VSM797S Piezoelectric Accelerometer

Installation Manual

(Product # 9400-09M4A-104)

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1. VSM797S MEASURING CHAIN OVERVIEW

1.1 Typical VSM797S measuring chain installation

Figure 1 : Typical VSM797S measuring chain installation

The following optional accessories are available to install a VSM797S accelerometer:

Qty	Description
1	extension cable, 2-pair shielded (45 m *[150 ft.]*), to connect the accelerometer to an acquisition unit

Qty	Description
1	mounting plate, nonconductive 1/2" thick FR4, with M6 and 1/4-28 threaded holes for installation without drilling into the structure

1.2 Safety information

This manual contains information and warnings that must be observed to keep the instruments in a safe condition and ensure safe operation.

Warning - Danger messages identify conditions or practices that could cause bodily harm, and result in damage to the measuring chain and other equipment to which it is connected.

Caution messages identify conditions or practices that could result in permanent loss of data.

Warning - Danger	Caution
• To use the described measuring chains correctly and safely, read and follow all the safety instructions or warnings given throughout this manual. • To avoid electric shock, personal injury, or death, carefully read the information under “Safety Information” before attempting to install, use, or service the measuring chains. • In addition, follow all generally accepted safety practices and procedures required when working with and around electricity. • For safe operation and to ensure that your system functions at its optimum capability, the installation and adjustment process should be handled only by VibroSystM trained service specialists.	

- Although most instruments and accessories are normally used at non-hazardous level voltages, hazardous conditions may be present in some situations.
- This product in intended for use by qualified operators and maintenance personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.
- Install and use the measuring chains only as specified in this manual, or the protection provided by the measuring chain might be impaired.
- Do not use this instrument in wet environments.
- Whenever it is likely that safety protection has been impaired, make this instrument inoperative and secure it against any unintended operation.
- Have this instrument serviced only by qualified service personnel.
- To avoid shock hazard, connect the power supply to a properly grounded line power source. If a two-conductor power cord must be used, a protective grounding wire must be connected between the ground terminal and earth ground before connecting the power cord or operating the instrument.
- Use caution when working with voltages above 30 V_{AC} rms, 42 V_{AC} peak, or 42 $V_{DC,}$ as these voltages pose a shock hazard.
- Safety and electrical symbols that appear in this manual and on the material:

	**Warning - Danger** - identify conditions or practices that could cause bodily harm, and result in damage to the measuring chain and other equipment to which it is connected. Conditions include a risk of electric shock (voltage > 30 V_{DC} or V_{AC} peak might be present).
	**Caution** - identify conditions or practices that could result in permanent loss of data.
	Important information.

2. INSTALLATION OF VSM797S PIEZOELECTRIC ACCELEROMETER

2.1 Preliminary considerations

- The VSM797S piezoelectric accelerometer is a low frequency sensor with an isolated piezoceramic sensing element capable of detecting high-level displacements on low speed machines. It contains no moving parts and can be oriented in any direction.
- Uses the industry standard ICP© 2-wire voltage transmission technique with a constant current supply.
- Signal ground is isolated from the housing to prevent ground loops.
- Operates under most harsh environmental conditions. Unaffected by dirt, oil, and most chemical atmospheres. Annular shear mode minimizes the effects of transverse motion.
- Flat frequency response: from 0.4 Hz to 1.6 kHz.
- The mounting location must be chosen according to application. Absolute shaft vibration measurement applications requires that the accelerometer be mounted on the same support structure, and in the same axis, as the proximity probe.
- The VSM797S piezoelectric accelerometer is shipped with two mounting studs (sizes: M6x1 and 1/4-28 UNF).
- In selecting mounting location, pay attention to accessibility. The accelerometer must, in most cases, directly contact the vibrating surface.

