IMI SENSORS
A PCB DIVISION

Model 641B00

Industrial vibration sensor, 4 to 20 mA output, 0 to 0.5 in/sec RMS, 10 to 1k Hz, top exit, 2-pin conn.

Installation and Operating Manual

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

Toll-free: 800-959-4464
24-hour SensorLine: 716-684-0001
Fax: 716-684-3823
E-mail: imi@pcb.com
Web: www.imi-sensors.com

IMI SENSORS
A PCB PIEZOTRONICS DIV.

Model 640/641/645/646 B Series Industrial 4-20mA Sensor

CE

Operating Guide with Enclosed Warranty Information

3425 Walden Avenue, Depew, New York 14043-2495

Phone (716) 684-0003

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MANUAL NUMBER: 25317
MANUAL REVISION: E
ECN NUMBER: 49766

IMI SENSORS
A PCB PIEZOTRONICS DIV.

Table of Contents

Introduction..... Page 3

General Features

Dimension Drawing ..... Page 4

Operation and Wiring ..... Page 5

Standard Wiring
Taking Measurements
RV Option
RVVO Option
TO Option

Installation ..... Page 9

Direct Adhesive Mount
Standard Stud Mount
Adhesive Stud Mount
Magnetic Mount

ESD Sensitivity..... Page 13

Warranty/Servicing

Warranty, Service & Return Procedure ..... Page 14

Customer Service..... Page 15

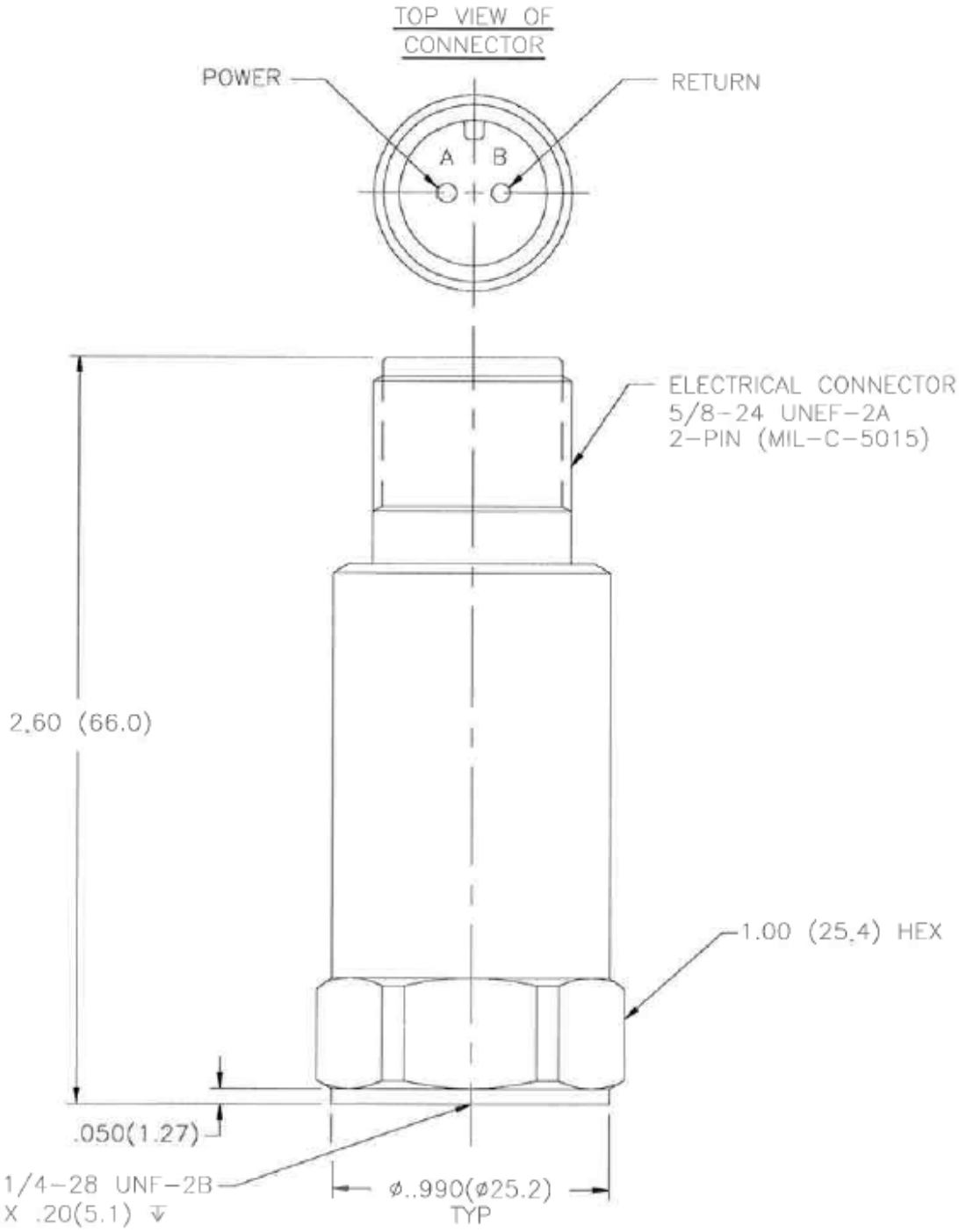
Introduction

The Model 640/641/645/646 B Series Industrial 4-20mA Sensors combine the capabilities of a piezoelectric vibration sensor and a 4-20mA vibration transmitter. The sensor outputs a 4-20mA signal that is proportional to the overall velocity or acceleration of the machinery. Ideal for monitoring the vibration of process equipment such as fans, motors and pumps, the output of the sensor is used for process control or predictive maintenance. There are many options in this series. Please refer to specific specification sheets for further details.

