

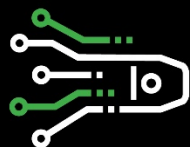
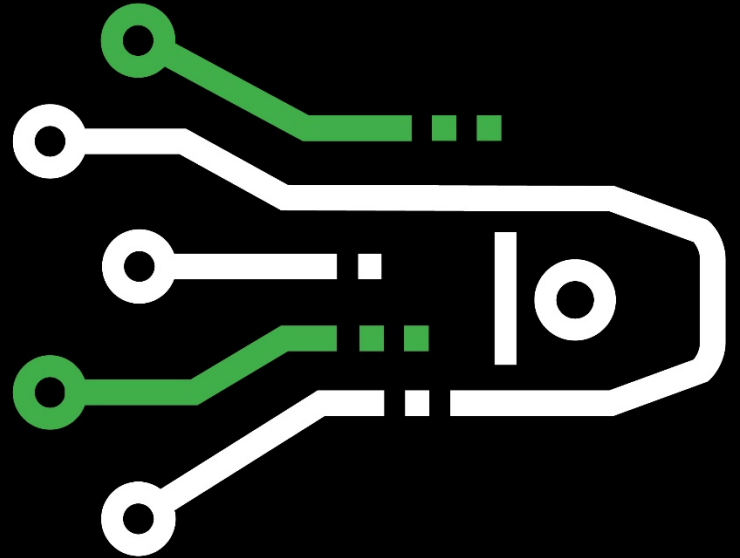
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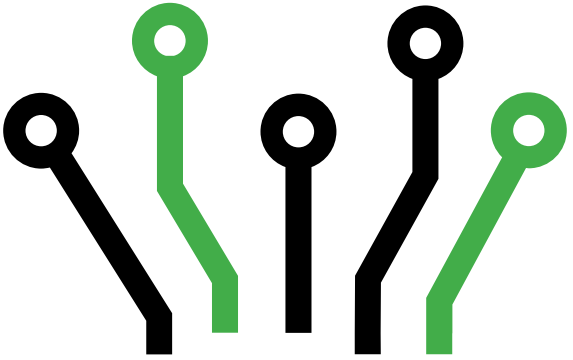


SENSORS

**A1512 / A2512
ACCELEROMETER**

OPERATIONS MANUAL





Document Revision History

Document	Rev.	Date	ECO	Changes
n/a	1.0	2/28/2012	n/a	Initial release document
n/a	1.1	6/7/2012	n/a	<ul style="list-style-type: none"> Minor changes
n/a	1.2	4/2/2013	n/a	<ul style="list-style-type: none"> Updated to reflect the recent CE compliance approval. Power ratings updated
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1. INTRODUCTION

1.1 ABOUT THE A1512/A2512 ACCELEROMETERS

The MEMS (MicroElectroMechanical Systems) accelerometers have been designed for recording dynamic responses on all types of structures in tough field conditions. This also makes them suitable for a wide range of laboratory and manufacturing applications.

Several models are available and are selected depending on the application with variables such as cable lengths, expected g-forces, and any possible size limitations.

Although there are some relatively minor differences in electronic interfaces and physical dimensions between the various available options, the installation for all BDI accelerometers are the same as outlined in this manual.

1.2 ABOUT THIS MANUAL

This is a comprehensive document that explains the installation and use of the A1512/A2512 range of accelerometers. BDI also manufactures two types of data acquisition systems, which will be referenced by their acronyms throughout the manual.

1. **Structural Testing System (STS):** Rugged, wireless, battery-powered DAQ that includes an intelligent (Intelliducer) connector design, designed primarily for temporary testing lasting between a few hours up to a few of days.
2. **Structural Monitoring System (SMS):** Modular system with 4- or 16-channel nodes that can be used in laboratories or for permanent, large-scale monitoring projects.

The following highlighted message blocks will periodically appear and contain important information that the user should be aware of.



STOP: This symbol and corresponding message represents information regarding the device that if not followed could lead to damaging the device! Pay close attention to this message.



WARNING: This symbol and corresponding message represents vital information and is critical for the device operation and/or the operational settings/configuration.



INFORMATION: This symbol and corresponding message represents general information and/or tips on successfully operating/configuring the device.

2. A1512 & A2512 OVERVIEW

2.1 TECHNICAL SPECIFICATIONS

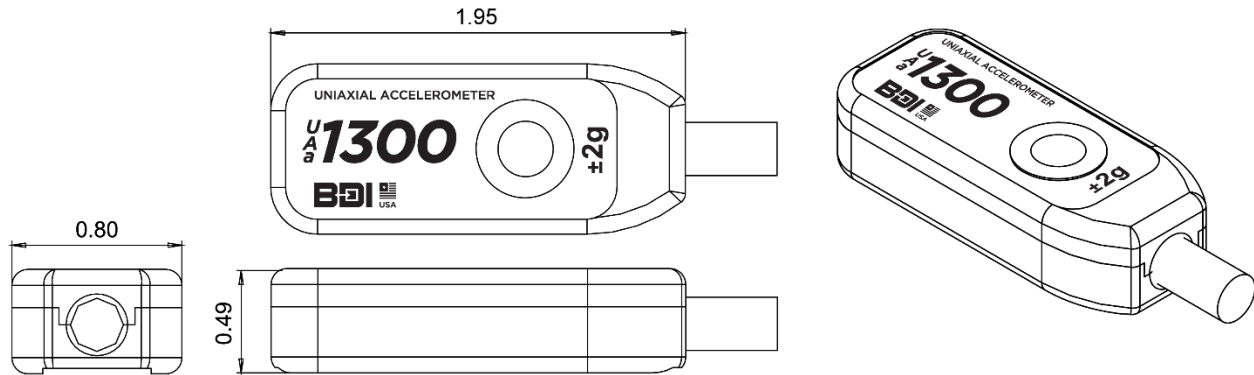


Figure 1: A1512 Uniaxial Accelerometer Dimensions (inches)

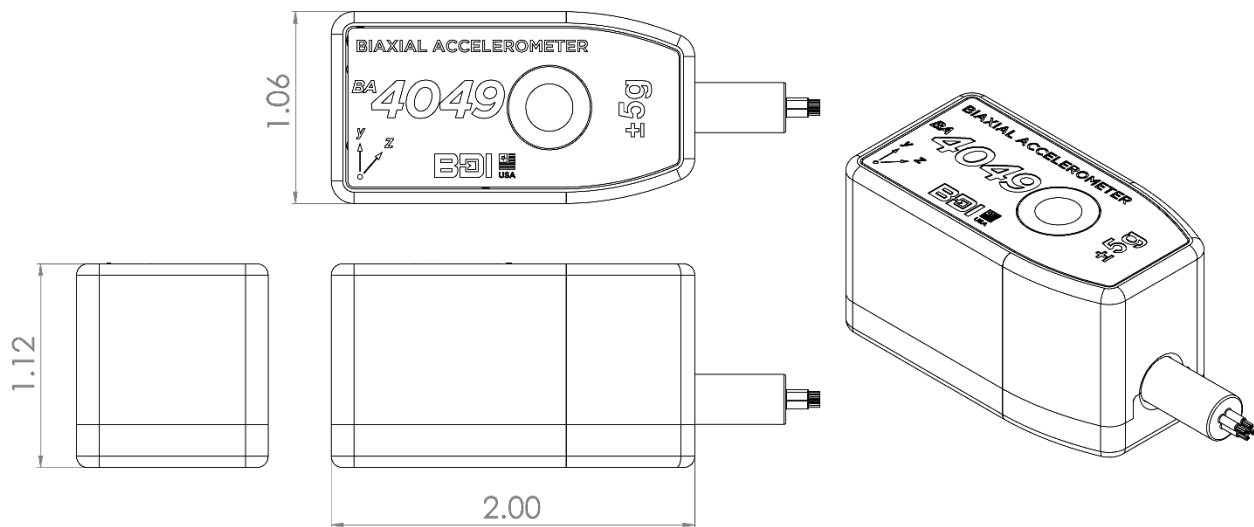


Figure 2: A1512 Biaxial & Triaxial Accelerometer Dimensions (inches)

