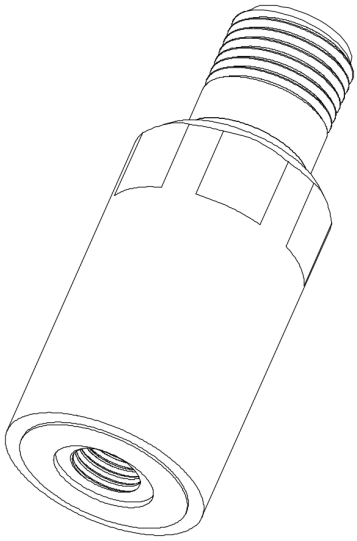
330530 Radiation Resistant Velomitor

Datasheet

Bently Nevada Machinery Condition Monitoring

176101 Rev. F



Description

Velomitor Piezo-velocity Sensors measure absolute bearing housing, casing, or structural vibration relative to free space. Unlike our Seismoprobe Sensor and other moving-coil velocity transducers, Velomitor Piezo-velocity Sensors are specialized solid-state piezoelectric accelerometers with embedded integration electronics. Because the sensors have no moving parts, they do not suffer from mechanical degradation or wear and can be mounted vertically, horizontally, or at any other angle of orientation. In addition, the 330530 sensor is specifically designed to function in a gamma-radiation environment.

If housing measurements are being made for overall machine protection, the user should consider the usefulness of the measurement for each application. Most common machine malfunctions (imbalance, misalignment, etc.) originate at the rotor and cause an increase (or at least a change) in rotor vibration. In order for any housing measurement alone to be effective for overall machine protection, the machine must faithfully transmit a significant amount of rotor vibration to the bearing housing or machine casing, or more specifically, to the mounting location of the transducer.

In addition, the user should exercise care when physically installing the transducer. Improper installation can degrade the transducer's performance, and/or generate signals that do not represent actual machine vibration. Integration of the output to displacement can worsen this. Exercise extreme caution if integrating to displacement, as this goes against our engineering best practices

Upon request, we can provide engineering services to determine the suitability of housing measurements for the machine in question and/or to provide installation assistance.

CE

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Specifications

Parameters are specified from +20 °C to +30 °C (+68 °F to +86 °F) room temperature and 100 Hz unless otherwise indicated.

Operation outside the specified limits may result in false readings or loss of machine monitoring.

Pre-Radiation Electrical

Sensitivity	3.94 mV/mm/s (100 mV/in/s) ± 5%
Output Bias Voltage, Ref: Pin B to Pin A	-12.0 ± 1.0 V @ room temperature -12.0 ± 3.45 V over temperature
Frequency Response	6.0 Hz to 2.5 kHz (360 cpm to 150 kcpm) ± 0.9 dB 4.5 Hz to 5.0 kHz (270 cpm to 300 kcpm) ± 3.0 dB
Temperature Sensitivity	-11.0% to +10.5% typical over the operating temperature range
Velocity Range	635 mm/s (25 in/s) peak
Transverse Sensitivity	Less than 5% of sensitivity
Amplitude Linearity	±2% to 152 mm/s (6 in/s) peak
Mounted Resonant Frequency	Greater than 12 kHz
Broadband Noise Floor (4.5 Hz to 5 kHz)	0.008 mm/s (320 min/s) rms, nominal
Maximum Cable Length	305 metres (1,000 feet) of cable, Part Number 175873, with no degradation of signal

Post-Radiation Electrical

Sensitivity	3.94 mV/mm/s (100 mV/in/s) ± 10% @ 3 Mrads 3.94 mV/mm/s (100 mV/in/s) ± 12% @ 12 Mrads
Output Bias Voltage, Ref: Pin B to Pin A	-12.0 ± 2.0 V @ room temperature -12.0 ± 3.70 V over temperature
Frequency Response	6.0 Hz to 2.5 kHz (360 cpm to 150 kcpm) ± 1.0 dB 4.5 Hz to 5.0 kHz (270 cpm to 300 kcpm) ± 3.0 dB
Temperature Sensitivity	-10.0% to +12.5% typical over the operating temperature range
Velocity Range	420 mm/s (16.5 in/s) peak
Transverse Sensitivity	Less than 5% of sensitivity
Amplitude Linearity	±2% to 152 mm/s (6 in/s) peak
Mounted Resonant Frequency	Greater than 12 kHz
Broadband Noise Floor (4.5 Hz to 5 kHz)	0.008 mm/s (320 min/s) rms, nominal
Maximum Cable Length	305 metres (1,000 feet) of cable, BN Part Number 175873, with no degradation of signal

Environmental Limits

Operating Temperature Range	-55 °C to +121 °C (-67 °F to +250 °F)
Shock Survivability	5,000 g peak, maximum
Relative Humidity	To 100% non-submerged (case is hermetically sealed)
Base Strain Sensitivity	0.005 in/s/mstrain
Magnetic Field Sensitivity	<51 min/s/gauss (50 gauss, 50 - 60 Hz)
Radiation Dosage	12.0 Mrads, maximum guarantee The limits listed above are what Bently Nevada, LLC guarantees. See the Summary Testing Report at the end of this document for more details.

