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## Описание на радиационные пьезодатчики скорости. Модель 330530

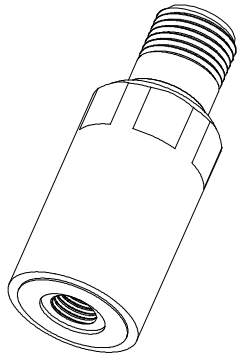


**BENTLY**  
Nevada

# Radiation Resistant Velomitor\* Piezo-velocity Sensor

## Bently Nevada\* Asset Condition Monitoring

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### 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.

### Application Alert

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 *in any case*, 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.

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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.

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

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### Pre-Radiation Electrical

#### Sensitivity

3.94 mV/mm/s (100 mV/in/s)  $\pm$  5%

#### Output Bias Voltage, Ref: Pin B to Pin A

-12.0  $\pm$  1.0 V @ room temperature

-12.0  $\pm$  3.45 V over temperature

#### Frequency Response

6.0 Hz to 2.5 kHz (360 cpm to 150 kcpm)  $\pm$  0.9 dB

4.5 Hz to 5.0 kHz (270 cpm to 300 kcpm)  $\pm$  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

$\pm$ 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  $\mu$ in/s) rms, nominal

### Maximum Cable Length

305 metres (1,000 feet) of cable, Part Number 175873, with no degradation of signal

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### Post-Radiation Electrical

#### Sensitivity

3.94 mV/mm/s (100 mV/in/s)  $\pm$  10% @ 3 Mrads

3.94 mV/mm/s (100 mV/in/s)  $\pm$  12% @ 12 Mrads

#### Output Bias Voltage, Ref: Pin B to Pin A

-12.0  $\pm$  2.0 V @ room temperature

-12.0  $\pm$  3.70 V over temperature

#### Frequency Response

6.0 Hz to 2.5 kHz (360 cpm to 150 kcpm)  $\pm$  1.0 dB

4.5 Hz to 5.0 kHz (270 cpm to 300 kcpm)  $\pm$  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

$\pm$ 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)

Greater than 12 kHz

**Maximum Cable Length**  
0.008 mm/s (320  $\mu$ in/s) rms, nominal  
305 metres (1,000 feet) of cable, BN Part Number 175873, with no degradation of signal

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## 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/ $\mu$ strain

**Magnetic Field Sensitivity**  
<51  $\mu$ in/s/gauss (50 gauss, 50 - 60 Hz)

**Radiation Dosage**  
12.0 Mrads, maximum guarantee

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**Note:** The limits listed above are what Bently Nevada Inc. guarantees. See the Summary Testing Report at the end of this document for more details.

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## Physical

**Weight**  
142 grams (5.0 ounces), typical

**Diameter**  
25.3 mm (0.995 in)

**Height**  
63.5 mm (2.5 in)

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## 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.

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## Compliance and Certifications

### EMC Standards

EN61000-6-2 Immunity for Industrial Environments  
EN61000-6-4 Emissions for Industrial Environments  
European Community Directives:  
EMC Directive 2004/108/EC

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## Ordering Information

Country specific approvals may be available. Please consult your local Customer Care Representative for more information.

### Velomitor sensor

#### 330530-AXX

**A:** Mounting Thread Adapter Option

<b>00</b>	No adapter
<b>01</b>	1/2 - 20 UNF
<b>02</b>	M8 x 1
<b>03</b>	1/4 - 28 UNF
<b>04</b>	1/4 - 20 UNC
<b>05</b>	1/4 - 18 NPT
<b>06</b>	5/8 - 18 UNF
<b>07</b>	3/8 - 16 UNC
<b>08</b>	1/2 - 13 UNC

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**Note:** 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

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## Interconnect Cable

### 330533-AXX

#### A: Cable Length Option in feet

For the cables listed below, order in increments of 1.0 ft (305 mm).

Example: **09** = 9.0 ft

**12** = 12.0 ft

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#### Note:

Minimum: 02 = 2 ft

Maximum: 99 = 99 ft

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The following are standard lengths	
Feet	Metres (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

**NOTE:** Non-standard/custom lengths can also be ordered at additional cost

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## Accessories

### Velocity Transducer Housing Assembly

#### 21128-AXX-BXX

#### A: Mounting Thread Option

**01** Unthreaded

**02** 3/4 - 14 NPT

**03** 1/2 - 14 NPT

**04** 1/2 - 14 BSP

#### B: Cable Exit Fitting Option

**01** 1/2 - 14 NPT plug

**02** 1/2 - 14 NPT explosion-proof

**03** ½ - 14 NPT explosion-proof  
with cable gland seal

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**Note:** When using the 21128 housing, cable part number 89477-AXX is necessary to connect the Velomitor Sensor to a monitor. Not Inspira

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## Part Numbers

### 100076-01

330500 Velomitor Sensor, 300525 Velomitor XA Sensor, and 330530 Radiation Resistant Velomitor Sensor Manual

### 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

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**Note:** The Velomitor Sensor is shipped with an  
adapter. Individual adapters are available as  
spares. Not Inspira

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**101212-01**

Velomitor Sensor connector kit.  
Used with housings and retrofits.