Table 1: Specifications for Model A1512

UNIAXIAL	UA1512-002	UA1512-005	UA1512-010	UA1512-025	UA1512-050	UA1512-100
BIAXIAL	BA1512-002	BA1512-005	BA1512-010	BA1512-025	BA1512-050	BA1512-100
TRIAXIAL	TA1512-002	TA1512-005	TA1512-010	TA1512-025	TA1512-050	TA1512-100
RANGE (g)¹	±2	±5	±10	±25	±50	±100
FREQUENCY RESPONSE [NOMINAL, 3dB] (Hz)	0-300	0-400	0-600	0-900	0-1200	0-1400
DIFFERENTIAL SENSITIVITY (mV/g)	1000	400	200	80	40	20

OUTPUT NOISE, DIFFERENTIAL [rms, TYPICAL] (µg/√Hz)	7	12	18	25	50	100
MAX MECHANICAL SHOCK [0.1 ms] (g)	2000			5000		
TYPE	Micro-machined capacitive sense element					
DAMPING	Nitrogen Gas Damped					
EXCITATION VOLTAGE	+5.0 Vdc ±5%					
POWER RATINGS: MAX (UNI, BI, TRI) TYPICAL (UNI, BI, TRI) INTELLIDUCER ² (UNI, BI, TRI)	75 mW, 150 mW, 225 mW 25 mW, 50 mW, 75 mW 13 mW, 26 mW, 39 mW @ +5.0 Vdc					
OUTPUT IMPEDANCE	50Ω					
DIFFERENTIAL OUTPUT	±2.0 Vdc Full Scale Output					
OPERATING TEMPERATURE ³	-58° to +176 °F (-50° to +80 °C)					
SIZE: UNIAXIAL BIAXIAL TRIAXIAL	0.80 in x 1.95 in x 0.49 in (20.3 mm x 49.5 mm x 12.4 mm) 2.0 in x 1.01 in x 1.07 in (50.8 mm x 26.8 mm x 27.2 mm) 2.0 in x 1.01 in x 1.07 in (50.8 mm x 26.8 mm x 27.2 mm)					
WEIGHT: UNIAXIAL BIAXIAL TRIAXIAL	0.12 lb (54 g) 0.26 lb (118 g) 0.26 lb (118 g)					
HOUSING	Machined 6061 Aluminum Alloy					
CORROSION RESISTANCE	Hard Anodized Clear (MIL-A-8625 Type III)					
CABLE	Custom lead cable length made to order: IC-02-187 [22 AWG, 2 shielded pair, drain wire, red PVC jacket] IC-03-250 [24 AWG, 3 shielded pair, drain wire, black PVC jacket] IC-04-250 [24 AWG, 4 shielded pair, drain wire, black PVC jacket]					
WEATHER PROTECTION	Designed to exceed IP67					
CIRCUIT PROTECTION	ESD Protection (IEC 61000-4-2) Reverse polarity protection					
MOUNTING	Through holes for ¼ in (M6) bolts or anchors Reusable mounting tabs (gluing/welding)					
COMPLIANCE	ESD protection conforming to IEC 61000-4-2					
CROSS AXIS SENSITIVITY	Max ±3%, TYP ±2%					
BIAS TEMPERATURE SHIFT	±200 (PPM of Full Scale)/°C					
NONLINEARITY (-90 TO +90% OF FULL SCALE)	Max 0.50%, TYP 0.15%					

¹ Higher ranges are available, contact BDI for more details

² Intelliducer connector required with STS4 Intelliducer data acquisition nodes.

³ Temperature limit based on instrumentation cable operating temperatures, call BDI for wide temperature range cable options.

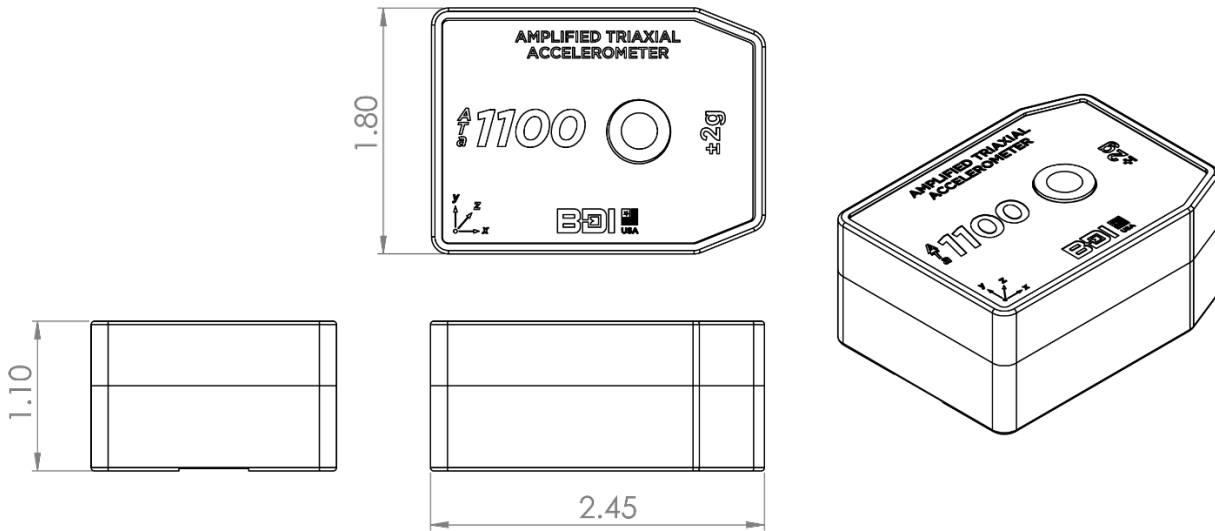


Figure 3: A2512 Uniaxial/Biaxial/Triaxial Accelerometer Dimensions (inches)

Table 2: Specifications for Model A2512

UNIAXIAL	UA2512-002	UA2512-005	UA2512-010	UA2512-025	UA2512-050	UA2512-100
BIAXIAL	BA2512-002	BA2512-005	BA2512-010	BA2512-025	BA2512-050	BA2512-100
TRIAXIAL	TA2512-002	TA2512-005	TA2512-010	TA2512-025	TA2512-050	TA2512-100
RANGE (g) ¹	±2	±5	±10	±25	±50	±100
FREQUENCY RESPONSE [NOMINAL, 3dB] (Hz)	0-300	0-400	0-600	0-900	0-1200	0-1400
DIFFERENTIAL SENSITIVITY (mV/g)	1000	400	200	80	40	20
OUTPUT NOISE, DIFFERENTIAL [rms, TYPICAL] (µg/√Hz)	7	12	18	25	50	100
MAX MECHANICAL SHOCK [0.1 ms] (g)	2000			5000		
TYPE	Micro-machined capacitive sense element					
DAMPING	Nitrogen Gas Damped					
EXCITATION VOLTAGE	9-30 Vdv					
POWER RATINGS: MAX (UNI, BI, TRI) TYPICAL (UNI, BI, TRI) INTELLIDUCER ² (UNI, BI, TRI)	38 mW, 75 mW, 112 mW 25 mW, 50 mW, 75 mW 13 mW, 26 mW, 39 mW @ +5.0 Vdc					
OUTPUT IMPEDANCE	50Ω					
DIFFERENTIAL OUTPUT	±2.0 Vdc Full Scale Output					
OPERATING TEMPERATURE ³	-58° to +176 °F (-50° to +80 °C)					
SIZE	2.45 x 1.80 x 1.10 in (62.2 x 45.7 x 27.9 mm)					
WEIGHT	0.33 lb (149 g)					
HOUSING	Machined 6061 Aluminum Alloy					
CORROSION RESISTANCE	Hard Anodized Clear (MIL-A-8625 Type III)					
CABLE	Custom lead cable length made to order:					





