



Model 105C23

Subminiature ICP® pressure sensor, 1 mV/psi, 0.099" dia. diaphragm, 5/16-24 clamp nut

Installation and Operating Manual

**For assistance with the operation of this product,
contact the PCB Piezotronics, Inc.**

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OPERATION MANUAL FOR MINIATURE ICP® PRESSURE SENSOR 105A AND 105C SERIES

1.0 INTRODUCTION

This model series is designed to satisfy the need for measurement of dynamic pressures where space is limited, such as in model testing.

The series consists of three basic mechanical configurations or styles, each featuring a .099" diameter diaphragm and each with a built-in impedance-converting amplifier for simple, convenient, two-wire, low-impedance operation.

2.0 DESCRIPTION

The Series 105A sensors utilize two quartz discs in a thickness compression mode to produce a high-impedance level signal which is impressed across the input of a microminiature impedance converter built into the sensor housing.

The signal is superimposed upon a +11 volt (nominal) bias level at the amplifier output and is normally decoupled from the bias voltage in the power unit.

This signal can be fed directly into most common readout instruments such as oscilloscopes, digital voltmeters, AC meters, peak meters, recorders, etc. The output impedance is less than 100 ohms.

Consult guide G-0001B "General Guide to ICP® Instrumentation" for a more complete treatment of the ICP® (Integrated Circuit Piezoelectric) principle.

3.0 INSTALLATION

Because of the miniature size of these units, extra care should be exercised in preparation of mounting ports and in installation of sensors into the ports.

Individual dimensional, performance and installation drawings are included in the manual for each particular model. Adhere carefully to instructions on these drawings.

It is not necessary to use low-noise treated coaxial cable as with high-impedance type sensors. PCB Model 002A Cable is recommended.

3.1 MODEL 105A

This is the smallest of the three styles and it is supplied in only the 100 psi range.

The Model 105A is normally mounted using Model 060A04 Clamp Nut (supplied); however, if lack of space precludes the use of the clamp nut, the sensor may be epoxied in place if necessary.

Do not over torque clamp nut, as to do so may distort the body of the sensor and affect the sensitivity of the device.

The electrical connection to this model is made by soldering the positive (center conductor) lead from the power unit to the .040 diameter solder terminal provided.

(IMPORTANT! See Section 8.0, page 4)

NOTE: Do not overheat this terminal. Use a small iron with only enough heat to obtain good solder joint.

The electrical ground return is made to the sensor body. This connection can be made by attaching electrically to the structure or by using the metal ribbon spotwelded to the sensor body.

3.2 MODELS 105C02, C12 & C22

This style utilizes a 10-32 external thread to facilitate mounting. It is supplied in three full-scale ranges: 100, 1000 and 5000 psi.

Prepare mounting port in accordance with installation drawing provided in manual. Do not over torque. Use only enough torque to obtain a seal.

The electrical connection is made via a 5-44 coaxial connector. Use coaxial 002G10 cable, 5-44 to 10-32 microdot.

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3.3 MODELS 105C03, C13, 23, C33, C43

This style is the largest and is supplied in five models with full-scale ranges to 100, 1000, 5000, 10,000 and 30,000 psi.

The electrical connection to this style sensor is made via a 10-32 coaxial connector.

3.4 FLASH TEMPERATURE PROTECTION

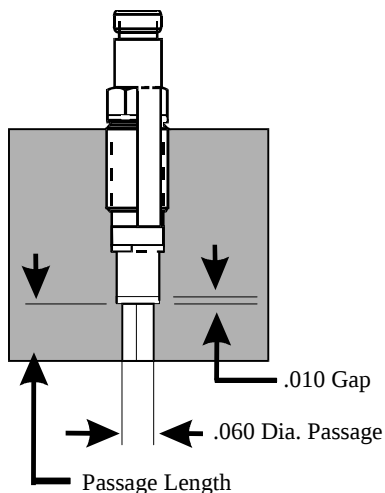
It is good practice to protect the diaphragm against flash thermal effects, especially when flush-mounted, to minimize spurious outputs generated by high heat influx due to blasts, high compression heating, etc.

One or more layers of black vinyl electrical tape on the diaphragm can be useful for this purpose in many cases. RTV-type silicone rubber has also proven effective.

Experimentation is the best method for determination of effectiveness of protective material for each sensor application.