⚠ Caution

A nonconductive mounting plate made of FR4 fiberglass materiel is available as an option. A mounting plate is required when the surface of the monitored structure cannot be drilled

- Direct contact between the accelerometer and the vibrating surface increases the ability to couple and measure high frequency signals. Best efforts must be made to provide a flat mounting surface, perpendicular to the vibration axis. For best results, the tapped mounting hole must be perpendicular within 1° to the mounting surface.
- Carefully select the mounting location, avoiding thin sections, vibration-free areas, and other unsuitable locations of the structure
- Excessive mechanical shock from hard impacts can destroy the internal electronic components or fracture the piezoelectric crystal. **Do not drop the accelerometer.**

Note: © ICP is a trademark of PCB Piezotronics Inc.

2.2 Sensor installation

Figure 2 : VSM797S Accelerometer and two mounting studs

2.2.1 Supplies needed

- mounting stud (two sizes supplied: M6x1 and 1/4-28 UNF)
- Loctite 222 thread adhesive

Also needed, when the optional insulating mounting plate is used:

- clean dry cloth
- glue (Loctite 330) and its activator (Loctite 7387), or equivalent

2.2.2 Tools needed

- torque wrench (to 2,4 Nm *[21 in-lb]*)
- drill bit 5mm (or 7/32")
- tap drill M6x1 (or 1/4-28 UNF)
- if required, boring / spot-facing machinery to prepare the surface on a 25 mm (1.0") minimum diameter

⚠ Caution

Though this instrument is designed to support shock, use great care in handling the Model VSM797S accelerometer. Do not drop it or hit it against a solid object. Keep it stored in its box until you have surveyed and prepared the location suitable for installation.

2.2.3 Preparation of the mounting location

The quality of the installation greatly affects the measurements of the accelerometer. The best installation consists in mounting the accelerometer directly on the surface of the monitored structure, tightening the accelerometer to the correct torque on a mounting stud, on a surface carefully prepared to ensure the best contact between the sensor and the structure.

Important information

A nonconductive mounting plate is available for installation when drilling into the structure is not allowed, such as on the stator core laminations, or when the VSM797S accelerometer must be installed on an insulated part of the machine.

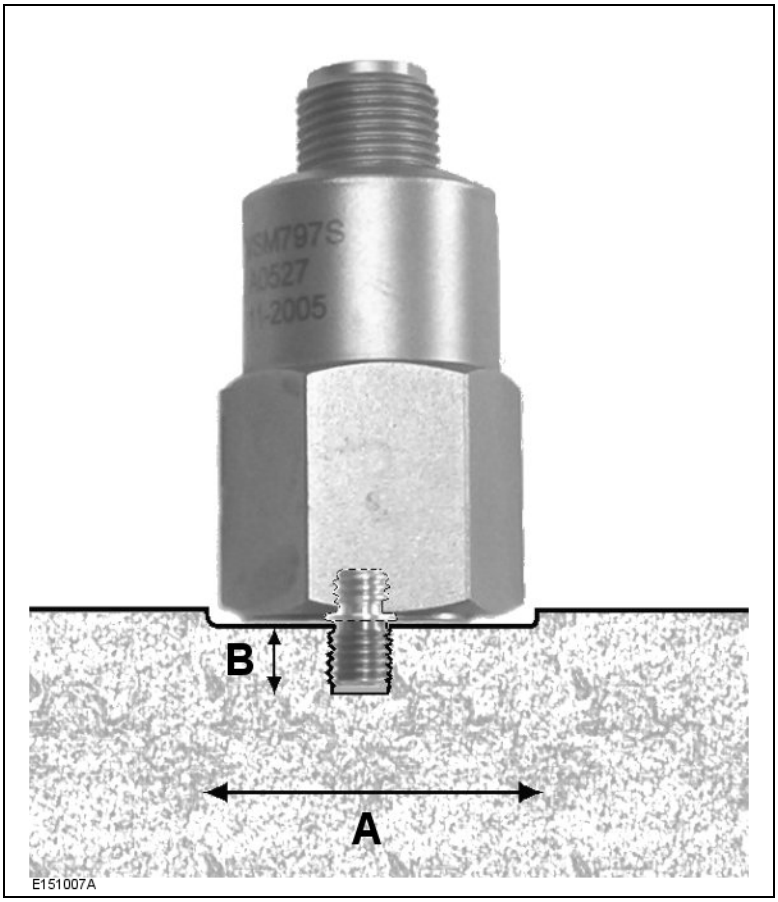


Figure 3 : Cross-section view of a VSM797S and its stud mounted on a spot-surfaced area

