Machinery Monitoring
Vibration Sensors & Accessories

CATALOG 2015
GOAL: Be your European vibration Sensor Partner

VibraSens is a European company that designs and manufactures vibration instrumentations such as industrial piezoelectric accelerometers, vibration sensors, vibration transmitters, signal conditioners, junction boxes, low noise cable assemblies, connectors, accessories and calibration equipments.

Mission

VibraSens’ mission is:
- Be one of the European leaders in the manufacture and design of piezoelectric accelerometer and piezoelectric dynamic pressure sensor.
- Offer innovative piezoelectric vibration sensor for niche market and harsh environment (700°C).
- Offer private labelling of our products for companies who want to outsource their piezoelectric accelerometer and pressure sensor manufacture.
- Be the ideal partner in terms of pricing, reliability and technical support.

Industry served

Our piezoelectric accelerometers are used throughout the following industry: Power generation (Gas turbine, Steam turbine, Wind turbine, Hydro generator), Petrochemical & Pipeline industry, Offshore platform industry, General process industry, Research and development facilities, Metals & Mining, Pulp and paper, Waste water treatment, Research and development and many others....

Applications

Industrial piezoelectric accelerometers can sense vibrations in terms of acceleration, velocity and displacement for machines such as: Air compressors, Air handlers, Pulp and paper dryer sections, Conveyors, Cooling towers, Fans, Fourdriniers, Gear boxes, Motors, Press sections, Presses, Stamping, Pumps, Roll and process equipment, Spindles,..

Experience

We have more than 20 years of experience in the piezoelectric accelerometer design, especially in harsh and high temperature environment (500°C, 700°C or even more).

In order to maintain our international expertise we closely work with two university laboratories LCEP (http://www.lcep.ens2m.fr) and LPMO (http://www.lpmo.edu) based in Besançon and specialized in Piezoelectricity.

We also have the chance to be located in a region where piezoelectricity, microtechnics, microelectronic, mechatronic, micro-sensors and precision are well known words. Besançon hosts one of the biggest microtechnology fair in Europe (http://www.micronora.com) devoted to microtechnology and strong of 850 exhibitors from 25 countries.

All this friendly environment strengthens our knowledge and gives our company a competitive advantage in the piezoelectric vibration sensor technology.

Technology

With advanced product development and manufacturing facilities in Besançon-France, VibraSens has the skills, experience and resources to provide the products and services that will fulfill your requirements.

A modern production facility exclusively engaged in the design and manufacture of piezoelectric vibration transducers, piezoelectric pressure sensor and vibration instrumentations help us to maintain a high quality level in our core business.

Our manufacturing and test equipment ranges from basic precision machinery for providing high quality sensor components,
to custom-built machinery specifically designed for piezoelectric vibration sensor fabrication.

During the years of development we have also built some specifically design systems to test our range of piezoelectric accelerometer. We have developed using ®Labview (National Instrument Trademark) a completely automated shaker test system to check the sensitivity and frequency response (up to 10 kHz) of our piezoelectric vibration sensors.

Our controlled process includes laser and microplasma welding, helium leak tester, resistance welding, temperature cycling, high temperature brazing. All those processes and others are strictly controlled by our process specification document.

We closely work with one of the best European company specialized in the manufacturing of hybrid circuit for the sensor industry. With this partnership, we are sure to stay ahead of this technology for the years to come.

Why should you buy from us:

We are focussed on the manufacture and design of piezoelectric vibration sensor. We could offer you the best quality price performance on the market.

We invest heavily in our core business and keep all of our products up to state of the art technology.

To better suit your market, we offer private labeling for all of our product line with two digits modifications in our part number.

Whatever your market is, condition monitoring, balancing, vibration diagnostic services company, we will be happy to serve you and share our extensive expertise. We are looking forward to being your vibration sensor partner.
Piezoelectric Accelerometer Selection

Accelerometer Technology Selection

If you want to assess the motion of an object then you need a sensor to do it. There are many styles like for example the eddy current probe, the velocimeter, the laser or the accelerometer. All have their output proportional to the motion of the object: let it be acceleration, velocity or displacement. All have their own characteristic in terms of temperature, frequency response, linearity, sensitivity, etc. The accelerometer have proved to be successful in many applications.

Accelerometer exhibits 3 technologies:

- piezoelectric
- capacitive
- piezoresistive

Their intrinsic characteristics are sum up in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Piezoelectric</th>
<th>Capacitive</th>
<th>Piezoresistive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>0.2 Hz to 50 kHz</td>
<td>DC to few hundreds hertz</td>
<td>DC to few thousands hertz</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>&lt;100 000 g</td>
<td>&lt;1000g</td>
<td>&gt; 100 000g</td>
</tr>
<tr>
<td>Temperature</td>
<td>-273°C to 800°C</td>
<td>-55°C to +120°C</td>
<td>-55°C to +120°C</td>
</tr>
<tr>
<td>Applications</td>
<td>Vibrations</td>
<td>Vibrations at low frequency and motion with no shock</td>
<td>Vibrations at low frequency and motion in presence of very high shock</td>
</tr>
</tbody>
</table>

VibraSens designs and manufactures piezoelectric accelerometer only. We can also manufacture using commercially available chip, capacitive or piezoresistive accelerometers.
<table>
<thead>
<tr>
<th>Piezo</th>
<th>Transmission</th>
<th>Output</th>
<th>Temp.</th>
<th>Pros</th>
<th>Cons</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>PZT ceramic</td>
<td>#ICP (1)</td>
<td>Acc. AC</td>
<td>-55 to 150°C</td>
<td>High reliability, higher resolution than quartz, versatility (2), high volume production, low cost, numerous options (5)</td>
<td>Less stable than quartz</td>
<td>General industrial vibration monitoring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vel. AC</td>
<td>-55 to 120°C</td>
<td>No external signal conditioning</td>
<td>Low reliability, lower temperature sensitivity, frequency range and full scale is fixed, no evolution, limited options (5)</td>
<td>General industrial vibration monitoring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dis. AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Vel. DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartz</td>
<td>#ICP (1)</td>
<td>Acc. AC</td>
<td>-273 to 200°C</td>
<td>High reliability, ageing stability, versatility (2), high volume production, low cost, numerous options (5)</td>
<td>Lower resolution than PZT ceramic (4)</td>
<td>General absolute laboratory, acceleration measurements, cryogenic application.</td>
</tr>
<tr>
<td>Quartz</td>
<td></td>
<td>Charge AC</td>
<td>-273 to 200°C</td>
<td>Very high reliability, ageing stability</td>
<td>Lower resolution than PZT ceramic (4)</td>
<td>Absolute laboratory, acceleration measurements, cryogenic application.</td>
</tr>
<tr>
<td>PZT ceramic</td>
<td></td>
<td></td>
<td>-55 to 260°C</td>
<td>Very high reliability, high resolution</td>
<td>Less stable than quartz</td>
<td>Industrial vibration measurements in high temp. environment</td>
</tr>
<tr>
<td>BT Ceramic</td>
<td></td>
<td></td>
<td>-55 to 500°C</td>
<td>Very high reliability, high resolution, compares to tourmaline</td>
<td>Less stable than tourmaline</td>
<td>Industrial vibration measurements in very high temp. environment</td>
</tr>
<tr>
<td>Tourmaline or eq.</td>
<td></td>
<td></td>
<td>-273 to 800°C</td>
<td>Very high reliability</td>
<td>Very expensive</td>
<td>Industrial vibration measurements in very high temp. environment</td>
</tr>
</tbody>
</table>

(1) #ICP is a worldwide voltage transmission standard that uses a constant current source supply. Some manufacturers still offer proprietary current transmission which is not useful for standard application: AC acceleration up to 10 kHz and 500 meters, AC velocity up to 5kHz and 1000 meters, displacement up to 1kHz and 2000 meters.

(2) The AC acceleration signal can be externally conditioned to have concomitant AC velocity, AC displacement, DC acceleration, DC velocity or DC displacement.

(3) With no AC acceleration output, you will not be able to connect a portable analyzer with enveloping algorithm for roller bearing defect detection.

(4) Resolution is important if you plan to make measurements at low frequency (<10Hz) with vibration parameters like velocity or displacement.

(5) This type of sensors covers the broadest range of characteristics: few grams to kilograms, epoxy or hermetically sealed, large choice of connector, top or side connector,.....
**Introduction**

VibraSens offers a comprehensive selection of ®ICP industrial piezoelectric accelerometers and vibration sensors in a variety of industrial packages. Each sensor utilizes proven annular shear or compression piezoceramic and is housed in a welded, hermetically sealed, stainless steel case to withstand harsh industrial environments.

**General purpose, premium (Model 101, 103, 104, 108)**

The most versatile, they use piezoceramic in the annular shear mode and provide Acceleration AC output (100 mV/g).

They usually sense vibration commonly find in industrial machinery: motors, fans, pumps, paper machine rolls, ....

**General purpose, compact (Model 109)**

They use piezoceramic in the annular shear mode and provide Acceleration AC output (100 mV/g).

They usually sense vibration commonly find in industrial machinery: motors, fans, pumps, paper machine rolls, ....

**Low frequency (Model 101, 103, 104, 108)**

They use piezoceramic in the annular shear mode and provide AC acceleration output with increased sensitivity (500mV/g).

They are used when low frequency measurement down to 0.1 Hz is necessary to balance or evaluate mechanical condition of low speed machinery: cooling towers, low speed agitators, hydromachinery, structural testing, ...

**High frequency (Model 101, 103, 104, 108)**

They use piezoceramic in the annular shear and provide acceleration AC output with reduced sensitivity (10mV/g).

They are used for modal testing or when very high frequency measurements up to 20-30kHz are needed.

**High temperature, ©ICP mode (Model 101.11 & 103.12)**

They use piezoceramic in the annular shear mode and provide AC acceleration output up to a temperature of 150°C.

**Multi output with Temperature (Model 101, 103, 104, 111, 113)**

Temperature output (10mV°C, +2°C to +120°C) is available for Model 101, 103, 105, 107, 111, 113. See ordering information to add the temperature output option.

**4-20mA Vibration sensor (Model 125, 127)**

They used the industry standard 4-20mA Loop that interfaces directly with PLC, DCS and 4-20mA monitor. Large choice of outputs are available: velocity, acceleration, RMS, equivalent Peak.

They are used in the rugged environments of industrial machinery monitoring. It allows continuous trending of overall machine vibration.
## Most Popular Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensitivity</th>
<th>Frequency Range</th>
<th>Connector Type</th>
<th>Max Temp</th>
<th>Mode (1)</th>
<th>Isolation (2)</th>
<th>Price</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td><strong>GENERAL PURPOSE</strong></td>
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</tr>
<tr>
<td>*101.51-6-2</td>
<td>100 mV/g ± 5%</td>
<td>0.5 Hz to 14 kHz</td>
<td>Top M12 Glass</td>
<td>120°C</td>
<td>A. Shear</td>
<td>I+FS</td>
<td>++</td>
<td>85 gr</td>
</tr>
<tr>
<td>*101.51-6D-2</td>
<td>100 mV/g ±10%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>*103.02-6-2</td>
<td>100 mV/g ± 5%</td>
<td>0.5 Hz to 10 kHz</td>
<td>Side M12 Glass</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>++</td>
<td>130 gr</td>
</tr>
<tr>
<td>*103.02-6D-2</td>
<td>100 mV/g ±10%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
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<td>&quot;</td>
</tr>
<tr>
<td>104.01-6-1</td>
<td>100 mV/g ± 5%</td>
<td>0.5 Hz to 10 kHz</td>
<td>Side M12 Glass</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>+++</td>
<td>130 gr</td>
</tr>
<tr>
<td>108.01-6-4</td>
<td>100 mV/g ± 5%</td>
<td>0.5 Hz to 14 kHz</td>
<td>Top TNC</td>
<td>&quot;</td>
<td>&quot;</td>
<td>I</td>
<td>++++</td>
<td>34 gr</td>
</tr>
<tr>
<td><strong>LOW FREQUENCY</strong></td>
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</tr>
<tr>
<td>*101.01-9-2</td>
<td>500 mV/g ±5%</td>
<td>0.2 Hz to 3.7 kHz</td>
<td>Top M12 Glass</td>
<td>90°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>+++</td>
<td>90 gr</td>
</tr>
<tr>
<td>*103.02-9-2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Side M12 Glass</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>++++</td>
<td>140 gr</td>
</tr>
<tr>
<td>108.01-9-4</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Top TNC</td>
<td>&quot;</td>
<td>&quot;</td>
<td>I</td>
<td>++++</td>
<td>44 gr</td>
</tr>
<tr>
<td><strong>HIGH FREQUENCY</strong></td>
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<tr>
<td>*101.01-3-2</td>
<td>10 mV/g ± 5%</td>
<td>0.5 Hz to 16 kHz</td>
<td>Top M12 Glass</td>
<td>120°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>++</td>
<td>80 gr</td>
</tr>
<tr>
<td>*101.51-3D-2</td>
<td>10 mV/g ±10%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
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</tr>
<tr>
<td>103.02-3-2</td>
<td>10 mV/g ± 5%</td>
<td>0.5 Hz to 13 kHz</td>
<td>Side M12 Glass</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>+++</td>
<td>130 gr</td>
</tr>
<tr>
<td>103.02-3D-2</td>
<td>10 mV/g ±10%</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
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</tr>
<tr>
<td>108.01-3-4</td>
<td>10 mV/g ± 5%</td>
<td>0.5 Hz to 16 kHz</td>
<td>Top TNC</td>
<td>&quot;</td>
<td>&quot;</td>
<td>I</td>
<td>++++</td>
<td>34 gr</td>
</tr>
<tr>
<td><strong>HIGH TEMPERATURE</strong></td>
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</tr>
<tr>
<td>101.11-6-1</td>
<td>100 mV/g ± 5%</td>
<td>0.5 Hz to 14 kHz</td>
<td>Top Mil-C-5015 Glass</td>
<td>150°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>+++</td>
<td>85 gr</td>
</tr>
<tr>
<td>103.12-6-1</td>
<td>&quot;</td>
<td>0.5 Hz to 10 kHz</td>
<td>Side Mil-C-5015 Glass</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>++++</td>
<td>&quot;</td>
</tr>
<tr>
<td><strong>PIEZOVELOCITY</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>111.01-6-2</td>
<td>100 mV/in/sec ±10%</td>
<td>1.9 Hz to 7 kHz</td>
<td>Top M12 Glass</td>
<td>120°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>++++</td>
<td>90 gr</td>
</tr>
<tr>
<td>113.01-6-2</td>
<td>100 mV/in/sec ±10%</td>
<td>1.9 Hz to 7 kHz</td>
<td>Side M12 Glass</td>
<td>120°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>++++</td>
<td>140 gr</td>
</tr>
<tr>
<td><strong>4-20mA</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>*125.01-VR20-2</td>
<td>10mm/s RMS</td>
<td>3 to 1000 Hz</td>
<td>Top M12 epoxy</td>
<td>90°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>+</td>
<td>85gr</td>
</tr>
<tr>
<td>125.01-AR10-2</td>
<td>20 g RMS</td>
<td>3 to 10000 Hz</td>
<td>Top M12 epoxy</td>
<td>90°C</td>
<td>&quot;</td>
<td>I+FS</td>
<td>+</td>
<td>85gr</td>
</tr>
</tbody>
</table>

Note: M12 connector is recommended for European and Asian market; MIL-C-5015 is recommended for North American market.

* : Best seller
Mode (1): A. Shear = Annular shear; Comp = Compression
Isolation (2): I: Isolated from machine surface; I+FS = Isolated from machine surface+ Faraday shield
®ICP Accelerometer Model 101
Premium, Top connector

Main Characteristics
- Annular shear mode
- 10, 50, 100, 500 mV/g version available
- -55°C to 150°C (-67°F to 302°F)
- Dual case isolation with Faraday shield
- Submersible version (150 metres) with associated IP68 overmolded cable
- Life time hermetic sealing warranty (M12/Mil glass seal connector)

Competitive advantage
- Compare to obsolete compression design, annular shear piezoelectric sensors feature better frequency response, improved base strain, lower noise, smaller size, thermal transient immunity and insensitivity to cable motion. Annular shear mode is also less susceptible to transverse vibrations and better immune to electronic saturation at high frequency.
- 80 g dynamic range (thanks to exceptional bias stability) at elevated temperatures.
- Resistant to shock (magnet mounting) thanks to JFet transistor input.
- ESD and reverse wiring protection.
- The glass seal hermetic connector protects the piezoelectric disc and the electronic from harmful environmental influences, significantly increasing their reliability and lifetime. Associated with low cost IP68 overmolded M12 cable assembly it is a perfect solution for submersible application down to 150 metres. Sensors with epoxy seal will always leak after few temperature cycles.
- M12 connector offers compatibility with numerous sensors used in automation. M12 overmolded cable assemblies are available from many cable manufacturers around the world. Mil cordset are expensive because they are only available from vibration sensor manufacturer.

Description
The hermetic sealed industrial piezoelectric accelerometer model 101 is design to monitor the vibration in harsh industrial environment. It uses the industry standard ©ICP / ©IEPE / ©LIVM 2-wire voltage transmission technique with a 4 mA standard constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to EMC to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirement. Low frequency accelerometers (A=9) incorporate a low-pass filter within the conditioning electronic. This filter attenuates the sensor mechanical resonance and the associated distortion and overload.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version monitor the vibration on roller bearing, pumps cavitation, ... Medium frequency version monitor overall vibration on pumps, motors, fans, ... Low frequency model is used in the petrochemical, machine tool, and paper industries for monitoring of slow speed agitators, cooling towers, ... High temperature version is typically used where extra temperature protection is needed, such as the dryer section of a paper machine.

Ordering information model 101
To order, specify model number, options, accessories and suffix:
101.51- AA - B - TT - MM - HH - YY

Model 101.51-A-2 with overmolded IP 68 submersible M12 cable assembly

AA : Sensitivity
3 : 10 mV/g ±5 % (high frequency)
3D : 10 mV/g ±10 % (high frequency)
5 : 50 mV/g ±5 % (high frequency)
5D : 50 mV/g ±10 % (high frequency)
6 : 100 mV/g ±5 % (medium frequency, general purpose)
6D : 100 mV/g ±10 % (medium frequency, general purpose)
6Q : 100 mV/g ±15 % (medium frequency, general purpose)
9 : 500 mV/g ±5 % (low frequency down to 0.2 Hz)
9D : 500 mV/g ±10 % (low frequency down to 0.2 Hz)

Available suffix : N, negative polarity

B : Connector
1 : MIL-C-5015, glass seal
2 : M12 glass seal

B(CC-DD) Integral cable
5 : (CC-DD) : Integral cable
7 : (CC-DD) : Integral cable with sstl overbraid protection
8 : (CC-DD) : Integral cable with stainless steel protection conduit

CC : Cable Type
01 : *Polyurethane cable (90°C)
02 : *Teflon FEP cable (200°C)
03 : Radox cable (120°C, halogen free)

DD : length in metre

TT : Temperature output.
omitted : no temperature output
T0 : 10 mV°C. (range +2° to +120°C)

MM : Machine thread
omitted : no mounting stud will be shipped with the sensor.
M6 : M6x1
M7 : 1/4" 28 UNF 2A
M8 : M8x1.25

HH : Housing thread
H6 or omitted : M6x1 (China, Europe, India, South America, ...)
H1 : M16x2 (quick mounting + 120° positioning) (Not stocked)
H2 : Quick fit mounting (Not stocked)
H7 : 1/4" 28 UNF-2A. (U.S.A., UK, ...)

YY : Agency Approval
omitted : no agency approval
Y1: Atex approved (July 2010)

Special Engraving:

Add ZXX at the end of the part number.