3.5 RECESSED INSTALLATION

If ultra-high frequency response is not needed, it is good practice to use a recessed diaphragm installation.



Typical Recessed Installation

Because of its one-piece machined diaphragm construction, the 105A series is sensitive over its entire frontal area. Use extreme care when preparing recessed installation port to ensure that no particles, burrs or other residue are entrapped in the .010" gap ahead of the diaphragm. Force on the diaphragm due to such entrapped particles may change the calibration of the sensor.

Recessed mounting protects the sensor diaphragm from the effects of high-flash temperatures and particle impingement due to blast effects, thereby prolonging sensor life.

The limitation is that this type of installation lies in the high-frequency limiting effects of the passage, due to its length.

The passage behaves like an underdamped second order system, the resonant frequency being determined by the passage length. This can have a limiting effect on pressure pulse rise time while causing passage ringing in cases where the passage is too long with respect to pulse rise time. (See chart below.)

The following relationship determines this resonant frequency (f_r):

$$f_r = \frac{V}{4L} \quad (\text{Hz}) \quad (\text{Eq. 1})$$

Where: f_r = Resonant frequency of passage (Hz)

V = Velocity of sound in air (ft/sec)

L = Length of column (ft)

For air at room temperature, (Eq. 1) becomes:

$$f_r = \frac{3300}{L}$$

Where L = Passage length (in.)

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The natural frequency and approximate fastest pressure step rise time for various length passages is shown in the following chart. (Medium, air at 25°C).

PASSAGE LENGTH (in.)	PASSAGE RESONANCE (kHz)	APPROX. FASTEST PULSE RISE TIME (u Sec)
.050	66	5
.100	33	10
.200	16.5	20
.50	6.6	50
1.0	3.3	100

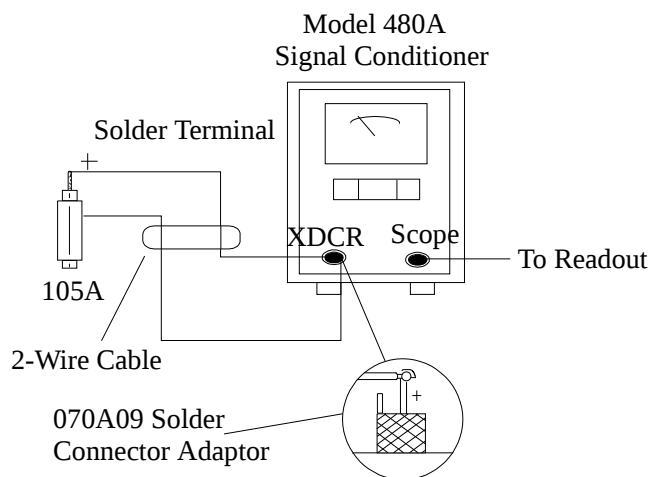
Passage Resonance vs. Passage Length

Actual resonant frequencies measured in practice may differ slightly from the chart values due to variations in the velocity of propagation of sound caused by changes in temperature and pressure of the medium in the passage.

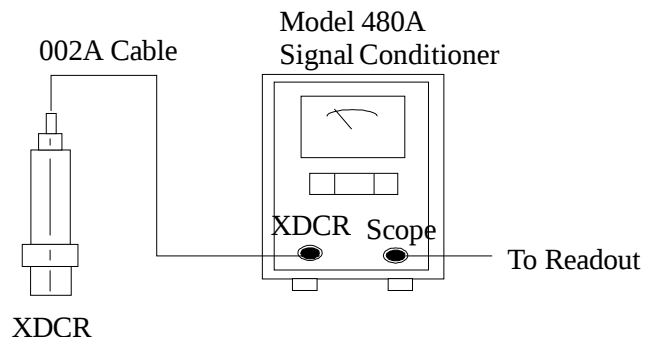
For best matching of passage to diaphragm, maintain the .010" clearance ahead of the diaphragm as shown in Typical Recessed Installation figure.

4.0 OPERATION

Connect sensor to signal conditioner as shown below, depending upon sensor style being used.



Typical Circuit Connection (For 105A)



Typical Circuit Connection (For 105C02,C03, C12, C13, C22, C23, C33, C43)

NOTE: All PCB signal conditioners for ICP® sensor contain current-limiting circuitry to set the input current in the range of 2 to 20 mA.