**123135-01**

Velomitor Sensor Power Module

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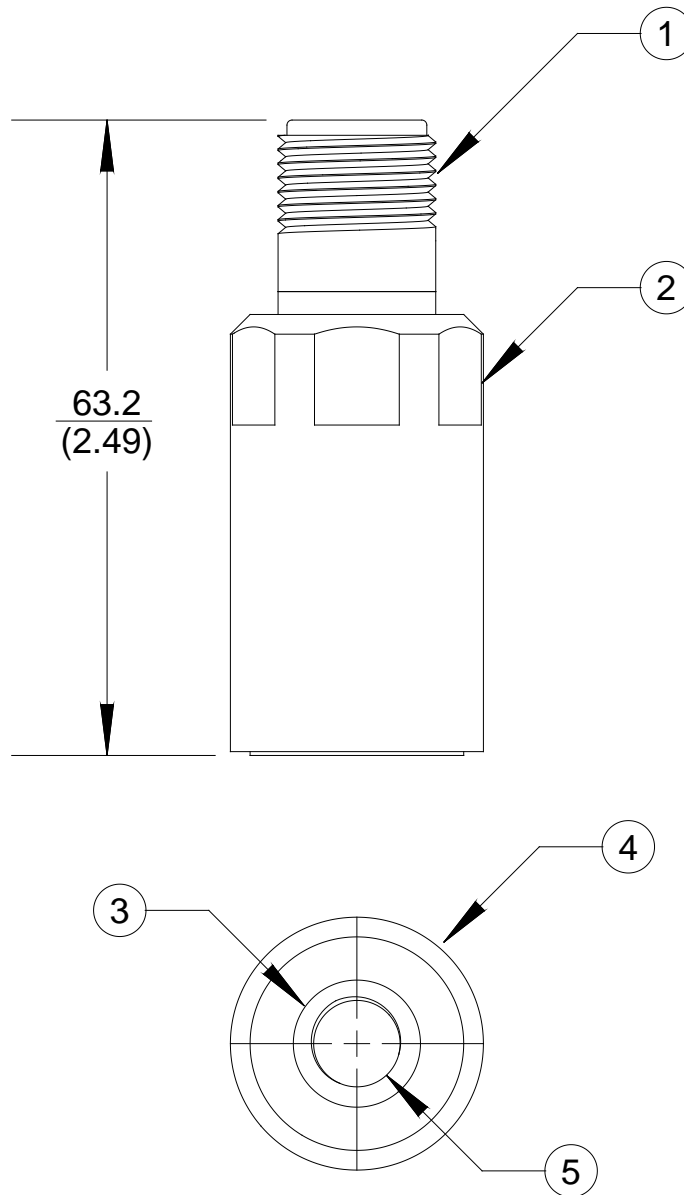
## **Product Disposal Statement**

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.