XX is a number supplied by VibraSens

In stock Model

Metric connector
101.51-6D-2-M6 100 mV/g ±10% general purpose version
101.51-6D-2-M6 100 mV/g ±5% general purpose version
101.51-9-2-M6 500 mV/g ±5% low frequency version
101.51-3-2-M6 10 mV/g ±5% high frequency version
101.51-6D-2-T0-M6 100 mV/g ±10% with temperature output

American/UK connector
101.51-6D-1-M7 100 mV/g±10% general purpose
101.51-6D-1-H7-M7 100 mV/g±10% (1/4"28UNF housing thread)
101.11-6-1-M7 100 mV/g±5% high temp. version (150°C)
101.51-9-1-M7 500 mV/g±5% low frequency version
101.51-3-1-M7 10 mV/g 5% high frequency version

Available Model with short lead time (1 week)

101.51-6D-5(01-Length)-M6 integral polyurethane cable
101.51-6D-6(02-Length)-M6 integral 200°C sstl overbraided teflon cable

Old Part number compatibility
101.21-6 is replaced by 101.51-6D
B=3: M12 epoxy seal connector is obsolete. B=2 should be ordered.

Ordering example:
101.51-6D-2-M6 Premium accelerometer, 100 mV/g, M12 glass seal connector
101.51-6D-7(02-05)-M6 Premium accelerometer, 5 metres Inte gra! teflon cable with Stainless steel overbraid.

Specifications (24°C)

Dynamic
Sensitivity (101.01)
A=3 ........................... 10 mV/g ±5%
A=3D ........................... 10 mV/g ±10%
A=6 ........................... 100 mV/g ±5%
A=6D ........................................ 100 mV/g ±10%
A=6Q ........................... 100 mV/g ±15%
A=9 ........................... 500 mV/g ±5%
A=9D ........................................ 500 mV/g ±10%

Frequency response 101.01 & 101.51 (fig. 4a, 4b)
A=3X ...................................... ±10 % : 1 to 11000 Hz
.............................................................. ±3 dB : 0.5 to 16000 Hz
A=6X ...................................... ±10 % : 1 to 11000 Hz
.............................................................. ±3 dB : 0.5 to 14000 Hz
A=9X ...................................... ±10 % : 0.4 to 16000 Hz
.............................................................. ±3 dB : 0.2 to 3700 Hz

Mounted Resonant frequency
A=3X ........................................ 35 kHz Nom
A=6X ........................................ 25 kHz Nom
A=9X ........................................ 16 kHz Nom

Dynamic range
A=3X ........................................ 500 g pk
A=6X ........................................ 80 g pk
A=9X ........................................ 10 g pk

Transverse sensitivity (20Hz, 5g) ..................... <5%

Temperature response .......................... fig.3

Polarity ...........................................(fig. 1) Suffix dependant

Linearity ........................................ ±1% Max

Warm up time (Typical)
A=3X, 6X .......................................... ≤ 1 Sec
A=9X .......................................... ≤ 10 Sec

Option T0 (only available if sensor is powered)
Output (between - and Temp) .................. 0VDC at 0°C
Range ........................................... ±2 to 120°C

Electrical

Grounding ........................................ Isolated from machine ground
Faraday shield (fig. 1)
Internal Faraday shielding (fig. 1)

Capacitance to ground ....................... 70 pF Nom

Output impedance .......................... 50 kΩ Nom

DC output bias, 4mA supply .................. 12 VDC Nom (Fig 2)

Residual noise (24°C) A=3X
1 Hz to 25 kHz .......................... 300 ug rms
1 Hz to 25 kHz .......................... 30 ug

Residual noise (24°C) A=9X
1 Hz to 25 kHz .......................... 300 ug rms
1 Hz to 25 kHz .......................... 30 ug

Residual noise (24°C) : A=6X
1 Hz to 25 kHz .......................... 25 ug rms
1 Hz to 25 kHz .......................... 2.4 ug

Power requirements Constant current : +2 to +10mA DC
Max voltage : ±22 to ±28 VDC

Protection ........................................ Overvoltage ........................................ : Reverse polarity ........................................ Yes

Environmental
Temperature, operating continuous : 10.01 & 101.51 (max. current 4mA)
A=3X, 6X ...................................... -55 to 120 °C (-65 to 250 °F)
A=9X ...................................... -55 to 90 °C (-65 to 212 °F)

Temperature, operating continuous : 10.11 (max. current 4mA)
A=6X, B=1 ...................................... -55 to 150°C (-65 to 302 °F)

Humidity / Enclosure
B=1, 2 ........................................ Not affected, hermetically sealed, 1E-8torr/l
B=5, 7, 8 .................................... IP68, epoxy sealed

Acceleration limit : Shock .......................... 5 000g peak
Continuous vibration .......................... 500g peak

Base strain sensitivity .................................. 0.0002 g/μV strain
Temp. transient sens. (3Hz, LLF, 20dB/dec) .................. 5 mg/°C

Acoustic sensitivity (164 dBSP) .......................... 0.5 mg
Electromagnetic sens. (50Hz, 0.03 T) .................. 0.2 g

Mean time between failure (MTBF) .................. 10 Years Nom

ESD Protection .................................. > 40 V

Safety ................................................ EN 61010-1 and IEC 60101-1

EMC emission .................................. EN 50081-1 and EN 50081-2

EMC immunity (1) .................................. EN 50082-1, EN 50082-2

Physical

Dimensions
B=1 ........................................ Fig. 1a
B=2 ........................................ Fig. 1b
B=5 ........................................ Fig. 1d
B=7 ........................................ Fig. 1e
B=8 ........................................ Fig. 1f

Design ........................................ Ceramic, annular shear mode

Weight with connector
A=3 ........................................ 80 gr Nom (2.8 Oz)
A=6 ........................................ 85 gr Nom (3.0 Oz)
A=9 ........................................ 95 gr Nom (3.4 Oz)

Connector
B=1 ........................................ MIL-C-5015 glass seal, Type MS3143 10SL-4P
B=2 ........................................ M12 glass seal, IEC 60947-5-2

Material ........................................ AISI 316L, DIN 1.4404 (Stainless steel)

Housing thread .................................. Fig 1h

Mounting torque (M6, M7, M8 suffix) .................. 2.4 N m (21 in-lbs)

Accessories, supplied

Calibration supplied .................................. Sensitivity (5g, 160 Hz)
........................................ No frequency response

Accessories, not supplied

Cable assembly B=1 (Mil connector)
Polyurethane cable ................................ 10.01-B22-A01-05-Length
FEP Teflon cable ................................ 10.01-B22-A01-02-Length

Cable assembly B=2 (M12 connector)
Polyurethane cable ................................ 10.01-E02-A01-31-Length
FEP Teflon cable ................................ 10.01-E02-A01-02-Length

For more cable option see Model 10.01 (specific cable harness).

Accessories, spares part

Mounting Stud with H11-H6
M6 machine thread ................................ 191.01-06-06-1
1/4” 28 UNF machine thread ...................... 191.01-06-16-1

...
**Standard Wiring color**
With Mil-C-5015 cable assembly: + = Red // - = White // Temperature=black
With M12 cable harness: + = Black // - = Blue // Temperature=White

**Repair**
Consult factory for replacement of connector in case of broken or bended pins. Repair of electronic is not possible.

(1) Guaranteed if using accessories listed in this product datasheet only

**Drawings**

![Outline drawing & Electrical layout, B=1 (MIL-C-5015)](image1)

![Outline drawing & Electrical layout, B=2 (M12 glass seal)](image2)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin A</th>
<th>Pin B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>(+)</td>
<td>(-)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(N/A): Not available

Fig 1a: Outline drawing & Electrical layout, B=1 (MIL-C-5015)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>NC</td>
<td>NC</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>NC</td>
<td>(Temp)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

(1) Not connected

Fig 1b: Outline drawing & Electrical layout, B=2 (M12 glass seal)

<table>
<thead>
<tr>
<th>CC=01, 02 (PU, Teflon)</th>
<th>White (-) / Red (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC=03 (Radox)</td>
<td>White N°1 (-) / White N°2 (+)</td>
</tr>
<tr>
<td>CC=12 (Teflon) (1)</td>
<td>White (-) / Red (+) / Black (Temp.)</td>
</tr>
<tr>
<td>CC=13 (Radox) (1)</td>
<td>White N°1 (-) / White N°2 (+) / White N°3 (Temp)</td>
</tr>
<tr>
<td>CC=31 (PU) (1)</td>
<td>Blue (-) / Black (+) / White (Temp.) / Brown (NC)</td>
</tr>
</tbody>
</table>

(1) T0 option (10mV/°C)

Fig 1d: Outline drawing & Electrical layout, B=5 (cable only)
Fig 1e: Outline drawing B=7 (cable with overbraid) electrical layout. See above B=5

Fig 1h: Housing thread, option H1, H2, H7

Detail of tapped hole

Standard

Option H7

Option H1

Fig 2: DC (Bias) deviation versus temperature

Bias deviation (%)

Temperature °C (°F)

-20

-10

0

10

Temperature °C

Fig 3: Sensitivity deviation versus temperature

Sensitivity deviation (%)

Temperature °C

-20

-10

0

10

20

Sensitivity deviation (%)

Frequency (Hz)

1

10

100

1000

1k

10k

40

30

20

10

0

-10

-20

-30

-40

Sensitivity deviation (dB)

Frequency (Hz)

1

10

100

1k

10k

Fig 4a: Frequency response, amplitude

Fig 4b: Low Frequency response, amplitude
ICP Accelerometer Model 109
Compact, Top connector

Main Characteristics
- Annular shear mode
- 20 kHz Bandwith
- 10, 50, 100 mV/g
- -55°C to 120°C (-67°F to 250°F)
- Dual case isolation with Faraday shield
- Submersible version (150 metres) with associated IP68 overmolded cable
- Life time hermetic sealing warranty (M12/Mil glass seal connector)

Competitive advantage
- Compare to obsolete compression design, annular shear piezoelectric sensors feature better frequency response, improved base strain, lower noise, smaller size, thermal transient immunity and insensitivity to cable motion. Annular shear mode is also less susceptible to transverse vibrations and better immune to electronic saturation at high frequency.
- Exceptional bias stability at elevated temperatures. (improved dynamic range, ex 80g dynamic for 100 mV/g sensitivity)
- Resistant to shock (magnet mounting) thanks to protected Mosfet transistor input.
- ESD and reverse wiring protection.
- The glass seal hermetic connector protects the piezoelectric disc and the electronic from harmful environmental influences, significantly increasing their reliability and lifetime. Associated with low cost IP68 overmolded M12 cable assembly it is a perfect solution for submersible application down to 150 metres. Sensors with epoxy seal will always leak after few temperature cycles.
- M12 connector offers compatibility with numerous sensors used in automation. M12 overmolded cable assemblies are available from many cable manufacturers around the world. Mil cordset are expensive because they are only available from vibration sensor manufacturer.

Description
The hermetic sealed industrial piezoelectric accelerometer model 109 is design to monitor the vibration in harsh industrial environment. It uses the industry standard ©ICP / ©IEPE / ©LIVM 2-wire voltage transmission technique with a 4 mA standard constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to EMC to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version (10mV/g) monitor the vibration on roller bearing, pumps cavitation, .... Medium frequency (100 mV/g) version monitor overall vibration on pumps, motors, fans, ...

Ordering information model 109
To order, specify model number, options, accessories and suffix:
109.01- AA - B - TT - MM - HH - YY
AA : Sensitivity
  3 : 10 mV/g ±5 %
  3D : 10 mV/g ±10 %
  3V : 10 mV/g ±20 %
  5 : 50 mV/g ±5 %
  5D : 50 mV/g ±10 %
  5V : 50 mV/g ±20 %.
  6 : 100 mV/g ±5 % (medium frequency, general purpose)
  6D : 100 mV/g ±10 % (medium frequency, general purpose)
  6V : 100 mV/g ±20 % (medium frequency, general purpose)

Available suffix : N, negative polarity
B : Connector
  2 : M12 glass seal
Cc-DD) Integral cable
  5 (CC-DD) : Integral cable
  7 (CC-DD) : Integral cable with sstl overbraid protection
  8 (CC-DD) : Integral cable with stainless steel protection conduit
CC : Cable Type
  02 : *Teflon FEP twisted pair Cable (200°C)
DD : length in metre
TT : Temperature output.
  omitted : no temperature output
  T0 : 10 mV/°C. (range +2° to +120°C)
MM : Machine thread
  omitted : no mounting stud will be shipped with the sensor.
  M6 : M6x1
  M7 : 1/4" 28 UNF 2A
  M8 : M8x1.25
HH : Housing thread
  H2 : 10-32 UNF-2A
  H7 : 1/4" 28 UNF-2A
YY : Agency Approval
  omitted : no agency approval
Special Engraving :
  Add ZXX at the end of the part number.
XX is a number supplied by VibraSens
Industrial ICP Piezoelectric Accelerometer

Specifications (24°C)

**Dynamic**

- **Sensitivity (101.01)**
  - AA=3 10 mV/g ± 5%
  - AA=3D 10 mV/g ± 10%
  - AA=3V 10 mV/g ± 20%
  - AA=5 50 mV/g ± 5%
  - AA=5D 50 mV/g ± 10%
  - AA=5V 50 mV/g ± 20%
  - AA=6 100 mV/g ± 5%
  - AA=6D 100 mV/g ± 10%
  - AA=6V 100 mV/g ± 20%

- **Frequency response**
  - AA=3X, 5X, 6X ±10 % : 1 to 10 000 Hz
  - ±3 dB : 0.5 to 20 000 Hz

- **Mounted Resonant frequency**
  - AA=3X, 6X 40 kHz Nom

- **Dynamic range**
  - AA=3X 800 g pk
  - AA=5X 160 g pk
  - AA=6X 80 g pk

- **Transverse response sensitivity (20Hz, 5g)**
  - <5%

- **Temperature response**
  - +2° to 120°C

- **Warm up time (Typical)**
  - <1Sec

- **Option T0 (sensor should be powered to get temperature output)**
  - Output (between - and Temp) Vout=10mV/°C * Temp (°C)
  - 0VDC at 0°C
  - Range -2°C to 120°C

**Electrical**

- **Electrical Grounding** Isolated from machine ground
- **Isolation (Case to shield)** 100 MΩ Min
- **Capacitance to ground** 70 pF Nom
- **Output impedance** 50 Ω Nom
- **DC output bias, 4mA supply** 12 VDC Nom (Fig 2)

- **Residual noise (24°C)**
  - AA=3X
    - 1 Hz to 25 kHz 300 uV rms
    - 1 Hz 30 uV
  - AA=6X
    - 1 Hz to 25 kHz 300 uV rms
    - 1 Hz 30 uV

- **Power requirements**
  - Constant current: +2 to +10mA DC
  - Voltage: +22 to +28 VDC

- **Protection**
  - Overvoltage
  - Reverse polarity

**Environmental**

- Temperature, operating continuous (4mA) 55 to 120 °C (-65 to 250 °F)
- Humidity
- Enclosure
Drawings

Fig 1b: Outline drawing & Electrical layout, B=2 (M12 glass seal)

Fig 1c: Outline drawing B=7 (cable with overbraid) electrical layout: See above B=5

Fig 1d: Outline drawing & Electrical layout, B=5 (cable only)

Table:

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>NC</td>
<td>NC</td>
<td>(−)</td>
<td>(+)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>NC (Temp)</td>
<td>(−)</td>
<td>(+)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

(NC): Not connected

CC=01, 02 (PU, Teflon): White (−) / Red (+)
CC=03 (Radox): White N°1 (−) / White N°2 (+)
CC=12 (Teflon) (1): White (−) / Red (+) / Black (Temp.)
CC=13 (Radox) (1): White N°1 (−) / White N°2 (+) / White N°3 (Temp)
CC=31 (PU) (1): Blue (−) / Black (+) / White (Temp.) / Brown (NC)

(1) T0 option (10mV/°C)

Fig 2: DC (Bias) deviation versus temperature

Fig 3: Sensitivity deviation versus temperature
Fig 4a: Frequency response, amplitude

*Sensitivity deviation (%) *Deviation

in [\%] for f < 10kHz

in [dB] for f > 10kHz

A=3, 6

Frequency (Hz)
**ICP Accelerometer Model 103**

**Premium, Side connector**

**Main Characteristics**
- -55°C to 150 °C (-67°F to 302°F)
- **ICP** transmission mode
- Annular shear mode
- Dual case isolation with Faraday shield
- Low, medium and high frequency version
- High temperature version
- IP67 with associated cable (B=2 only)
- Complies with API 670 requirements (A=6 only)

**Competitive advantage**
- Annular shear mode is less susceptible to transverse vibrations and better immune to electronic saturation at high frequency
- Exceptional bias voltage stability at elevated temperatures.
- Low cost IP67 overmolded M12 cable assembly
- M12 overmolded cable assembly is available through local electronic distributor
- M12 offers compatibility with sensors used in automation

**Description**
The hermetic sealed industrial piezoelectric accelerometer model 103 is design to monitor the vibration in harsh industrial environment. It uses the industry standard **ICP** 2-wire voltage transmission technique with a 4 mA minimum constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to ESD to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements. Low frequency accelerometers (A=9) incorporate a low-pass filter within the conditioning electronics. This filter attenuate the sensor mechanical resonance and the associated distortion and overload.

**Typical applications**
Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version will monitor the vibration on roller bearing, pumps cavitation, .... Medium frequency version will monitor overall vibration on pumps, motors, fans, ... Low frequency model is used in the petrochemical, machine tool, and paper industries for monitoring of slow speed agitators, cooling towers, ....

**Ordering information Model 103.02**
To order, specify model number, options, accessories and suffix :

103.02-  A  -   B  -  Options - Accessories
A : Sensitivity (±10%)
3 : 10 mV/g (high frequency)
6 : 100 mV/g (medium frequency, general purpose)
9 : 500 mV/g (low frequency)
Available suffix : N, negative polarity

B : Connector / Integral cable
1 : MIL-C-5015, glass seal
2 : *M12 glass seal
5 : Integral cable
7 : Integral cable with stainless steel overbraid protection
8 : Integral cable with stainless steel protection conduit

Option 5, 7, 8 needs additional information : (CC-DD)
Options 5, 7, 8 are not stocked. Leadtime : 2 to 4 weeks.

