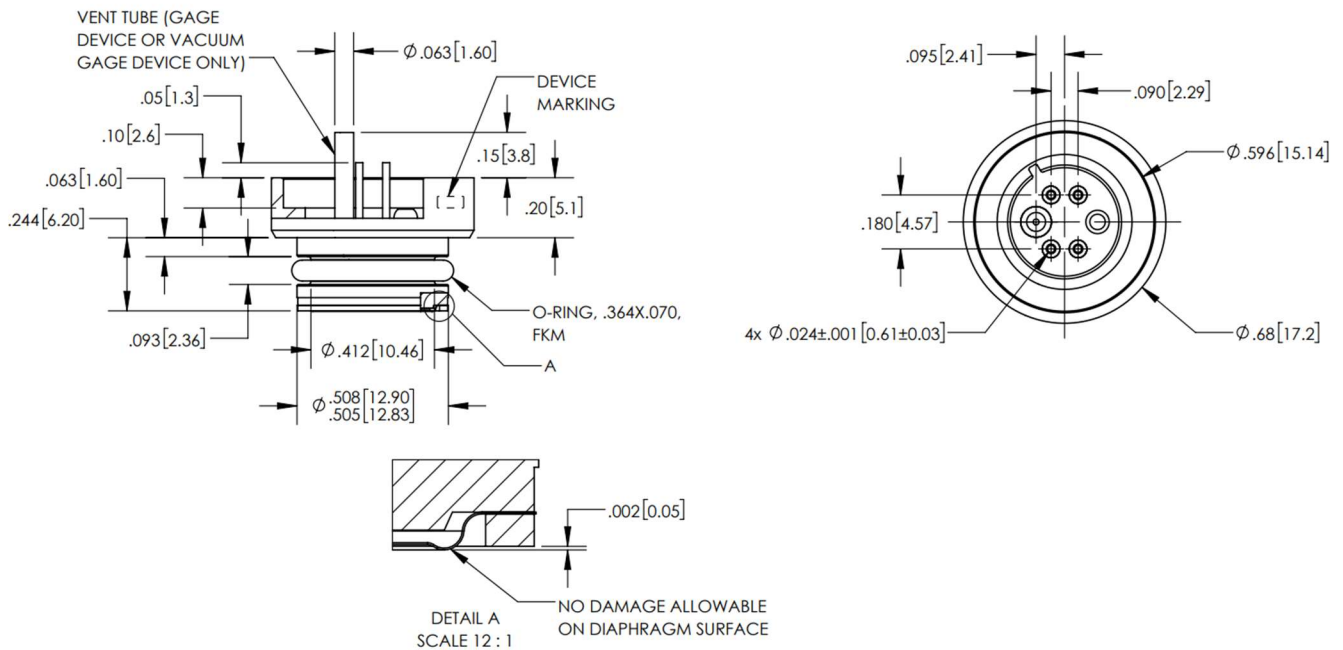
85H Series with Pins

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



85FH Series with Pins

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

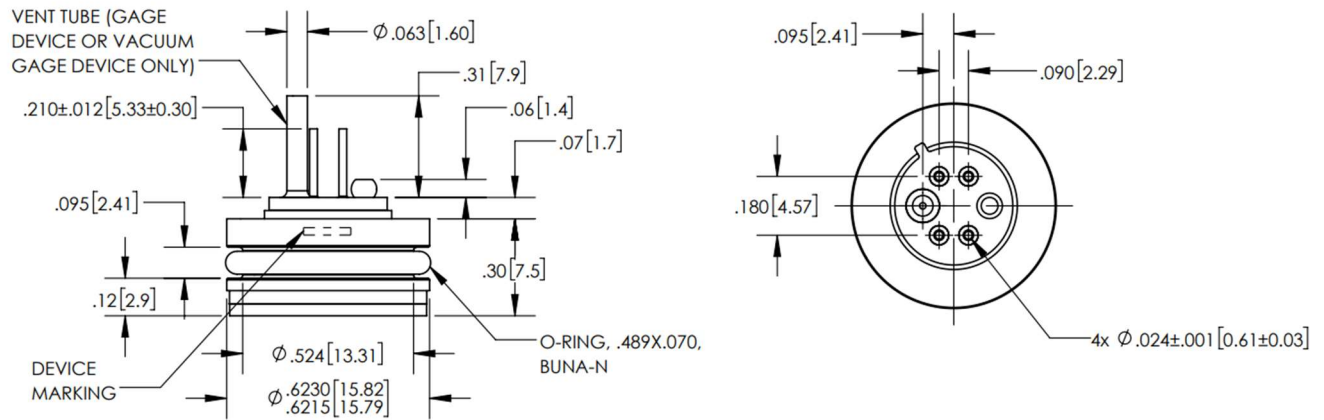


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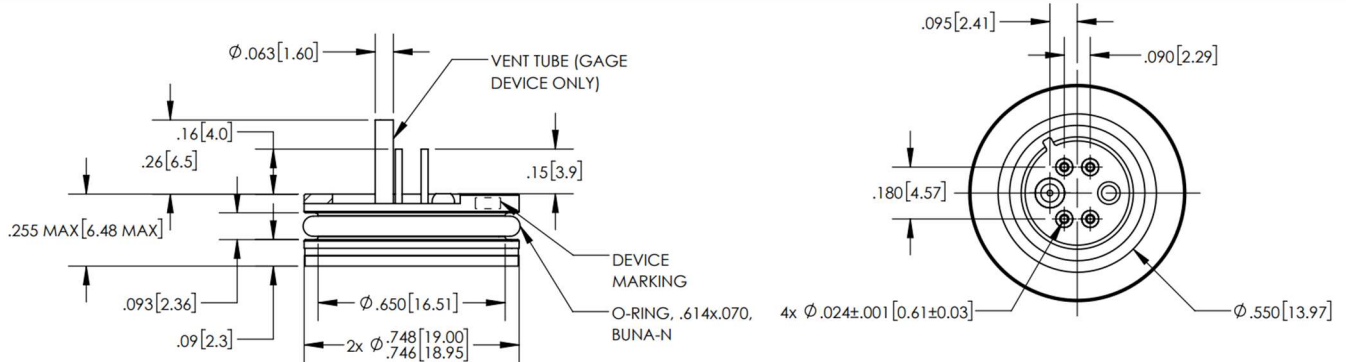
86H Series with Pins

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



H SERIES

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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			
Notes: Other process connections are available upon order			