1. Select the best mounting location according to your application (refer to preliminary considerations).

   If needed, prepare the surface as follows:

   A) Counterbore or spot-face an area with diameter of a least 25 mm (1.0”)

   B) In the center of the prepared area, drill and thread a hole with a minimum depth of 7 mm (0.25 “)

2. Mount the accelerometer using a torque wrench for tightening to 2,4 Nm (21 in-lb). Under-torquing the accelerometer reduces the stiffness of the coupling, while over-torquing can cause permanent thread damage.

   Note: Use loctite 222 thread adhesive for better results.

2.2.4 Installation using a mounting plate

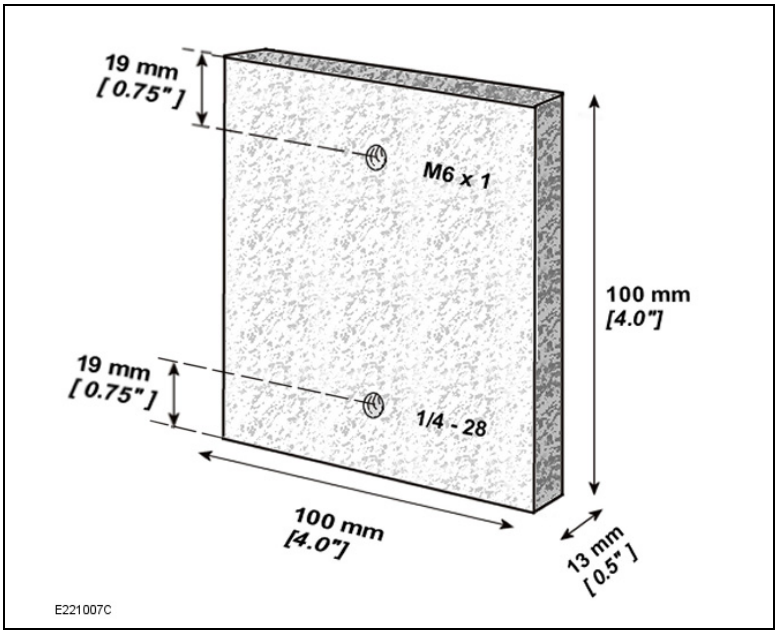


Figure 4 : Isolating Mounting Plate

A pre-drilled FR4 fiberglass mounting plate with two mounting holes is offered as an option.

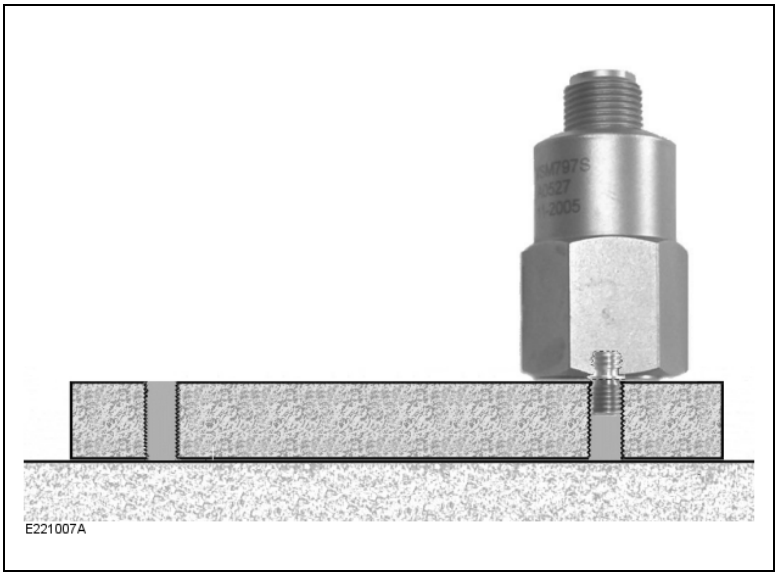


Figure 5 : Cross section of a VSM797S sensor and stud on a mounting plate

Prepare the area where the mounting plate will be glued by thoroughly cleaning the location.