CC : Cable Type (only integral cable B=5, 7, 8)

Model 103.02-A-2 with Overmolded M12 cable assembly
01 : Polyurethane twisted pair cable (90°C)
02 : Teflon FEP twisted pair Cable (200°C)
03 : Radox twisted pair cable (120°C, halogen free)
12 : Teflon FEP twisted triple Cable (200°C). For TO option.
13 : Radox twisted triple (120°C, halogen free). For TO option
31 : Polyurethane 4 conductors cable (90°C). For TO option

DD : length in metre (only integral cable B=5, 7, 8)

Options :
Temperature output
T0 : 10 mV/°C. (+2° to +120°C)
Not available with Mil-C-5015 connector

Special Agency Approval
X1 : Atex approved (July 2009)

Accessories (Machine thread):
M6  : M6x1 Bolt, captive, hex socket
M7  : 1/4" 28 UNF 2A Bolt, captive, hex socket

Special Engraving :
Add ZXX at the end of the part number.
XX is a number supplied by VibraSens

Note : * = preferred and stocked items

Ordering information Model 103.12 (150°C Version)
To order, specify model number, options, accessories and suffix :

103.12- A - B (CC-DD) - Options - Accessories
A : Sensitivity (±5%)
3 : 10 mV/g (high frequency)
6 : 100 mV/g (medium frequency, general purpose)
9 : 500 mV/g (low frequency)
Available suffix : N, negative polarity

B : Connector / Integral cable
1 : MIL-C-5015, glass seal

Options & Accessories : see model 103.02

Ordering information Model 103.22 (±10% sensitivity)
To order, specify model number, options, accessories and suffix :

103.22- A - B (CC-DD) - Options - Accessories
A : Sensitivity (±10%)
3 : 10 mV/g (high frequency)
6 : 100 mV/g (medium frequency, general purpose)
Available suffix : N, negative polarity

B : Connector / Integral cable
see model 103.02

CC : Cable Type (only integral cable B=5, 7, 8)
see model 103.02

DD : length in metre (only integral cable B=5, 7, 8)

* Most Popular model :
103.02-6-2 / 103.02-9-2 / 103.02-3-2 / 103.02-6-2-T0
103.22-6-2
Ordering example:  
103.02-6-2-M6  
Premium Accelerometer, 100mV/g, M12 connector

Specifications

Dynamic

Sensitivity (103.02)
A=3 ................................................................................................................. 10 mV/g ±5%
A=6 ................................................................................................................. 100 mV/g ±5%
A=9 ................................................................................................................. 500 mV/g ±5%

Sensitivity (103.12)
A=3 ................................................................................................................. 10 mV/g ±5%
A=6 ................................................................................................................. 100 mV/g ±5%

Frequency response (103.02 & 103.12)
A=3 ................................................................................................................. ±10 % : 1 to 9000 Hz
A=6 ................................................................................................................. ±3 dB : 1 to 13000 Hz
A=9 ................................................................................................................. ±3 dB : 0.5 to 10000 Hz

Transverse response sensitivity (20Hz, 5g) ................................................. <5% max

Temperature range (See fig13)

Polarity ............................................................................................................. Suffix dependant

Linearity ............................................................................................................. ±1% Max

Warm up time (Typical)
A=3, 6 ........................................................................................................... < 15Sec
A=9 .................................................................................................................... < 10 Sec

Option T0
Output (between - and Temp)........................................................................... Vout=10mV/°C * T(°C)

Residual noise (24°C): A=6
1 Hz to 25 kHz .............................................................................................. 300 ug rms
1 Hz ..................................................................................................................... 30 ug

Residual noise (24°C): A=9
1 Hz to 25 kHz .............................................................................................. 25 ug rms
1 Hz ..................................................................................................................... 2.4 ug

Power requirements: Constant current : +2 to +10mA DC
Voltage : +22 to +28 VDC

Protection: Overvoltage .................................................................................... Yes
Protection: Reverse polarity .............................................................................. Yes

Environmental

Temperature:
Operating continuous: 103.02 & 103.22 (max. current ~4mA)
A=3, 6 ............................................................................................................. ±55 to 120 °C (-65 to 250 °F)
A=9 ................................................................................................................. ±55 to 90 °C (-65 to 212 °F)

Operating continuous: 103.12 (max. current ~4mA)
B=1, 2 ............................................................................................................. ±55 to 150 °C (-65 to 302 °F)

Humidity / Enclosure: B=1, 2 Not affected, hermetically sealed, 1E-8torr/Ls

Acceleration limit: Shock 5 000g peak

Acceleration limit: Continuous vibration ......................................................... 300g peak

Base strain sensitivity .................................................................................... 0.0002 ug/µs strain

Temp. transient sens. (3Hz, LIF, 20dB/dec) .................................................. 5 mg/°C

Acoustic sensitivity (164 dBSP) ....................................................................... 0.5 mg

Electromagnetic sens. (50Hz, 0.03 T) ............................................................. 0.2 g

Mean time between failure (MTBF) 10 Years Nom

ESD Protection ................................................................................................... > 40 V

EMC emission .................................................................................................. EN 61010-1 and IEC 61010-1

EMC immunity (1) .......................................................................................... EN 50081-1, EN 50081-2

Physical

Dimensions: B=1, 2, 6 ......................................................................................... See Fig. 1a
Industrial ICP Piezoelectric Accelerometer

**Model Number** | **Pin A** | **Pin B**
---|---|---
Standard, no option | (+) | (-)
T0 Option (10mV/°C) | N/A | N/A

(N/A) : Not available

Fig 1a: Outline drawing & Electrical layout for MIL-C-5015 Connector (B=1)

---

**Model Number** | **Pin 1** | **Pin 2** | **Pin 3** | **Pin 4**
---|---|---|---|---
Standard, no option | NC | NC | (-) | (+)
T0 Option (10mV/°C) | NC | (Temp) | (-) | (+)

(NC) : Not connected / (Temp) : Temperature

Fig 1b: Outline drawing & Electrical layout for M12 Glass seal Connector (B=2)

---

**Model Number** | **White (-) / Red (+)**
---|---
CC=01, 02 (PU, Teflon) | White (-) / Red (+)
CC=03 (Radox) | White N°1 (-) / White N°2 (+)
CC=12 (Teflon) | White (-) / Red (+) / Black (Temp.)
CC=13 (Radox) | White N°1 (-) / White N°2 (+) / White N°3 (Temp)
CC=31 (PU) | Blue (-) / Black (+) / White (Temp.) / Brown (NC)

Fig 1d: Outline drawing & Electrical layout, B=5 (cable only)

---

Fig 1e: Outline drawing B=7 (cable with overbraid) electrical layout: See above B=5
Industrial ICP Piezoelectric Accelerometer

Fig 12: DC (Bias) deviation versus temperature

Fig 13: Sensitivity deviation versus temperature

Fig 14a: Frequency response, amplitude

Fig 14b: Low Frequency response, amplitude
@ICP Accelerometer Model 104

Premium, Side connector

Main Characteristics
- -55°C to 120°C (-67°F to 250°F)
- @ICP transmission mode
- Annular shear mode
- Dual case isolation with Faraday shield
- Low, medium and high frequency version
- High temperature version
- IP67 with associated cable (B=2 only)
- Complies with API 670 requirements (A=6 only)

Competitive advantage
- Annular shear mode is less susceptible to transverse vibrations and better immune to electronic saturation at high frequency
- Exceptional bias voltage stability at elevated temperatures.
- Low cost IP67 overmolded M12 cable assembly
- M12 overmolded cable assembly is available through local electronic distributor
- M12 offers compatibility with sensors used in automation

Description
The hermetic sealed industrial piezoelectric accelerometer model 104 is designed to monitor the vibration in harsh industrial environment. It uses the industry standard @ICP 2-wire voltage transmission technique with a 4 mA minimum constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to ESD to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements. Low frequency accelerometers (A=9) incorporate a low-pass filter within the conditioning electronics. This filter attenuate the sensor mechanical resonance and the associated distortion and overload.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version will monitor the vibration on roller bearing, pumps cavitation, ... Medium frequency version will monitor overall vibration on pumps, motors, fans, ... Low frequency model is used in the petrochemical, machine tool, and paper industries for monitoring of slow speed agitators, cooling towers, ....

Ordering information Model 104.01 (120°C version)
To order, specify model number, options and suffix:
104.01- A - B - Options - Accessories

A : Sensitivity
3 : 10 mV/g (high frequency)
6 : *100 mV/g (medium frequency, general purpose)
9 : 500 mV/g (low frequency)
Available suffix : N, negative polarity

B : Connector / Integral cable
1 : *MIL-C-5015, glass seal
2 : *M12 glass seal

Options :
Temperature output
T0 : 10 mV/°C. (+2° to +120°C)
Not available with Mil-C-5015 connector

Special Agency Approval
none

Accessories
Specifications

Dynamic

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>A=3</th>
<th>10 mV/g ±5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>100 mV/g ±5%</td>
<td></td>
</tr>
<tr>
<td>A=9</td>
<td>500 mV/g ±5%</td>
<td></td>
</tr>
</tbody>
</table>

Frequency response...

<table>
<thead>
<tr>
<th>A=3</th>
<th>...±10 % : 1 to 9000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>...±3 dB : 0.5 to 13000 Hz</td>
</tr>
<tr>
<td>A=9</td>
<td>...±3 dB : 0.5 to 10000 Hz</td>
</tr>
</tbody>
</table>

Mounted Resonant frequency

<table>
<thead>
<tr>
<th>A=3</th>
<th>32 kHz Nom</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>22 kHz Nom</td>
</tr>
<tr>
<td>A=9</td>
<td>16 kHz Nom</td>
</tr>
</tbody>
</table>

Dynamic range

<table>
<thead>
<tr>
<th>A=3</th>
<th>500 g pk</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>80 g pk</td>
</tr>
<tr>
<td>A=9</td>
<td>10 g pk</td>
</tr>
</tbody>
</table>

Transverse response sensitivity (20Hz, 5g)...<5% max

Temperature response...

<table>
<thead>
<tr>
<th>A=3</th>
<th>(See fig13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>Suffix dependant</td>
</tr>
<tr>
<td>A=9</td>
<td>±1% Max</td>
</tr>
</tbody>
</table>

Warm up time

<table>
<thead>
<tr>
<th>A=3</th>
<th>&lt; 1Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>&lt; 10 Sec</td>
</tr>
</tbody>
</table>

Option T0

Output (between - and Temp)...Vout=10mV/°C * T(°C)

Range...

<table>
<thead>
<tr>
<th>A=3</th>
<th>-2° to 120°C</th>
</tr>
</thead>
</table>

Electrical

Electrical Grounding...

<table>
<thead>
<tr>
<th>A=3</th>
<th>Isolated from machine ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=6</td>
<td>Internal shielding</td>
</tr>
</tbody>
</table>

Isolation (Case to shield)-55°C to +120°C...

<table>
<thead>
<tr>
<th>A=3</th>
<th>100 MΩ Min</th>
</tr>
</thead>
</table>

Capacitance to ground...

| A=3 | 70 PF Nom |

Output impedance...

| A=3 | 50 ΩNom |

DC output bias, 4mA supply...

| A=3 | 12 VDC (See Fig 12) |

Residual noise (24°C): A=3

<table>
<thead>
<tr>
<th>1 Hz to 25 kHz</th>
<th>300 ug rms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>30 ug</td>
</tr>
</tbody>
</table>

Residual noise (24°C): A=6

<table>
<thead>
<tr>
<th>1 Hz to 25 kHz</th>
<th>300 ug rms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>30 ug</td>
</tr>
</tbody>
</table>

Residual noise (24°C): A=9

<table>
<thead>
<tr>
<th>1 Hz to 25 kHz</th>
<th>25 ug rms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hz</td>
<td>2.4 ug</td>
</tr>
</tbody>
</table>

Power requirements...

| Constant current : | ±2 to ±10mA DC |
| Voltage : | ±22 to ±28 VDC |

Protection:

| Overvoltage | Yes |
| Protection | Reverse polarity | Yes |

Environmental

Temperature:

<table>
<thead>
<tr>
<th>Operating continuous :</th>
<th>104.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>A=3</td>
<td>-55 to 120 °C (-65 to 250 °F)</td>
</tr>
<tr>
<td>A=6</td>
<td>-55 to 90 °C (-65 to 212 °F)</td>
</tr>
</tbody>
</table>

Humidity / Enclosure

| B=1, 2 | Not affected, hermetically sealed, 1E-8torr/ls |
| B=3    | IP67, epoxy sealed |

Acceleration limit: Shock

| 5000g peak |

Base strain sensitivity...

| 0.0002 ug pk/strain |

Temp. transient sens. (3Hz, LLF, 20dB/dec)...

| 5 mg/°C |

Acoustic sensitivity (164 dBSP)...

| 0.5 mg |

Electromagnetic sens. (50Hz, 0.03 T)...

| 0.2 g |

Mean time between failure (MTBF)...

| 10 Years Nom |

ESD Protection...

| >40 V |

Safety...

| EN 61010-1 and IEC 1010-1 |

EMC emission...

| EN 50081-1, EN 50081-2 |

EMC immunity (1)...

| EN 50082-1, EN 50082-2 |

Physical

Dimensions...

| B=1 | See Fig. 1a |
| B=2 | See Fig. 1b |

Design...

| Ceramic, preloaded annular shear mode |

Weight...

| A=3 | 150 gr Nom (5.2 Oz) |
| A=6 | 155 gr Nom (5.6 Oz) |
| A=9 | 165 gr Nom (6.0 Oz) |

Connector 104.01

| B=1 | MIL-C-5015 glass seal, Type MS3143 10SL-4P |
| B=2 | MIL2 glass seal, IEC 60947-5-2 |
| B=3 | MIL2 epoxy seal, IEC 60947-5-2 |

Material...

| ASI 316L, DIN 1.4404 (Stainless steel) |

Mounting torque (M8 suffix)...

| 2.4 N.m (23 in-lbs) |

Accessories, supplied

Calibration supplied...

| Sensitivity (5g, 160 Hz) |

| No frequency response |

Accessories, not supplied

Cable assembly

| MIL connector (B=1), Polyurethane cable | 10.01-B01-A01-01-Length |
| MIL connector (B=1), FEP Teflon cable | 10.01-B01-A02-02-Length |
| M12 connector B=2, 3 Polyurethane cable | 10.01-E01-A01-31-Length |

PU and FEP Armored cables are also available. See Model 10.01.

Mounting Bolt

| M8 | 194.01-08-1 |

Standard Wiring color

With Mil-C-5015 cable assembly: + = Red // - = White

With M12 cable harness: + = Black // - = Blue // Temperature=White

Repair

Consult factory for replacement of connector in case of broken or bended pins. Repair of electronic is not possible

(1) Guaranteed if using accessories listed in this datasheet only

Drawings

Model Number | Pin A | Pin B
-------------|------|------
Standard, no option | (+) | (-) |
T0 Option (10mV/°C) | N/A | N/A

(N/A) : Not available

Fig 1a: Outline drawing & Electrical layout for B=1 (MIL-C-5015)
Industrial ICP Piezoelectric Accelerometer

- **Frequency response, amplitude**
  - Figure 14a: Frequency response, amplitude
  - Figure 14b: Low Frequency response, amplitude

**Model Number**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>NC</td>
<td>NC</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>NC</td>
<td>(Temp)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

(NC) : Not connected  / (Temp) : Temperature

**Bias deviation (%)**

- Figure 12: DC (Bias) deviation versus temperature

**Sensitivity deviation (%)**

- Figure 13: Sensitivity deviation versus temperature
©ICP Accelerometer Model 108
Premium, Top connector

Main Characteristics
- Low size
- -55°C to 120°C (-67°F to 248°F)
- ©ICP transmission mode
- Annular shear mode
- Low, medium and high frequency version
- IP67 with associated cable (B=2 only)

Competitive advantage
- Annular shear mode is less susceptible to transverse vibrations and better immune to electronic saturation at high frequency
- Exceptional bias voltage stability at elevated temperatures.
- Low cost IP67 overmolded M12 cable assembly
- M12 overmolded cable assembly is available through local electronic distributor
- M12 offers compatibility with sensors used in automation.

Description
The epoxy sealed piezoelectric accelerometer model 108 is design to monitor the vibration in harsh industrial environment. It uses the industry standard ©ICP 2-wire voltage transmission technique with a 4 mA standard constant current supply. Signal ground is isolated from the mounting surface to prevent ground loops. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements. Low frequency accelerometers (A=9) incorporate a low-pass filter within the conditioning electronic. This filter attenuates the sensor mechanical resonance and the associated distortion and overload.

Typical applications
Ideal for walk-around vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version monitor the vibration on roller bearing, pumps cavitation, ... Medium frequency version monitor overall vibration on pumps, motors, fans, ... Low frequency model is used in the petrochemical, machine tool, and paper industries for monitoring of slow speed agitators, cooling towers, ... Model 108 sensors are not recommended for permanent monitoring because they have external faraday shield subject to loss of isolation. For such applications, Models 101, 103, 104, 105, 107 with internal faraday shield are prefered.

Ordering information.
To order, specify model number, options and suffix:
108.01- A - B - Options - Accessories
A : Sensitivity
3 : *10 mV/g (high frequency)
6 : *100 mV/g (medium frequency, general purpose)
9 : *500 mV/g (low frequency)
Available suffix : N, negative polarity
B : Connector
1 : MIL-C-5015, glass seal
2 : M12 glass seal
4 : *TNC epoxy seal
Options :
Special Agency Approval
none
Accessories (Machine thread):
M2 : 10-32 UNF 2A mounting stud
M5 : M5x0.8 mounting stud
Special Engraving :
Add ZXX at the end of the part number.
XX is a number supplied by VibraSens
Popular model (in stock) :
108.01-3-4 / 108.01-6-4 / 108.01-9-4
Ordering example :
108.01-6-4 M5 Accelerometer, TNC top connector, 100mV/g, M5 machine thread.
Specifications (24°C)

**Dynamic**

Sensitivity
- A=3: 10 mV/g ±5%
- A=6: 100 mV/g ±5%
- A=9: 500 mV/g ±5%

Frequency response
- A=3: ±10%: 1 to 11000 Hz
- A=6: ±10%: 1 to 9000 Hz
- A=9: ±10%: 0.5 to 14000 Hz

Mounting Resonant frequency
- A=3: 35 kHz Nom
- A=6: 25 kHz Nom
- A=9: 16 kHz Nom

Dynamic range
- A=3: 500 g pk
- A=6: 80 g pk
- A=9: 10 g pk

Transverse response sensitivity (20Hz, 5g) <5%

Polarity
- (fig. 1) Suffix dependant

Warm up time (Typical)
- A=3, 6: <15sec
- A=9: <10 Sec

**Electrical**

Electrical Grounding:
- Isolated from machine ground

Isolation (Case to shield):
- 100 MΩ Min

Capacitance to ground:
- 70 pF Nom

Output impedance:
- 50 ΩNom

DC output bias, 4mA supply:
- 12 VDC (Fig 2)

Residual noise (24°C): A=3
- 1 Hz to 25 kHz: 300 ug rms
- 1 Hz: 30 ug

Residual noise (24°C): A=6
- 1 Hz to 25 kHz: 300 ug rms
- 1 Hz: 30 ug

Residual noise (24°C): A=9
- 1 Hz to 25 kHz: 25 ug rms
- 1 Hz: 2.4 ug

Power requirements:
- Constant current: +2 to +10mA DC
- Voltage: ±22 to ±28 VDC

Protection:
- Overvoltage: Yes
- Reverse polarity: Yes

**Environmental**

Temperature:
- Operating continuous (4mA max)
  - A=3, 6: -55 to 120 °C (-65 to 252 °F)
  - A=9: -55 to 90 °C (-65 to 212 °F)

Humidity / Enclosure:
- IP67, epoxy sealed

Acceleration limit:
- Shock: 5000g peak
- Continuous vibration: 500g peak

Base strain sensitivity:
- 0.0002 g/µstrain

Temp. transient sens. (3Hz, LLF, 20dB/sec):
- 5 mg/°C

Acoustic sensitivity (164 dBSP):
- 0.5 mg

Electromagnetic sens. (50Hz, 0.03 T):
- 0.2 g

Mean time between failure (MTBF):
- 14 Years Nom

ESD Protection:
- > 40 V

Safety:
- EN 61010-1 and IEC 1010-1
- EN 50081-1, EN 50081-2
- EN 50082-1, EN 50082-2

**Physical**

Dimensions
- B=1: Fig 1a
- B=2: Fig 1b
- B=4: Fig 1d

Design:
- Ceramic, preloaded annular shear mode

Weight
- A=3: 34 gr Nom (2.8 Oz)
- A=6: 39 gr Nom (3.0 Oz)
- A=9: 44 gr Nom (3.4 Oz)

Connector
- B=1: MIL-C-5015 glass seal, Type MS3143 10SL-4P
- B=2: MIL2 glass seal, IEC 69947-5-2
- B=4: TNC

Cable assembly
- MIL (B=1), Polyurethane cable dia 5mm:
  - 10.01-B01-A01-01-Length
- MIL (B=2), Polyurethane cable dia 5mm:
  - 10.01-B02-A01-31-Length
- PVC RG 174 dia 2.8:
  - 10.01-T02-F02-51-Length
- PVC RG 58 dia 5:
  - 10.01-T02-F02-52-Length

Mounting Stud
- M5:
  - 191.01-15-50-1
  - 10-32 UNF 2A

Repair:
- Consult factory for replacement of connector in case of broken or bent pins.

