



Model 115A04
Charge Output Pressure Sensor
Installation and Operating Manual

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

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com



Repair and Maintenance

PCB guarantees Total Customer Satisfaction through its “Lifetime Warranty Plus” on all Platinum Stock Products sold by PCB and through its limited warranties on all other PCB Stock, Standard and Special products. Due to the sophisticated nature of our sensors and associated instrumentation, **field servicing and repair is not recommended and, if attempted, will void the factory warranty.**

Beyond routine calibration and battery replacements where applicable, our products require no user maintenance. Clean electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the material of construction. Observe caution when using liquids near devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth—never saturated or submerged.

In the event that equipment becomes damaged or ceases to operate, our Application Engineers are here to support your troubleshooting efforts 24 hours a day, 7 days a week. Call or email with model and serial number as well as a brief description of the problem.

Calibration

Routine calibration of sensors and associated instrumentation is necessary to maintain measurement accuracy. We recommend calibrating on an annual basis, after exposure to any extreme environmental influence, or prior to any critical test.

PCB Piezotronics is an ISO-9001 certified company whose calibration services are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to our standard calibration services, we also offer specialized tests, including: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For more information, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment

If factory repair is required, our representatives will provide you with a Return Material Authorization (RMA) number, which we use to reference any information you have already provided and expedite the repair process. This number should be clearly marked on the outside of all returned package(s) and on any packing list(s) accompanying the shipment.

Contact Information

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine: (716) 684-0001
General inquiries: info@pcb.com
Repair inquiries: rma@pcb.com

For a complete list of distributors, global offices and sales representatives, visit our website, www.pcb.com.

Safety Considerations

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the precautions required to avoid injury. While our equipment is designed with user safety in mind, the protection provided by the equipment may be impaired if equipment is used in a manner not specified by this manual.

Discontinue use and contact our 24-Hour Sensorline if:

- Assistance is needed to safely operate equipment
- Damage is visible or suspected
- Equipment fails or malfunctions

For complete equipment ratings, refer to the enclosed specification sheet for your product.

Definition of Terms and Symbols

The following symbols may be used in this manual:



DANGER

Indicates an immediate hazardous situation, which, if not avoided, may result in death or serious injury.

**CAUTION**

Refers to hazards that could damage the instrument.

**NOTE**

Indicates tips, recommendations and important information. The notes simplify processes and contain additional information on particular operating steps.

The following symbols may be found on the equipment described in this manual:



This symbol on the unit indicates that high voltage may be present. Use standard safety precautions to avoid personal contact with this voltage.



This symbol on the unit indicates that the user should refer to the operating instructions located in the manual.



This symbol indicates safety, earth ground.



PCB工业监视和测量设备 - 中国RoHS2公布表

PCB Industrial Monitoring and Measuring Equipment - China RoHS 2 Disclosure Table

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
住房	0	0	0	0	0	0
PCB板	X	0	0	0	0	0
电气连接器	0	0	0	0	0	0
压电晶体	X	0	0	0	0	0
环氧	0	0	0	0	0	0
铁氟龙	0	0	0	0	0	0
电子	0	0	0	0	0	0
厚膜基板	0	0	X	0	0	0
电线	0	0	0	0	0	0
电缆	X	0	0	0	0	0
塑料	0	0	0	0	0	0
焊接	X	0	0	0	0	0
铜合金/黄铜	X	0	0	0	0	0
本表格依据 SJ/T 11364 的规定编制。						
0：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。						
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。						
铅是欧洲RoHS指令2011/65/ EU附件三和附件四目前由于允许的豁免。						

CHINA RoHS COMPLIANCE

Component Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chromium VI Compounds (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	O	O	O	O	O	O
PCB Board	X	O	O	O	O	O
Electrical Connectors	O	O	O	O	O	O
Piezoelectric Crystals	X	O	O	O	O	O
Epoxy	O	O	O	O	O	O
Teflon	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Thick Film Substrate	O	O	X	O	O	O
Wires	O	O	O	O	O	O
Cables	X	O	O	O	O	O
Plastic	O	O	O	O	O	O
Solder	X	O	O	O	O	O
Copper Alloy/Brass	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.

Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

OPERATION MANUAL FOR ENGINE COMBUSTION SENSORS

1.0 INTRODUCTION

Piezoelectric sensors excel in measuring repetitive and transient phenomena because of the sensors' extreme rigidity and wide dynamic range. In most applications, the instruments do not significantly alter the process or structure being tested. In addition, they accurately measure within any partial or incremental portion of their full-scale range but they cannot measure static inputs or absolute levels over extended time periods because of excessive drift when operating electrostatically.

Piezoelectric combustion sensors use diaphragms to convert internal engine pressure into a proportional force. This force applies a load to the sensor's crystal element, which produces an electrostatic charge that is transferred via electrode to the sensor's connector. The connector and cable connect to a charge amplifier that converts the electrostatic charge from the sensor into a voltage output suitable for data acquisition.

2.0 INSTALLATION

Carefully install the engine combustion sensor according to instructions detailed on the included installation drawing. Take care not to damage the threads or exceed the specified torque setting. The sensor can be installed with a thermal protection baffle (supplied). The sensor may be used with or without baffle. Use of the sensor with the baffle may require more frequent cleaning and inspection to ensure the holes in the baffle do not become clogged. The cleaning instructions mentioned later are also suitable for use on the baffle.

178 series engine combustion sensors are designed to be used in areas where sensor installation may be more difficult due to obstructions from other components, deep bore holes, or components which may be too hot to contact cabling. When preparing mounting this style of sensor, keep unsupported length at connector end of sensor to a minimum. This will ensure the best quality measurements possible. If a water jacket is to be breached, the bore diameter tolerances of where the sensor's o-rings will be sealing are very critical. See installation drawing for specific details regarding bore diameter and tolerance.

An installation tool is available for the 115A04 sensor to aid installation into mounting recesses. The tool slides over the cable and onto the sensor to provide an accessible connection point for a torque wrench or driver.

3.0 OPERATION

Using the supplied cable, connect the combustion sensor to a charge amplifier. Charge amplifiers convert the high-impedance charge signal from the sensor to a low-impedance voltage signal. A low-impedance voltage signal is more desirable for transmitting over long cable lengths and is also more suitable for input to data acquisition systems. When selecting a charge amplifier, it is important to be aware of the charge amplifier's low frequency response. This is determined by the "Discharge Time Constant" (DTC) of the amplifier. Amplifiers with longer DTCs will pass signals of lower frequency. Consult the specification sheet of the charge amplifier for its low frequency response and select the appropriate amplifier for your application.

4.0 CALIBRATION

This combustion sensor is calibrated by static methods according to NIST standards. Calibration is performed at room temperature and 392°F (200°C). For highest accuracy, use the calibration certificate supplied or calibrate the sensor over the range of anticipated use. Periodic calibration is recommended to ensure sensor accuracy and performance. Factory calibration service is available at a nominal charge.

OPERATION MANUAL FOR ENGINE COMBUSTION SENSORS

5.0 SERVICING THE SENSOR

The combustion sensor is a precision instrument; keep it clean at all times to ensure reliable measurements.

The preventive maintenance schedule for cleaning engine combustion sensors depends on the type of use, the length of time the sensor is used, and the type of fuel the engine uses.

When cleaning the sensor, make sure the cable remains connected to the sensor. After the sensor is carefully extracted from the test port, remove the baffle if installed. Then, gently remove contaminants such as fuel residues, soot, and lubricating oil from the surface of the sensor's diaphragm using a cotton swab and a suitable solvent. Use only light pressure and a circular motion to clean the diaphragm. Rinse with a cleansing solvent such as Isopropyl Alcohol or Acetone and allow diaphragm to dry (or blow dry with grease-free compressed air) before re-installing the sensor. The baffle may also need to be cleaned mechanically by using a pin of the appropriate size to unblock any of the holes clogged by combustion products. Take care not to damage the sealing surfaces on the baffle or diaphragm when cleaning.