Do not connect a power supply to these units without current limiting. To do so will destroy the built-in IC amplifier.

All PCB signal conditioners feature fault-monitoring voltmeters on the front panel. During normal operation, the meter will indicate about mid-scale (+11 volts). If one of the connections to the sensor is open, the meter will read full scale (yellow area). Should a short occur on the sensor line, the meter will read 0 volts (red area).

5.0 CALIBRATION

Because of the relatively short discharge time constant of this series, static calibration means cannot be used. Fast dynamic means such as step function or pulse generators must be used instead.

Contact the factory for help in solving specific calibration problems.

6.0 MAINTENANCE

The small size and sealed construction of these sensors precludes field maintenance and repair. Should a problem develop, contact the factory for assistance.

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7.0 CAUTIONS

1. Do not apply voltage to the electrical terminals without current-limiting protection.
2. Do not apply more than 30 VDC to the sensor.
3. Do not put more than 20 mA current into the input terminals.
4. Do not overtorque sensors when installing.
5. Do not apply too much heat to the solder pin of style 1.

8.0 TERMINAL LEAD AND GROUND

To eliminate any possibility of overheating the solder terminal and destroying the microamplifier in the sensor, a 2.0 inch long insulated wire has been provided on the solder terminal for soldering a connector lead from the power unit. The ground return is provided by a metal ribbon (.003 x .020) welded to the Model 060A04 clamp nut.

Model Number 105C23		ICP® PRESSURE SENSOR		Revision: C ECN #: 55250		
Performance		ENGLISH	SI	OPTIONAL VERSIONS		
Measurement Range(for ±5V output)		5,000 psi	35,000 kPa	Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used. M - Metric Mount Supplied Accessory: Model 060A05 Clamp nut M7 x 0.75-6g thd (1) replaces Model 060A03 W - Water Resistant Cable		
Sensitivity(± 15 %)		1.0 mV/psi	0.145 mV/kPa			
Maximum Pressure		7,500 psi	51,700 kPa			
Resolution		0.1 psi	0.69 kPa			[1]
Resonant Frequency		≥ 250 kHz	≥ 250 kHz			
Rise Time(Reflected)		≤ 2.0 μ sec	≤ 2.0 μ sec			
Low Frequency Response(- 5 %)		0.5 Hz	0.5 Hz			
Non-Linearity		≤ 2.0 % FS	≤ 2.0 % FS			[2]
Environmental						
Acceleration Sensitivity		0.04 psi/g	0.028 kPa/(m/s ²)			[1]
Temperature Range(Operating)		-100 to +250 °F	-73 to +121 °C			
Temperature Coefficient of Sensitivity		≤ 0.03 %/°F	≤ 0.054 %/°C			
Maximum Flash Temperature		3,000 °F	1,650 °C			
Maximum Vibration		1,000 g pk	9,800 m/s ² pk			
Maximum Shock		5,000 g pk	49,000 m/s ² pk			
Electrical						
Output Polarity(Positive Pressure)		Positive	Positive			
Discharge Time Constant(at room temp)		≥ 1.0 sec	≥ 1.0 sec			
Excitation Voltage		22 to 30 VDC	22 to 30 VDC			
Constant Current Excitation		2 to 20 mA	2 to 20 mA			
Output Impedance		< 100 Ohm	< 100 Ohm			
Output Bias Voltage		8 to 14 VDC	8 to 14 VDC			
Physical						
Sensing Geometry		Compression	Compression			
Sensing Element		Quartz	Quartz			
Housing Material		Stainless Steel	Stainless Steel			
Diaphragm		17-4 Stainless Steel	17-4 Stainless Steel			
Sealing		Welded Hermetic	Welded Hermetic			
Electrical Connector		10-32 Coaxial Jack	10-32 Coaxial Jack			
Weight		0.01 oz	3.0 gm			

NOTES:

[1]Typical.

[2]Zero-based, least-squares, straight line method.

[3]See PCB Declaration of Conformance PS023 for details.

SUPPLIED ACCESSORIES:

Model 060A03 Clamp nut, 5/16-24-2A thd, 1/4" hex, stainless steel (1)

Model 065A21 Seal ring 0.154" OD x 0.100" ID x 0.022" thk brass (3)

Model PCS-1 Calibration of dynamic pressure sensors at 100% full scale, max 15 kpsi range.

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