Repair of electronic is not possible

(1) Guaranteed if using accessories listed in this product datasheet only

**Drawings**

Fig 1a: Outline drawing & Electrical layout, B=1 (MIL-C-5015)
Industrial ICP Piezoelectric Accelerometer

Model Number | Pin 1 | Pin 2 | Pin 3 | Pin 4
---|---|---|---|---
Standard, no option | NC | NC | (-) | (+)

(NC) : Not connected

fig 1b : Outline drawing & Electrical layout, B=2 (M12 glass seal)

model number | Pin 1 | TNC thread
---|---|---
Standard, no option | (+) | (-)

fig 1d : Outline drawing & Electrical layout, B=4 (TNC connector)
@ICP PiezoVelocity sensor Model 111
Top Connector

Main Characteristics
- 100 mV/ips or 4 mV/mm/s
- -55°C to 120 °C (-67°F to 248°F)
- ®ICP transmission mode
- Annular shear mode
- Dual case isolation with Faraday shield
- IP67 with associated cable (B=2, 3 only)

Competitive advantage
- Annular shear mode is less susceptible to base strain.
- Ultra low noise electronic
- Miswiring and surge protections
- Low cost IP67 overmolded M12 cable assembly
- M12 overmolded cable assembly is available through local electronic distributor
- M12 offers compatibility with sensors used in automation.

Description
The hermetic sealed industrial piezovelocity transducer model 111 is designed to monitor the vibration in harsh industrial environment. It uses the industry standard @ICP 2-wire voltage transmission technique with a 4 mA standard constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to EMC to a minimum. Annular shear mode design will prevent from thermal transient and base strain. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range.

Typical applications
Velocity is the preferred measurement for most rotating machines with rolling element bearings. Unfortunately it is sometimes impossible to get velocity (with digital or analog integration) from standard piezoelectric accelerometer: very high frequency noise can overload the accelerometer and saturate the output. Piezovelocity sensors use an internal integration circuit which inherently decrease high frequency signals allowing better measurement of low frequency signal. Paper machine dryers (when steam leaks), pumps (cavitation high frequency noise) are prone to such phenomenon.

Ordering information model 111.01
To order, specify model number, options and suffix :
111.01- A - B (CC-DD) - Options - Accessories
A : Sensitivity (Suffix)
 6 : 100 mV/ips (4mV/mm/s)
  Available suffix : N, negative polarity
B : Connector / Integral cable
 1 : *MIL-C-5015, glass seal
 2 : *M12 glass seal
 3 : M12 epoxy sealed
 5 : *Integral cable
 7 : *Integral cable with stainless steel overbraid protection
 8 : Integral cable with stainless steel protection conduit
Option 5, 7, 8 needs additional information: (CC-DD)
Options 3, 5, 7, 8 are not stocked. Leadtime : 2 to 4 weeks.
CC : Cable Type (only integral cable B=5, 7, 8)
 01 : *Polyurethane twisted pair cable (90°C)
 02 : *Teflon FEP twisted pair Cable (200°C)
 03 : Radox twisted pair cable (120°C, halogen free)
 12 : Teflon FEP twisted triple Cable (200°C). For TO option.
 13 : Radox twisted triple (120°C, halogen free). For TO option
 31 : *Polyurethane 4 conductors cable (90°C). For TO option
DD : length in metre (only integral cable B=5, 7, 8)
Specifications (24°C)

**Dynamic**
- Sensitivity A=6: 100 mV/ips ±10% (4 mV/mm/s)
- Frequency response (fig. 4a, 4b): ≤10 % : 2.5 to 3500 Hz
- ≤3 dB : 1.9 to 7000 Hz
- Mounted Resonant frequency A=6: 16 kHz Nom
- Dynamic range A=6: 50 in/sec pk (1250 mm/sec)
- Transverse response sensitivity (20Hz, 5g): <5%
- Temperature response
- Polarity: fig. 1 Suffix dependent
- Linearity: ±1% Max
- Warm up time (Typical) A=6: 55sec

**Electrical**
- Electrical Grounding: Isolated from machine ground
- Isolation (Case to shield): 100 MΩ Min
- Capacitance to ground: 70 pF Nom
- Output impedance: 200 Ω Nom
- DC output bias, 4mA supply: 10 VDC (Fig. 2)
- Residual noise (24°C): A=6
  - 2.5 Hz to 25 kHz: 100 µin/sec
  - 10 Hz: 10 µin/sec
  - 1000 Hz: 0.1 µin/sec
- Power requirements
  - Constant current: +2 to +10mA DC
  - Voltage: +22 to +28 VDC

**Environmental**
- Temperature, operating continuous (max. current ~4mA)
  - -55 to 120 °C (-65 to 250 °F)
- Humidity / Enclosure
  - B=1, 2: Not affected, hermetically sealed, 1E-8torr/1/s
  - B=3: IP67, epoxy sealed
- Acceleration limit: Shock: 2 500g peak
- Base strain sensitivity: 0.004 in/sec/µstrain
- Mean time between failure (MTBF): 10 Years Nom
- Safety
  - EN 61010-1 and IEC 1010-1
- ESD Protection: Reverse polarity: Yes
- EMC immunity (1)
  - EN 50082-1, EN 50082-2

**Physical**
- Dimensions
  - B=1: 5/8"24 UNEF2A
  - B=2: 1/4" 28 UNF
  - B=3: M12 connector (B=2), 3 Polyurethane cable
- Weight A=6: 95 gr Nom (3.4 Oz)
- Connector
  - B=1: MIL-C-5015 glass seal, Type MS3143 10SL-4P
  - B=2: M12 glass seal, IEC 60947-5-2
  - B=3: M12 epoxy seal, IEC 60947-5-2
- Material
  - AISI 316L, DIN 1.4401 (Stainless steel)
- Sensor mounting thread: Fig 1h
- Mounting torque (M6, M7, M8 suffix): 2.4 N.m (21 in-lbs)

**Accessories, supplied**
- Calibration supplied
- Sensitivity (5 in/sec, 160 Hz)
- No frequency response

**Accessories, not supplied**
- Cable assembly
  - MIL connector (B=1), Polyurethane cable: 10.01-B01-A01-01-Length
  - MIL connector (B=1), TEP Teflon cable: 10.01-B01-A01-02-Length
  - M12 connector B=2, 3 Polyurethane cable: 10.01-E01-A01-31-Length
  - PU or FEP Armored cables are also available. See Model 10.01.
- Mounting Stud
  - M6: 191.01-06-06-1
  - M8: 191.01-06-08-1

**Repair**
- Consult factory for replacement of connector in case of broken or bented pins.
- Repair of electronic is not possible.

**Standard Wiring color**
- With Mil-C-5015 cable assembly: + = Red // - = White
- With M12 cable harness: + = Black // - = Blue // Temperature=White

(1) Guaranteed if using accessories listed in this product datasheet only

**Drawings**
- Fig 1a: Outline drawing & Electrical layout, B=1 (MIL-C-5015)
- Fig 1b, 1c, 1d, 1e: Fig. 1a
- Fig 1f, 1g, 1h: Fig. 1h
- Fig 1i: Fig 1g

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Industrial ICP Piezoelectric Accelerometer

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>NC</td>
<td>NC</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>NC</td>
<td>NC</td>
<td>(Temp)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

(NC): Not connected

(CC=01, 02 (PU, Teflon)) White (-) / Red (+)

CC=03 (Radox) White N°1 (-) / White N°2 (+)

CC=12 (Teflon) (1) White (-) / Red (+) / Black (Temp.)

CC=13 (Radox) (1) White N°1 (-)/ White N°2 (+) / White N°3 (Temp)

CC=31 (PU) (1) Blue (-) / Black (+) / White (Temp.) / Brown (NC)

(1) T0 option (10mV/°C)

Fig 1b: Outline drawing & Electrical layout, B=2 (M12 glass seal)

Fig 1c: Outline drawing B=3 (M12 Epoxy)

Fig 1d: Outline drawing & Electrical layout, B=5 (cable only)

Fig 1e: Outline drawing B=7 (cable with overbraid)

Electrical layout: See above B=5
Fig 1h: Housing thread, option H1, H2, H7

Fig 2: DC (Bias) deviation versus temperature

Fig 3: Sensitivity deviation versus temperature

Fig 4a: Frequency response, amplitude
The hermetic sealed industrial piezovelocity transducer model 113 is designed to monitor the vibration in harsh industrial environments. It uses the industry standard ICP 2-wire voltage transmission technique with a 4 mA standard constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to EMC to a minimum. Annular shear mode design prevents thermal transient and base strain. Low noise electronic and temperature compensated design will give you accurate results over the complete temperature range.

Typical applications

Velocity is the preferred measurement for most rotating machines with rolling element bearings. Unfortunately it is sometimes impossible to get velocity (with digital or analog integration) from standard piezoelectric accelerometer. Very high frequency noise can overload the accelerometer and saturate the output. Piezovelocity sensors use an internal integration circuit which inherently decrease high frequency signals allowing better measurement of low frequency signal. Paper machine dryers (when steam leaks), pumps (cavitation high), etc., can be used with rolling element bearings. Unfortunately it is sometimes impossible to get velocity (with digital or analog integration) from standard piezoelectric accelerometer. Very high frequency noise can overload the accelerometer and saturate the output. Piezovelocity sensors use an internal integration circuit which inherently decreases high frequency signals allowing better measurement of low frequency signal. Paper machine dryers (when steam leaks), pumps (cavitation high), etc., can be used with rolling element bearings.

Ordering information model 113.01
To order, specify model number, options and suffix:

113.01-A B (CC-DD) - Options - Accessories

A : Sensitivity (Suffix)
6 : 100 mV/ips (4mV/mm/s)
Available suffixes: N, negative polarity

B : Connector / Integral cable
1 : *MIL-C-5015, glass seal
2 : *M12 glass seal
3 : *Integral cable
7 : *Integral cable with stainless steel overbraid protection
8 : Integral cable with stainless steel protection conduit

CC : Cable Type (only integral cable B=5, 7, 8)
01 : *Polyurethane twisted pair cable (90°C)
02 : *Teflon FEP twisted pair cable (200°C)
03 : Radox twisted pair cable (120°C, halogen free)
12 : Teflon FEP twisted triple cable (200°C). For TO option.
13 : Radox twisted triple (120°C, halogen free). For TO option
31 : *Polyurethane 4 conductors cable (90°C). For TO option

DD : length in metre (only integral cable B=5, 7, 8)

Options:

Temperature output
T0 : 10 mV/°C (+2° to +120°C)
Not available with Mil-C-5015 connector

Special Agency Approval
None

Accessories (Machine thread):
M6 : M6x1 Bolt, captive, hex socket
M7 : 1/4" 28 UNF 2A Bolt, captive, hex socket

Special Engraving:
Add ZXX at the end of the part number.
XX is a number supplied by VibraSens

*Most Popular model (in stock):
113.02-6-2 / 113.02-6-1

Ordering example:
113.02-6-2-M6 piezovelocity sensor, 100 mV/ips, M12 top connector

Specifications (24°C)

Dynamic
Sensitivity A=6.................................................. 100 mV/ips ±10% (4 mV/mm/s)
Frequency response (figs. 4a, 4b)
A=6.................................................. ±10% : 2.5 to 3500 Hz
A=3 dB : 1.9 to 7000 Hz
Mounted Resonant frequency A=6.................................................. 16 kHz Nom
Dynamic range A=6.................................................. 50 in/sec pk (1250 mm/sec)
Transverse response sensitivity (20Hz, 5g).................................................. <5%
Temperature response .................................................. see fig3
Polarity .................................................. (fig. 1) Suffix dependant
Linearity .................................................. ±1% Max
Warm up time (Typical) A=6.................................................. < 5Sec

Electrical
Electrical Grounding.................................................. Isolated from machine ground
Isolation (Case to shield).................................................. 100 MΩ Min
Capacitance to ground.................................................. 70 pF Nom
Output impedance.................................................. 200 Ω Nom
DC output bias, 4mA supply.................................................. 10 VDC (fig 2)
Residual noise (24°C) : A=6.................................................. 2.5 Hz to 25 kHz
10 Hz.................................................. 100 µin/sec
1000 Hz.................................................. 0.1 µin/sec
Power requirements Constant current :.................................................. -2 to +10mA DC
Voltage : 22 to +28 VDC
Protection : Overvoltage .................................................. Yes
Reverse polarity .................................................. No

Environmental
Temperature, operating continuous (max. current ~4mA).................................................. -55 to 120 °C (-65 to 250 °F)

Humidity / Enclosure
B=1, 2.................................................. Not affected, hermetically sealed, 1E-8torr/l/s
B=3.................................................. IP67, epoxy sealed
Acceleration limit : Shock .................................................. 2500g peak
Continuous vibration .................................................. 0.004 in/sec/µstrain

Base strain sensitivity .................................................. 0.004 in/sec/µstrain
Mean time between failure (MTBF) ................................................................. 10 Years Nom
ESD Protection ......................................................................................... > 40 V
Safety ........................................................................................................ EN 61010-1 and IEC 1010-1
EMC emission ......................................................................................... EN 50081-1, EN 50081-2
EMC immunity (1) ................................................................................... EN 50082-1, EN 50082-2

**Physical**

- Dimensions
  - B=1............................................................................................... Fig. 1a
  - B=2............................................................................................... Fig. 1b
  - B=5............................................................................................... Fig. 1d
  - B=6............................................................................................... Fig. 1e

- Design: Ceramic, preloaded annular shear mode

- Weight A=6 ....................................................................................... 165 gr Nom (5.8 Oz)

- Connector
  - B=1............................................................................................... MIL-C-5015 glass seal, Type MS3143 10SL-4P
  - B=2............................................................................................... M12 glass seal, IEC 69047-5-2

- Material: AISI 316L, DIN 1.4401 (Stainless steel)

- Mounting torque (M6, M7, M8 suffix) .............................................. 2.4 N.m (21 in-lbs)

**Accessories, supplied**

- Calibration supplied ......................................................................... Sensitivity (5 in/sec, 160 Hz)

**Accessories, not supplied**

- Cable assembly
  - MIL connector (B=1), Polyurethane cable ...................................... 10.01-B01-A01-01-Length
  - MIL connector (B=1), Teflon cable .............................................. 10.01-B01-A01-02-Length
  - M12 connector B=2, 3 Polyurethane cable .................................. 10.01-E01-A01-31-Length

- Captive screw
  - M6 .................................................................................................. 193.01-06-1
  - 1/4”28UNF ..................................................................................... 193.01-16-1

**Standard Wiring color**

- With Mil-C-5015 cable assembly: + = Red // - = White
- With M12 cable harness: + = Black // - = Blue // Temperature=White

**Repair**

Consult factory for replacement of connector in case of broken or bended pins. Repair of electronic is not possible.

(1) Guaranteed if using accessories listed in this product datasheet only

---

**Fig 1a**: Outline drawing & Electrical layout for MIL-C-5015 Connector (B=1)
Industrial ICP Piezoelectric Accelerometer

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>NC</td>
<td>NC</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>T0 Option (10mV/°C)</td>
<td>NC</td>
<td>(Temp)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

(NC) : Not connected / (Temp) : Temperature

Fig 1b : Outline drawing & Electrical layout for M12 Glass seal Connector (B=2)

<table>
<thead>
<tr>
<th>CC=01, 02 (PU, Teflon)</th>
<th>White (-) / Red (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC=03 (Radox)</td>
<td>White N°1 (-) / White N°2 (+)</td>
</tr>
<tr>
<td>CC=12 (Teflon)</td>
<td>White (-) / Red (+) / Black (Temp.)</td>
</tr>
<tr>
<td>CC=13 (Radox)</td>
<td>White N°1 (-) / White N°2 (+) / White N°3 (Temp)</td>
</tr>
<tr>
<td>CC=31 (PU)</td>
<td>Blue (-) / Black (+) / White (Temp.) / Brown (NC)</td>
</tr>
</tbody>
</table>

Fig 1c : Outline drawing & Electrical layout, B=5 (cable only)

Fig 1d : Outline drawing & Electrical layout, B=5 (cable only)

Fig 1e : Outline drawing B=7 (cable with overbraid) electrical layout : See above B=5

Fig 2 : DC (Bias) deviation versus temperature

Fig 3 : Sensitivity deviation versus temperature
Fig 4a: Frequency response, amplitude
4-20 mA Vibration Sensor Model 125
Top Connector

Main Characteristics
- Annular shear mode (better than obsolete compression design)
- Velocity (RMS, Peak) or Acceleration (RMS, Peak)
- Dynamic output available: Velocity or Acceleration
- Temperature output available (10 mV/°C)
- Dual case isolation with Faraday shield
- Submersible version (150 metres) with associated IP68 overmolded cable
- Life time hermetic sealing warranty (M12/Mil glass seal connector)

Competitive advantage
- Price
- Compare to obsolete compression design, annular shear piezoelectric sensors feature better frequency response, improved base strain, lower noise, smaller size, thermal transient immunity and insensitivity to cable motion (compression design will be affected by cable motion in the velocity range: 3Hz to 1000 Hz). Annular shear mode is also less susceptible to transverse vibrations and better immune to electronic saturation at high frequency.
- Resistant to shock (magnet mounting) thanks to protected Mosfet transistor input.
- ESD and reverse wiring protection.
- The glass seal hermetic connector protects the piezoelectric disc and the electronic from harmful environmental influences, significantly increasing their reliability and lifetime. Associated with low cost IP68 overmolded M12 cable assembly it is a perfect solution for submersible application down to 150 metres. Sensors sealed with epoxy will leak after few temperature cycles.
- M12 connector (4-Pin) offers compatibility with numerous sensors used in automation. M12 overmolded cable assemblies are available from many cable manufacturers around the world. Mil cordset are expensive because they are only available from vibration sensor manufacturer. Moreover the 2-Pin mil connector doesn’t allow for optional output like temperature or acceleration.

Description
The hermetic sealed 4-20 mA loop powered industrial accelerometer model 125 is designed to monitor the vibration in harsh industrial environment. It uses the industry standard 4-20mA Loop that interfaces directly with PLC, DCS and 4-20mA monitor. Large choice of output (velocity, acceleration, RMS, equivalent Peak) and frequency range will help to fit almost every customer requirements. Their compact size allows for installation in tight places. The dynamic signal output (acceleration or velocity) can allow spectral vibration measurements.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. It allows continuous trending of overall machine vibration.