	IC-02-187 [22 AWG, 2 shielded pair, drain wire, red PVC jacket] IC-03-250 [24 AWG, 3 shielded pair, drain wire, black PVC jacket] IC-04-250 [24 AWG, 4 shielded pair, drain wire, black PVC jacket]
WEATHER PROTECTION	Designed to exceed IP67
CIRCUIT PROTECTION	ESD Protection (IEC 61000-4-2) Reverse polarity protection
MOUNTING	Through holes for ¼ in (M6) bolts or anchors Reusable mounting tabs (gluing/welding)
COMPLIANCE	ESD protection conforming to IEC 61000-4-2
CROSS AXIS SENSITIVITY	Max ±3%, TYP ±2%
BIAS TEMPERATURE SHIFT	±200 (PPM of Full Scale)/°C
NON-LINEARITY -90 TO +90% OF FULL SCALE	Max 0.50%, TYP 0.15%

¹ Higher ranges are available, contact BDI for more details

² Intelliducer connector required with STS Intelliducer data acquisition nodes.

³ Temperature limit based on instrumentation cable operating temperatures, call BDI for wide temperature range cable options.

2.2 OPTIONS & ACCESSORIES

	Intelliducer Connector – Required for use with STS data acquisition nodes, cable is connected and potted for a weatherproof seal
	Reusable Mounting Tabs – ¼-20 or M6, zinc plated steel mounting tab
	V-Notch Cable Mount: Machined aluminum mount for attaching accelerometer to a rod or cable.
	Protective Covers – Insulated aluminum protective covers

2.3 APPLICATIONS

Typical applications for A1512 & A2512 accelerometers include:

- + Structure Modal Analysis
- + Seismic Monitoring
- + Earthquake Detection
- + Cable Force Measurements

- + Vibration Monitoring
- + Vehicle Dynamics

3. OPERATION

3.1 THEORY OF OPERATION

The internal components of the A1524/A2512 accelerometer consist of a MEMS (MicroElectroMechanical Systems) capacitive sense element supported by an integrated circuit that includes a sense amplifier and a differential output stage. An optional internal temperature sensor allows the output to be corrected to address any temperature changes that may have occurred during testing.

4. CONNECTING TO DATA ACQUISITION SYSTEMS

This section outlines how to connect and test A1524/A2512 accelerometers for most standard data acquisition systems that are designed to handle either a differential voltage signal or a single ended voltage signal.

The accelerometers produce two analog output voltages which vary with acceleration as shown in Figure 4. The outputs can be used either in differential or single ended mode depending on the user's DAQ capabilities. Both outputs are roughly +0.625 Vdc at a zero-acceleration state.

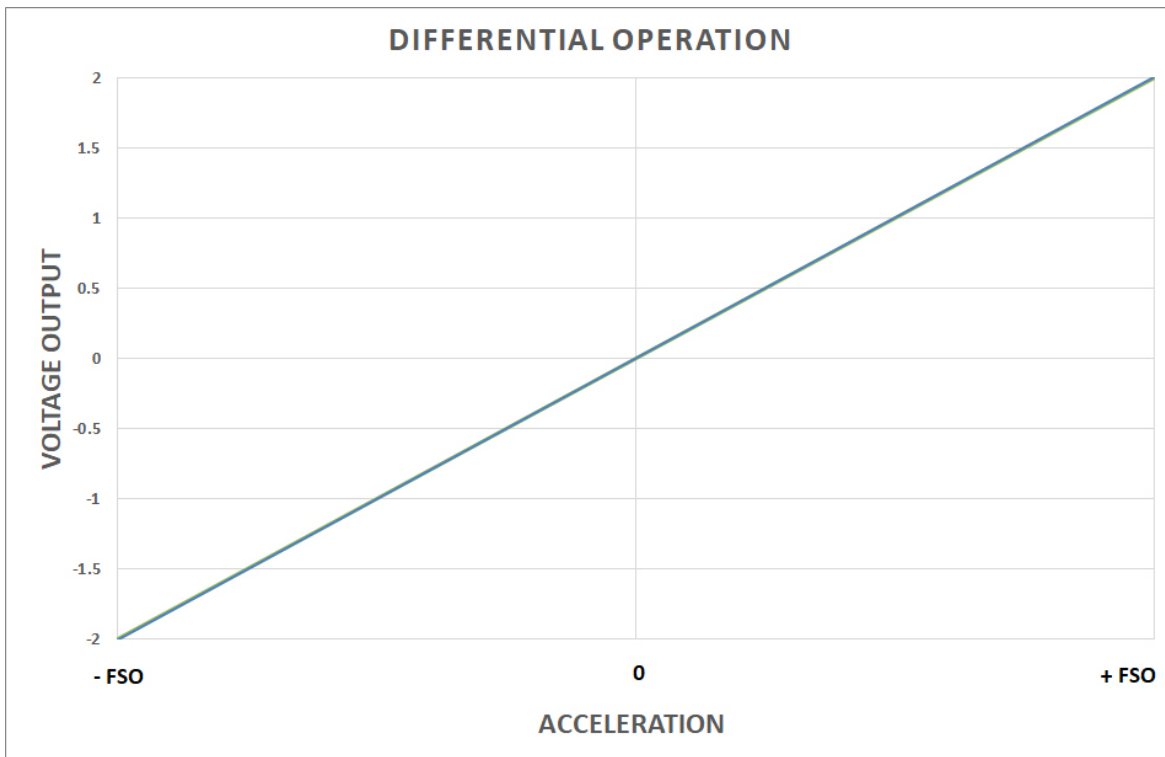


Figure 4: Voltage Output as Function of Acceleration

4.1 ELECTRICAL CONNECTIONS

The uniaxial A1512 & A2512 is a typical 4-wire hook up when using the differential signal output, while the biaxial and triaxial A1512 & A2512 share a common power and ground lines and have individual pairs for the differential signal outputs. See [Table 3](#) through [Table 5](#) for a description of the wiring, this table also includes the pinout for the STS Intelliducer connector pinout.



INFORMATION: When using the A1521 or A2521 with an STS Intelliducer node, the connection has already been pre-wired with an Intelliducer plug and no further action is necessary.

Table 3: Uniaxial A1512 & A2512 Wiring

Red	+ Excitation	G (A1512) A (A2512)
Black	- Excitation (Ground)	K
Green	+ Signal	C
White	- Signal	J
Bare	Shield/Drain	Integrated into pin K

¹ An Intelliducer connector is required for each axis of the A1512 or A2512 accelerometers.