WARNING!

Never clean the front of the sensor or baffle with metallic items such as wire brushes, abrasives, sandblasting, grinding, scraping, etc., because this could damage the diaphragm and render the sensor unusable.

5.1. ALTERNATE ULTRASONIC CLEANING THE SENSOR

As an alternative to cleaning the sensor as described above, you can clean the sensor in an ultrasonic bath:

1. Make sure the connecting cable is securely attached to the sensor. Never immerse the sensor in the ultrasonic bath without its cable connector.
2. Prepare the bath with an aqueous alkaline (pH 7–9) or cleansing solvent such as Isopropyl Alcohol and set the temperature to no more than 140° F (60° C) maximum.
3. Immerse the sensor into the bath only up to the sensor's shoulder or mounting hex.
4. Set the ultrasonic output power so the power in the bath is no more than 50 W/liter maximum.
5. Set the time as needed to remove the contamination, no more than 2 minutes maximum.

WARNING!

Do not exceed the maximums specified in the procedure. Excess cleaning times and excess ultrasonic output power can damage the sensor.

5.2. MAINTAINING INSULATION RESISTANCE

The sensor requires the insulation resistance (IR) shown on the attached specification. If the signal on the output device (e.g., oscilloscope) drifts or becomes erratic, check for low IR.

Low IR indications are typically caused by a combination of environmental factors such as humidity and contamination of the sensor with oil or dirt. If low IR is present, clean all cables and connectors in use. This includes the sensor, all connectors in the circuit such as cables and switch boxes, and the input connector to the signal conditioner. Never touch the open ends of the cable or the sensor connector with bare hands. This may contaminate the cable or sensor and cause insulation problems.

3425 Walden Avenue, Depew, NY 14043-2495

E-Mail: info@pcb.com

Website: www.pcb.com

24-hour SensorLineSM: 716-684-0001

Fax: 716-684-0987

Toll Free in the USA: 800-828-8840

A PCB GROUP COMPANY

ISO 9001 CERTIFIED

A2LA/ILAC-MRA accredited Cal cert #1862.01

© 2013 PCB Group, Inc. In the interest of constant product improvement, specifications are subject to change without notice. PCB and ICP are registered trademarks of PCB Group, Inc. SensorLine is a service mark of PCB Group, Inc. All other trademarks are properties of the respective owners.

Manual Number: 51633

Manual Revision: A

ECN Number: 42985

	<u>ENGLISH</u>	<u>SI</u>	
Performance			
Sensitivity(± 15 %)	1.40 pC/psi	20.3 pC/bar	
Measurement Range	3.5 kpsi	241.4 bar	
Maximum Pressure	4.35 kpsi	300 bar	
Resonant Frequency	>125 kHz	>125 kHz	
Non-Linearity	≤ 0.3 % FS	≤ 0.3 % FS	
Environmental			
Acceleration Sensitivity	<0.007 psi/g	<0.0005 bar/g	
Temperature Range(Operating)	-4 to +662 °F	-20 to +350 °C	
Temperature Range(Survivable Limit)	-58 to +752 °F	-50 to +400 °C	
Thermal Sensitivity Shift(20 to +250 °C)	2 %	2 %	[1]
Thermal Sensitivity Shift(20 to +350 °C)	5 %	5 %	[1]
Thermal Sensitivity Shift(200 °C ± 50 °C)	1 %	1 %	[1]
Thermodynamic Error(ΔP mi)	<2%	<2%	[2]
Thermodynamic Error(ΔP max)	<1%	<1%	[2]
Thermodynamic Error(ΔP(short term drift))	<7.25 psi	<0.5 bar	[2]
Maximum Shock	2000 g pk	19,600 m/s ² pk	
Electrical			
Capacitance(with cable)	120 pF	120 pF	[1]
Insulation Resistance(at room temp)	>10 ¹³ Ohm	>10 ¹³ Ohm	
Physical			
Sensing Element	UHT-12™	UHT-12™	
Sensing Geometry	Compression	Compression	
Housing Material	17-4 Stainless Steel	17-4 Stainless Steel	
Diaphragm	17-4 Stainless Steel	17-4 Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	M4 x .35 Coaxial	M4 x .35 Coaxial	[3]
Cable Length	3.3 ft	1 m	
Weight(without cable)	.085 oz	2.4 gm	

OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

NOTES:

[1] Typical.
 [2] 9 bar IMEP; 1500 rpm
 [3] Attached 006M40 cable with 070A54 BNC connector adaptor; o-ring sealed.
 [4] See PCB Declaration of Conformance PS158 for details.