Ordering information model 125.01
To order, specify model number, options and suffix:
125.01-AAAA-B-TT-MM-HH-YY
AAA: Full Scale (=20mA)
AR05: Acceleration RMS 5g (3Hz to 10kHz ±10%)
AR10: Acceleration RMS 10g (3Hz to 10kHz ±10%)
AR20: Acceleration RMS 20g (3Hz to 10kHz ±10%)
AR50: Acceleration RMS 50g (3Hz to 10kHz ±10%)
AP05: Acceleration Peak 5g (3Hz to 10kHz ±10%)
AP10: Acceleration Peak 10g (3Hz to 10kHz ±10%)
AP20: Acceleration Peak 20g (3Hz to 10kHz ±10%)
AP50: Acceleration Peak 50g (3Hz to 10kHz ±10%)
VR10: Velocity RMS 10 mm/s (3Hz to 1000 Hz ±10%)
VR11: Velocity RMS 0.5 ips (3Hz to 1000 Hz ±10%)
VR20: Velocity RMS 20 mm/s (3Hz to 1000 Hz ±10%)
VR21: Velocity RMS 1 ips (3Hz to 1000 Hz ±10%)
VR51: Velocity RMS 2 ips (3Hz to 1000 Hz ±10%)
VR100: Velocity RMS 100 mm/s (3Hz to 1000 Hz ±10%)
SR10: Velocity RMS 10 mm/s (10Hz to 1000 Hz ±10%)
SR11: Velocity RMS 0.5 ips (10Hz to 1000 Hz ±10%)
SR20: Velocity RMS 20 mm/s (10Hz to 1000 Hz ±10%)
SR21: Velocity RMS 1 ips (10Hz to 1000 Hz ±10%)
SR51: Velocity RMS 2 ips (10Hz to 1000 Hz ±10%)
SR100: Velocity RMS 100 mm/s (10Hz to 1000 Hz ±10%)
VP10: Velocity Peak 10 mm/s (3Hz to 1000 Hz ±10%)
VP11: Velocity Peak 0.5 ips (3Hz to 1000 Hz ±10%)
VP20: Velocity Peak 20 mm/s (3Hz to 1000 Hz ±10%)
VP21: Velocity Peak 1 ips (3Hz to 1000 Hz ±10%)
VP51: Velocity Peak 2 ips (3Hz to 1000 Hz ±10%)
VP100: Velocity Peak 100 mm/s (3Hz to 1000 Hz ±10%)
SP10: Velocity Peak 10 mm/s (10Hz to 1000 Hz ±10%)
SP11: Velocity Peak 0.5 ips (10Hz to 1000 Hz ±10%)
SP20: Velocity Peak 20 mm/s (10Hz to 1000 Hz ±10%)
SP21: Velocity Peak 1 ips (10Hz to 1000 Hz ±10%)
SP51: Velocity Peak 2 ips (10Hz to 1000 Hz ±10%)
SP100: Velocity Peak 100 mm/s (10Hz to 1000 Hz ±10%)

Note: Peak is based on the true RMS value of vibration. For a sine wave, the equivalent peak output is 1.414 times the RMS value.
Industrial ICP Piezoelectric Accelerometer

Sensitivity Specifications (24°C)

<table>
<thead>
<tr>
<th>Model</th>
<th>4-20mA sensor, FS=20mm/s RMS, M12 top connector, Dynamic Acceleration output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0: Temperature output 10 mV/°C. (range +2° to +120°C) (Not available with Mil-C-5015 2-pin connector)</td>
</tr>
<tr>
<td></td>
<td>DA: Acceleration Dynamic Output 100 mV/g +30% for VRXX, VPXX, AR05, AP05 10mV/g +30% for AR10, AR20, AR50, AP10, AP20, AP50 (not available with MIL-C-5015 2-pin connector)</td>
</tr>
<tr>
<td></td>
<td>DV: Velocity Dynamic Output 100 mV/ips +30% for VRXX, VPXX, ARXX, APXX (not available with MIL-C-5015 2-pin connector)</td>
</tr>
<tr>
<td>MM :</td>
<td>Machine thread Omitted: no mounting stud will be shipped with the sensor. M6 : M6x1 M7 : 1/4”28 UNF 2A M8 : M8x1.25</td>
</tr>
<tr>
<td>HH :</td>
<td>Housing thread Omitted or H6 : M6x1 (China, Europe, India, South America, ...) H1 : M16x2 (quick mounting + 120° positioning) (Not stocked) H2 : Quick fit mounting (Not stocked) H7 : 1/4”28 UNF-2A. (U.S.A., UK, ...)</td>
</tr>
<tr>
<td>YY :</td>
<td>Agency Approval omitted: no agency approval Y1 : Atex approved (October 2010)</td>
</tr>
</tbody>
</table>

Special Engraving:
Add ZXX at the end of the part number. XZ is a number supplied by Vibrasens

*Most Popular model (in stock):
125.01-VR20-2-DA // 125.01-VR21-2-DA

Ordering example:
125.01-VR20-2-DA-M6 4-20mA sensor, FS=20mm/s RMS, M12 top connector, Dynamic Acceleration output

Specifications (24°C)

Dynamic

Sensitivity

- No vibration ........................................... 4 mA ±5%
- Full scale (see AAAA ordering information) ...... 20 mA ±5%

Note: Equivalent Peak is based on the true RMS value of vibration. For a sine wave, the equivalent peak output is 1.414 times the RMS value.

Frequency response .................................. See AAAA ordering information

Mounted Resonant frequency .......................... 25 kHz Nom

Transverse response sensitivity (20kHz, 5g) ............. <5%

Linearity ..................................................... ±1% Max

Turn on time, 4-20 mA loop .............................. < 10 Sec

Option: Temperature output (T0)

Output .................................................. Vout=10mV/°C * Temp(°C)

- Range ............................................. 0°C to 120°C

Power ............................................. Need 4-20 mA loop

Option: Dynamic acceleration (DA)

Sensitivity ............................................. See ordering information: 10 or 100 mV/g

Dynamic .................................................. 250 g for 100 mV/g output

Power ............................................. Need 4-20 mA loop, no constant current source is needed, DC bias=2.6V.

Frequency response .................................. ±10 % : 3 to 9000 Hz

Option: Dynamic velocity (DV)

Sensitivity ............................................. 100 mV/ips (4 mV/mm/s)

Dynamic ............................................. 1.5 ips

Power ............................................. Need 4-20 mA loop, no constant current source is needed, DC bias=2.6V.

Frequency response .................................. ±10 % : 3 to TBD Hz

Environmental

Temperature, operating continuous

- max. loop current =10mA.......................... -55 to 120 °C (-65 to 250 °F)
- max. loop current =20mA.......................... -55 to 90 °C (-65 to 212 °F)

Humidity / Enclosure

B1, 2 ........................................... Glass seal, Not affected, hermetically sealed, 1E-9torr/l/s

B5, 7, 8 ........................................... Epoxy sealing

Acceleration Limit: Shock .................................. 250g peak

Mean time between failure (MTBF) ..................... 6 Years Nom

ESD Protection ........................................................ > 40 V

Safety ...................................................... EN 61010-1 and IEC 1010-1

EMC emission ............................................. EN 55081-1, EN 55081-2

EMC immunity (1) .......................................... EN 55082-1, EN 55082-2

Physical

Dimensions

- B=1 .............................................. Fig. 1a
- B=2 .............................................. Fig. 1b
- B=5 .............................................. Fig. 1d
- B=7 .............................................. Fig. 1f
- B=8 .............................................. Fig. 1f

Design ...................................................... ceramic annular shear

Weight ...................................................... 85 gr Nom (3.0 Oz)

Connector

B=1 .............................................. MIL-C-5015 glass seal, Type MS3143 10SL-4P

B=2 .............................................. M12 glass seal, IEC 69479-5-2

Material ...................................................... AISI 316L, DIN 1.4404 (Stainless steel)

Mounting stud ............................................. Fig 1h

Mounting torque (M6, M7, M8 suffix) ................. 2,4 N.m (21 in-lbs)

Accessories, supplied

Calibration supplied ......................................................... 4-20mA Loop // DA or DV if applicable

Accessories, not supplied

Cable assembly

- MIL connector (B=1), Polyurethane cable ............. 10.01-B22-A01-01-Length
- FEP Teflon cable ................................................. 10.01-B22-A01-02-Length
- M12 connector (B=2) Polyurethane cable .......... 10.01-E02-A01-31-Length
- MIL connector (B=2), FEP Teflon cable ......... 10.01-E02-A01-12-Length
- MIL-C-5015 glass seal, Type MS3143 10SL-4P
- PU or FEP Armored cables are also available. See Model 10.01.

Accessories, spares part

Mounting Stud with M6 Housing thread (HH=H6)

M6 .............................................. 191.01-06-16-1

M8 .............................................. 191.01-06-16-1

Repair

Consult factory for replacement of connector in case of broken or benden pins. Repair of electronic is not possible.

(1) Guaranteed if using accessories listed in this product datasheet only

Wiring Schematic
Industrial ICP Piezoelectric Accelerometer

4-20 mA Input card

- 12 V to 30 V
DC Power Supply

0-10 VDC Input card

- 12 V to 30 V
DC Power Supply

Dynamic Output should be galvanically isolated from Power Supply Gnd

1 (mA)=U(mV)/R (Ohms)

Drawings

Model Number | Pin A | Pin B |
-------------|-------|-------|
Standard, no option | (+) | (-) |

Fig 1a: Outline drawing & Electrical layout, B=1 (MIL-C-5015)

Model Number | (+) | (-) | DA/DV (+) | T0 (+) | T0 (-) |
-------------|-----|-----|-----------|-------|-------|
CC=01, 02 (PU, Teflon), no option | Red | White | NA | NA | NA |
CC=03 (Radox) with DA/DV option | White N°1 | White N°2 | White N°3 | NA | NA |
CC=01 (PU) with DA/DV option | Brown | White | Black | NA | NA |
CC=02 (Teflon) with DA/DV option | Red | White | Black | NA | NA |
CC=01 (PU) with T0 option | Brown | White | N/A | Black | Blue |

(NA): Not Applicable

Fig 1d: Outline drawing & Electrical layout, B=5 (cable only)
Fig 1e: Outline drawing B=7 (cable with overbraid)
electrical layout: See above B=5

Fig 1f: Outline drawing B=8 (cable with conduit protection)
electrical layout: See above B=5

Detail of tapped hole

Fig 1h: Housing thread, option H1, H2, H7
4-20 mA Vibration Sensor Model 127
Side Connector

Main Characteristics
• Velocity (RMS, Peak) or Acceleration (RMS, Peak)
• Dynamic output available Velocity or Acceleration
• IP67 with associated cable (B=2, 3 only)

Competitive advantage
• Price
• Low cost IP67 overmolded M12 cable assembly
• M12 overmolded cable assembly is available through local electronic distributor
• M12 offers compatibility with sensors used in automation.

Description
The hermetic sealed 4-20 mA loop powered industrial accelerometer model 127 is designed to monitor the vibration in harsh industrial environments. It uses the industry standard 4-20mA Loop that interfaces directly with PLC, DCS and 4-20mA monitor. Large choice of output (velocity, acceleration, RMS, equivalent Peak) and frequency range will help to fit almost every customer requirements. Their compact size allows for installation in tight places. The dynamic signal output (acceleration or velocity) can allow spectral vibration measurements.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. It allows continuous trending of overall machine vibration.

Ordering information model 127.01
To order, specify model number, options and suffix:
127.01- AAAA - B (CC-DD) - Options - Accessories

AAAA : Full Scale (=20mA)
AR05 : Acceleration RMS 5g (3Hz to 10kHz ±10%)
AR10 : Acceleration RMS 10g (3Hz to 10kHz ±10%)*
AR20 : Acceleration RMS 20g (3Hz to 10kHz ±10%)
AR50 : Acceleration RMS 50g (3Hz to 10kHz ±10%)
AP05 : Acceleration Peak 5g (3Hz to 10kHz ±10%)
AP10 : Acceleration Peak 10g (3Hz to 10kHz ±10%)
AP20 : Acceleration Peak 20g (3Hz to 10kHz ±10%)
AP50 : Acceleration Peak 50g (3Hz to 10kHz ±10%)
VR10: Velocity RMS 10 mm/s (3Hz to 1000 Hz ±10%)*
VR11: Velocity RMS 0.5 ips (3Hz to 1000 Hz ±10%)
VR20: Velocity RMS 20 mm/s (3Hz to 1000 Hz ±10%)
VR21: Velocity RMS 1 ips (3Hz to 1000 Hz ±10%)
VR51: Velocity RMS 2 ips (3Hz to 1000 Hz ±10%)
VP10: Velocity Peak 10 mm/s (3Hz to 1000 Hz ±10%)*
VP11: Velocity Peak 0.5 ips (3Hz to 1000 Hz ±10%)
VP20: Velocity Peak 20 mm/s (3Hz to 1000 Hz ±10%)
VP21: Velocity Peak 1 ips (3Hz to 1000 Hz ±10%)
VP51: Velocity Peak 2 ips (3Hz to 1000 Hz ±10%)

VR10: Velocity RMS 10 mm/s (3Hz to 1000 Hz ±10%)*
VR11: Velocity RMS 0.5 ips (3Hz to 1000 Hz ±10%)
VR20: Velocity RMS 20 mm/s (3Hz to 1000 Hz ±10%)
VR21: Velocity RMS 1 ips (3Hz to 1000 Hz ±10%)
VR51: Velocity RMS 2 ips (3Hz to 1000 Hz ±10%)
VP10: Velocity Peak 10 mm/s (3Hz to 1000 Hz ±10%)*
VP11: Velocity Peak 0.5 ips (3Hz to 1000 Hz ±10%)
VP20: Velocity Peak 20 mm/s (3Hz to 1000 Hz ±10%)
VP21: Velocity Peak 1 ips (3Hz to 1000 Hz ±10%)
VP51: Velocity Peak 2 ips (3Hz to 1000 Hz ±10%)

Note: Peak is based on the true RMS value of vibration. For a sine wave, the equivalent peak output is 1.414 times the RMS value.

B : Connector / Integral cable
1 : *MIL-C-5015, glass seal
2 : *M12 glass seal
5 : *Integral cable
7 : *Integral cable with stainless steel overbraid protection
8 : Integral cable with stainless steel protection conduit
Option 5, 7, 8 needs additional information \(CC-DD\)
Options 5, 7, 8 are not stocked. Leadtime : 2 to 4 weeks.
CC : Cable Type (only integral cable B=5, 7, 8)

Model 127.01-AAAA-2 with Overmolded M12 cable assembly
01 : Polyurethane twisted pair cable (90°C)
02 : Teflon FEP twisted pair Cable (200°C)
03 : Radox twisted pair cable (120°C, halogen free)
12 : Teflon FEP twisted triple Cable (200°C). For DA/DV option.
13 : Radox twisted triple (halogen free). For DA/DV option
31 : *Polyurethane 4 conductors cable (90°C). For DA/DV option

DD : length in metre (only integral cable B=5, 7, 8)

Options :
Acceleration Dynamic Output DA
100 mV/g +/−30% for VRXX, VPXX, AR05, AP05
10mV/g +/−30% for AR10, AR20, AR50, AP10, AP20, AP50.

Velocity Dynamic Output DV
100 mV/ips +/−30% for VRXX and VPXX

Note: DA or DV are not available for MIL-C-5015 2-pin connector (B=1).

Agency approval
none

Accessories (Machine thread):
M6  : M6x1 Bolt, captive, hex socket
M7  : 1/4” 28 UNF 2A Bolt, captive, hex socket

Special Engraving :
Add ZXX at the end of the part number.
XX is a number supplied by VibraSens

*Most Popular model (in stock) :
127.01-VR10-2-DA // 125.07-VR21-2-DA
127.01-AR20-2-DA

Ordering example :
127.01-VR10-2-DA-M6    4-20mA sensor, FS=10mm/s RMS, M12 glass seal connector
Specifications (24°C)

Dynamic

Sensitivity
No vibration ................................. 4 mA
Full scale (see AAAA ordering information) ............... 20 ma ±2%
Note: Equivalent Peak is based on the true RMS value of vibration. For a sine wave, the equivalent peak output is 1.414 times the RMS value.

Accuracy (Repeatability) ........................... 2%
Frequency response .................................. See AAAA ordering information
Mounted Resonant frequency ...................... 25 kHz Nom
Transverse response sensitivity (20Hz, 5g) .............. ±5%
Linearity .................................................. ±1% Max
Turn on time, 4-20 mA loop ...................... < 15 Sec

Option: Dynamic acceleration (DA)

Sensitivity ............................................. 25 g for 100 mV/g output
Dynamic .............................................. 250 g for 10 mV/g output
Power .......... Need 4-20 mA loop, no constant current source is needed. DC bias=2.6V
Frequency response .................................. ±10 % ; 3 to 9000 Hz
±3 dB : 1 to 14000 Hz

Option: Dynamic velocity (DV)

Sensitivity ............................................. 100 mV/in/sec
Dynamic ............................................. 1.5 in/sec
Power .......... Need 4-20 mA loop, no constant current source is needed.
Frequency response .................................. ±10 % ; 3 to TBD Hz
±3 dB : 1 to TBD Hz

Electrical

Grounding .............................................. Isolated from machine ground
.............................................. Internal Faraday shielding (fig. 1)
Isolation(Case to shield) .............................. 100 MΩ Min
Capacitance to ground ................................ 70 pf Nom
Maximum Loop resistance ...................... Rmax=VDC power - 10V/20mA
Minimum RI wattage ................................. Watt min=0.0004xRI
Power requirements for two wire loop ............. Voltage : +10 to +30 VDC
Protection : Overvoltage .............................. Yes
Reverse polarity ...................................... Yes

Environmental

Temperature, operating continuous max. loop current +10mA .............................. -55 to 120 °C (-65 to 250 °F)
max. loop current +20mA .............................. -55 to 90 °C (-65 to 212 °F)
Humidity / Enclosure
B=1, 2 ............................................. Not affected, hermetically sealed. 1E-8torr.l/s
B=3 ............................................. IP67, epoxy sealed
Acceleration limit : Shock .............................. 2 500g peak
Continuous vibration .................................. 250g peak
Mean time between failure (MTBF) ................. 7 Years Nom
ESD Protection ...................................... > 40 V
Safety .............................................. EN 61010-1 and IEC 1010-1
EMC emission ...................................... EN 50081-1, EN 50081-2
EMC immunity (1) ...................................... EN 50082-1, EN 50082-2

Physical

Dimensions
B=1 .................................................. Fig. 1a
B=2 .................................................. Fig. 1b
B=5 .................................................. Fig. 1e
B=6 .................................................. Fig. 1f
Design ............................................... PZT Ceramic
Weight ............................................. 155 gr Nom (5.6 Oz)
Connector
B=1 ............................................... MIL-C-5015 glass seal, Type MS3143 10SL-4P
B=2 ............................................... M12 glass seal, IEC 69947-5-2
Material ............................................. AISI 316L, DIN 1.4404 (Stainless steel)
Mounting torque (M6, M7) ......................... 2.4 N.m (21 in-lbs)

Accessories, supplied

Calibration supplied ................................. DA or DV if applicable

Accessories, not supplied

Cable assembly
MIL connector (B=1), Polyurethane cable ................. 10.01-B01-A01-02-Length
MIL connector (B=1), FEP Teflon cable .................. 10.01-B01-A01-02-Length
M12 connector B=2, 3 Polyurethane cable ............ 10.01-E01-A01-31-Length
PU or FEP Armored cables are also available. See Model 10.01.

Accessories, spares part
Mounting Stud
M6 .................................................. 191.01-06-06-1

Repair

Consult factory for replacement of connector in case of broken or bended pins. Repair of electronic is not possible.

(1) Guaranteed if using accessories listed in this product datasheet only

Wiring Schematic

Sensor Connector
DCS / PLC
4-20 mA input
- 0 V

Sensor Connector
DCS / PLC
0-10 V input

Dynamic Output
(should be galvanically isolated from Power Supply Grid)
4-20 mA input card

1/4" 28 UNF .......................................... 191.01-06-16-1
M8 .................................................. 191.01-06-08-1

DC Power Supply
- 12 V to 30 V

DC Power Supply
- 12 V to 30 V

0-10 VDC Input card

Dynamic Output
(should be galvanically isolated from Power Supply Grid)

1(mA)=UmV/R (Ohms)
Industrial ICP Piezoelectric Accelerometer

**Model Number**
- PNR: 103.12-6-1
- SNR: A0091
- DNF: 06-2006

**Specifications**
- 100 mV/g
- 5/8" - 24 UNEF

**Table**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
<th>Pin 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard, no option</td>
<td>(+)</td>
<td>(-)</td>
<td>NC</td>
<td>NC</td>
</tr>
<tr>
<td>DA / DV Option</td>
<td>(+)</td>
<td>(-)</td>
<td>NC</td>
<td>DA or DV</td>
</tr>
</tbody>
</table>

**Notes**
- (NC): Not connected
- (Temp): Temperature

**Fig 1a**: Outline drawing & Electrical layout for MIL-C-5015 Connector (B=1)

**Fig 1b**: Outline drawing & Electrical layout for M12 Glass seal Connector (B=2)

**Fig 1c**: Outline drawing & Electrical layout, B=5 (cable only)

**Fig 1d**: Outline drawing & Electrical layout, B=7 (cable with overbraid)

**Fig 1e**: Electrical layout: See above B=5
OEM Piezoelectric Accelerometer Model 160

Main Characteristics
- TO-5 eq. Transistor-Style Package
- Small size (9mm), light weight (3 grammes, 0.1 Oz)
- Variety of Sensitivities : 100 mV/g, 11 pC/g...
- Variety of transmission : 2-Wire ICP/IEPE transmission mode / 3-Wire Voltage output / 2-wire charge output
- Annular shear mode

Competitive advantage
- Low Cost
- Electronic is protected from Overload (Magnet mounting, shock protected)
- Life time hermetic sealing warranty (glass seal and laser weld)
- Base strain isolation (easier epoxy mounting)
- Exceptional bias stability (improved dynamic range)

Description
The piezoelectric accelerometer model 160 uses a solid-state piezoelectric element in the annular shear mode. It is available with 2-wire ICP - IEPE - LIVM Voltage output for easy compatibility with existing piezoelectric accelerometer. 3-wire Voltage output is also available for simplified operation and connectivity to low power data acquisition unit.