Physical

Weight	142 grams (5.0 ounces), typical
Diameter	25.3 mm (0.995 in)
Height	63.5 mm (2.5 in)
Case Material	304L stainless steel
Connector	2-pin MIL-C-5015 hermetically sealed, 304 stainless steel
Mounting Torque	4.52 N-m (40 in-lbf) maximum
Polarity	Pin A goes positive with respect to Pin B when the sensor case motion is towards the connector.

Compliance and Certifications

FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

EMC

EMC Directive 2014/30/EU

RoHS

RoHS Directive 2011/65/EU

Maritime

330400 and 330425 only

ABS 2009 Steel Vessels Rules

1-1-4/7.7,4-8-3/1.11.1,4-9-7/13

Ordering Information

For the detailed listing of country and product specific approvals, refer to the *Approvals Quick Reference Guide* (108M1756) available from Bently.com.

Velomitor Sensor

330530-AA

A: Mounting Thread Adapter Option	
0 0	No adapter
0 1	1/2 - 20 UNF
0 2	M8 x 1
0 3	1/4 - 28 UNF
0 4	1/4 - 20 UNC
0 5	1/4 - 18 NPT
0 6	5/8 – 18 UNF
0 7	3/8 – 16 UNC
0 8	1/2 - 13 UNC If an application requires a housing, our 21128 Velocity Transducer Housing uses the Mounting Thread Adapter Option –01 for 1/2 - 20 UNF. Not Inspira

Interconnect Cable

330533-AA

A: Cable Length Option in feet	
For the cables listed below, order in increments of 1.0 ft (305 mm).	
Example:	
0 9	9.0 ft
1 2	12.0 ft Note: Minimum: **02** = 2 ft Maximum: **99** = 99 ft
The following are standard lengths	
Feet	Meters (approx.)
6	1.8
8	2.4
10	3.0
12	3.6
15	4.5
17	5.0
20	6.0
25	7.6
30	9.0
33	10.0
50	15.2
99	30.0
Non-standard/custom lengths can also be ordered at additional cost	

Velocity Transducer Housing Assembly

21128-AA-BB

A: Mounting Thread Option	
0 1	Unthreaded
0 2	3/4 - 14 NPT
0 3	1/2 - 14 NPT
0 4	1/2 - 14 BSP
B: Cable Exit Fitting Option	

0 1	1/2 - 14 NPT plug
0 2	1/2 - 14 NPT explosion-proof
0 3	½ - 14 NPT explosion-proof with cable gland seal When using the 21128 housing, cable part number 89477-AXX is necessary to connect the Velomitor Sensor to a monitor.

Accessories

175873	Bulk Tefzel cable; 2 conductor 18 AWG twisted, shielded cable (same wire used in 330533) without connectors or terminal lugs. Specify number of feet
46000-01	Magnetic base for temporary mounting of Velomitor Sensors. Used with 1/4 - 28 UNF mounting thread adapters.
46122-01	Quick Connect for semi-permanent mounting of Velomitor Sensors. Used with 1/2 - 20 UNF mounting thread adapters.
89409-01	Individual 1/2 - 20 UNF mounting adapter
89410-01	Individual M8 x 1 mounting adapter
89411-01	Individual 1/4 - 28 UNF mounting adapter
89412-01	Individual 1/4 - 20 UNC mounting adapter
89413-01	Individual 1/4 - 18 NPT mounting adapter
04300015	Individual 5/8 – 18 UNF mounting adapter
161191	Individual 1/2 - 13 UNC mounting adapter The Velomitor Sensor is shipped with an adapter. Individual adapters are available as spares. Not Inspira
101212-01	Velomitor Sensor connector kit. Used with housings and retrofits.
123135-01	Velomitor Sensor Power Module