General Features

- Imbedded Piezoelectric Accelerometer for improved accuracy and frequency response.
- Vibration range can be in Acceleration or Velocity.
- Allows for continuous vibration monitoring of critical applications.
- Reduces sophisticated vibration analysis requirements.
- RV (Raw Vibration) option for conducting frequency analysis and machinery diagnostics.
- RVVO (Raw Vibration Velocity Output) option for conducting freq. analysis and machinery diagnosis.
- TO (Temperature Output) option via an independent 4-20mA loop.
- Readily interfaces to existing process control and predictive maintenance equipment.
- Rugged stainless steel construction for applications in harsh environments.
- Flexible design allows for various custom requirements.

Dimension Drawing



Inch (mm)

Operation and Wiring

Standard Wiring

The Model 640/641/645/646 B Series operates from a standard 2-Wire, 4-20mA loop. If using a loop powered unit, attach the positive (+) input from the power supply to Pin A or **Red** wire on the sensor and the negative (-) input from the power supply to Pin B or **Blue** Wire of the sensor.

Figure 1 – wiring: loop powered

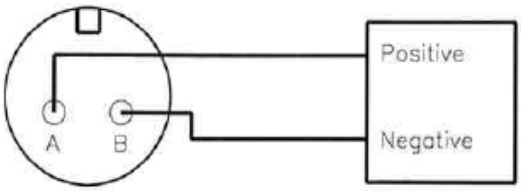
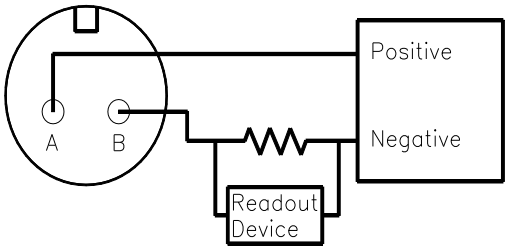


Figure 2 – wiring: loop powered/DC source



If using a standard DC power supply, install either an ammeter and/or load resistor in line with the output, Pin B or **Blue** Wire.