Typical applications
The piezoelectric accelerometer model 160 is design for vibration and shock measurements in high-volume and OEM applications. It is well suited for vibration monitoring and machinery protection.

Ordering information model 160.01
To order, specify model number, options, and suffix as:

160.01-AAA-B

Specifications (24°C)

Dynamic
Sensitivity
AAA=V6V (2-Wire ICP) ..................................................... 100 mV/g ±20%  
AAA=V5V (2-Wire ICP) ..................................................... 50 mV/g ±20%  
AAA=V4V (2-Wire ICP) ..................................................... 25 mV/g ±20%  
AAA=V3V (2-Wire Voltage) .................................................. 10 mV/g ±20%

Frequency response
AAA=VXX ........................................................... ±1 dB : 1 to 10 000 Hz  
AAA=VXX ........................................................... ±3 dB : 0.4 to 20 000 Hz

Mounted resonant frequency
Dynamic range
AAA=V6X ........................................................... >42 kHz Nom  
AAA=V5X ........................................................... 80 g pk  
AAA=V4X ........................................................... 160 g pk

Model 160.01-AAA-1

AAA=I1X ...................................................................................... 800 g pk  
AAA=V3X (5 VDC supply) ................................................... 25 g pk  
AAA=V5X (5 VDC supply) ................................................... 50 g pk  
AAA=V4V (5 VDC supply) ................................................... 100 g pk  
AAA=I3V ...................................................................................... Not Applicable

Transverse response sensitivity (20Hz, 5g) ...................................... <5%  
Temperature response sensitivity ............................................. +12% at 120 °C  
Polarity ............................................................................... (fig. 1) Suffix dependent  
Linearity ............................................................................... ±1% Max

Warm up time (Typical)  
AAA=IXX, VXX ........................................................................< 2 Sec (Typical)  

AAA=I3V...................................................................................... 80 g pk

AAA=I5V ...................................................................................... 10 mV/g ±20%  
AAA=I6V ...................................................................................... 50 mV/g ±20%  
AAA=I6V ...................................................................................... 100 mV/g ±20%  
AAA=I6V ...................................................................................... Not Applicable

1 Hz to 25 kHz ........................................................................ TBD g rms  
1 Hz to 25 kHz ........................................................................ TBD g rms

Power requirements :  
AAA=I1X (Fig 2a) .............................................................. Constant current : +2 to +10mA DC  
Voltage : +22 to +28 VDC

Protection, overvoltage .............................................................. Yes  
Protection, reverse polarity ...................................................... Yes  
ESD Protection ................................................................. > 20V

AAA=VXX (Fig 2b) .............................................................. Voltage : +3 to +5 VDC  
Current draw .......................................................................... 1 mA max  
Protection, overvoltage .............................................................. Yes  
Protection, reverse polarity ...................................................... No  
ESD Protection ................................................................. none

AAA=I3V ...................................................................................... 800 g pk

AAA=I5V ...................................................................................... 10 mV/g ±20%  
AAA=I6V ...................................................................................... 50 mV/g ±20%  
AAA=I6V ...................................................................................... Not Applicable

Temperature, operating continuous  
AAA=I1X ........................................................... -55 to 120 °C (-65 to 250°F)  
AAA=VXX ........................................................... -55 to 120 °C (-65 to 250 °F)  
AAA=VXX ........................................................... -55 to 120 °C (-65 to 250 °F)

Humidity / Enclosure  
B=1 ...................................................................................... Not affected, hermetically sealed, 1E-Stor1/s

Acceleration limit : Shock ...................................................... 5 000g peak  
Continuous vibration .............................................................. 500g peak

Base strain sensitivity ............................................................... TBD g pk/s strain

Temp. transient sens. (3Hz, LLF, 20dB/dec) ................................. 0.8 mg/°C  
Acoustic sensitivity (164 dBSP) ................................................ TBD mg

Electromagnetic sens. (50Hz, 0.03 T) ........................................ TBD g

Mean time between failure (MTBF) ............................................ 10 Years Nom

Physical
Dimensions  
B=1 ...................................................................................... Fig 1a
Mounting .................................................................................. Fig 1b

Design ................................................................. Ceramic, annular shear mode

Weight  
AAA=2X, 3X, 41 ................................................................. 3 g Nom (0.1 Oz)

Material ................................................................. AISI 304L, DIN 1.4306 (Stainless steel)

Accessories, supplied
Calibration supplied  
Sensitivity check (5g, 160 Hz)
Drawings

Fig 1a: Outline drawing

Fig 1b: Mounting drawing

Fig 2a: Electrical layout - 2-Wire ICP / IEPE

Fig 2b: Electrical layout - 3 Wire Voltage Output

Fig 2c: Electrical layout - 2-Wire Charge Output

No frequency response
Main Characteristics

- ICP transmission mode
- Annular shear mode (better than obsolete compression design)
- Dual case isolation with internal Faraday shield (suitable for permanent installation, no need for insulation pad, no ground loop)
- Low, medium and high frequency version (10, 50, 100, 500, 1000 mV/g)
- Hermetically sealed (laser welded)

Competitive advantage

- Compare to obsolete compression design, annular shear piezoelectric sensors feature better frequency response, improved base strain, lower noise, smaller size, thermal transient immunity and insensitivity to cable motion. Annular shear mode is also less susceptible to transverse vibrations and better immune to electronic saturation at high frequency.
- improved dynamic range (thanks to exceptional bias stability) at elevated temperatures.
- Resistant to shock (magnet mounting) thanks to JFET transistor input.
- ESD and reverse wiring protection.
- The glass seal hermetic connector protects the piezoelectric disc and the electronic from harmful environmental influences, significantly increasing their reliability and lifetime. Associated with low cost IP68 overmolded M12 cable assembly it is a perfect solution for submersible application down to 150 metres. Sensors with epoxy seal will leak after few temperature cycles.
- M12 connector offers compatibility with numerous sensors used in automation. M12 overmolded cable assemblies are available from many cable manufacturers around the world. Mil cordset are expensive because they are only available from vibration sensor manufacturer.

Description

The hermetic sealed triaxial industrial piezoelectric accelerometer model 131 is designed to monitor the vibration in harsh industrial environment. It uses the industry standard ICP 2-wire voltage transmission technique with a 2 mA minimum constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to ESD to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements. Low frequency accelerometers (A=9X, 0X) incorporate a low-pass filter within the conditioning electronics. This filter attenuates the sensor mechanical resonance and the associated distortion and overload.

Typical applications

Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version will monitor the vibration on roller bearing, pumps cavitation, .... Medium frequency version will monitor overall vibration on pumps, motors, fans, .... Low frequency model is used in the petrochemical, machine tool, and paper industries for monitoring of slow speed agitators, cooling towers, ....

Ordering information Model 131.01

To order, specify model number, options, accessories and suffix:

131.01- AA - B - MM - YY

AA : Sensitivity
3 : 10 mV/g ±5 % (high frequency)
### Specifications (24°C)

#### Dynamic

<table>
<thead>
<tr>
<th>Frequency response (≤3 dB)</th>
<th>A=3X (Z axis)</th>
<th>0.5 to 11000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A=5X, 6X (Z axis)</td>
<td>0.5 to 8000 Hz</td>
</tr>
<tr>
<td></td>
<td>A=9X, 0X (Z axis)</td>
<td>0.2 to 7300 Hz</td>
</tr>
</tbody>
</table>

- **Mounted Resonant frequency**
  - A=3X: 35 kHz Nom
  - A=5X: 25 kHz Nom
  - A=6X: 16 kHz Nom

- **Transverse response sensitivity (20Hz, 5g)**: <5%
- **Temperature response**: -10% at 50°C
- **Polarity**: see figure 1b
- **Linearity**: ±1% Max

#### Electrical

- **Electrical Grounding**: Isolated from machine ground
- **Isolation (Case to shield)**: 100 MΩ Min
- **Output impedance**: 50 kΩ Nom
- **DC output bias, 4mA supply (AA=3X, 6X)**: 132 VDC Nom (Fig 2)
- **DC output Bias, 4 mA supply (AA=9X, 0X)**: 10 VDC Nom (Fig 2)
- **DC temperature response**: +5% at -5°C

#### Environmental

- **Residual noise (24°C)**:
  - A=3X: 1 Hz to 25 kHz: 300 ug rms
  - A=6X: 1 Hz to 25 kHz: 300 ug rms
  - A=9X: 1 Hz to 25 kHz: 25 ug rms

- **Humidity / Enclosure**:
  - B=2: Not affected, hermetically sealed, 1E-8torr.l/s

- **Acceleration limit**:
  - Shock: 5000g peak
  - Continuous vibration: 500g peak

- **Temp. transient sens. (3Hz, LLF, 20dB/dec)**: -15% at max operating temperature

- **Mean time between failure (MTBF)**: 10 Years Nom

- **ESD Protection**: > 40 V

- **Safety**:
  - EN 61010-1 and IEC 1010-1

- **EMC emission**:
  - EN 55011-1, EN 55011-2

- **EMC immunity (1)**:
  - EN 55082-1, EN 55082-2

#### Physical

- **Dimensions**:
  - B=2: Ceramic, annular shear mode

- **Weight with connector**:
  - A=3X: 228 g Nom (8.0 Oz)
  - A=5X, 6X: 238 g Nom (8.4 Oz)
  - A=9X, 0X: 275 g Nom (9.7 Oz)

- **Connector**:
  - B=2: M12 glass seal, IEC 60947-5-2
- **Material**:
  - AISI 316L, DIN 1.4404 (Stainless steel)

- **Mounting torque (M6, M7 suffix)**: 2.4 N.m (21 in-lbs)

---

#### Accessories, supplied

- **Calibration supplied**:
  - Sensitivity (5g, 160 Hz)
  - No frequency response

#### Accessories, not supplied

- **Cable assembly B=2 (M12 connector)**: Polyurethane cable
- **For more cable options see Model 10.01 (specific cable harness)**

#### Accessories, spares part

- **Mounting Stud**
  - M6 machine thread
  - 1/4" 28 UNF machine thread

#### Repair

Consult factory for replacement in case of broken or bent pins. Repair of electronic is not possible.

(1) Guaranteed if using accessories listed in this product datasheet only.

---

### Drawings

![Fig 1b: Outline drawing](image-url)
ICP Triaxial Accelerometer Model 138

Main Characteristics
- ®ICP transmission mode
- Annular shear mode (better than obsolete compression design)
- Dual case isolation with internal Faraday shield (suitable for permanent installation, no need for insulation pad, no ground loop)
- medium and high frequency version (10, 50, 100 mV/g)
- Hermetically sealed (laser welded)

Competitive advantage
- World smallest industrial triaxial accelerometer. Industrial means with internal faraday shield isolated from mounting surface.
- Compare to obsolete compression design, annular shear piezoelectric sensors feature better frequency response, improved base strain, lower noise, smaller size, thermal transient immunity and insensitivity to cable motion. Annular shear mode is also less susceptible to transverse vibrations and better immune to electronic saturation at high frequency.
- improved dynamic range (thanks to exceptional bias stability) at elevated temperatures.
- Resistant to shock (magnet mounting) thanks to protected MosFet transistor input.
- ESD and reverse wiring protection.
- The glass seal hermetic connector protects the piezoelectric disc and the electronic from harmful environmental influences, significantly increasing their reliability and lifetime. Associated with low cost IP68 overmolded M12 cable assembly it is a perfect solution for submersible application down to 150 metres. Sensors with epoxy seal will leak after few temperature cycles.
- M12 connector offers compatibility with numerous sensors used in automation. M12 overmolded cable assemblies are available from many cable manufacturers around the world. Mil cordset are expensive because they are only available from vibration sensor manufacturer.

Description
The hermetic sealed triaxial industrial piezoelectric accelerometer model 138 is design to monitor the vibration in harsh industrial environment. It uses the industry standard ®ICP 2-wire voltage transmission technique with a 2 mA minimum constant current supply. Signal ground is isolated from the mounting surface and outer case to prevent ground loops. Faraday shielding will limit sensitivity to ESD to a minimum. Annular shear mode design will prevent from thermal transient and from spurious signal from high transverse vibrations. Low noise electronic and a temperature compensated design will give you accurate result over the complete temperature range. Large choice of frequency range will help to fit almost every customer requirements.

Typical applications
Vibrations measurement in the rugged environments of industrial machinery monitoring. High frequency version will monitor the vibration on roller bearing, pumps cavitation, ... Medium frequency version will monitor overall vibration on pumps, motors, fans, ...
Specifications (24°C)

Dynamic

Frequency response (+3 dB)
- A=3X, 5X, 6X (Z axis) 
  0.5 to 13000 Hz
- X, Y axis 
  0.5 to 10000 Hz

Mounted Resonant frequency
- A=3X, 5X, 6X 
  40 kHz Nom

Dynamic range
- A=3X 
  800 g pk
- A=5X 
  160 g pk
- A=6X 
  80 g pkr

Transverse response sensitivity (20Hz, 5g) 
< 5%

Temperature range
- -10% at -50°C
- +10% at 120 °C

Polarity
- see figure 1b

Linearity
- ±1% Max

Warm up time (Typical)
- A=3X, 5X, 6X 
  < 15sec

Electrical

Electrical Grounding
- Isolated from machine ground

Isolation (Case to shield)
- 100 MΩ Min

Output impedance
- 50 Ω Nom

DC output bias, 4mA supply (AA=3X, 5X, 6X) 
12 ± 2 VDC

DC temperature response
- ±2% at -50 °C

Residual noise (24°C): A=3X 
- 1 Hz to 25 kHz: 300 ug rms
- 1 Hz: 30 ug

Residual noise (24°C): A=6X 
- 1 Hz to 25 kHz: 300 ug rms
- 1 Hz: 30 ug

Power requirements
- Constant current: +2 to +10mA DC
- Voltage: +22 to +28 VDC

Protection
- Overvoltage: Yes
- Reverse polarity: Yes

Environmental

Temperature, operating continuous: (max. current ~4mA)
- A= 3X, 5X, 6X 
  -55 to 120 °C (-65 to 250 °F)

Humidity / Enclosure
- B=2 
  Not affected, hermetically sealed, 1E-10torr/s

Acceleration limit: Shock
- 5000g peak
- Continuous vibration
- 500g peak

Temp. transient sens. (3Hz, LLF, 20dB/dec)
- 5 mg/°C

Mean time between failure (MTBF)
- 10 Years Nom

ESD Protection
- > 40 V

Safety
- EN 61010-1 and IEC 1010-1
- EN 50082-1, EN 50082-2

EMC emission
- EN 61010-1 and IEC 1010-1
- EN 50082-1, EN 50082-2

EMC immunity (1)
- EN 61010-1 and IEC 1010-1
- EN 50082-1, EN 50082-2

Physical

Dimensions
- B=2 
  Ceramic, annular shear mode

Weight with connector
- A=3X, 5X, 6X 
  84 gr Nom (3.0 Oz)

Connector
- B=2 
  M12 glass seal, IEC 60947-5-2

Material
- AISI 316L, DIN 1.4404 (Stainless steel)

Mounting torque (M6, M7 suffix)
- 2,4 N.m (21 in-lbs)

Accessories, supplied

Calibration supplied
- Sensitivity (5g, 160 Hz)

No frequency response

Accessories, not supplied

Cable assembly B=2 (M12 connector)
- Polyurethane cable 
  10.01-E02-A01-31-Length
  For more cable option see Model 10.01 (specific cable harness).

Accessories, spares part

Mounting Stud
- M6 machine thread 
  193.38-06-1
- 1/4" 28 UNF machine thread 
  193.38-16-1

Repair

Consult factory for replacement of connector in case of broken or bended pins. Repair of electronic is not possible.
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Stud, Non Isolated, Model 191

Main Characteristics
- -260°C to 700 °C (-436°F to 1292°F) (options dependant)
- Large choice of options for material and thread
- For top connector accelerometer model 101 and 105

Description
This is the most usual method for accelerometer mounting. These studs are detachable, permitting rapid, low cost replacement. They are used by most accelerometer manufacturers but they are not fully compatible due to the sensor shoulder diameter and the thread length. You should not use ordinary machine screw because they lack a flange or shoulder and might bottom in the accelerometer and degrades his dynamic response. Stud mounting is considered as the most reliable way to mount a vibration sensor. Stud mounting will attain the maximum sensor frequency range. Stud mountind requires a tapped hole drilled directly into the structure. The sensor requires a flat spot faced surface with a perpendicular tapped hole.

Ordering information
To order, specify part number, options and suffix :
191.01- AA - B B - C (Mod)
AA : Sensor end
05 - M5x0.8
06 - M6x1
15 - 10-32 UNF 2A
16 - 1/4 28 UNF 2A
BB : Machine/Structure end
05 - M5x0.8
06 - M6x1
08 - M8x1.25
15 - 10-32 UNF 2A
16 - 1/4 28 UNF 2A
C : Material
1 - Aisi 303
2 - Aisi 316L
3 - Nimonic 90
(Mod)** : modification defined by customers. For example shoulder diameter.

Ordering example
191.01-05-05-1 Stud, non isolated

Stocked models :
191.01-15-15-1 / 191.01-15-05-1 / 191.01-06-06-1 / 191.01-06-16-1 / 191.01-06-08-1 / 191.01-16-06-1 / 191.01-16-16-1 / 191.01-16-08-1

Competitor’s cross reference list
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<tr>
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<th>Competitor’s Ref.</th>
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<td>Wilcoxon SF6, PCB 081B20</td>
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<td>191.01-16-06-1</td>
<td>PCB M081B20</td>
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<td>191.01-15-15-1</td>
<td>Wilcoxon SF1, Endevco 2984-2, PCB 081B05</td>
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<td>191.01-15-05-1</td>
<td>PCB M081B23</td>
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<td>191.01-15-16-1</td>
<td>Wilcoxon SF3, Endevco 22330, PCB 081A08</td>
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<td>191.01-16-08-1</td>
<td>Wilcoxon SF6M,</td>
</tr>
<tr>
<td>191.01-16-06-1</td>
<td>Wilcoxon SF6M-1,</td>
</tr>
</tbody>
</table>

Specifications

Environmental
Temperature
C=1, 2 .......................................................... -70°C to 260 °C (-436 to 500 °F)
C=3 .......................................................... -260 to 700 °C (-436 to 1292 °F)

Physical
Dimensions .......................................................... See outline drawing
Weight .......................................................... between 1.5 and 3 gr
.......................................................... between 0.05 and 0.1 Oz

Material
C=1.................................................. AISI 303, DIN1.4301, AFNOR Z10 CNF 18 09
C=2.................................................. AISI 316L, DIN1.4404, AFNOR Z2 CND 17 13
C=3.................................................. Nimonic 90, WNR 2.4969

Mounting torque
AA=05, 15 or BB=05, 15 .......................................................... 2 N.m (18 in-lbs)
AA=06, 16 or BB=06, 16 .......................................................... 2.7 N.m (24 in-lbs)

Outline drawing
See table below to check the associated drawing

<table>
<thead>
<tr>
<th>BB (Machine)</th>
</tr>
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<tbody>
<tr>
<td>05</td>
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<tr>
<td>08</td>
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<td>15</td>
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<td>16</td>
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</table>

<table>
<thead>
<tr>
<th>AA (sensor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
</tr>
<tr>
<td>06</td>
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<tr>
<td>08</td>
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<tr>
<td>15</td>
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<tr>
<td>16</td>
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Model 191.01-06-1
# Drawings

<table>
<thead>
<tr>
<th>Sensor end</th>
<th>M5</th>
<th>M6</th>
<th>10-32 UNF 2A</th>
<th>1/4 28 UNF 2A</th>
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</thead>
<tbody>
<tr>
<td><strong>Fig 11</strong></td>
<td><img src="image1.png" alt="Fig 11" /></td>
<td><img src="image2.png" alt="Fig 11" /></td>
<td><img src="image3.png" alt="Fig 11" /></td>
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<td><strong>Fig 21</strong></td>
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<td><strong>Fig 31</strong></td>
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<td><strong>Fig 41</strong></td>
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<td><strong>Fig 32</strong></td>
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<td><strong>Fig 34</strong></td>
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<td><strong>Fig 44</strong></td>
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<td><strong>Fig 45</strong></td>
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<td><img src="image52.png" alt="Fig 45" /></td>
<td><img src="image53.png" alt="Fig 45" /></td>
</tr>
</tbody>
</table>
Bolt, captive, Hex socket, Model 193

Main Characteristics
- -260°C to 260 °C (-436°F to 500°F)
- Bolt for accelerometer model 103 and 107

Description
This bolt is used to mount side connector industrial accelerometers (model 103 and 107) with through hole mounting.