SUPPLIED ACCESSORIES:

Model 065A69 Thermal baffle (1)
 Model 066A17 Dummy plug (1)
 Model 100-9169-50 FKM O-Ring (1)
 Model PCS-1AP NIST Traceable Calibration, room temperature and 200°C. (1)

OPTIONAL ACCESSORIES:

Model 040A39 Finishing tool (1)
 Model 040A40 Extaction Tool (1)
 Model 040A41 Mounting Key (1)

Entered: LK	Engineer: RPF	Sales: RWM	Approved: BAM	Spec Number:
Date: 9/24/2018	Date: 9/24/2018	Date: 9/24/2018	Date: 9/24/2018	41918



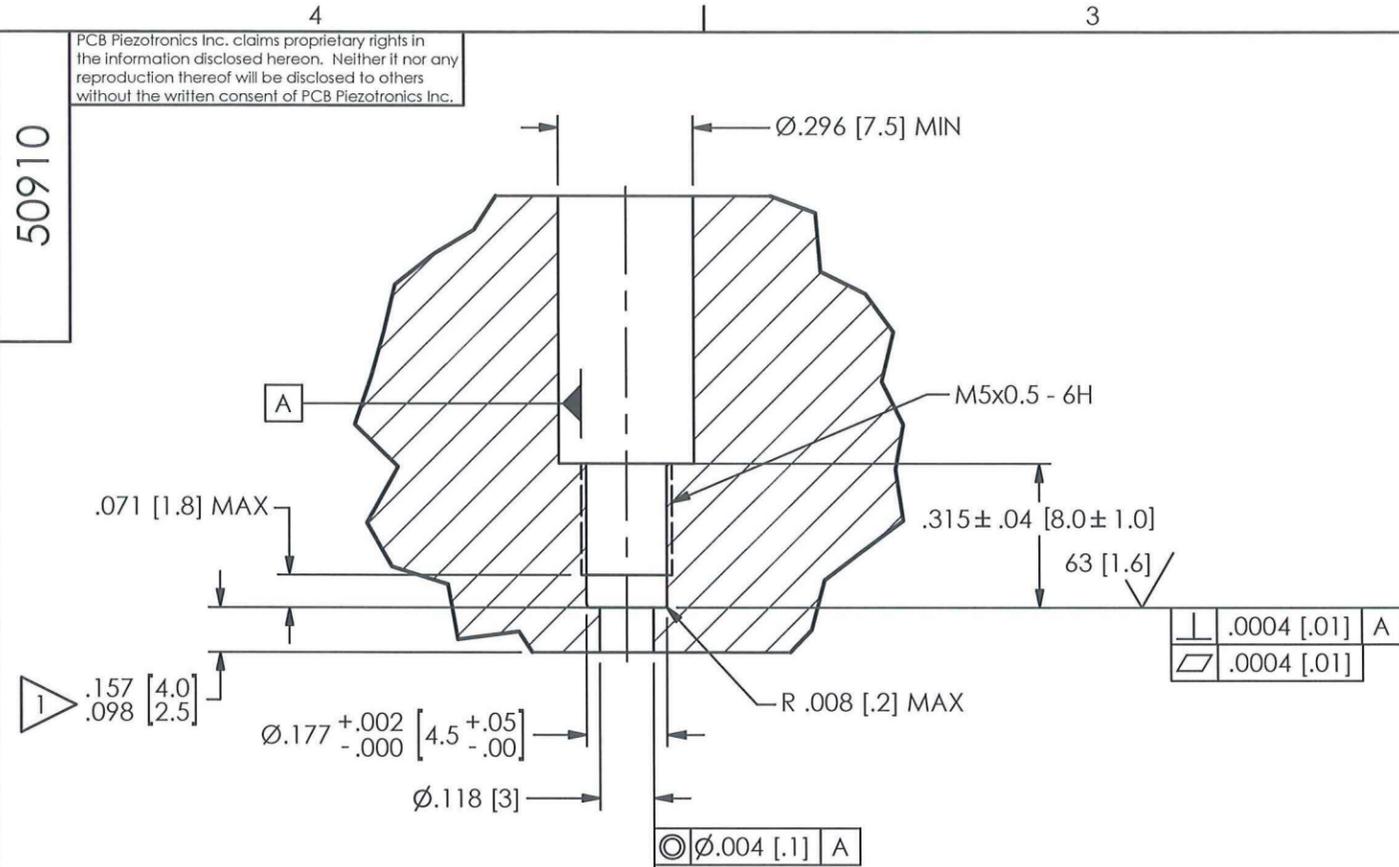
All specifications are at room temperature unless otherwise specified.
 In the interest of constant product improvement, we reserve the right to change specifications without notice.
 ICP® is a registered trademark of PCB Group, Inc.