Table 4: Biaxial A1512 & A2512 Wiring

Red	+ Excitation	G (A1512) A (A2512)
Black (w/ Red)	- Excitation (Ground)	K
Green	+ Signal (z axis)	C
Black (w/ Green)	- Signal (z axis)	J
White	- + Signal (y axis)	C
Black (w/ White)	- Signal (y axis)	J
Bare	Shield/Drain	Integrated into pin K

¹ An Intelliducer connector is required for each axis of the A1512 or A2512 accelerometers.

Table 5: Triaxial A1512 & A2512 Wiring

Blue	+ Excitation	G (A1512) A (A2512)
White/Blue	- Excitation (Ground)	K
Brown	+ Signal (z axis)	C
White/Brown	- Signal (z axis)	J
Green	+ Signal (y axis)	C
White/Green	- Signal (y axis)	J
Orange	+ Signal (x axis)	C

White/Orange	- Signal (x axis)	J
Bare	Shield/Drain	Integrated into pin K

¹ An Intelliducer connector is required for each axis of the A1512 or A2512 accelerometers.

4.2 APPLYING CALIBRATION FACTORS

Each A1512/A2512 accelerometer is supplied with a traceable calibration factor. Since this sensor should be supplied a +5.0 Vdc excitation voltage the calibration factor supplied is set to that excitation voltage. If the data acquisition system that is being used requires a normalized calibration factor, then the supplied calibration factor must be divided by +5.0 Vdc. The following is an example of the supplied calibration factor:

$$\text{GGF} = \text{### g/V}_{\text{out}}$$

Where:

GGF = General Gage Factor
 ### = Numeric Calibration Factor
 g = Units of gravity
 V_{out} = Output Voltage in Volts DC

Example of applying the GGF:

This example is using a UA1512 ±5g accelerometer. The supplied GGF = 4.439 g/V_{out}. The data acquisition system reads the output in millivolts so the GGF must be adjusted to g/mV_{out} before applying the GGF in the results. The current reading on the data acquisition system is 623 mV.

Step 1: Convert GGF to g/mV_{out}

$$\text{GGF} = 4.439 \frac{\text{g}}{\text{V}_{\text{out}}} \times \frac{1 \text{V}_{\text{out}}}{1000 \text{mV}_{\text{out}}} = 0.004439 \frac{\text{g}}{\text{mV}_{\text{out}}}$$

Step 2: Apply GGF to output voltage from data acquisition system

$$\text{Reading} = \text{mV}_{\text{out}} \times \text{GGF} = 623 \text{mV}_{\text{out}} \times 0.004439 \frac{\text{g}}{\text{mV}_{\text{out}}}$$

$$\text{Reading} = 2.765 \text{ g}$$

4.3 VERIFYING ACCELEROMETER OUTPUT

Once the A1512/A2512 accelerometer has been connected to the data acquisition system as outlined above, the user should perform the following tests. These tests should also be conducted on a regular basis to verify proper continued operation of these sensitive instruments.

The A1512/A2512 accelerometer has been designed to minimize the amount of maintenance required to keep the accelerometers operational. Before each use it is recommended that every sensor be visually inspected for damage and powered on to ensure it is working properly. This should be done two to three weeks before any scheduled testing in case any repairs are required.

4.3.1 2g Test

Depending on the data acquisition system being used, it is easier to verify the output if the sensor offset can be zeroed before completing this test. To start, place the sensor on a flat surface with the serial plate facing up (towards the sky) and then zero the sensor offset. Begin the data acquisition and hold the sensor steady for a few seconds and verify that the output is zero. If the data acquisition system cannot zero the initial offset then simply record what the offset is before starting. Rotate the accelerometer 90° and then hold the sensor steady on the flat surface. Verify that the change in output is very close to 1g.

Next, rotate the accelerometer another 90° so that the serial plate is facing down (towards the earth) and verify that the change in output is very close to 2g. If the output is significantly different please verify the data acquisition setting are correct before contacting BDI to have the sensor repaired or recalibrated.

4.3.2 Noise Verification Test

The test results for this type of test will vary between different data acquisition systems and the analog to digital electronics within the data acquisition system. BDI uses a 24-bit data acquisition system and the noise results presented in this manual reflect that. In general, it is good practice to understand the level of noise that is present with the data acquisition equipment that is being used. Knowing the level of noise that is expected, this test simply requires check to verify that the noise levels expected are what are being recorded.

To complete this test simply mount the accelerometer to a flat surface and begin recording data with the data acquisition system. We recommend that data be collected at the typical rate that would be used in a test environment. Zoom in on roughly 30 seconds worth of data and verify the noise level is acceptable based on the data acquisition system that is being used. [Figure 5](#) shows the noise level of a $\pm 5g$ accelerometer using a 24-bit data acquisition system.

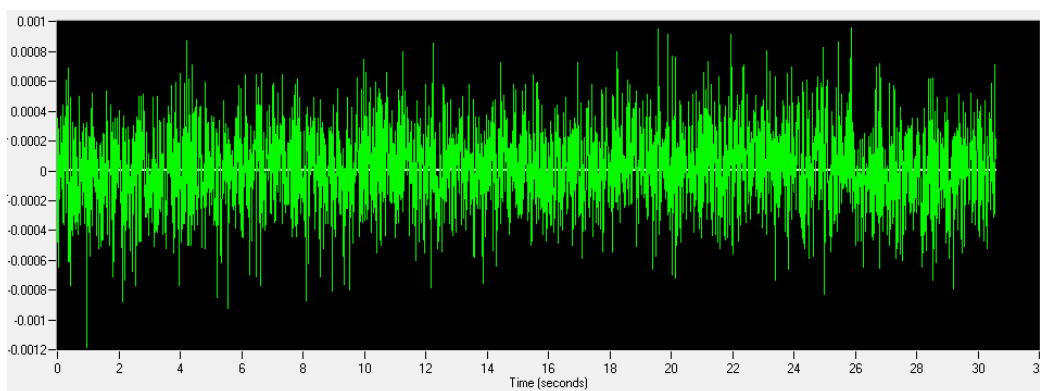


Figure 5: Noise level from a $\pm 5g$ accelerometer using a 24-bit data acquisition system

4.3.3 Frequency Response

Mount the accelerometer to a flat sturdy surface and collect a couple of minute's worth of data at high sample frequencies. Ensure that the surface is not subjected to any outside vibration from nearby equipment. Once the data collection is completed use a Fast Fourier Transform (FFT) algorithm to transform the data into the frequency domain. The results should show no dominating frequencies as shown in [Figure 6](#). A common problem that arises from this test is a dominant frequency at 50-60Hz and that is usually caused by a "dirty" power supply.