Electrical Connections

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

86H Series			
82H Series			
Notes: 1. Wire ends of standard Ribbon cables are tin-plated 2. Ribbon cable size: 26AWG 3. Other cable lengths and sizes can be available upon order			

Connection Diagram

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

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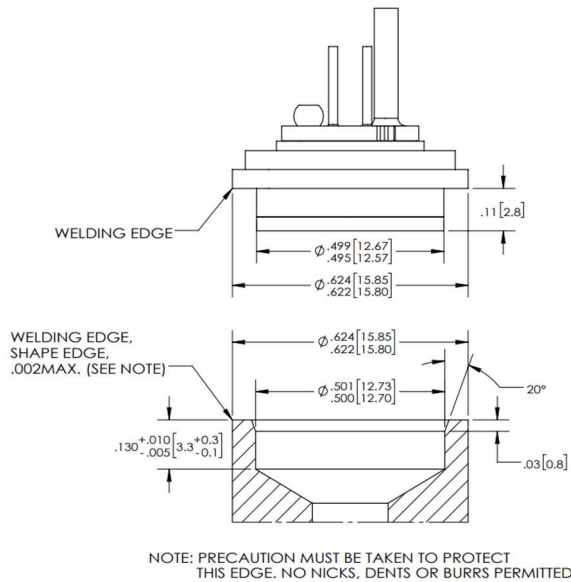
Installation Notes

- Do not exert any tension on the diaphragm during installation.
- Avoid mechanical damage to the diaphragm.
- Wet O-rings with a suitable lubricant before use.