Apply the Loctite 330 glue and activator according to the manufacturer's instructions and hold the mounting plate in place until the glue has set.

Mount the accelerometer using a torque wrench for tightening to 2,4 Nm (21 in-lb). Under-torquing the accelerometer reduces the stiffness of the coupling, while over-torquing can cause permanent thread damage or tear off the mounting plate.

Note: Use loctite 222 thread adhesive for better results.

2.3 General specifications of the VSM797S Piezoelectric Accelerometer

Specifications @ 24°C *[75°F]*

Operation

• Sensitivity	500 mV/g ± 5%
• Acceleration range	10g peak
• Amplitude nonlinearity	1%
• Frequency response	0.4 to 1600 Hz (± 10%)
	0.2 to 3700 Hz (-3 dB)
• Resonance frequency	16 kHz nominal
• Transverse sensitivity	<7% of axial
• Temperature response	-8% at -50°C *[-58°F],*
	+5% at 120°C *[+248°F]*

Electrical

• Power type	ICP transmission mode
- Voltage source	22 to 28 V_{DC}
- Constant current	2 to 10 mA
• Electrical noise	25µg RMS (1 Hz to 25 kHz)
• Output impedance (max.)	50 Ω
• Bias output voltage	12 V_{DC} nominal, ± 10%,
• Protection	Overload and reverse polarity
• Grounding	Case isolated, internally shielded
• Isolation (case to shield)	100 MΩ min.

Connection

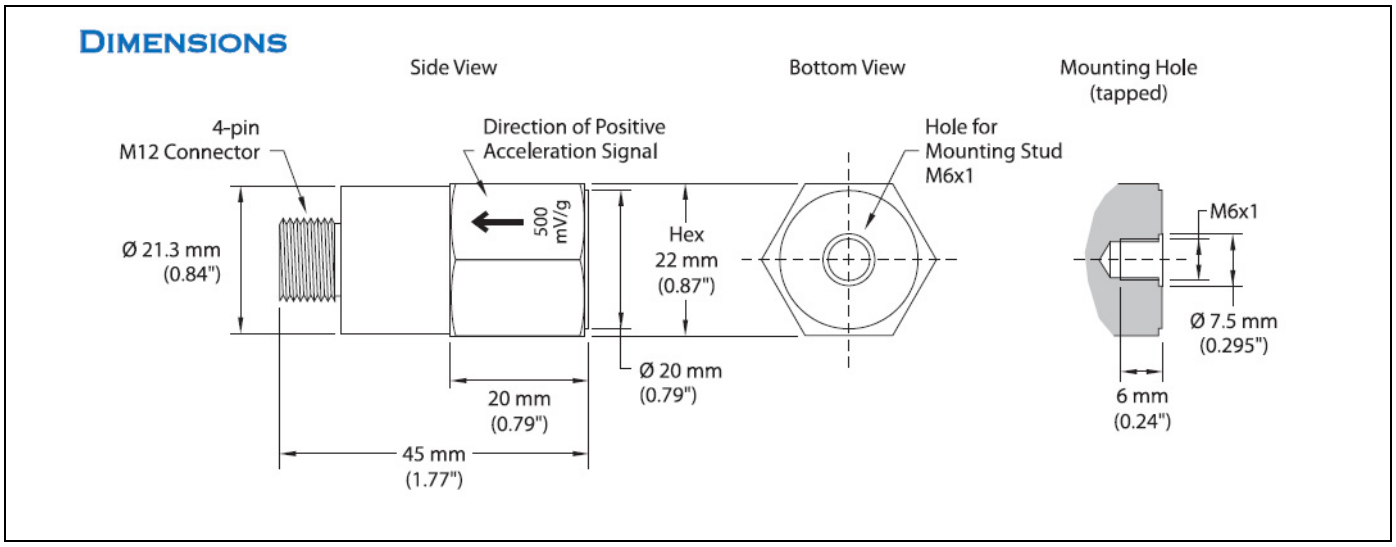
• Extension cable (optional)	
- Type:	4 conductors shielded with molded connector at one end
- Length (typical):	45 m *[150 ft.]*
	(other lengths also available upon request, max.: 100 m *[330 ft.]*)
• Connector	M12, 4-pin (only 2 pins used)

