



**Model 422E39**

**In-line charge converter, 1 mV/pC, with 0.1 uF blocking cap, for high-temp sensors**

**Installation and Operating Manual**

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

**Toll-free: 716-684-0001  
24-hour SensorLine: 716-684-0001  
Fax: 716-684-0987  
E-mail: [info@pcb.com](mailto:info@pcb.com)  
Web: [www.pcb.com](http://www.pcb.com)**



***The Model 422E In-Line Charge Converter***

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***Operating Guide with Enclosed Warranty Information***

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***3425 Walden Avenue, Depew, New York 14043-2495***

***Phone 716 684-0001***

***Fax 716 684-0987***

***E-Mail [electronics@pcb.com](mailto:electronics@pcb.com)***

***Toll Free Line 1-800-828-8840***

***24 Hour Sensor Line 716 684-0001***

***MANUAL NUMBER: 18882  
MANUAL REVISION: A  
ECN: 24741***

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### ***introduction***

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The 422E series in-line charge converters are designed to convert the high impedance of a charge mode piezoelectric transducer to a low-impedance voltage by means of an ICP® signal conditioner. These units may be used with either quartz or ceramic charge-mode piezoelectric sensors.

### ***description***

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The 422E series in-line charge amplifiers operate from an ICP® signal conditioner. The unit employs a high gain amplifier to perform the impedance transformation. The charge output of the transducers may be scaled in terms of acceleration, pressure or force. The output is then mV/g, mV/psi or mV/lb, respectively.

### ***installation***

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Connect the 422E series to the transducer with low-noise cable (003A) only. Standard coaxial or two-wire cable may be used between the amplifier and the signal conditioner, and between the signal conditioner and the readout device.

**Note:** *For optimum noise performance, the cable length between the sensor and the 422E should be minimized.*

### ***operation***

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To operate, simply connect the input of the 422E to the transducer using low-noise (003A) cable and the output to any ICP® signal conditioner using standard cable. The output of the signal conditioner may then be connected to an oscilloscope or other monitoring device. This output will be an AC signal (see **specification** for actual frequency response) with a DC bias. Many PCB signal conditioners remove the bias via an AC coupling circuit.

### **calculation of output scaling**

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The 422E contains a high-gain, low-noise amplifier connected in a charge amplifier configuration. The charge output of the transducer is transferred to the feedback capacitor of the amplifier to develop a voltage which may be calculated using the following equation.

$$V_{out} = 422E \text{ Scaling (mV/pC)} \times \text{Transducer Sensitivity (pC/Engineering Unit)}$$

**where:**

$$V_{out} = \text{Output of 422E in mV/Engineering Unit}$$

*the Engineering Unit may be g's, Newtons, psi, etc., depending on the sensor*

**Example:** A 357A12 (3 pC/g) is used with a 422E02 (10 mV/pC). Calculate the output in mV/g.

**Answer:**  $10 \text{ mV/pC} \times 3 \text{ pC/g} = 30 \text{ mV/g}$

### **TEDS functionality**

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422E units with a "T" prefix incorporate TEDS (Transducer Electronic Data Sheet) technology. Using a TEDS capable signal conditioner, or TEDS reader, the user is able to read calibration data stored in the sensor. Some systems allow the user to also write user data and calibration information to the 422E. All data is formatted in accordance with IEEE 1451.4.

***special considerations***

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High source capacitance may degrade the performance of the 422E (source capacitance is the input capacitance defined as transducer capacitance + cable capacitance). In particular, noise may increase and high frequency response may decrease if source capacitance exceeds the recommended level. In some cases, low frequency oscillation of the output may occur. The maximum recommended level in pF's is determined using the following formula:

$$\text{maximum recommended source capacitance} = 10,000 / 422E \text{ sensitivity in mV/pC}$$

For example, the level for a 422E02/E12 would be  $10,000/10 \text{ pF} = 1,000 \text{ pF}$ , and the level for a 422E03/E13 would be  $10,000 \text{ pF}$ . If PCB 003 type low noise cable is used, these values correspond to 10 meters and 100 meters of length respectively.

***422E series models for use with high temperature sensors***

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The 422E35 (1 mV/pC) and 422E36 (10 mV/pC) have been specifically designed to operate with the lower insulation resistance values which piezoelectric sensors may exhibit when subjected to very high temperatures (generally greater than 500° F). Both units will operate with insulation resistances as low as 10kΩ.

**Note:** *Because of the special circuitry required, the 422E35 and 422E36 have somewhat higher noise and longer turn on time than the equivalent units designed for use with sensors with high insulation resistance (the 422E03 and 422E02 respectively). Consult the **specifications** for details.*

**Caution!** *Excessive accumulated charges on the input cables can destroy the field effect transistor (FET) in the amplifier. These charges can be grounded by shorting the center pin on the cable connector plug to its knurled nut with any metallic object.*

**422E series models for use in radioactive environments**

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The 422E65 (1mV/pC) and 422E66 (10mV/pC) were designed to offer resistance to the effects of radiation exposure up to 1 Mrad Integrated Gamma Flux or  $10^{10}$  N/cm<sup>2</sup> of Integrated Neutron Flux. They are also designed to operate with lower insulation values which piezoelectric sensors may exhibit when subjected to the high temperatures that generally accompany high levels of radioactivity.