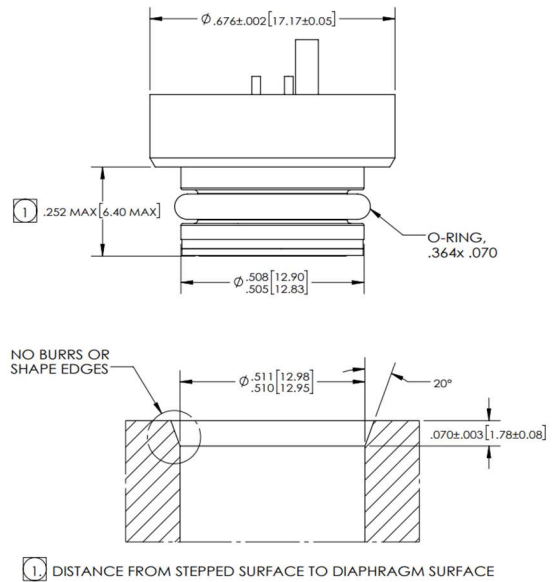
Assembly examples

(Dimensions Unit: inch[mm])

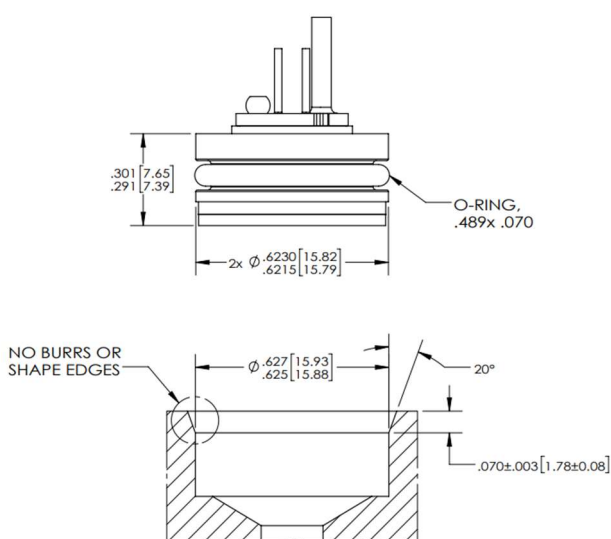
85H Series, weldable (TIG welding or Laser welding)