Environmental

• Temperature Range	-55° to 100°C *[-65° to 212°F]*
• Vibration limit	500 g peak
• Shock limit	5000 g peak
• Sealing	Hermetic
• Safety	EN 61010-1, IEC 1010-1
• EMC Emission	EN 50081-1, EN 50081-2
• EMC Immunity	EN 50082-1, EN 50082-2

Physical characteristics

• Sensing element design	Ceramic, preloaded annual shear mode	
• Dimensions		
- Height	45 mm	*[1.77 in.]*
- Diameter	21.3 mm	*[0.84 in.]*
- Hex flat	22 mm	*[0.87 in.]*
- Weight	95 g	*[3.4 oz]*
• Case material	Stainless steel AISI 316L, DIN 1.4435	
• Mating connector	M12, glass seal IEC 60947-5.2	
• Mounting	M6x1 tapped center hole (mating stud supplied)	
- Torque	2.4 Nm	*[21 in-lb]*



3. VSM797S EXTENSION CABLE INSTALLATION

3.1 Preliminary considerations

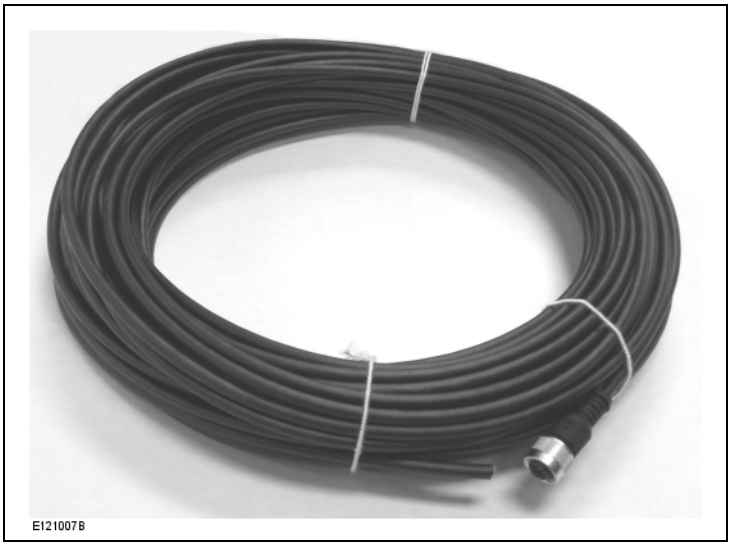


Figure 6 : Typical M12 cable (model with straight connector)

- The standard shielded cable is 45 m (150 ft.) long and will run between the piezoelectric accelerometer and the acquisition / monitoring unit (typically, a ZPU-5000, PCU-5000, or PCU-100 Vibration Unit).
- For applications involving longer distances, an additional length of shielded cable and a tapping box can be used. In applications of 1 kHz maximum frequency such as the ones this sensor is designed for, the cable capacitance of 30 pF per foot allows a total length of 100 m (330 ft.).
- The cable should be enclosed in a protective conduit.