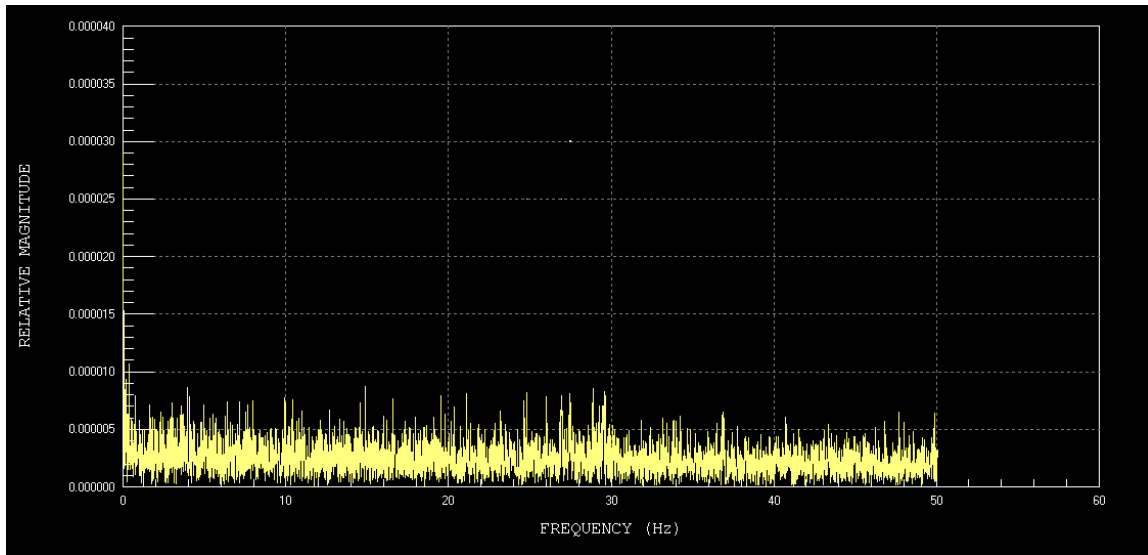


Figure 6: FFT results from frequency response test

4.3.4 Cable Strain Relief Test

Mount the accelerometer to a sturdy flat surface and begin the data acquisition systems data collection. Gently wiggle the cable near the entry point on the accelerometer. The output may show some signs of acceleration or change in voltage; however, it should not be very high, and the output should return to its original value. If the output does not return to the original value or the output looks very erratic, then it is possible that the cable is damaged at the entry point and may need to return for repair.

5. SENSOR INSTALLATION

There are several alternative mounting methods that can be used depending on the orientation, location, material being mounted to (steel, concrete, timber), and the length of test (hours, weeks, months, years). Due to the large number of variables associated with adhesive use (thermal cycles, UV exposure, vibration, impact, moisture, corrosion of base steel, etc.) adhesive is recommended for temporary testing and monitoring applications only. Please contact BDI for further mounting alternatives.

This section outlines mounting of a uniaxial model; however, bi and tri axial mounting is the same with the exception of slightly longer mounting tabs.

5.1 ALIGNMENT TEST

The uniaxial accelerometer axis is perpendicular to the face, meaning they measure accelerations along the axis of the mounting hole. When connected properly, they should provide a positive output (+Vdc) when the unit moves in the direction of the serial number plate, therefore, it is necessary to orient the plate in the direction that positive movement is to be measured. For bi and tri axial versions, please refer to the markings on the serial plate for axis directions.



INFORMATION: For the $\pm 2g$ accelerometers, half of the sensor's range will be lost in one direction when the accelerometer is mounted vertically (i.e. label facing the ground or the sky). This is typical of accelerometers as the active portion of the sensor is affected by earth's gravity. Due to the limited range of the $\pm 2g$ units, this should be considered. So, when the label is facing the sky the sensor's range will be 0g to $-2g$.

5.2 INSTALLATION ON STEEL MEMBERS

In most situations, the most efficient method of mounting an accelerometer is using the tab/glue method, and the following section outlines an installation for a flat a steel plate.



INFORMATION: BDI manufactures both Imperial (1/4-20) and metric (M6) tabs. To easily distinguish them from each other, BDI has scribed all metric items as seen in **Error! Reference source not found..**

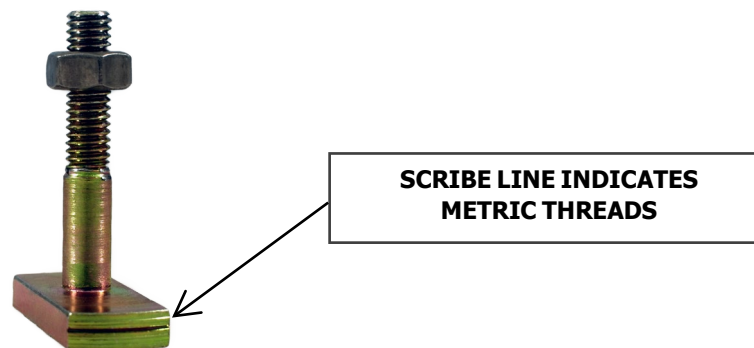


Figure 7: Identifying Metric vs. Imperial Tabs

1. Place a tab through the in mounting hole from the bottom and tighten the 1/4-20 (or M6) nut to approximately 40 in-lb. Note that the bottom of the sensor has a machined slot to capture the mounting tab as shown in Figure 8 so there should be no need to hold the mounting tab in-place.



Figure 8: Noise level from a $\pm 5g$ accelerometer using a 24-bit data acquisition system

2. Locate the centerline of the gaging area in both the longitudinal and transverse directions. First, locate the midpoint and draw two centerlines as shown in Figure 9. The longitudinal centerline should be approximately 4 inches (100 mm) long and the transverse centerline should be approximately 2 inches (50 mm) long. This will allow the marks to be seen while the accelerometer is being positioned.

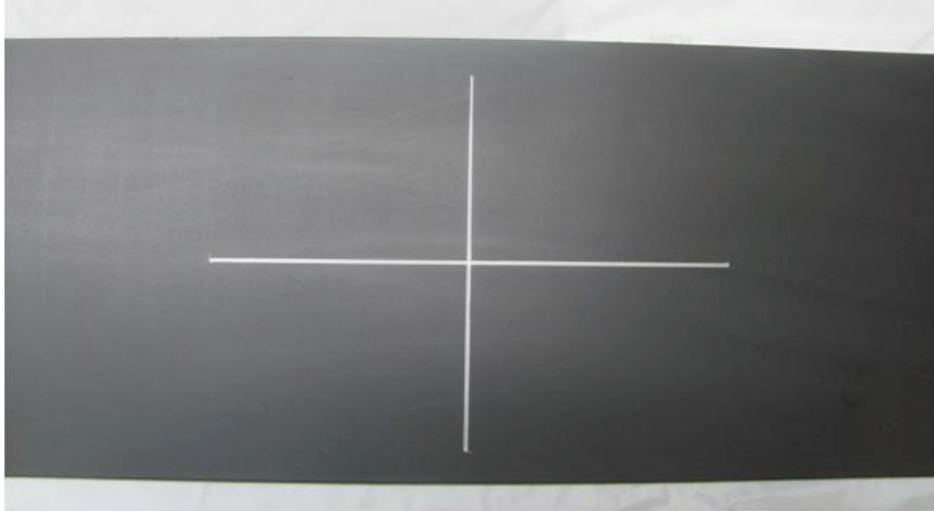


Figure 9: Marking accelerometer mounting location

3. Remove paint or scale from the area where the two lines intersect using a power grinder until a clean metal surface is obtained.
4. Next, very lightly grind the bottom of the tab that has already been mounted to the sensor to remove any oxidation and/or other contaminants. Before mounting, set the sensor in the location it is to be attached, and ensure that the unit is flush to the surface as this is important for achieving a good bond and that the measurement axis is perpendicular to the surface.
5. Apply a thin line of adhesive to the bottom of the tab (see "Information" below) about 1/4 in (6.4mm) wide. Mount the sensor in the marked location, and then pull it away. This action will apply adhesive to the structural member at tab location.
6. Spray the adhesive spot on the structural member with a "light shot" of the adhesive accelerator (Loctite Tak Pak 7452, Part # 18637 in 0.7oz aerosol spray container).
7. Very quickly, mount sensor in its proper location and apply a light force to the top of the tab for approximately 15-20 seconds.