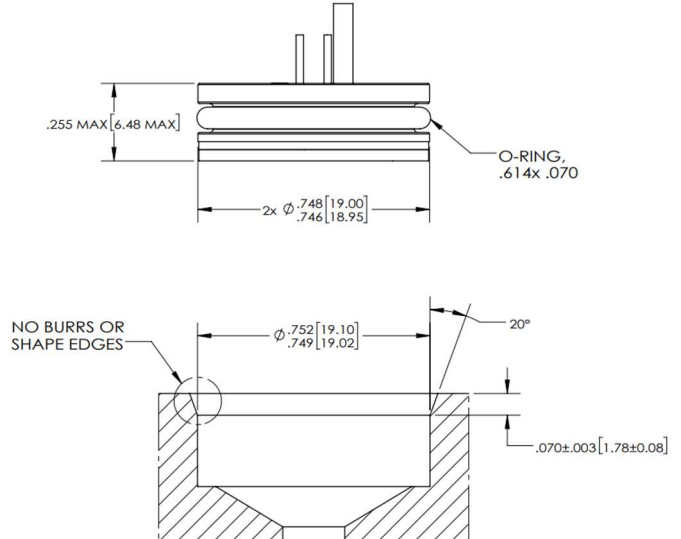
85FH Series, O-ring mount



86H Series, O-ring mount



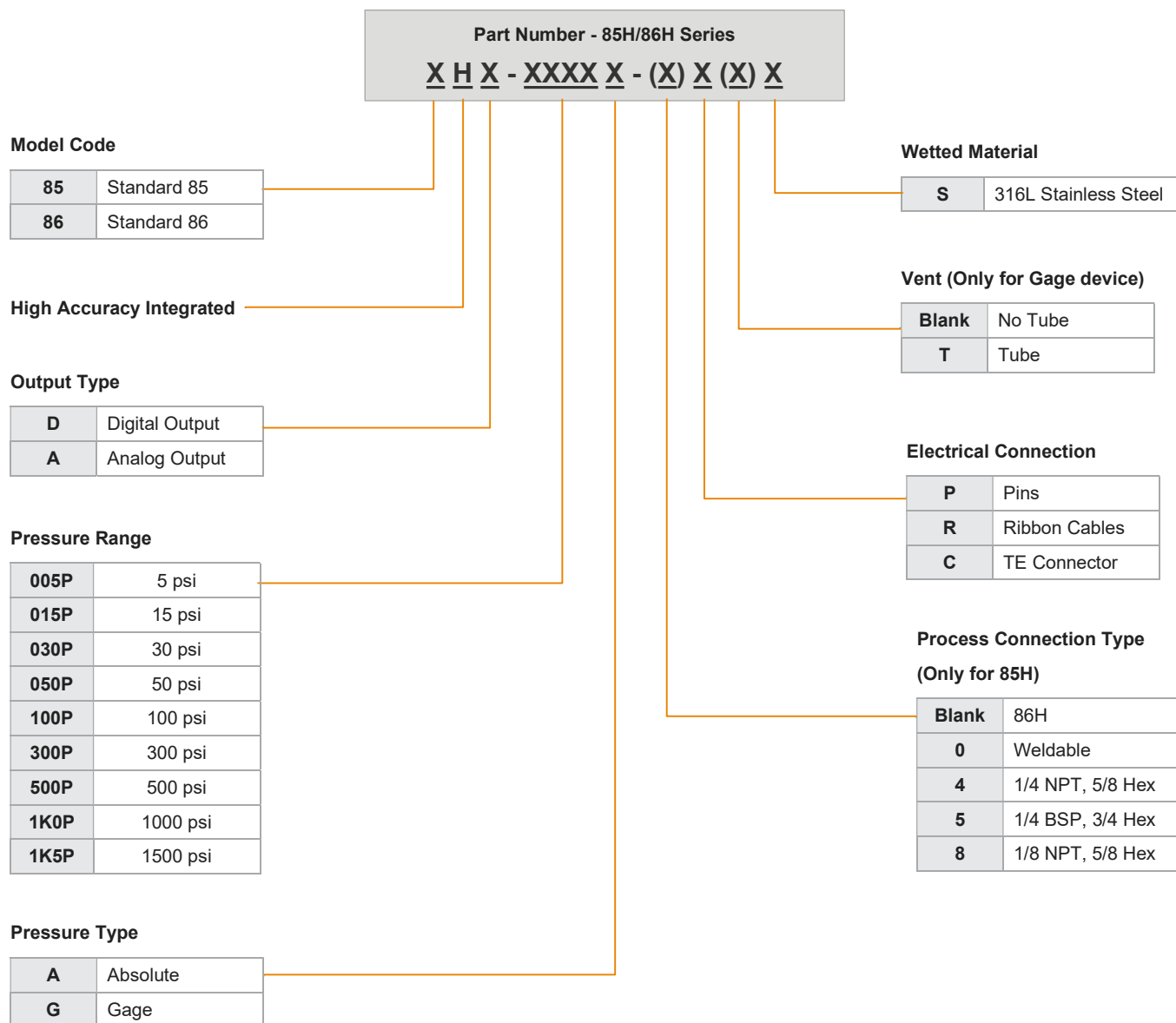
82H Series, O-ring mount



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Ordering Information – 85H/86H Series