The resistor will generate a DC voltage that is proportional to current by:

$$V = IR$$

If R = 500 ohms and I = 6 mA, then V = 3 VDC

Note:

- Resistor value must be less than: (Vsupply – 12) x 50.
- For integral cable sensors: RED wire is positive, BLUE wire is negative.

Taking Measurements

When measuring the current output from the unit, use the following formula to calculate the vibration level:

Vibration Output = (Measured Output – 4mA) x (Full Scale Vibration Output /16mA)

Measured mA	**640BX0**	**640BX1**	**640BX2**
4.00	*0.0 ips, pk*	*0.0 ips, pk*	*0.0 ips, pk*
8.00	*0.125 ips, pk*	*0.25 ips, pk*	*0.5 ips, pk*
12.0	*0.25 ips, pk*	*0.5 ips, pk*	*1.0 ips, pk*
15.75	*0.37 ips, pk*	*0.73 ips, pk*	*1.47 ips, pk*
20	*0.5 ips, pk*	*1.0 ips, pk*	*2.0 ips, pk*

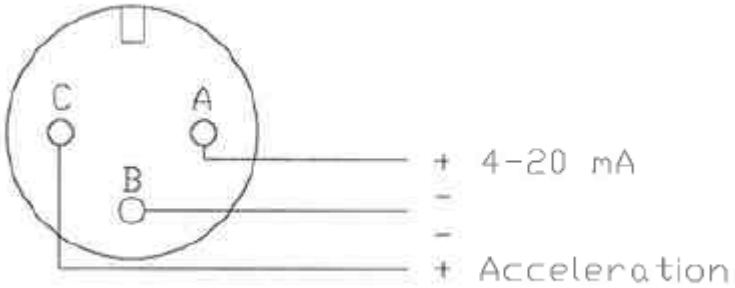
Measured mA	**641BX0**	**641BX1**	**641BX2**
4.00	*0.0 ips, rms*	*0.0 ips, rms*	*0.0 ips, rms*
8.00	*0.125 ips, rms*	*0.25 ips, rms*	*0.5 ips, rms*
12.0	*0.25 ips, rms*	*0.5 ips, rms*	*1.0 ips, rms*
15.75	*0.37 ips, rms*	*0.73 ips, rms*	*1.47 ips, rms*
20	*0.5 ips, rms*	*1.0 ips, rms*	*2.0 ips, rms*

Measured mA	**645**	***646***
4.00	*0.0 g rms*	*0.0 g rms*
8.00	*1.25 g rms*	*2.50 g rms*
12.0	*2.50 g rms*	*5.00 g rms*
15.75	*3.67 g rms*	*7.34 g rms*
20	*5.00 g rms*	*10.0 g rms*

RV Option

The RV (raw vibration) option includes a 100mV/g ±20% additional output. The accelerometer frequency range is 1 Hz-1 kHz, maximum amplitude of 15 g-pk. Data collectors or analyzers can use this vibration signal for further analysis. This output is extended to the RVVO (Raw Vibration Velocity Output) option, which integrates the signal to a value of 100 mV/IPS (±20%).

Figure 3 – RV and RVVO wiring



For integral cable sensors:

RED	**4-20mA Positive**
BLACK	**4-20mA Negative (same as green)**
GREEN	**–RV and RVVO negative (same as black)**
WHITE	**+RV and RVVO positive**

Note:

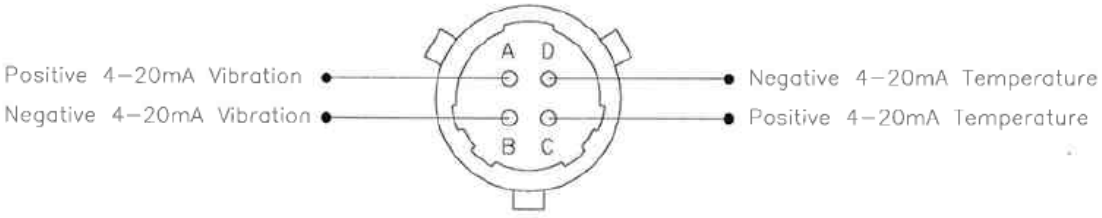
-The RV and RVVO Signal Negative has to be isolated from any grounding. If this terminal is grounded, the 4-20mA loop will short, causing no output.