INFORMATION: Loctite 410 is suggested to be used for short installations, such as a load test.

Loctite H4500 suggested for applications where Loctite 410 is not adequate, such as longer duration load tests, high force application, or temporary monitoring applications

To find the closest Loctite Distributor please call 1 (800) 243-4874 or visit www.loctite.com

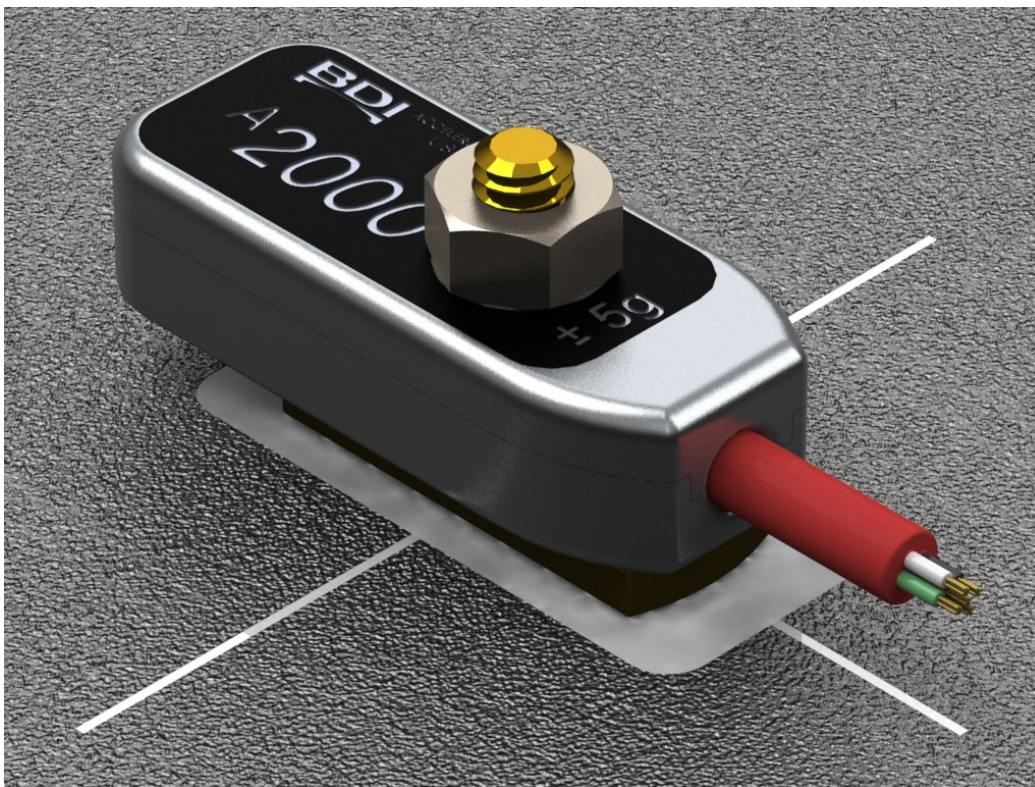


Figure 10: Accelerometer glued to a steel surface

If the above steps are followed, it should be possible to mount each sensor in approximately five minutes. After installation, a strain relief loop should be made within two inches of the sensor and “tied off” with another tab as seen in Figure 11. This loop is very important for high acceleration situations to reduce the possibility of the cable becoming dislodged from the sensor’s housing.



Figure 11: Sensor mounted with cable strain relief loop



INFORMATION: Cable anchoring can be done using many techniques based on the duration of testing. The above example is ideal for temporary applications. Other methods include gluing the cable directly to the member, cable clamps, and conduit cable Hubbells. Please contact BDI to discuss other possible solutions.

Often, the above approach will make removing the tabs very difficult from steel members due to the strength of the glue. Therefore, BDI has developed a Tab Removal Tool (TRT) to help reduce the possibility of damaging BDI sensors and tabs (see Figure 12). Each TRT has a hex head machined into bottom face for tightening and/or loosening the designated nut size, and the small hole in the face of the hex head has been threaded to capture the threaded stud.

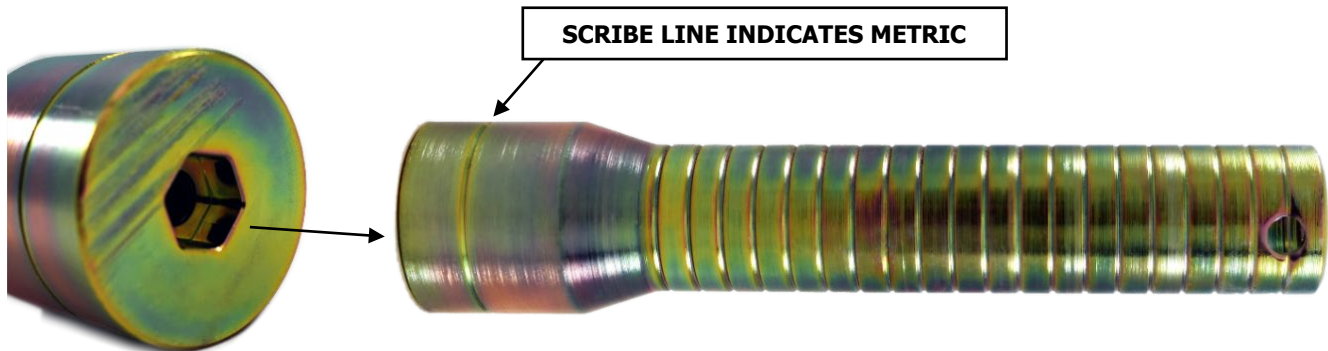


Figure 12: Tab Removal Tool (TRT)



INFORMATION: Please remember that BDI manufactures both imperial (1/4-20) and metric (M6) tabs. Ensure that the matching TRT threads are used with the tabs.

The following instructions describe the method used to remove a sensor that has been mounted to a steel surface. If a TRT is not available, a pair of vise grips can be used to remove the tabs, but there is a greater chance of damaging the tabs using a vise grip.

1. Use the cutout in the TRT or an end wrench; remove the nut from the tab. Carefully slide the accelerometer from the tab stud.
2. Thread the TRT on to the tab until the face is flush with the foot of the tab as seen below. If a gap remains between the TRT and the tab foot, there is a high likelihood that the stud will be bent in the next step. Also, do not over tighten the tab into the TRT or it will be hard to remove the tab from the TRT. After a few tries this process will become a simple procedure.



Figure 13: TRT with a Tab inserted

3. In the direction of "thin" axis of the tab, give the TRT a quick tug or tap and the tab should pop off the member surface. Depending on how well the tab is fixed, particularly on a steel surface, more force may be required. In this case, simply hit the handle of the tool with a small rubber mallet. Note that holes in the top of the tool have been supplied so that a lanyard can be added if necessary.