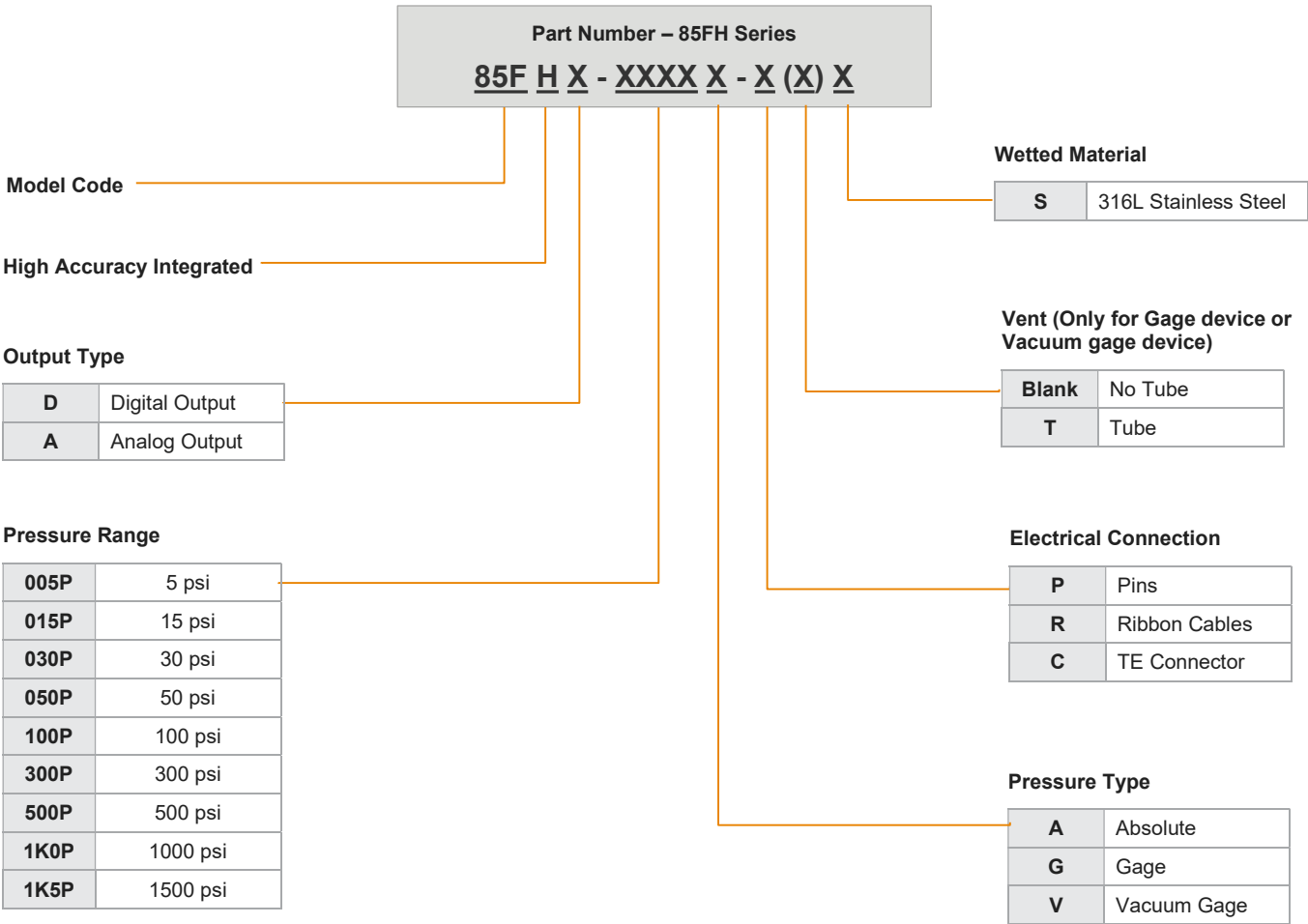
Notes:

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

H SERIES

High Accuracy Integrated Pressure Sensor

Ordering Information – 85FH Series



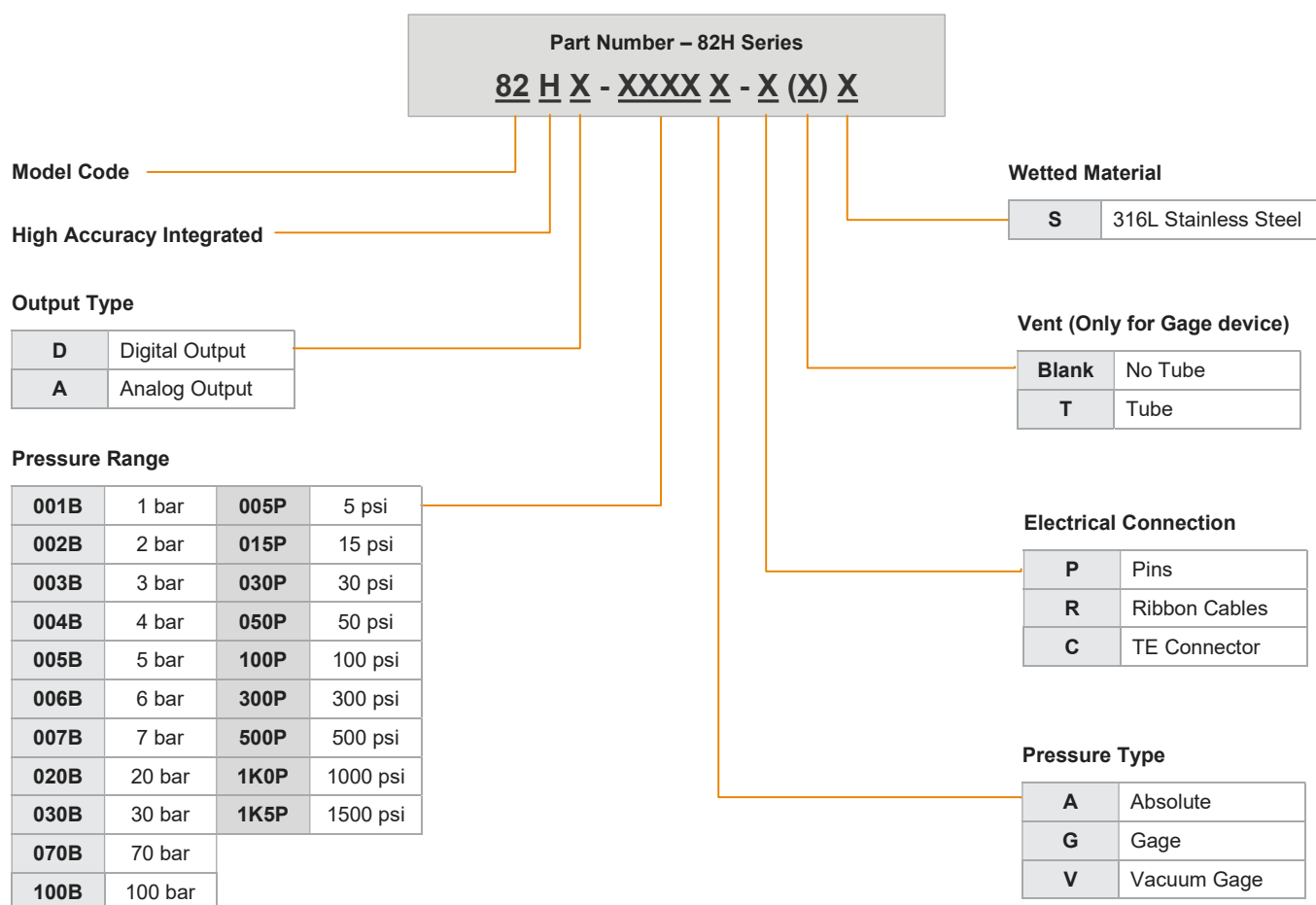
Notes:

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

H SERIES

High Accuracy Integrated 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.

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