-The RV and RVVO output signal is ideally suited for use with portable battery powered data collectors or analyzers.

TO Option

The TO (Temperature Output) option includes an additional independent 4-20mA output for temperature measurement. The temperature range is from -40°C to 125°C with an overall accuracy of ±5%FSO. The imbedded temperature sensor monitors the environment internal to the sensor housing and is situated at approximately mid level.

Figure 4 – TO wiring



For integral cable sensors:

RED	**4-20mA Vibration Positive**
BLACK	**4-20mA Vibration Negative**
GREEN	**4-20mA Temperature Negative**
WHITE	**4-20mA Temperature Positive**

Note:

- The same power supply can be used for both 4-20mA loops. Connect both positive terminals directly to the power supply, then use the negative terminals for independent process loops.

Installation

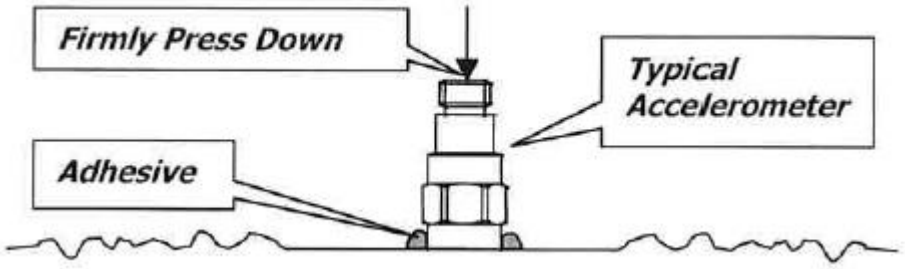
When choosing a mounting method, consider closely the advantages and disadvantages of each technique. Typical mounting types are stud, direct adhesive, adhesive mounting base and magnetic mounting base. Since the frequency response is limited to 1 kHz on the 640/641, any of the four methods can be used without seriously affecting the data values. The mounting method might affect some of the 645/646 series because of the increased frequency response.

Direct Adhesive Mount Procedure

For restrictions of space or for convenience, most sensors (with the exception of integral stud models) can be adhesive-mounted directly to the machine surface.

STEP 1 Prepare a smooth, flat surface. A minimum surface finish of 63 µin [0.0016 mm] generally works best.
STEP 2 Place a small portion of adhesive on the underside of the sensor. Firmly press down on the top of the assembly to displace any adhesive. Be aware that excessive amounts of adhesive can make sensor removal difficult.

Figure 5– direct adhesive mounting

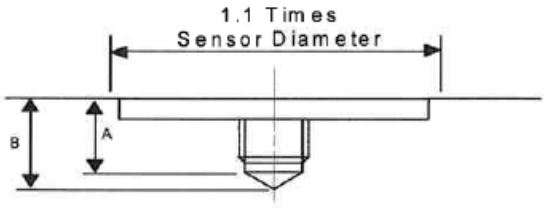


Standard Stud Mount Procedure

This mounting technique requires smooth, flat contact surfaces for proper operation and is recommended for permanent and/or secure installations. Stud mounting is also recommended when testing at high frequencies. **Note:** DO NOT attempt mounting on curved, rough or uneven sufaces, as the potential for misalignmen and limited contact surface may significantly reduce the senor's upeer operating frequnecy range.