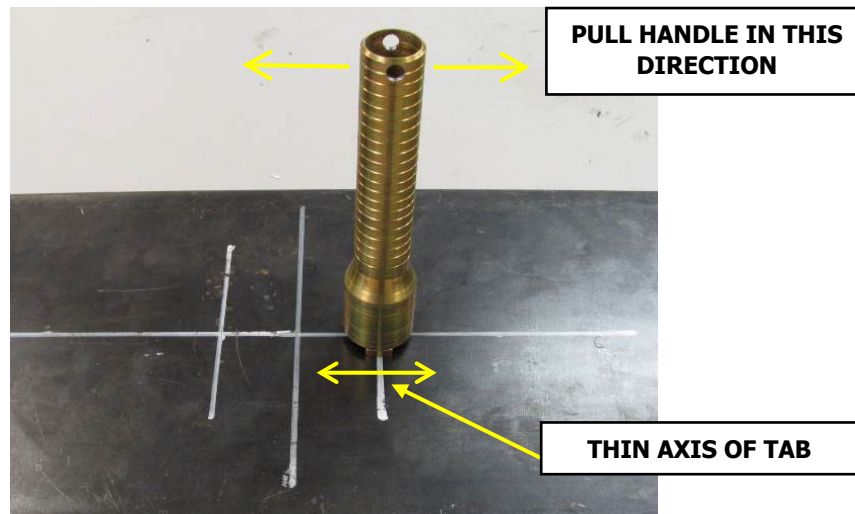


Figure 14: Removing a Tab with the TRT

4. Unthread the tab from the TRT and continue with the other sensors. If the tab remained with the sensor during removal, use vice grips to hold the foot of the tab while loosening the nut.
5. The tabs can be re-used by soaking them in acetone for 30-40 minutes to remove the hardened adhesive. Be sure to cover the container since the acetone will evaporate quickly and is very flammable! The mounting tabs have been designed to be reusable by simply dissolving the glue with acetone. Acetone can be reused multiple times, but if it becomes too saturated with glue it will start leaving a thin layer of glue in the threads of the mounting tabs. Also, sometimes when the mounting tabs are removed from a structure, the top threads can be chipped. If it becomes hard to thread nuts onto the mounting tab stud, run a 1/4-20 (or M6) die down the threads to remove these chips and glue from the threaded stud.

5.3 INSTALLATION ON OTHER STRUCTURES

A1512/2521 Accelerometers can be installed on many structure types and in all types of applications, so it is impossible to outline all the details for each installation. However, with practice and experience, the user can select from a combination of the mounting techniques that BDI has developed over the years depending on the application.

5.3.1 Tab and Glue System on Concrete

In general, the basic “tab and glue” technique described above is suitable for most applications, however, if any of the following parameters exist; BDI recommends using mechanical anchors rather than glue:

- + If concrete is moist or wet
- + If the sensor must remain in place for more than a day or two
- + If the structure being instrumented is subjected to significant vibrations (e.g. traffic)
- + If the instrumented areas are directly over automobile or train traffic where if the sensor came loose, it could create a hazard.
- + If the instrumented area is difficult to re-access during the testing period in case sensor comes loose.

If it is judged that the tab/glue system is sufficient, some extra steps should be followed when using this method for concrete members. The primary concern when mounting sensors on either reinforced or pre-stressed concrete is that the surface must be clean, dry, and dust-free in order for the glue to adhere to. Therefore, it is highly recommended that compressed air (either in cans or from a compressor) be used to remove the dust after grinding has been completed. Follow the above steps as outlined for steel, except just prior to applying the glue to the tabs, use the compressed air to clean any surface dust away from the mounting point.

5.3.2 Concrete Mounting Studs

If it is judged that the conditions warrant more secure mounting system, then threaded mounting studs can be used. These will require a hole to be accurately drilled in the concrete with a hammer drill as described below.

- + Locate the gaging point on the structure and using a concrete drill, drill a $\frac{1}{4}$ in hole approximately 1.0 in deep. If mounting to pre-stressed concrete, ensure to avoid drilling into the pre-stressing tendons.
- + Drop in a 1/4-20 x 1-1/2 in Power Fasteners Power-Stud or similar and lightly tap in with a hammer to set.
- + Slide the sensor over the stud.
- + While holding the sensor in place, screw a nut on the stud and tighten with an open-end wrench.

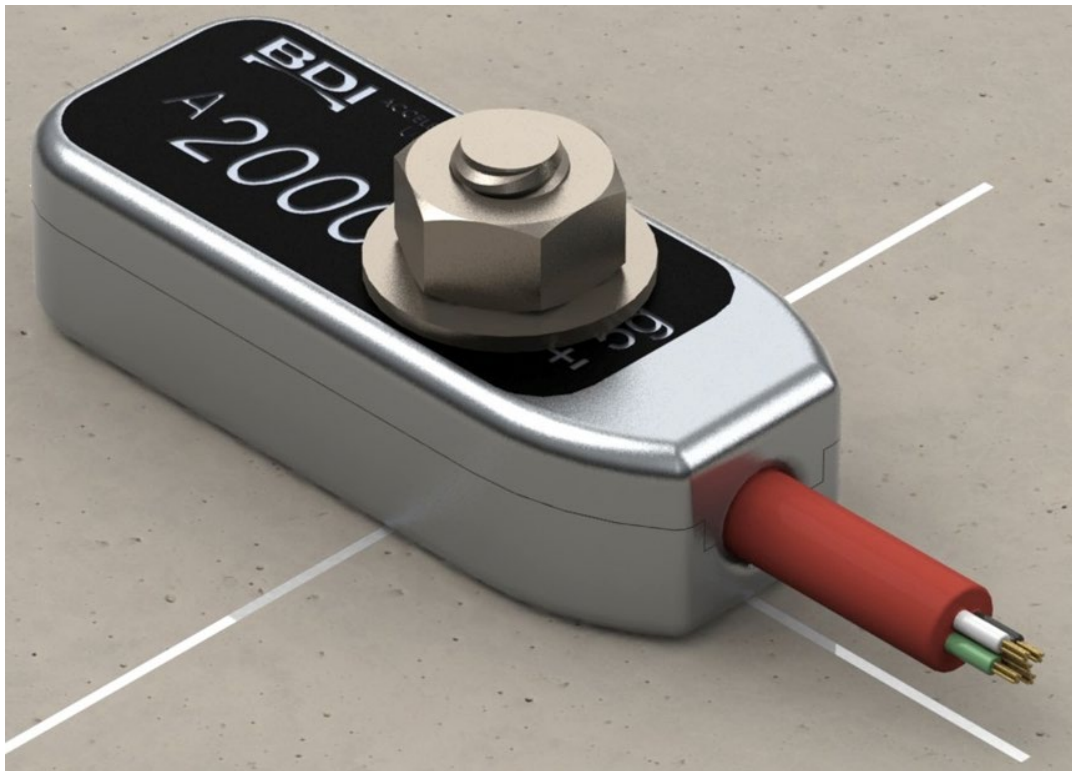


Figure 15: Accelerometer mounted with a concrete stud

5.3.3 C-Clamp

Note that there is a raised area around the mounting hole. A C-clamp should be centered over this area and tightened until snug, DO NOT OVERTIGHTEN!