Ordering information
To order, specify part number, options and suffix:
193.01- AA - C (Mod)
AA : Machine/Structure end
  06 - M6x1
  16 - 1/4 28 UNF 2A
C : Material
  1 - Aisi 303
  2 - Aisi 316L
(Mod)
(Mod)** : modification defined by customers. For example shoulder diameter.

Ordering example
193.01-06-1 Bolt, captive, Hex socket

Stocked models:
193.01-06-1 and 193.01-16-1

Specifications
Environmental
Temperature ..................................................-260 to 260 °C (-436 to 500 °F)
Physical
Dimensions .......................................................... See outline drawing
Weight .............................................................. ~7 gr (~0.25 Oz)
Material
C=1 ...................................................... AISI 303, DIN1.4301, AFNOR Z10 CNF 18 09
C=2 .................................................... AISI 316L, DIN1.4435, AFNOR Z2 CND 17 13
Mounting torque ................................................. 2.7 N·m (24 in-lbs)

Outline drawing
See table below to check the associated drawing

<table>
<thead>
<tr>
<th>AA</th>
<th>Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6x1</td>
<td>06</td>
</tr>
<tr>
<td>1/4 28 UNF 2A</td>
<td>16</td>
</tr>
</tbody>
</table>

Model 193.01-06-1

Fig 21

Fig 41
Bolt, captive, Hexagonal, Model 194

Main Characteristics
- -260°C to 260 °C (-436°F to 500°F)
- Bolt for accelerometer model 104

Description
This bolt is used to mount side connector industrial accelerometers (model 104) with through hole mounting.

Ordering information
To order, specify part number, options and suffix:
194.01- AA - C (Mod)
AA : Machine/Structure end
08 - M8x1.25
C : Material
1 - Aisi 303
2 - Aisi 316L
(Mod)
(Mod)** : modification defined by customers. For example shoulder diameter.

Ordering example
194.01-08-1 Bolt, captive, Hex socket

Stocked models:
194.01-08-1

Specifications
Environmental
Temperature ..........................................................-260 to 260 °C (-436 to 500 °F)

Physical
Dimensions .......................................................... See outline drawing
Weight .................................................................~9 gr (~ 0.35 Oz)

Material
C=1 ......................................................AISI 303, DIN1.4301, AFNOR Z10 CNF 18 09
C=2 .....................................................AISI 316L, DIN1.4435, AFNOR Z2 CND 17 13

Mounting torque ..................................................... 2.7 N.m (24 in-lbs)

Outline drawing
See table below to check the associated drawing

<table>
<thead>
<tr>
<th>AA</th>
<th>Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8x1.25</td>
<td>08</td>
</tr>
</tbody>
</table>

Model 194.01-08-1

Fig 11
Flat magnet, Model 210

Main Characteristics
- portable route measurements
- high temperature up to 200°C
- for top connector sensors with M5 and 10-32 UNF thread
- for flat surfaces only
- Stainless steel

Description
The use of magnet bases is convenient and quick for many applications (route measurements). They produce an intimate and stiff contact between DC and few kilohertz. The high frequency response (above few kHz) is significantly distorted. Obviously the machine surface should be magnetically attractive and free of paint chips and scale. Painted surface should use our stainless steel magnet target model 208 that greatly improve the high frequency response. We also recommend the use of coupling fluids, such as oil.

Customer should pay attention to magnet attaching on the machine. The shock could overload the vibration sensor and destroy the electronic.

Ordering information
To order, specify part number, options and suffix:
210.01- AA - BB

AA : Sensor thread
05 - M5x0.8
15 - 10-32 UNF

BB : Diameter
19 - 19 mm

Stocked models:
210.01-15-19

Ordering example
210.01-15-19  Flat magnet, 10-32 UNF

Specifications
Dynamic
Frequency response ........................................... 10% : DC to 2.5 kHz
Environmental
Temperature ...........................................-55°C to 200 °C (-67°F to 320°F)
Physical
Dimensions ...........................................See outline drawing Fig 1a
Weight ...........................................~9.5 gr (0.33 Oz)
Material ...........................................Stainless steel
Magnet ...........................................high temperature rare earth magnet
pull force  ...........................................23 kg (50 Lbs)

Accessories
Magnet targets ...........................................model 208

Competitors cross reference list
Wilcoxon B2a, B4 / CTC online TBD / PCB TBD / AMPO EMID 22 / Dytran
Flat magnet, Model 211

Main Characteristics
- portable route measurements
- for top connector vibration sensors with M6 and 1/4" 28 UNF thread
- for flat surfaces only (to be used whenever possible with our magnet targets model 208)
- Stainless steel

Description
The use of magnet bases is convenient and quick for many applications (route measurements). They produce an intimate and stiff contact between DC and few kilohertz. The high frequency response (above few kHz) is significantly distorted. Obviously the machine surface should be magnetically attractive and free of paint chips and scale. Painted surface should use our stainless steel magnet target model 208 that greatly improve the high frequency response. We also recommend the use of coupling fluids, such as oil. Customer should pay attention to magnet attaching on the machine. The shock could overload the vibration sensor and destroy the electronic.

Ordering information
To order, specify part number, options and suffix:
211.01- AA - BB
AA : Sensor thread
  06 - M6x1
  16 - 1/4" 28 UNF
BB : Diameter
  25 - 25 mm

Stocked models:
211.01-06-25 / 211.01-16-25

Ordering example
211.01-06-25 Flat magnet, M6

Specifications
Dynamic
Frequency response .......................................................... 10% : DC to 2.5 kHz
......................................................................................................................... see fig 4a

Environmental
Temperature .......................................................... -55°C to 160 °C (-67°F to 320°F)

Physical
Dimensions .......................................................... See outline drawing Fig 1a
Weight .......................................................... ~ 42 gr (~ 1.5 Oz)
Material .......................................................... Stainless steel
Magnet .......................................................... high temperature rare earth magnet
pull force .......................................................... 23 kg (50 Lbs)

Accessories
Magnet targets .......................................................... model 208

Competitors cross reference list
Wilcoxon B3 / CTC online MH103-1B - MH136-1A / PCB 080A121 (080A120) / AMPO EMID 22 (very low pull force) / Dytran

Outline drawing

Mounting drawing

Typical frequency response
Flat magnet, Model 212

Main Characteristics
- portable route measurements
- for side connector sensors with M6 and 1/4” 28 UNF thread
- for flat surfaces only (to be used whenever possible with our magnet targets)
- Stainless steel

Description
The use of magnet bases is convenient and quick for many applications (route measurements). They produce an intimate and stiff contact between DC and few kilohertz. The high frequency response (above few kHz) is significantly distorted. Obviously the machine surface should be magnetically attractive and free of paint chips and scale. Painted surface should use our stainless steel magnet target model 208 that greatly improve the high frequency response. We also recommend the use of coupling fluids, such as oil.
Customer should pay attention to magnet attaching on the machine. The shock could overload the sensor and destroy the electronic.

Ordering information
To order, specify part number, options and suffix :
212.01- AA - BB
AA : Sensor thread
06 - M6x1
16 - 1/4” 28 UNF
BB : Diameter
25 - 25 mm

Stocked models :
212.01-06-25 / 212.01-16-25

Ordering example
212.01-06-25 Flat magnet, M6

Specifications
Dynamic
Frequency response......................................................... 10% : DC to 2.5 kHz
................................................................. see fig 4a
Environmental
Temperature ...............................................................-55°C to 160 °C (-67°F to 320°F)
Physical
Dimensions ................................................................. See outline drawing Fig 1a
Weight ................................................................. ~63 gr (~2.22 Oz)
Material ................................................................. Stainless steel
Magnet ................................................................. high temperature rare earth magnet
pull force ................................................................. 23 kg (50 Lbs)
Accessories
Magnet targets ................................................................. model 208

Competitors cross reference list
Wilcoxon B3 / CTC online MH103-1B - MH136-1A / PCB 080A121 (080A120) / AMPO EMID 22 (very low pull force)
Curved magnet, Model 220

Main Characteristics
- portable route measurements
- for top connector sensors with M6 and 1/4” 28 UNF thread
- for flat surfaces only (to be used whenever possible with our magnet targets)
- Stainless steel

Description
The use of magnet bases is convenient and quick for many applications (route measurements). They produce an intimate and stiff contact between DC and few kilohertz. The high frequency response (above few kHz) is significantly distorted. Obviously the machine surface should be magnetically attractive and free of paint chips and scale. Painted surface should use our stainless steel magnet target model 208 that greatly improve the high frequency response. We also recommend the use of coupling fluids, such as oil.

Customer should pay attention to magnet attaching on the machine. The shock could overload the sensor and destroy the electronic.

Ordering information
To order, specify part number, options and suffix:
220.01- AA - BB
AA : Sensor thread
  06 - M6 x 1
  16 - 1/4” 28 UNF
BB : Diameter
  25 - 25 mm

Stocked models:
220.01-06-25 / 220.01-16-25

Ordering example
220.01-06-25 Curved magnet, M6

Specifications
Dynamic
Frequency response ................................................................. 10% : DC to 2.5 kHz
......................................................................................................................... see fig 4a

Environmental
Temperature .......................................................... -55°C to 160 °C (-67°F to 320°F)

Physical
Dimensions .......................................................... See outline drawing Fig 1a
Weight .......................................................... 48 gr (~ 1.70 Oz)
Material .......................................................... Stainless steel
Magnet .......................................................... high temperature rare earth magnet
pull force .......................................................... 23 kg (50 Lbs)

Accessories
Magnet targets .......................................................... model 208

Competitors cross reference list
Wilcoxon B3 / CTC online MH103-1B - MH136-1A / PCB 080A121 (080A120) / AMPO EMID 22 (very low pull force)
Curved magnet, Model 221

Main Characteristics
- portable route measurements
- for side connector sensors with M6 and 1/4” 28 UNF thread
- for flat surfaces only (to be used whenever possible with our magnet targets)
- Stainless steel

Description
The use of magnet bases is convenient and quick for many applications (route measurements). They produce an intimate and stiff contact between DC and few kilohertz. The high frequency response (above few kHz) is significantly distorted. Obviously the machine surface should be magnetically attractive and free of paint chips and scale. Painted surface should use our stainless steel magnet target model 208 that greatly improve the high frequency response. We also recommend the use of coupling fluids, such as oil.

Customer should pay attention to magnet attaching on the machine.

Ordering information
To order, specify part number, options and suffix :
221.01- AA - BB
AA : Sensor thread
06 - M6x1
16 - 1/4” 28 UNF
BB : Diameter
25 - 25 mm

Stocked models :
221.01-06-25 / 221.01-16-25

Ordering example
221.01-06-25 Curved magnet, M6

Specifications
Dynamic
Frequency response ....................................................... 10% : DC to 2.5 kHz
......................................................................................... see fig 4a
Environmental
Temperature .............................................................. -55°C to 160 °C (-67°F to 320°F)
Physical
Dimensions .............................................................. See outline drawing Fig 1a
Weight ........................................................................... ~75 gr (~ 2.64 Oz)
Material ................................................................. Stainless steel
Magnet ................................................................. high temperature rare eath magnet pull force ........................................................................... 23 kg (50 Lbs)
Accessories
Magnet targets ............................................................... model 208

Competitors cross reference list
Wilcoxon B3 / CTC online MH103-1B - MH136-1A / PCB 080A121 (080A120) / AMPO EMID 22 (very low pull force)

Magnetic mounting pad, Model 208
Main Characteristics
- portable route measurements
- improved frequency response when used with our magnet model 210, 211, ...
- Useful for machine without magnetic surface
- Stainless steel

Description
The use of magnetic mounting pad ensures consistent measurement location for accurate trending. It also greatly improves the frequency response when used with our magnet model 210, 211, ... Magnetic mounting pads / magnet targets are the only way to use flat or curved magnet when the machine to be monitored has no magnetic surface. Our pads feature an abraded adhesive mounting surface for superior bonding.

Ordering information
To order, specify part number, options and suffix :
208.01- BB
BB : Diameter
25 - 25 mm

Ordering example
208.01-25 Magnetic mounting pad, dia 25

Stocked models :
208.01-25

Specifications
Environmental
Temperature ................................................................. depends on adhesive
Physical
Dimensions ...................................................................... See outline drawing Fig 1a
Weight ................................................................................ 22 gr (0.78 Oz)
Material ................................................................................ Stainless steel
Accessories
Magnet .................................................................................. model 21X, 22X
Adhesive ................................................................................ Locite 330

Competitors cross reference list

Outline drawing

Mounting drawing
Cementing - Adhesive pad, Model 202

Main Characteristics
- Permanent mounting in corrosive environment
- For industrial top connector accelerometer
- Stainless steel (AISI 316L)

Description
Cementing pads are used for permanent installations. It eliminates tapping into the structure but provide high frequency capability approaching stud mount. The pad is epoxied in place of the tapped hole; the sensor is then mounted to the pad. Cementing - adhesive pads can provide additional electrical isolation. Adhesive selection is critical for long term reliability. Our cemented pads feature a flat abraded mounting surface for superior bonding and a stud (M5, 10-32 UNF, M6 or 1/4" 28 UNF) for mounting the accelerometer.

Ordering information
To order, specify part number, options and suffix :
**202.01- AA - BB - C**  
**AA : Sensor thread**
- 05 - M5x0.8
- 15 - 10-32 UNF
- 06 - M6x1
- 16 - 1/4" 28 UNF

**BB : Hexagonal**
- 13 - 13 mm
- 19 - 19 mm
- 22 - 22 mm

**C : Material**
- 2 - AISI 316L

Stocked models :
202.01-06-22-2 / 202.01-16-22-2

Ordering example
202.01-06-22-2  Adhesive pad, M6, AISI 316

Specifications

Environmental
Temperature ................................................................. depends on adhesive

Physical Dimensions ........................................................ See outline drawing Fig 1a
Weight ..............................................................................17 gr ( 0.60 Oz)
Material .................................................................Stainless steel AISI 316L

Accessories
Adhesive ..............................................................................Loctite 330

Competitors cross reference list
Wilcoxon SF8, SF8-2 / CTC online MH130-1A, MH133-1A / AMPO ERD20 (not stainless steel)
Cementing - Adhesive pad, Model 204

Main Characteristics
- Permanent mounting
- For industrial top connector accelerometer
- Stainless steel (AISI 303)

Description
Cementing pads are used for permanent installations. It eliminates tapping into the structure but provide high frequency capability approaching stud mount. The pad is epoxied in place of the tapped hole; the sensor is then mounted to the pad. Cementing - adhesive pads can provide additional electrical isolation. Adhesive selection is critical for long term reliability. Our cemented pads feature a flat abraded mounting surface for superior bonding and a stud (M5, 10-32 UNF, M6 or 1/4" 28 UNF) for mounting the accelerometer.

Ordering information
To order, specify part number, options and suffix:

- **204.01- AA - BB - C**
  - **AA**: Sensor thread
    - 05 - M5x0.8
    - 15 - 10-32 UNF
    - 06 - M6x1
    - 16 - 1/4" 28 UNF
  - **BB**: Diameter
    - 13 - 13 mm
    - 19 - 19 mm
    - 22 - 22 mm
  - **C**: Material
    - 1 - AISI 303

Stocked models:
- 204.01-15-17-1 / 204.01-06-22-1 / 204.01-16-22-1

Ordering example
- 204.01-06-22-1 Adhesive pad, M6, AISI 303

Specifications

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Physical</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td>Adhesive</td>
</tr>
<tr>
<td>depends on adhesive</td>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>See outline drawing Fig 1a</td>
<td>Weight</td>
<td>5.5 gr (~0.19 Oz)</td>
</tr>
<tr>
<td>204.01-XX-17-1</td>
<td>204.01-XX-22-1</td>
<td></td>
</tr>
<tr>
<td>5.5 gr (~0.19 Oz)</td>
<td>9.5 gr (~0.33 Oz)</td>
<td></td>
</tr>
</tbody>
</table>

Competitors cross reference list
- Wilcoxon SF8, SF8-2 / CTC online MH130-1A, MH133-1A / AMPO ERD20 (not stainless steel)
Cementing - Adhesive pad, Model 206

Main Characteristics
• Permanent mounting
• For industrial side connector accelerometer
• Stainless steel (AISI 303, AISI 316L)

Description
Cementing pads are used for permanent installations. It eliminates tapping into the structure but provide high frequency capability approaching stud mount. The pad is epoxied in place of the tapped hole; the sensor is then mounted to the pad. Cementing - adhesive pads can provide additional electrical isolation. Adhesive selection is critical for long term reliability. Our cemented pads feature a flat abraded mounting surface for superior bonding and a tapped hole (M6, M8 or 1/4” 28 UNF) for mounting the accelerometer.

Ordering information
To order, specify part number, options and suffix :
206.01- AA - BB - C
AA : Sensor thread
  06 - M6x1
  16 - 1/4” 28 UNF
BB : Diameter
  25 - 25 mm
C : Material
  1 - AISI 303
  2 - AISI 316L

Stocked models :
206.01-16-25-1 / 206.01-06-25-1

Ordering example
206.01-06-25-1 Adhesive pad, M6, AISI 303

Specifications
Environmental
Temperature ................................................................. depends on adhesive
Physical
Dimensions ................................................................. See outline drawing Fig 1a
Weight ................................................................. ~XX gr (~ XX Oz)
Material ................................................................. Stainless steel

Accessories
Adhesive ................................................................................. Loctite 330

Competitors cross reference list
Wilcoxon SF8, SF8-2 / CTC online MH130-1A, MH133-1A / AMPO ERD20 (not stainless steel)

Model 206.01-06-25

Outline drawing

Mounting drawing
Twisted Pair, Model 600103 & 600104

Main Characteristics
- Twisted pair shielded cable
- Rund cable
- -55°C to 200 °C (-67°F to 392°F)
- Selection of halogen free & flame retardant cable
- Selection of Stainless steel (AISI 316) overbraid

Description

Fig 1: without overbraid (PNR 600103.XX)

Fig 2: with overbraid (PNR 600104.XX)

- These cables are specifically manufacture for our applications.
- They all have fillers for a perfectly rund cable.
- All cables are available with a stainless steel overbraid for harsh environment.