**warning 1 – ESD sensitivity**

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**The power supply/signal conditioner should not be opened by anyone other than qualified service personnel.** This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury.

**warning 2 – ESD sensitivity**

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This equipment is designed with user safety in mind; however, the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by PCB Piezotronics, Inc.

**caution 1 – ESD sensitivity**

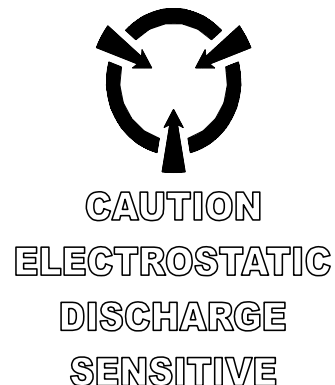
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**Cables can kill your equipment.** High voltage electrostatic discharge (ESD) can damage electrical devices. Similar to a capacitor, a cable can hold a charge caused by triboelectric transfer, such as that which occurs in the following:

- *Laying on and moving across a rug,*
- *Any movement through air,*
- *The action of rolling out a cable, and/or*
- *Contact with a non-grounded person.*

**The PCB solution for product safety:**

- *Connect the cables only with the AC power off.*
- *Temporarily “short” the end of the cable before attaching it to any signal input or output.*



**caution 2 – ESD sensitivity**

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**ESD considerations should be made prior to performing any internal adjustments on the equipment.** Any piece of electronic equipment is vulnerable to ESD when opened for adjustments. Internal adjustments should therefore be done ONLY at an ESD-safe work area. Many products have ESD protection, but the level of protection may be exceeded by extremely high voltage.

**warranty**

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PCB instrumentation is warranted against defective material and workmanship for 1 year unless otherwise expressly specified. Damage to instruments caused by incorrect power or misapplication, is not covered by warranty. *If there are any questions regarding power, intended application, or general usage, please consult with your local sales contact or distributor.* Batteries and other expendable hardware items are not covered by warranty.

**service**

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Because of the sophisticated nature of PCB instrumentation, field repair is typically **NOT** recommended and may void any warranty. If factory service is required, return the instrumentation according to the “Return Procedure” stated below. *A repair and/or replacement quotation will be provided prior to servicing at no charge.* Before returning the unit, please consult a factory PCB applications engineer concerning the situation as certain problems can often be corrected with simple on-site procedures.

**return procedure**

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*To expedite returned instrumentation, contact a factory PCB applications engineer for a RETURN MATERIAL AUTHORIZATION (RMA) NUMBER.* Please have information available such as model and serial number. Also, to insure efficient service, *provide a written description of the symptoms and problems with the equipment to a local sales representative or distributor, or contact PCB if none are located in your area.*

Customers outside the U.S. should consult their local PCB distributor for information on returning equipment. For exceptions, please contact the International Sales department at PCB to request shipping instructions and an RMA. For assistance, please call (716) 684-0003, or fax us at (716) 684-3823. You may also receive assistance via e-mail at [electronics@pcb.com](mailto:electronics@pcb.com) or visit our web site at [www.pcb.com](http://www.pcb.com).

**customer service**

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PCB guarantees **Total Customer Satisfaction**. If, at any time, for any reason, you are not completely satisfied with any PCB product, PCB will repair, replace, or exchange it at no charge. You may also choose, within the warranty period, to have your purchase price refunded.

PCB offers to all customers, at no charge, 24-hour phone support. This service makes product or application support available to our customers, day or night, seven days a week. When unforeseen problems or emergency situations arise, call the **24 Hour SensorLine at 716 684-0001**, and an application specialist will assist you.



3425 Walden Avenue, Depew, NY 14043-2495

**Phone** 716 684-0001 **Fax** 716 684-0987 **E-Mail** [electronics@PCB.com](mailto:electronics@PCB.com)

**PCB** [www.PCB.com](http://www.PCB.com) **IMI** [www.IMI-Sensors.com](http://www.IMI-Sensors.com) **Key** [www.KeyTransducers.com](http://www.KeyTransducers.com)