Figure 6– direct adhesive mounting

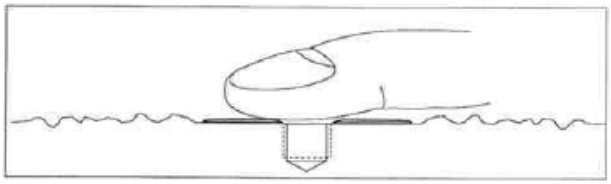
1/4-28 stud	***1/4-28 Captive Screw-****
A (in)	*0.250*	*0.250*
B (in)	*0.350*	*0.350*
Torque (ft-lb)	*2 to 5*	*2 to 5*



STEP 1 First, prepare a smooth, flat mounting surface, and then drill and tap a mounting hole in the center of this area as shown in Figure 6. A precision-machines mounting surface with a minimum finish of 63 µin [0.0016 mm] is recommended. (If it is not possible to properly prepare the machine surface, consider using an adhesive mounting pad as a possible alternative.) Inspect the area, checking that there are no burrs or other foreign particles interfering with the contact surface.

STEP 2 Wipe clean the mounting surface and spread on a light film of grease, oil or similar coupling fluid prior to installation.

Figure 7– mounting surface lubrication.



Adding a coupling fluid improves vibration transmissibiliy by filling small voids in the mounting surface and increasing the mounting stiffness. For semi-ermanent mounting, substitue epoxy or another type of adhesvie.

STEP 3 HAND – tighten the sensor/mounting stud to the machine, then secure the sensor with a torque wrench to the mounting surface by applying the recommended mounting torue (see enclosed specification data sheet for proper mounting torque). It is important to use a toque wrench during this step. **Under-toruing the sensor may not adequately couple the device; over-torquing may result in stud failure and possible permanent damage.**

Adhesive Stud Mount Procedure

Adhesive mounting is often used for temporary installation or when the machine surface cannot be adequately prepared for stud mounting. Adhesives like hot glue or wax work well for temporary mounts; two-part epoxies and quick –bonding gels provide a more permanent mount.

Note: Adhesively mounted sensors often exhibit a reduction in high-frequency range. Generally, smooth surfaces and stiff adhesvies provide the best frequency response.

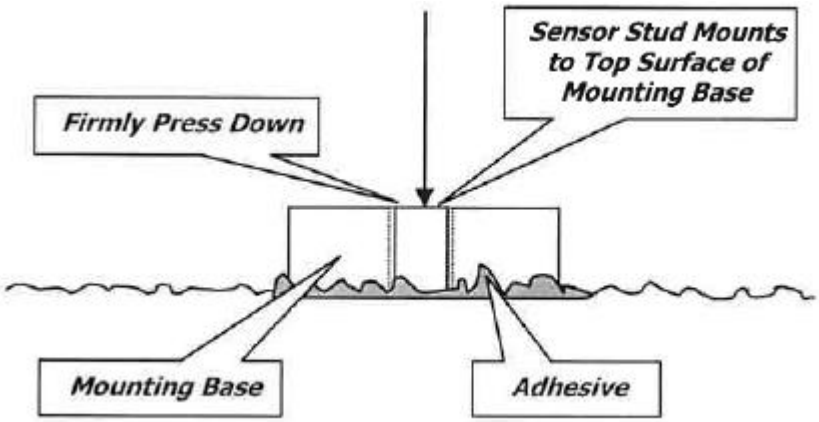
This method involves attaching a base to the machine surface, then securing the snesor to the base. This alows for easy removal of the accelerometer.

STEP 1 Prepare a smooth, flat mounting surface. A minimum surface finish of 63 µin [0.0016 mm] generally works best.

STEP 2 Stud-mount the sensor to the appropriate adhesive mounting base according to the guidelines set forth in Steps 2 and 3 of the *Standard Stud Mount Procedure*.

STEP 3 Place a small portion of adhesive on the underside of the mounting base. Firmly press down on the assembly to displace any extra adhesive remaining under the base.