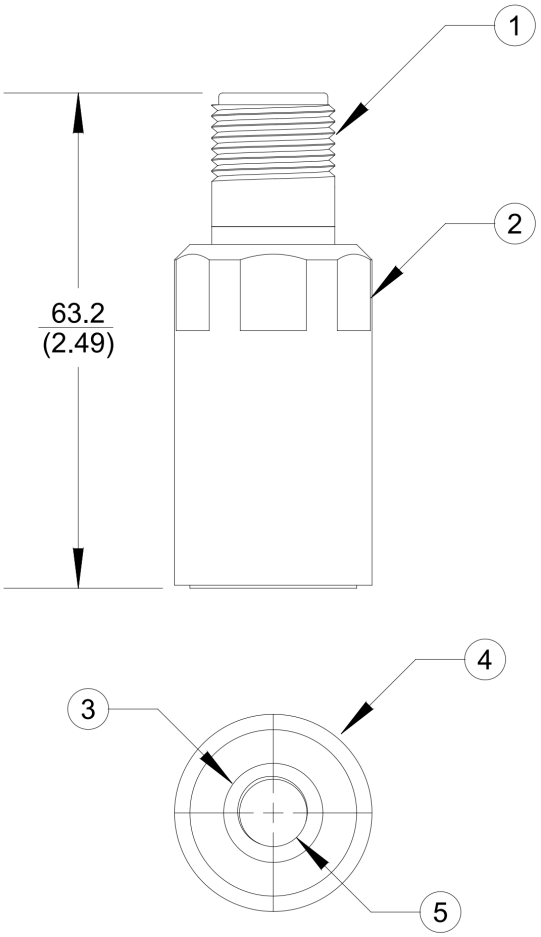
For more information concerning this product, please refer to the 330500 Velomitor Sensor, 300525 Velomitor XA Sensor, and 330530 Radiation Resistant Velomitor Sensor User Guide (document 100076).

Product Disposal Statement

It is the responsibility of the nuclear site to correctly dispose of this hardware as required by regulations. The product is not covered under the WEEE directive.

Graphs and Figures

Note: All dimensions in millimetres (inches) unless otherwise specified.



1. 2-pin, MIL-C-5015 receptacle
2. 15/16" hexagonal
3. 12.7 (0.500) diameter, 0.8 (0.030) deep counterbore
4. 25.3 (0.995) diameter
5. 3/8 - 24 UNF-2B, 6.4 (0.250) minimum threaded depth, 14.0 (0.550) maximum drill depth