	Phone: 716-684-0001 Fax: 716-684-0987 E-Mail: info@pcb.com
3425 Walden Avenue, Depew, NY 14043	

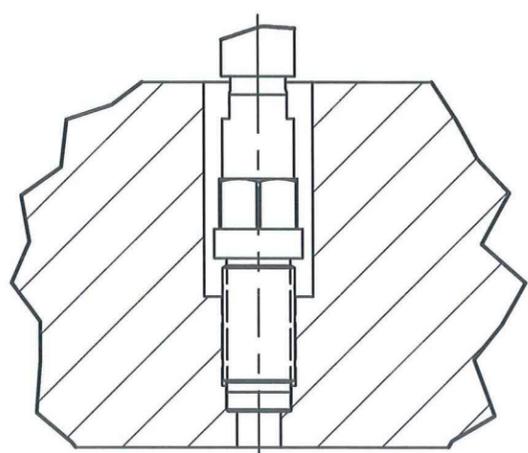
PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without the written consent of PCB Piezotronics Inc.

REVISIONS		
REV	DESCRIPTION	DIN
C	ADDED 070A54	41368

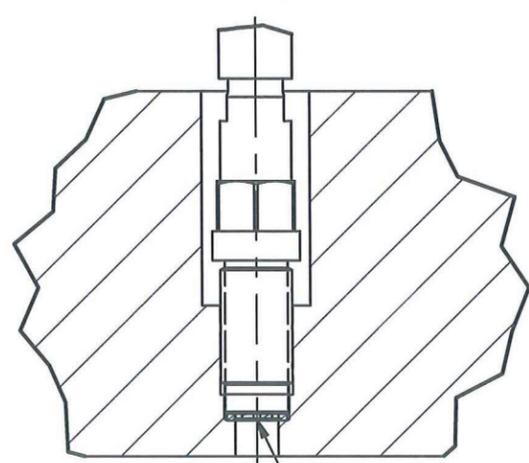
50910



SENSOR MOUNT WITHOUT THERMAL BAFFLE

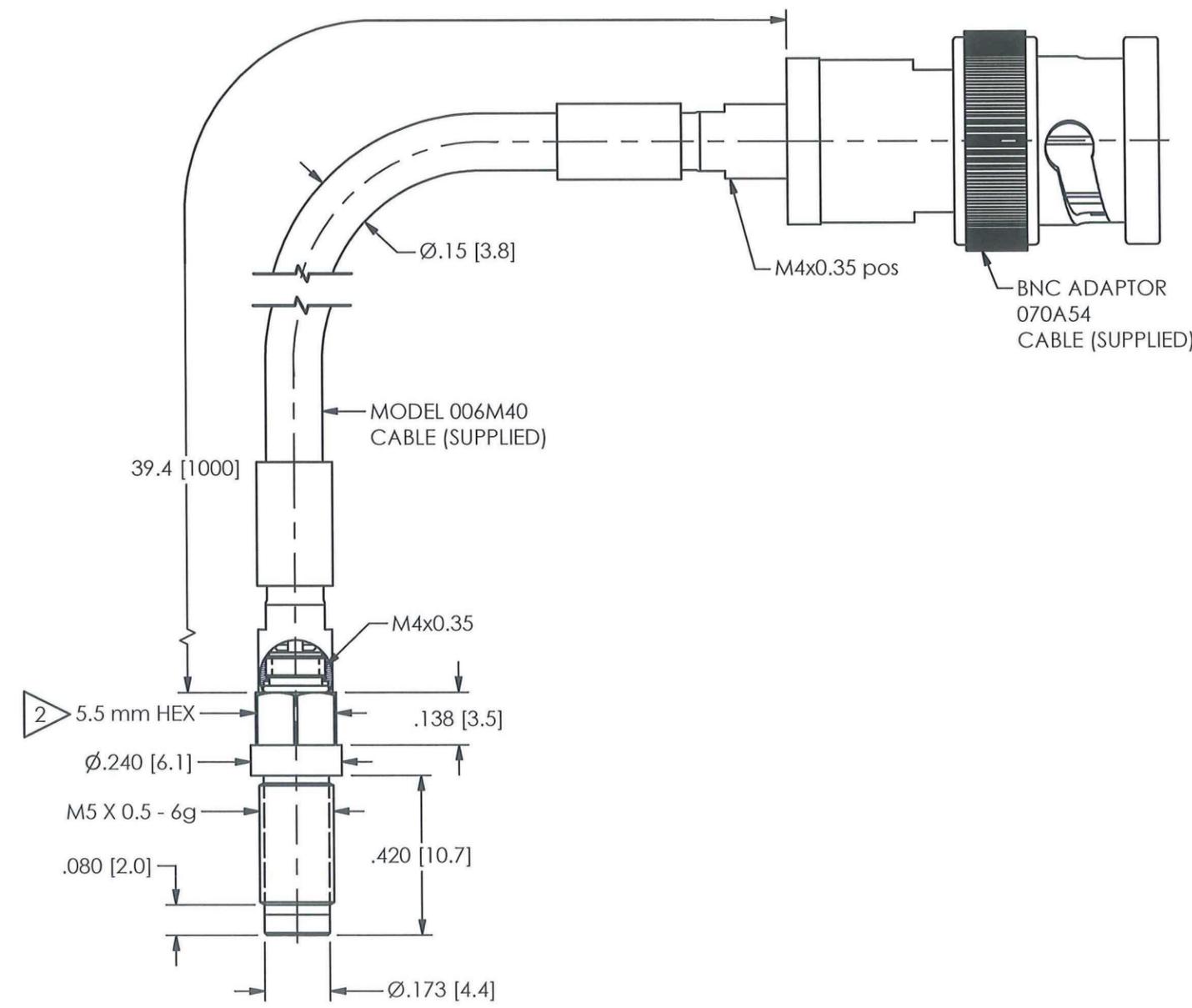


SENSOR MOUNT WITH THERMAL BAFFLE



MODEL 065A69 THERMAL BAFFLE (SUPPLIED)

- 2 MOUNTING TORQUE 13-18 lbf-in [1.5-2.0 N-m]
- 1 .157in [4.0mm] FOR CAST IRON AND ALUMINUM ALLOY
.098in [2.5mm] FOR STEEL



UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN	CHECKED	ENGINEER
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	JDM	5/14/13	RF
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ±.03 XX ±.013	TITLE INSTALLATION DRAWING MODEL 115A04 PRESSURE SENSOR		
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	CODE IDENT. NO. 52681 DWG. NO. 50910 SCALE: 2.5X SHEET 1 OF 1		
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13	PCB PIEZOTRONICS 3425 WALDEN AVE. DEPEW, NY 14043 (716) 684-0001 E-MAIL: sales@pcb.com		