Figure 8– mounting base: adhesive installation



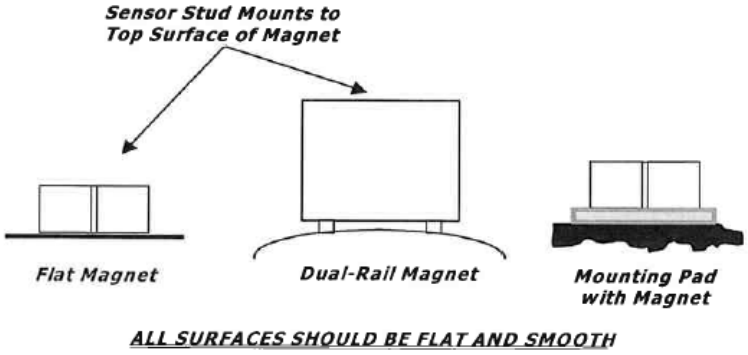
Magnetic Mount Procedure

Magnetic mounting provides a convenient means for making portable measurements and is commonly used for machinery monitoring and other portable or tending applications.

Note: The correct magnet choice and an adequately prepared mounting surface is critical for obtaining reliable measurements, especially at high frequencies. Poot installations can cause as much as a 50% drop in the sensor frequency range.

Not every magnet is suitable for all applications. For example, rare earth magnets are commonly used because of their high strength. Flat magners work well on smooth, flat surfaces, while dual-rail magnets are required for curved surfaces. In the case o non-magnetic or rough surfaces, it is recommended that the user first weld, epocy or otherwise adhere a stell mounting pad to the test surface. This provides a smooth and repeatable location for mounting.

Figure 9– magnet types



STEP 1 After choosing the correct magnet type, inspect the unit, verifying that the mounting surfaces are flat and smooth.

STEP 2 Stud- mount the accelerometer to the appropriate magnet according to the guidelines set forth in Steps 2 and 3 of the Standard Stud Mount Procedure.

STEP 3 Prepare a smooth, flat mounting surface. A minimum surface finish of 63 µin [0.0016 mm] generally works best. After cleaning the surface and checking for burrs, wipe on a light film of silicone grease, machine oil or similar-type coupling fluid.

STEP 4 Mount the magnet/sensor assembly to the prepared test surface by gently ‘rocking” or “sliding” it into place.

Note: Magnetically mounting accelerometers carelessly as the potential to generate very high (and very damaging) g levels. To prevent damage, install the assembly gently. If unsure, please contact the factory for assistance.

Warning 1 – ESD sensitivity

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

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

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 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

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

IMI instrumentation is warranted against defective material 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 or expendable hardware items are not covered by warranty.

Service

Because of the sophisticated nature of IMI 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 IMI applications engineer concerning the situation as certain problems can often be corrected with simple on-site procedures.

Return procedure

To expedite returned instrumentation, contact a factory IMI applications engineer for 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 IMI if none are located in your area.*

Customers outside the U.S. should consult their local IMI distributor for information on returning equipment. For exceptions, please contact that International Sales department at IMI 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 **imi@pcb.com** or visit our website at **www.pcb.com**.

Customer Service

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

IMI 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 **IMI Hot Line at (716) 684-0003**, and an application specialist will assist you.

Model Number 641B00	4-20 MA OUTPUT VELOCITY SENSOR	Revision: D ECN #: 50726

Performance	ENGLISH	SI	
Measurement Range	0.0 to 0.5 in/sec rms	0.0 to 12.7 mm/s rms	[1]
Output	4-20 mA	4-20 mA	
Frequency Range(± 10 %)	600 to 60 kcpm	10 to 1 kHz	[2][3]
Broadband Resolution	0.005 in/sec pk	0.13 mm/s pk	[4]
Non-Linearity	± 1 %	± 1 %	
Environmental			
Temperature Range	-40 to 185 °F	-40 to 85 °C	
Enclosure Rating	IP68	IP68	
Electrical			
Excitation Voltage	12 to 30 VDC	12 to 30 VDC	
Settling Time(within 2% of value)	< 15 sec	< 15 sec	
Electrical Isolation(Case)	> 10^8 Ohm	> 10^8 Ohm	
Physical			
Size (Hex x Height)	1.0 in x 2.6 in	25.4 mm x 66 mm	
Weight	4.7 oz	131 gm	
Mounting Thread	1/4-28 UNF	No Metric Equivalent	
Mounting Torque	3 to 5 ft-lb	4 to 7 Nm	
Sensing Element	Ceramic	Ceramic	
Sensing Geometry	Shear	Shear	
Housing Material	Stainless Steel	Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	2-Pin MIL-C-5015	2-Pin MIL-C-5015	
Electrical Connection Position	Top	Top	
Electrical Connections(Pin A)	4-20 mA Pos (+)	4-20 mA Pos (+)	
Electrical Connections(Pin B)	4-20 mA Neg (-)	4-20 mA Neg (-)	

CE[5]

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 Piezotronics, Inc.