Figure 1: Velomitor Piezo-velocity Sensor Dimensional Drawing

Frequency Response Graphs

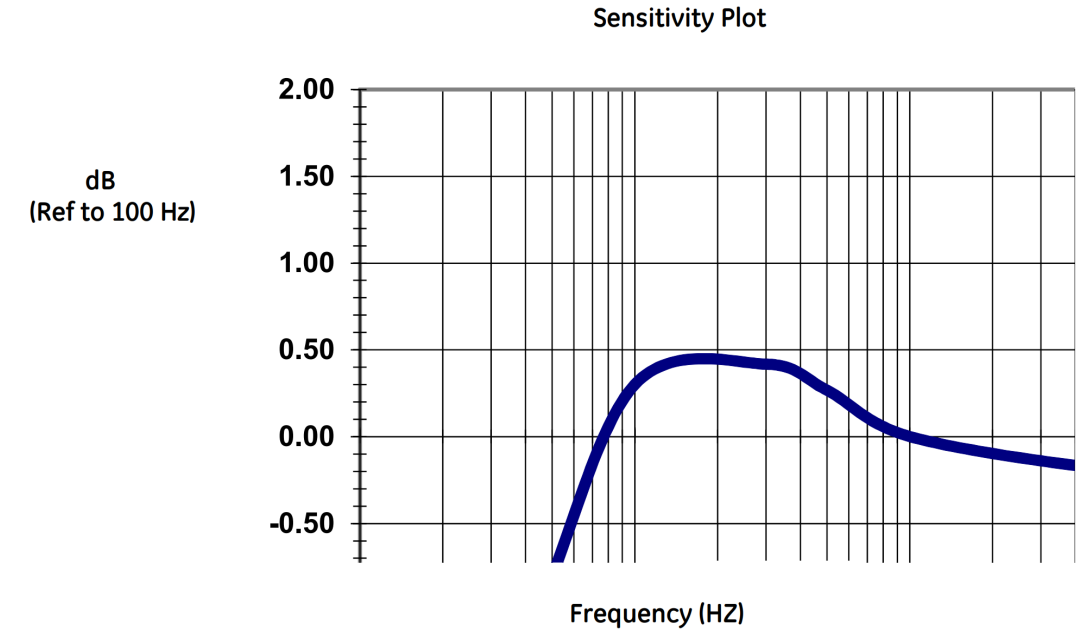


Figure 2: Frequency Response, Typical Amplitude Response

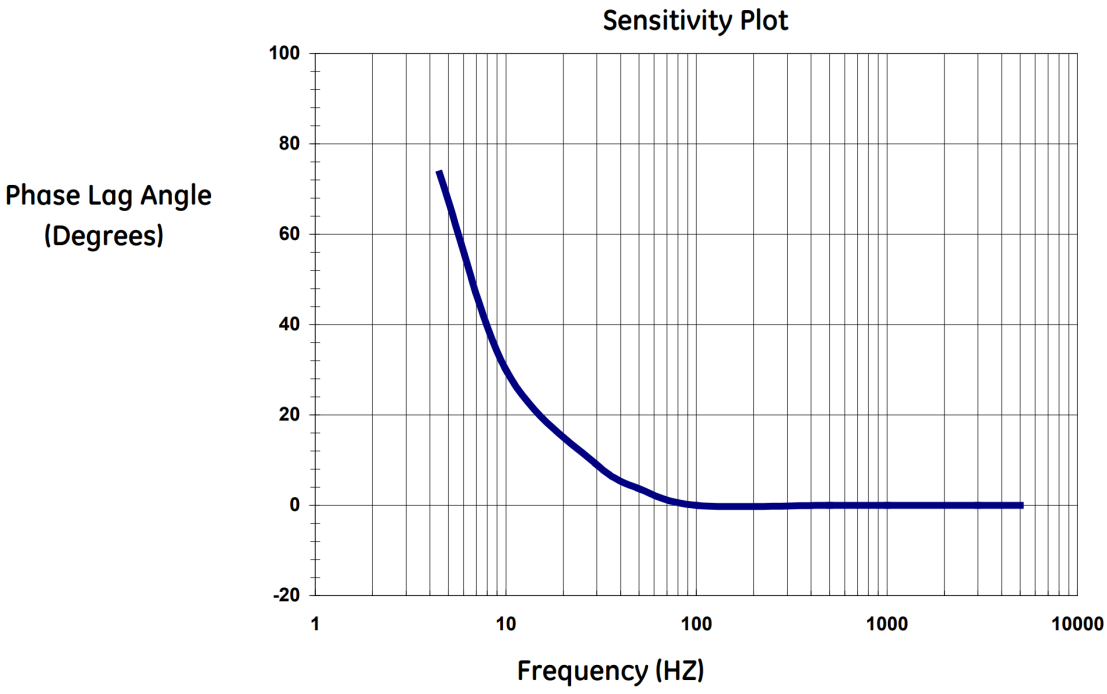


Figure 3: Frequency Response, Typical Phase Response

Summary - Testing Report

(For complete details refer to the white paper "Test Report of the Radiation Resistant Velomitor sensor 330530")

We completed a series of tests to insure that the product will meet the specifications contained in this document. The information in the white paper outlines the details regarding the testing and irradiation. The customer can use the information in the whitepaper to validate how the product is used and infer how the product could change with gamma-radiation exposures. Note, however, that any observation or extrapolation of this data is not a guarantee of the product performance. Listed below are limitations and boundary conditions.

Important items about the testing:

- The Device Under Test (DUT) will have the largest parameter shift when the unit is powered up and being irradiated at the same time.
- The gamma-radiation was from a Co60 source. A number of 16-inch-long rods were placed in a circular pattern around the DUT to establish uniform radiation and exposure levels around the DUT. The length of the rods ensured that the top and bottom of the DUT were also being irradiated, albeit at a slightly lower level. The dosage rate is the sum effect of all of the rays intersecting at the DUT.

The product was not designed or tested:

- to be a part of the control loop as the product design is for monitoring purposes only,
- for LOCA (loss of coolant accident), sometimes called LOC (loss of coolant), events,
- to withstand neutron radiation, or
- for spike or burst events.

Observation:

- Sensitivity:
  - Starts at 3.94 mV/mm/s (100 mV/in/s) ± 5%.
  - With each 3 Mrad gamma-radiation exposure the average change decreased 3%.
- Output Bias Voltage
  - Starting point:
    - -12.0 ± 1.0 volts @ room temperature
    - -12.0 ± 3.45 volts @ over temperature

    As the device is irradiated, the DUT will shift in both directions, making the window larger. This wider window results in a smaller dynamic range.
- As a note: We tested a number of the units and at no time did any of the units fail. The numbers of units tested at the higher radiation level (maximum of 13 Mrad) did not constitute a significant sample size to guarantee the product at these higher levels.

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