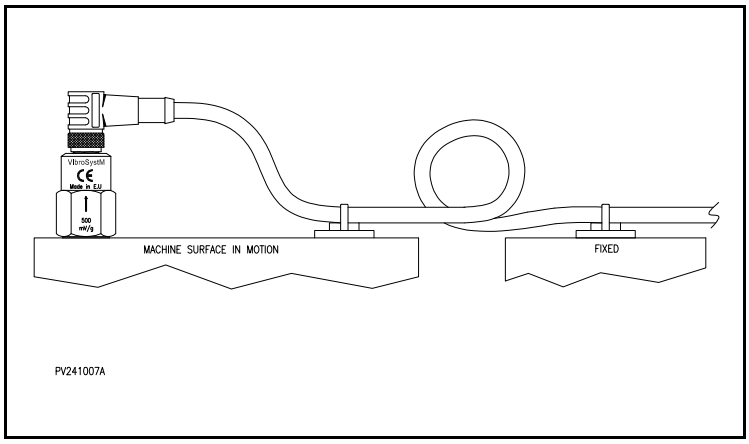
⚠ Caution

On some models of molded cables, the M12 connector is equipped with an internal ratchet element preventing unintentional loosening of the compression nut. M12 connectors with this feature produce a clicking sound when turning the compression nut.

When the ratchet mechanical device is present, make sure the coupling nut is well tightened, and the connector is correctly seated. A firm finger-tight connection suffice to prevent loosening.

3.2 Installation of the cable

1. Determine the run of the cable, keeping in mind its maximum total length is 100 m (330 ft.).
2. Unroll the protective conduit following the planned course of the cable. Cut the conduit to desired length.
3. With a fish tape, carefully pull the cable into the conduit, with the socket connector on the accelerometer side.
4. Connect the cable to the sensor.



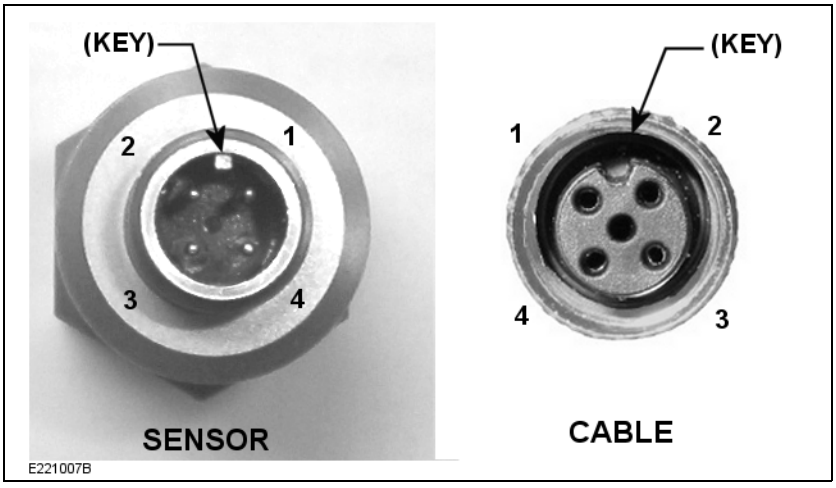
5. Anchor the cable to reduce stress at the cable terminations, and also avoid the creation of false signals that may be created by movement of the cable.

   When securing the cable, leave enough slack to allow free movement of the accelerometer as shown in Figure 6. To minimize the possibility of generating electrostatic charges, make sure however that the cable cannot come into intermittent contact with any material and is not rubbing against any surface.

Figure 7 : Securing the cable (drawing shows model with right angle connector)

3.2.1 Connection of the power and output cable

1. Connect the wires according to the following designation:



PIN #	WIRE COLOR	DESIGNATION
1	Brown	[not used]
2	White	[not used]
3	Blue	Signal (-)
4	Black	Signal (+)