**ISO 9001 Certified**

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422-5010-95

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REVISIONS		
REV	DESCRIPTION	DIN
L	REMOVED ITAR STAMP	37190

B

B

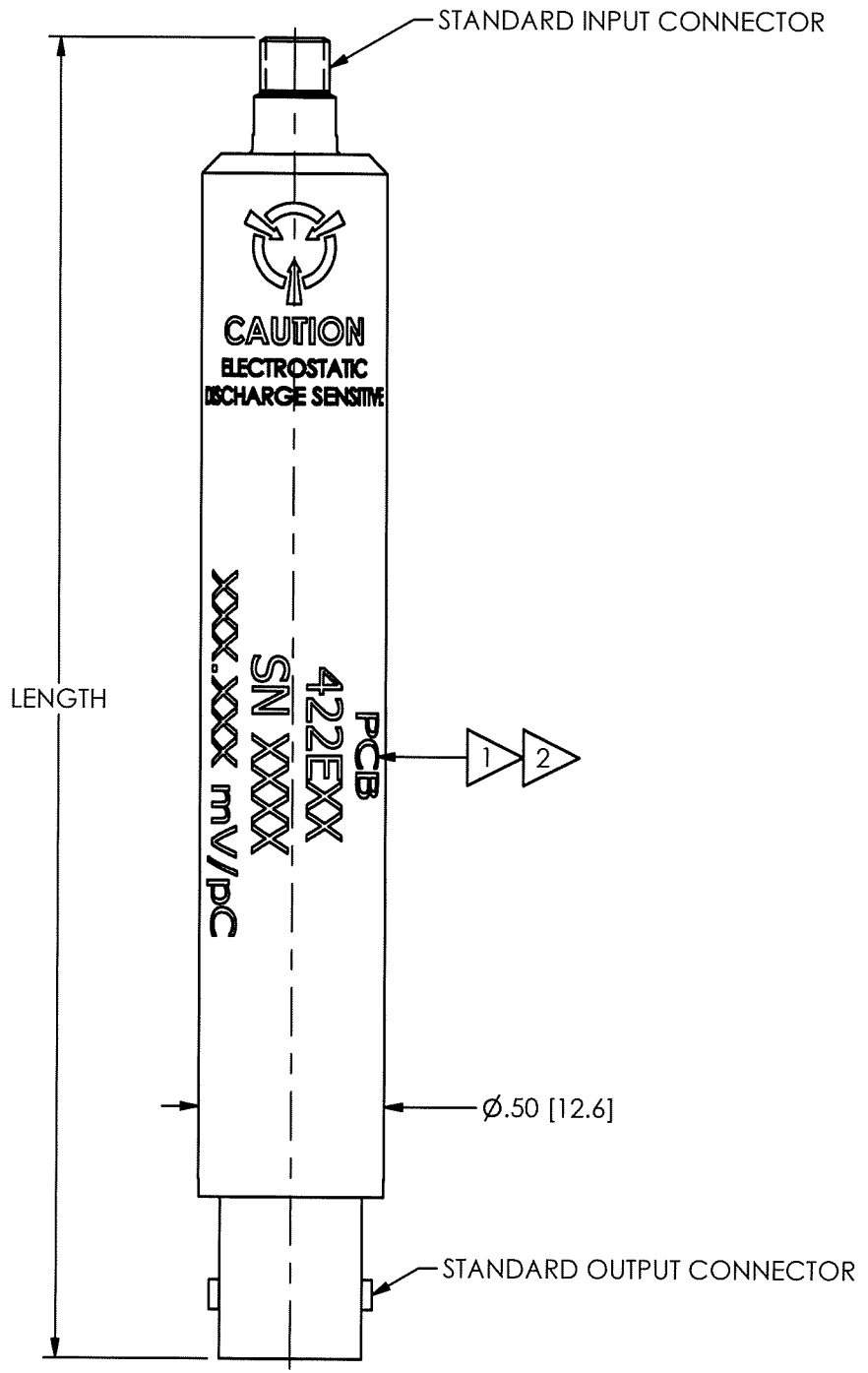
AVAILABLE CONNECTOR OPTIONS:

STANDARD MODEL NUMBER  
 INPUT: 10-32 MICRO DOT JACK  
 OUTPUT: BNC JACK  
 LENGTH: 3.4 [85]

MODEL NO./A  
 INPUT: 10-32 MICRO-DOT JACK  
 OUTPUT: 10-32 MICRO-DOT JACK  
 LENGTH: 3.0 [76]

MODEL NO./C  
 INPUT: 10-32 MICRO-DOT JACK  
 OUTPUT: BNC PLUG  
 LENGTH: 3.2 [81]

MODEL NO./D  
 INPUT: BNC JACK  
 OUTPUT: BNC JACK  
 LENGTH: 4.2 [107]



- 2 ETCH WITH "IN ← → OUT" TO INDICATE PROPER ORIENTATION.
- 1 ETCH WITH NORMAL SENSITIVITY, AS IT APPEARS ON SPEC SHEET.

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UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER		<p>3425 WALDEN AVE. DEPEW, NY 14043        (716) 684-0001 E-MAIL: sales@pcb.com</p>
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [ IN BRACKETS ]	SMB	10/7/11	EeB	10/7/11	BAM	10/7/11	
DECIMALS XX ±.03 XXX ±.010	DECIMALS X ± 0.8 XX ± 0.25	TITLE						
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES	OUTLINE DRAWING MODEL 422E SERIES IN-LINE CHARGE AMPLIFIER						CODE IDENT. NO. 52681
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13							DWG. NO. 422-5010-95
		SCALE: 2X		SHEET 1 OF 1				