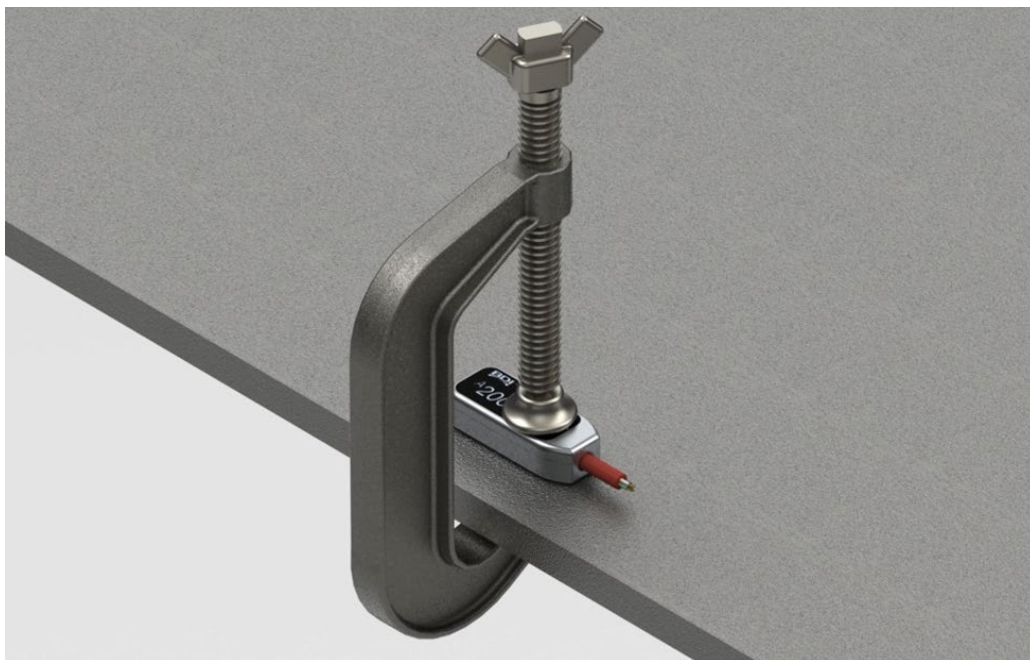


Figure 16: Accelerometer mounted with a C-Clamp

5.3.4 Self-Tapping Wood Screws

If the accelerometer is to be mounted to a timber member or other relatively soft materials, use a 1-1/2 in self-tapping Phillips-head screw and a power screwdriver. If the wood has any sort of glue laminated section or it has been chemically treated, it is recommended that a pilot hole be drilled.

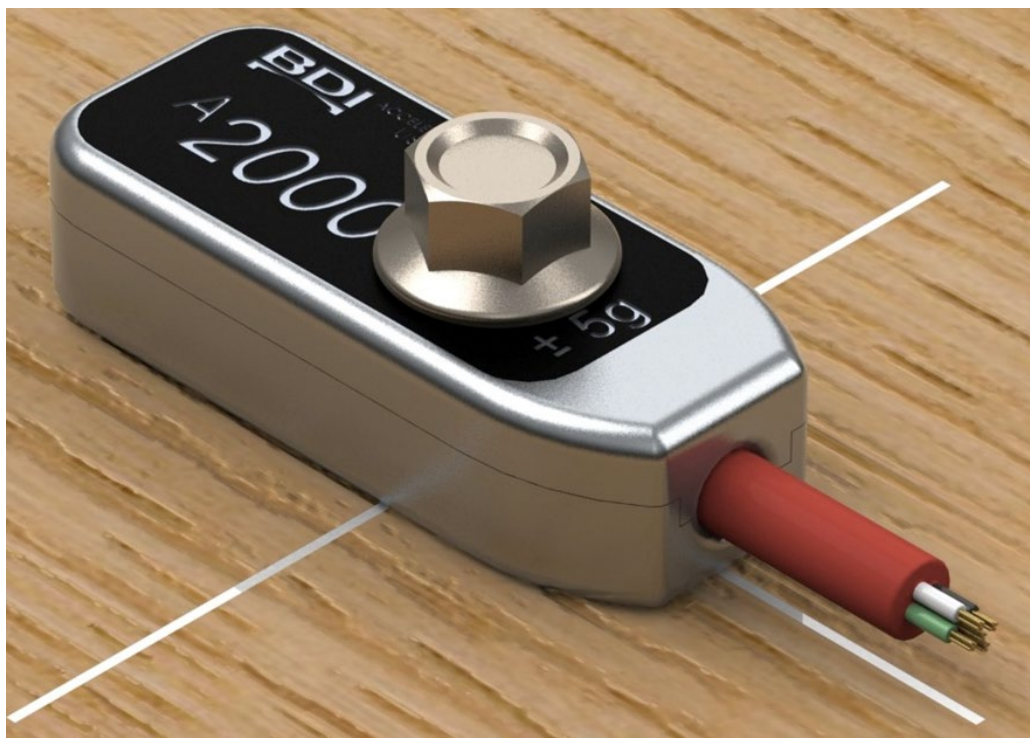


Figure 17: Accelerometer mounted to a wood surface with self-tapping screw

5.3.5 Mounting to Cables or Wire Ropes

For short term applications, attaching to steel cables requires Velcro to loop around both the accelerometer and the cable as shown in Figure 18. Hold the A1512/A2512 accelerometer firmly on the surface of the cable, wrap a Velcro strap around the cable and A1512/A2512 accelerometer and pull tight. Note that BDI also manufactured a V-Notch mounting bracket that can be used to permanently mount the A1512/A2512 accelerometers to cables or rods of various sizes.

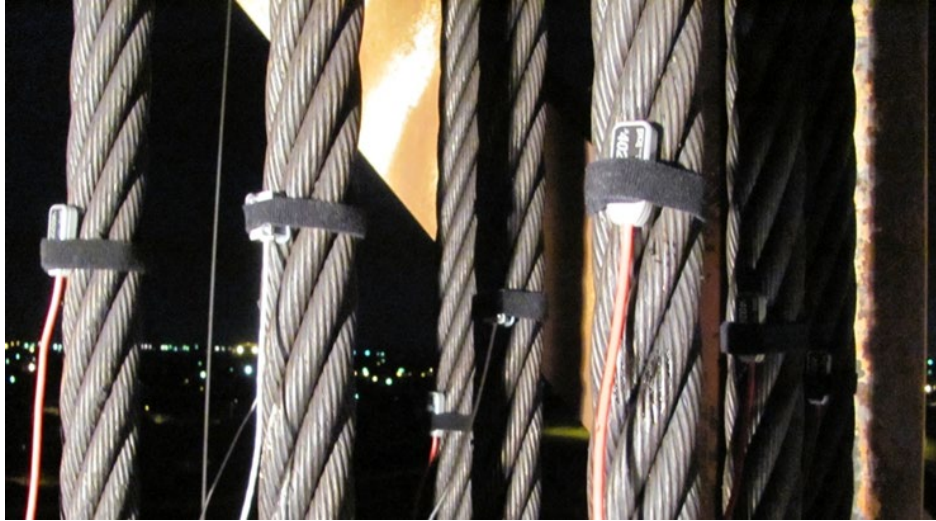


Figure 18: Accelerometers mounted to cables using Velcro straps



INFORMATION: For long term applications, use the BDI manufactured V-Notch mounting bracket with hose clamps or stainless-steel strapping.

6. RECALIBRATION & REPLACEMENT

6.1 RECALIBRATION

Calibration is performed on each accelerometer prior to shipping and a Calibration Certificate is shipped with each sensor. If this sensor is out of specification, it can be sent to BDI for re-calibration.

The customer is responsible for any cost associated with the removal of the sensor and shipping to BDI. If the part is under warranty, the sensor will be re-calibrated at no further cost to the customer. If the part is out of warranty, it will be repaired and calibrated for a nominal fee.

6.2 REPLACEMENT

In order to meet an IP67 rating the sensor has been potted with a non-re-enterable encapsulant. Due to this design, the only replacement part available for the sensor is the cable. For the cable to be replaced, the sensor should have at least twelve inches of cable exiting the sensor body. This cable can be spliced to a new cable of the proper length.



INFORMATION: If a sensor is damaged beyond repair, the sensor may be replaced at a discounted price to the original purchaser. Please contact Bridge Diagnostics, Inc. or the local distributor to obtain authorization for return.



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