Figure 8 : Pinout of the VSM797S sensor and cable

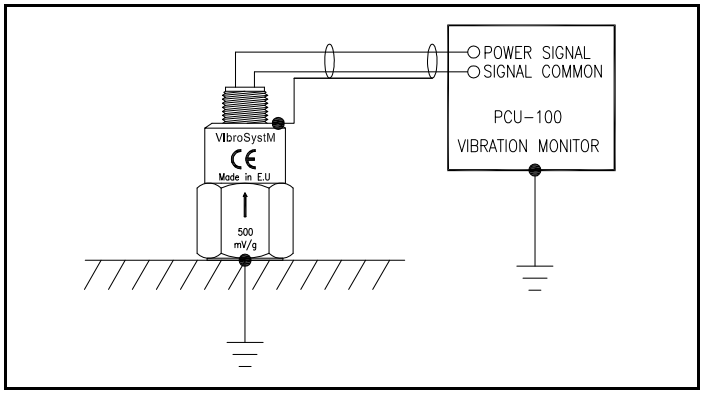


Figure 9 : Sensor casing in direct contact with grounded structure

CASE A) Sensor mounted directly on a grounded structure

The housing of the accelerometer is in contact with the grounded structure. To prevent adding an undesirable ground loop, the cable shield must **not** be connected to ground on the instrumentation side.

Do not connect the cable shield-to-ground at the instrumentation end.

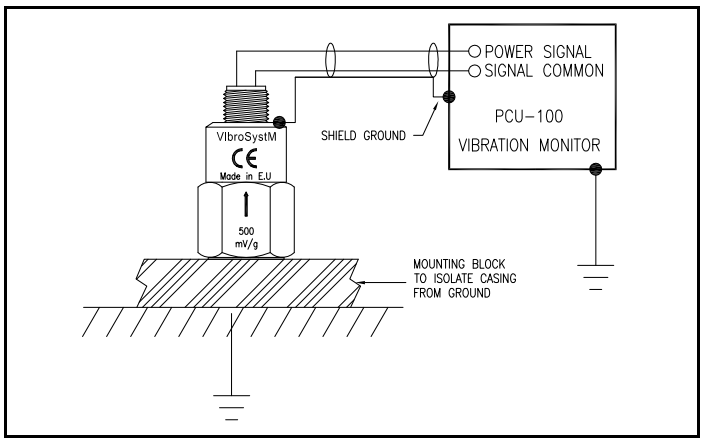


Figure 10 : Sensor casing isolated from grounded structure by mounting block

CASE B) Sensor mounted on an insulating mounting block

The housing of the accelerometer is not in contact with the grounded structure. To ensure proper signal protection, the cable shield must be connected on the instrumentation side.

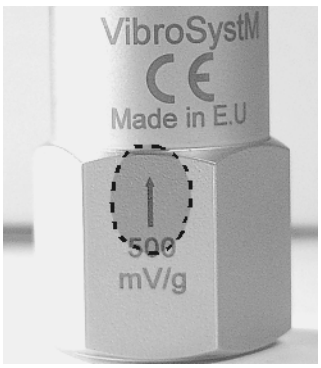
Connect the cable shield-to-ground at the instrumentation end.

4. VSM797S SIGNAL

4.1 Signal Verification

1. Verify that the VSM797S piezoelectric accelerometer is functioning well: measure the voltage at the output of the accelerometer (e.g. between blue and black wires, at input of the monitoring instrumentation unit). Note that the warm-up time is about two minutes.

   The bias voltage (or voltage at rest) should be about 12 V_{DC} (+/- 1V).



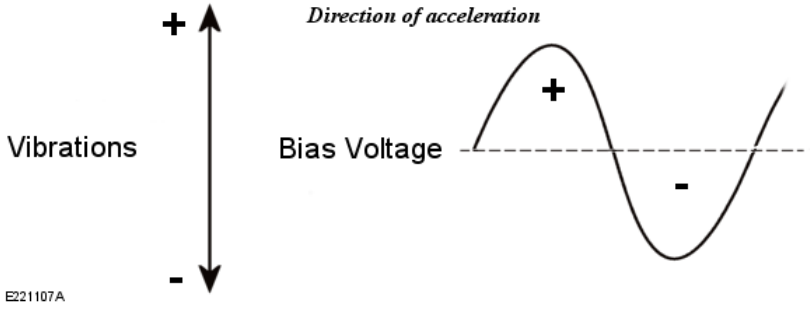


Figure 11 : Vibrations to bias voltage