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.

EX - Hazardous Area Approval- contact factory for specific approvals

Hazardous Area Approval	DIV II, CL I, GRPS A-D, ExnL, AExnA, IIC T4	DIV II, CL I, GRPS A-D, ExnL, AExnA, IIC T4
Hazardous Area Approval	EEx ia IIC T4, -40°C≤Ta≤80°C, II 1 G	EEx ia IIC T4, -40°C≤Ta≤80°C, II 1 G
Hazardous Area Approval	EEx nL IIC T4, -40°C≤Ta≤80°C, II 3 G	EEx nL IIC T4, -40°C≤Ta≤80°C, II 3 G
Hazardous Area Approval	DIV I, CL I, II, III, GRPS A-G, Exia, AExia, IIC T4	DIV I, CL I, II, III, GRPS A-G, Exia, AExia, IIC T4

M - Metric Mount
Supplied Accessory: Model M081A61 Mounting Stud 1/4-28 to M6 X 1 (1)

RV - Buffered Analog Signal Output - 100 mV/g (±20%)

Electrical Connector	2-Pin MIL-C-5015	2-Pin MIL-C-5015
Electrical Connections(Pin A)	4-20 mA Pos (+)	4-20 mA Pos (+)
Electrical Connections(Pin B)	4-20 mA Neg/Signal Output Neg	4-20 mA Neg/Signal Output Neg
Electrical Connections(Pin C)	Signal Output Pos	Signal Output Pos

NOTES:

[1]Conversion Factor 1 in/sec = 0.0254 m/sec.
[2]Current will fluctuate at frequencies below 5 Hz.
[3]1Hz = 60 cpm (cycles per minute).
[4]Typical.
[5]See PCB Declaration of Conformance PS039 or PS053 for details.

SUPPLIED ACCESSORIES:

Model 081A40 Mounting Stud (1)
Model ICS-4 NIST-traceable single-axis amplitude response calibration from 0 cpm (0 Hz) to upper 10% frequency for 4 - 20 mA output vibration sensor (1)

Entered: LK	Engineer: NJF	Sales: MC	Approved: NJF	Spec Number:
Date: 04/22/2020	Date: 04/22/2020	Date: 04/22/2020	Date: 04/22/2020	27871

IMI SENSORS
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E-Mail: imi@pcb.com