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## Dimensional Drawing

Note: All dimension 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

### Sensitivity Plot

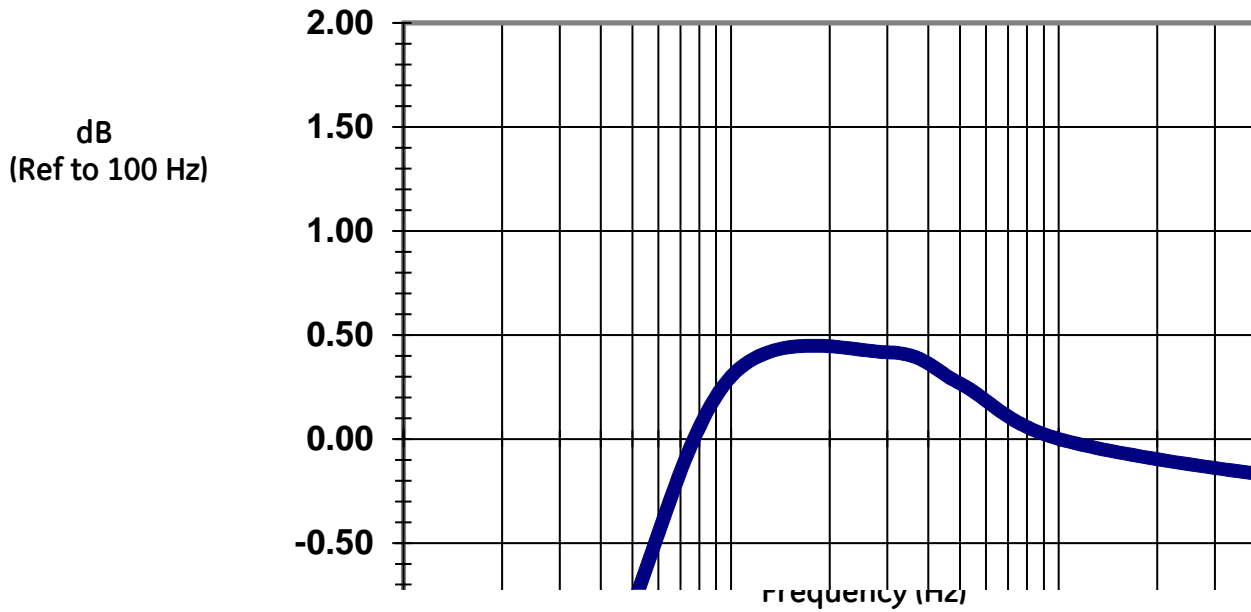


Figure 2: Typical Amplitude Response

### Sensitivity Plot

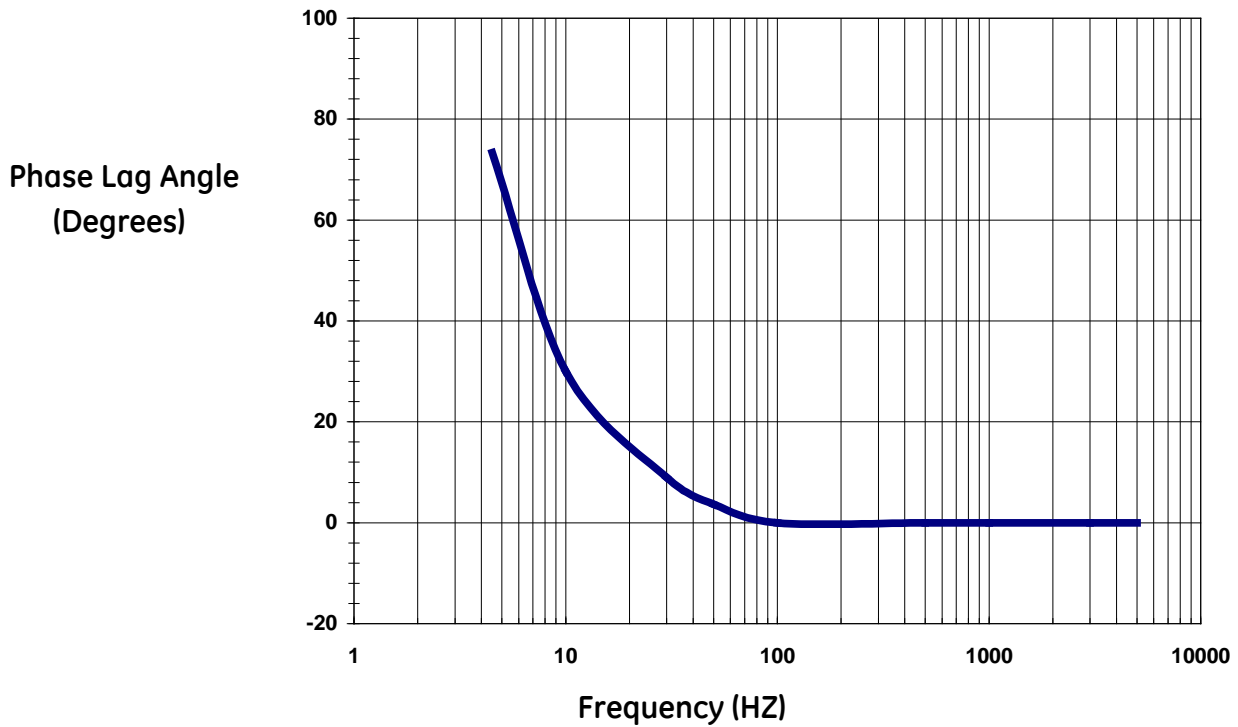


Figure 3: Typical Phase Response



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## 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)  $\pm$  5%.
  - With each 3 Mrad gamma-radiation exposure the average change decreased 3%.
- Output Bias Voltage:
  - Starting point:
    - -12.0  $\pm$  1.0 volts @ room temperature
    - -12.0  $\pm$  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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