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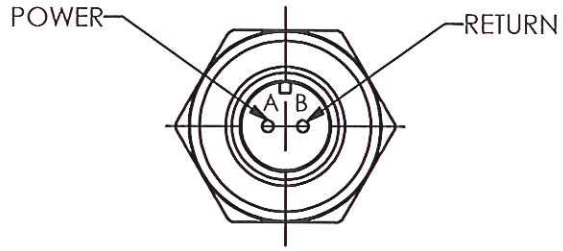
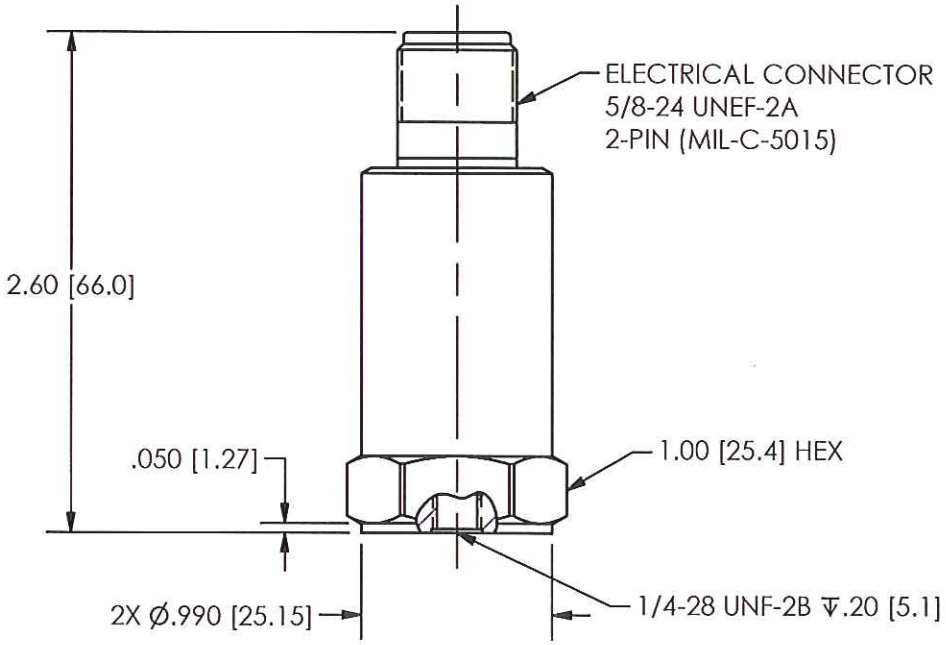
REVISIONS		
REV	DESCRIPTION	ECO
C	REMOVED TABLE	34217

TOP VIEW OF CONNECTOR





UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN	CHECKED	ENGINEER	
DIMENSIONS IN INCHES DECIMALS XX ±.03 XXX ±.010 ANGLES ± 2 DEGREES	DIMENSIONS IN MILLIMETERS [IN BRACKETS] DECIMALS X ± 0.8 XX ± 0.25 ANGLES ± 2 DEGREES	[signature] 10/19/10	ECB 10/19/10	JDK 10/19/10	
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13				

TITLE

OUTLINE DRAWING
MODEL 640B0X, M, 641B0X, M
4-20 mA VELOCITY TRANSMITTER

PCB PIEZOTRONICS INC
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com

CODE IDENT. NO.	DWG. NO.	
52681	25316	
SCALE: FULL	SHEET 1 OF 1	

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- PCB工业监测和测量设备 - 中国RoHS 公布表

PCB Industrial Monitoring and Measuring Equipment - China RoHS Disclosure Table

部件名称 Part Name	有毒和危险品 Toxic and Hazardous Substances or Elements									
Part	铅 (Pb)	水银 (Hg)	镉 (Cd)	六价 铬 (Cr(VI)	多溴化 苯 (PBB)	多溴化二苯 醚 (PBDE)	邻苯二甲酸 二(2-乙基) 己酯 (DEHP)	邻苯二甲丁 基苄酯 (BBP)	邻苯二甲酸 二酸正丁酯 (DBP)	邻苯二甲酸 二异丁酯 (DIBP)
电气外壳 (Electrical Enclosures)	X	O	O	O	O	O	O	O	O	O
紧固件和弹簧 (Fasteners)	X	O	O	O	O	O	O	O	O	O
电缆组件 (Cable Assembly)	X	O	O	O	O	O	O	O	O	O
印刷电路板组装 (PCBAs)	X	O	O	O	O	O	O	O	O	O
机械零件(Mechanical Parts)	O	O	O	O	O	O	O	O	O	O
塑料和橡胶零件 (Plastic & Rubber Parts)	O	O	O	O	O	O	O	O	O	O
金属零件 (Metal Parts)	X	O	O	O	O	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制

O =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 (indicates that the content of the toxic and hazardous substance in all the Homogeneous Materials of the part is below the concentration limit requirement as described in GB/T 26572).

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 (indicates that the content of the toxic and hazardous substance in at least one Homogeneous Material of the part exceeds the concentration limit requirement as described in GB/T 26572).