Typical application
- They are used for 2-pole sensors that exhibit a low impedance output:
  - ®ICP, piezo resistive, capacitive accelerometer
  - velocimeter
  - piezoelectric accelerometer with integrated electronic

Ordering information
To order specify the part number with the following options:
600103.XX - AAA or 600104.XX - AAA (for overbraid version)
AAA : Length in meters
Ordering example:
600103.21-010 Twisted pair cable, PU, 10 metres
<table>
<thead>
<tr>
<th>Material, Coverage</th>
<th>Braided TPC (note 1), 85% min Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21</td>
<td>3.67</td>
</tr>
<tr>
<td>600103.31</td>
<td>3.27</td>
</tr>
<tr>
<td>600103.51</td>
<td>3.1</td>
</tr>
<tr>
<td>600103.61</td>
<td>4.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material, Color, Diameter mm (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21 TPE-U (polyurethane) / Black / 4.9 ±0.2 (0.193 inch)</td>
</tr>
<tr>
<td>600103.31 Teflon (FEP) / White / 4.7 ±0.2 (0.185 inch)</td>
</tr>
<tr>
<td>600103.51 Radox (see note 3) / Black / 4.3 ±0.2 (0.169 inch)</td>
</tr>
<tr>
<td>600103.61 Silicone / Red / 6.4 ±0.2 (0.255 inch)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overbraid PNR / Material / wire dia / Diameter / coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21 600104.21 / AISI 316 Ti / 0.2 mm / 5.7 mm / 80% Min</td>
</tr>
<tr>
<td>600103.31 600104.31 / AISI 316 Ti / 0.2 mm / 5.5 mm / 80% Min</td>
</tr>
<tr>
<td>600103.51 600104.51 / AISI 316 Ti / 0.2 mm / 5.1 mm / 80% Min</td>
</tr>
<tr>
<td>600106.61 N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiation resistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21, 600103.51 Yes</td>
</tr>
<tr>
<td>600103.31 Yes</td>
</tr>
<tr>
<td>600103.61 No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical .......... see the tutorial polymer section in the appendix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note :</td>
</tr>
<tr>
<td>(1) TPC - Tin Plated Copper</td>
</tr>
<tr>
<td>(2) Radox is a trademark of Huber&amp;Suhner. Radox is a radiation cross link copolymer.</td>
</tr>
<tr>
<td>TBD : To be determined</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Electrical Impedance Ω</th>
<th>50 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Cond to Cond (pF/m) / Cond to shield (pF/m)</td>
<td></td>
</tr>
<tr>
<td>600103.21 TBD, TBD</td>
<td></td>
</tr>
<tr>
<td>600103.31 96, TBD</td>
<td></td>
</tr>
<tr>
<td>600103.51 110, 190</td>
<td></td>
</tr>
<tr>
<td>600103.61 TBD</td>
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</table>

<table>
<thead>
<tr>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Continuous °C (°F)</td>
</tr>
<tr>
<td>600103.21 -50 to 90°C (-58 to 194°F)</td>
</tr>
<tr>
<td>600103.31 -100 to 200°C (-148 to 392°F)</td>
</tr>
<tr>
<td>600103.51 -40 to 120°C (-40 to 248°F)</td>
</tr>
<tr>
<td>600103.61 -50 to 180°C (-58 to 382°F)</td>
</tr>
<tr>
<td>Dielectric strength (kV)</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>Voltage rating Vrms</td>
</tr>
<tr>
<td>600103.21 250</td>
</tr>
<tr>
<td>600103.31 600103.51, 600103.61 TBD</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Resistance Conductor (Ω / km) / Shield (Ω / km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21, 600103.31 32.4 / TBD</td>
</tr>
<tr>
<td>600103.51 TBD / 31.1</td>
</tr>
<tr>
<td>600103.61 TBD / TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (g/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21 TBD</td>
</tr>
<tr>
<td>600103.31 30</td>
</tr>
<tr>
<td>600103.51 34</td>
</tr>
<tr>
<td>600103.61 45.5</td>
</tr>
<tr>
<td>600106.21 TBD</td>
</tr>
<tr>
<td>600106.31 TBD</td>
</tr>
<tr>
<td>600106.61 TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bending Radius static / Dynamic</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21, 600103.31 TBD / TBD</td>
</tr>
<tr>
<td>600103.51, 600103.61 3 x diameter / 5 x diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame retardant / Halogen free / Corrosive gas</td>
</tr>
<tr>
<td>600103.21 No / Yes / No</td>
</tr>
<tr>
<td>600103.31 Yes / No / Yes</td>
</tr>
<tr>
<td>600103.51 Yes / Yes / No</td>
</tr>
<tr>
<td>600103.61 Yes / Yes / No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limited oxygen index / Smoke</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21 TBD / Medium</td>
</tr>
<tr>
<td>600103.31 TBD / Slight</td>
</tr>
<tr>
<td>600103.51 38% / Low</td>
</tr>
<tr>
<td>600103.61 TBD / Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>600103.21, 600103.31 none</td>
</tr>
<tr>
<td>600103.51 DIN 5510</td>
</tr>
<tr>
<td>.......................... NF F16-101</td>
</tr>
<tr>
<td>.......................... BS 6853</td>
</tr>
<tr>
<td>.......................... DIN EN 50265, 50267, 50286 NF C82-070, X10-702</td>
</tr>
<tr>
<td>IEC 60332-1 IEC 60754-1 IEC 61034-2</td>
</tr>
<tr>
<td>600103.61</td>
</tr>
</tbody>
</table>
Twisted Pair, Low Noise Model 600050.XX, 600052.XX

Main Characteristics
- Twisted pair shielded cable
- 2 Low noise treatments
- Teflon (PTFE) jacketed
- Rund cable
- -70°C to 260°C (-94°F to 500°F)
- Stainless steel overbraid is optional

Description
When subjected to flexure and vibration, these cables must not generate noise (triboelectric noise) in excess of the below specifications. To improve the sealing with stuffing gland, the cables use glass fiber fillers for a perfectly rund cable.
To improve the mechanical protection, a stainless steel overbraid is available.

Typical application
They are used to transmit low voltage signal from high impedance sensors to signal conditioner at audio frequencies. Twisted pair cables are mainly used by 2-pole differential sensors that have pico Coulomb output:
- Piezoelectric accelerometer or pressure sensor with pico Coulomb output

A length not more than 30 metres is recommended between the sensor and his charge amplifier

Ordering Information
To order specify the part number with the following options:
600050.01 - AAA
600052.XX - AAA
AAA : total length in meter

Please indicate minimum continuous length.

Overview

<table>
<thead>
<tr>
<th>600050.01</th>
<th>600052.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon PTFE / -55 to 260°C (-67 to 500°F) dia 4.2 mm (0.165 inch)</td>
<td>Teflon PTFE / AISI 316 Overbraid / -55 to 260°C (-67 to 500°F) dia 5.8 mm (0.228 inch)</td>
</tr>
</tbody>
</table>

Competitors cross reference

<table>
<thead>
<tr>
<th></th>
<th>Endevco 6960</th>
<th>600050.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endevco cable is not rund.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specifications

Construction

(1) Conductors
Material .............................................................. SPC (1)
Gauge (mm) ........................................................... 19x0.16 mm / AWG22 / 0.45 mm²
Diameter (mm) ...................................................... 0.76 mm

(2) Primary low noise treatment .................................. N/A

(3) Dielectric
Material, diameter (mm) .................................... Teflon (PTFE) extruded, 1.40 mm
color conductor 1, color conductor 2 ........................................ Blue, White

(4) Secondary low noise treatment semiconductor black carbon tape

(5) Fillers / Rund cable .............................................. glass fibre

(6) Tertiary low noise treatment semiconductor black carbon tape

(7) Screen : Material, coverage, diameter (mm) Braided SPC (note 1), AWG38, 80% min, 3.45

(8) Outer sheath
Material / Material 2 ...Polyimide Kapton F tape / PTFE double wrapped tape fused
Diameter mm (inch) / Color .................................................. 4.25 nominal / White

(9) Overbraid
PNR / Material / Dia / Coverage ....60050.01 / AISI 316 Ti / 6 mm / 80% Min
Protection / wire dia / Dia / carrierGlass fiber / 0.2 mm / 24 carriers, 4 wires/carrier
Identification ...60050.01-DMF/MM-YYYY where YYYY = year, MM=Month

Electrical

Capacitance
Cond to Cond pF/m / Cond to shield pF/m.............................. 100 / 200

Physical
Temperature Continuous °C (°F) .............................. -55 to 200°C (-67 to 392°F)

Dielectric strength (kV) .................................................. 3
Voltage rating Vrms....................................................... 600

Resistive Conductor (Ω / km) / Shield (Ω / km) .............. 100 / 15

Weight (g/m)

600050.01 ............................................. 43
600052.01 ............................................. TBD

Bending Radius static / Dynamic
600050.01, 600052.01 ..................................... 5 x diameter / 10 x diameter

Fire
Flame retardant / Halogen free / Corrosive gas ...Yes / No / Yes
Limited oxygen index / Smoke ...................... TBD / Slight
Radiation resistant ............................................. TBD / Slight

Chemical .......... see the tutorial polymer section in the appendix

Triboelectric noise
2mm displacement (10-70 Hz) ..................................... <10 pC, 2Hz 40mm pk-pk
5mm displacement (5-50 Hz) ..................................... <1 pC, 5 to 50Hz 5mm pk-pk
40mm displacement (2 Hz) ..................................... <0.15 pC, 10 to 70Hz 2mm pk-pk

(1) SPC: Silver Plated Copper
TBD: To be determined
N/A: Not applicable
## Twisted Triples, Model 600106 & 600107

### Main Characteristics
- Twisted triples shielded cable
- Rund cable
- -55°C to 200°C (-67°F to 392°F)
- Selection of halogen free & flame retardant cable
- Selection of Stainless steel (AISI 316L) overbraid

### Description
These cables are specifically manufacture for our applications. All cables are available with a stainless steel overbraid for harsh environment.

### Typical application
They are used for 3-pole sensors that exhibit a low impedance output:
- ICP accelerometers with temperature output
- Dual output sensor with dual acceleration & velocity

### Ordering information
To order specify the part number with the following options:
600106.XX - AAA
600107.XX - AAA
AAA: Length in meters
Ordering example:
600106.31-010 Twisted triples cable, FEP, 10 metres

### Overview

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>600106.31</td>
<td>Teflon FEP / -100 to 200°C / dia 4.7 mm (0.185 inch) expensive / excellent oil resistance / excellent chemical resistance</td>
</tr>
<tr>
<td>600106.51</td>
<td>Radox / -55 to 125 °C / dia 4.3 mm (0.169 inch) expensive / Halogen free and flame retardant</td>
</tr>
</tbody>
</table>

### SPECIFICATIONS

#### CONSTRUCTION

**1) Conductors**
- Material: TPC (1)
- Gauge (mm): 19x0.203mm / AWG20 / 0.6 mm²
- Diameter (mm): 19x0.18mm / AWG20 / 0.5 mm²

**2) Dielectric**
- Material, diameter (mm):
  - Teflon (FEP), 1.53 mm
  - Radox (see note 3), 1.30 mm

**3) Fillers / Rund cable**
- Material, coverage, diameter (mm):
  - Teflon (FEP), 1.53 mm
  - Radox (see note 3), 1.30 mm

**4) Foil**
- Material, coverage, diameter (mm):
  - Black, White, Red: 4.7 ±0.2 (0.177 inch)

**5) Screen**
- Material, coverage, diameter (mm):
  - Braided TPC (note 1), 85% min, 3.92 mm
  - Braided TPC (note 1), 85% min, 3.3 mm

**6) Outer sheat**
- Material / Color / Diameter mm (inch):
  - Teflon (FEP) / White / 4.7 ±0.2 (0.185 inch)
  - Radox (see note 3) / Black / 4.5 ±0.2 (0.177 inch)

**7) Overbraid : PNR / Material / wire dia / Diameter / coverage**
- Material / Color / Diameter mm: 85%
  - Teflon (FEP), 85% min, 3.3 mm

### ELECTRICAL

#### Impedance Ω
- 600106.31 50 Ω
- 600106.51 TBD

#### Capacitance : Cond to Cond pF/m / Cond to shield pF/m
- 600106.31 96 / TBD
- 600106.51 TBD / 110 / 190

### PHYSICAL

**Temperature Continuous °C (°F)**
- 600106.31 -100 to 200°C (-148 to 392°F)
- 600106.51 -40 to 120°C (-40 to 248°F)

**Dielectric strength (kV)**
- 600106.31 3.4
- 600106.51 TBD

**Voltage rating Vrms**
- 600106.51, 600106.51 TBD

**Resistance Conductor (Ω / km) / Shield (Ω / km)**
- 600106.31 32.4 / TBD
- 600106.51 TBD / 31.1

**Weight (g/m)**
- 600106.31 49
- 600106.51 TBD
- 600107.31 75
- 600107.51 TBD
### Bending Radius static / Dynamic
- 600106.31: TBD / TBD
- 600106.51: 3 x diameter / 5 x diameter

### Fire
- **Flame retardant / Halogen free / Corrosive gas**
  - 600106.31: Yes / No / Yes
  - 600106.51: Yes / Yes / No

### Limited oxygen index / Smoke
- 600106.31: TBD / Slight
- 600106.51: 38% / Low

### Standards
- 600106.31: none
- 600106.51: DIN 5510, NF F16-101, BS 6853, DIN EN 50265, 50267, 50268 NF C82-070, X10-702, IEC 60332-1, IEC 60754-1, IEC 61034-2

### Radiation resistant
- 600106.31: No
- 600106.51: Yes

### Chemical
- See the tutorial polymer section in the appendix
Contents

Cable assemblies, Model 10.................................................................66

Cable assemblies, Model 10

Main Characteristics
- Choice of connectors to interface with various sensor
- Choice of cable to suit various environment
- -55°C to 260 °C maxi (-67°F to 500°F)
- Rugged construction for harsh environment
- Conduit or stainless steel overbraid protection

Description
10 series are cable assemblies to interface with a variety of industrial sensors.
Typical application is to connect a sensor to a junction box or directly
to the signal conditioner. It allows to get out in a cooler and less ex-
posed environment where a standard multipair low cost cable could
be used.

Ordering information

To order specify part number, options and suffix :
10.01 - AAA - AAA - CC - DD (EE)
Special Version :
(EE) is a deviation suffix. Omitted for standard version
Special Engraving :
Add ZXX at the end of the part number. (XX is a number supplied
by VibraSens)
AAA : Connectors

AAA | Front | Plug Type / Material / Protection
| Application : | Sealing :
| Wiring | Shield | Spy | Cables |

Termination
Blunt cut

A01
None

A03
Overbraid (101)

A04
Conduit (15X)

A05
Conduit (16X)

A11
Overbraid (101)

A13
Conduit (15X)

A14
Conduit (16X)

A21
Overbraid (101)

A23
Conduit (15X)

A24
Conduit (16X)

A25
Conduit (16X)

Sensors
MIL-C-5015-2 sockets - Field installable - MS 3106F
Aluminium, cadmium olive with silver plated solder contact
Sealing : IP64 - Operating continuous :125 °C
Application : Industrial

B01
Connector only : order 600583.05

B02
Fig AB01

B03
Overbraid (101)
### Cable Assembly

<table>
<thead>
<tr>
<th>AA</th>
<th>Front</th>
<th>Plug Type / Material / Protection</th>
<th>Application:</th>
<th>Sealing:</th>
<th>Wiring</th>
<th>Shield (W)</th>
<th>Cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>B22</td>
<td></td>
<td>M12, IEC 60947-5-2</td>
<td>Gold plated contacts, PVC, SSTL316L (V4A) locking nut.</td>
<td>Sealing: IP 67 - Operating continuous :90 °C</td>
<td>M12</td>
<td>E12</td>
<td>SNC WB01 SNC 32</td>
</tr>
<tr>
<td>B24</td>
<td></td>
<td>MIL-C-5015, AISI 316L. (V4A)</td>
<td>PA 6.6 Shell with Gold plated solder contact</td>
<td>Sealing : IP67 - Operating continuous :125 °C</td>
<td>E51</td>
<td>E61</td>
<td>SNC WB01 SNC 0X WE01 SNC 0X 1X 2X 3X</td>
</tr>
<tr>
<td>B13</td>
<td></td>
<td>MIL-C-5015, AISI 316L. (V4A)</td>
<td>PA 6.6 Shell with Gold plated solder contact</td>
<td>Sealing : IP67 - Operating continuous :125 °C</td>
<td>B24</td>
<td>C13</td>
<td>SNC WE01 SNC PNC 0X 2X</td>
</tr>
<tr>
<td>C13</td>
<td></td>
<td>MIL-C-5015, AISI 316L. (V4A)</td>
<td>PA 6.6 Shell with Gold plated solder contact</td>
<td>Sealing : IP67 - Operating continuous :125 °C</td>
<td>E71</td>
<td>E81</td>
<td>SNC SC 31</td>
</tr>
<tr>
<td>E01</td>
<td></td>
<td>MIL-C-5015, AISI 316L. (V4A)</td>
<td>PA 6.6 Shell with Gold plated solder contact</td>
<td>Sealing : IP67 - Operating continuous :125 °C</td>
<td>E02</td>
<td>E31</td>
<td>SNC SC 00 SC 10</td>
</tr>
<tr>
<td>E04</td>
<td></td>
<td>MIL-C-5015, AISI 316L. (V4A)</td>
<td>PA 6.6 Shell with Gold plated solder contact</td>
<td>Sealing : IP67 - Operating continuous :125 °C</td>
<td>E03</td>
<td>E34</td>
<td>SNC SC 00 SC 10</td>
</tr>
</tbody>
</table>

**Note:**
- E61 Connector only : order 600597.03
- E63 Overbraid (101)
- E64 Conduit (15X)
- E81 Connector only : order 600597.04
- E83 Overbraid (101)
- E84 Conduit (15X)
Cable Assembly

<table>
<thead>
<tr>
<th>Plug Type / Material / Protection</th>
<th>Application</th>
<th>Sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemo, S serie, size 0 - Brass nickel plated, gold plated contacts</td>
<td>Gas turbine connection of piezoelectric differential accelerometer</td>
<td>IP 64 - Operating continuous : 250 °C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plug Type / Material / Protection</th>
<th>Application</th>
<th>Sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fischer, 6 pins, Brass nickel plated, gold plated contacts</td>
<td>SKF datalogger</td>
<td>IP 64 - Operating continuous : 250 °C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plug Type / Material / Protection</th>
<th>Application</th>
<th>Sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphenol ECTA 133, gold plated pins, push pull, aluminum nickel plated</td>
<td>-40°C to +125 °C</td>
<td>01dB - Metravib datalogger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plug Type / Material / Protection</th>
<th>Application</th>
<th>Sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphenol C091 A, gold plated pins, plastic shell, screw locking</td>
<td>Schenck / Bruel &amp; Kjaer datalogger</td>
<td>+40°C to +85 °C</td>
</tr>
</tbody>
</table>
### Cable Assembly

#### CC : Cable

<table>
<thead>
<tr>
<th>CC</th>
<th>Type</th>
<th>PNR</th>
<th>Material</th>
<th>T° Dia (1)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td></td>
<td>600103.21</td>
<td>Polyurethane</td>
<td>d4.9</td>
<td>Low cost with good oil &amp; fluid resistance</td>
</tr>
<tr>
<td>02</td>
<td></td>
<td>600103.31</td>
<td>Teflon FEP</td>
<td>d4.3</td>
<td>improved oil &amp; fluid resistance</td>
</tr>
<tr>
<td>03</td>
<td></td>
<td>600103.51</td>
<td>®Radox</td>
<td>d4.3</td>
<td>halogen free + flame retardant</td>
</tr>
<tr>
<td>04</td>
<td></td>
<td>600103.61</td>
<td>Silicone</td>
<td>d6.5</td>
<td>halogen free + fire retardant</td>
</tr>
<tr>
<td>05</td>
<td></td>
<td>600103.11</td>
<td>Polyurethane</td>
<td>d4.9</td>
<td>Low cost with good oil &amp; fluid resistance</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>600106.31</td>
<td>Teflon FEP</td>
<td>d4.7</td>
<td>improved oil &amp; fluid resistance</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>600106.51</td>
<td>®Radox</td>
<td>d4.5</td>
<td>Flame resistant &amp; retardant halogen free</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>600050.01</td>
<td>Teflon PTFE tape</td>
<td>d4.2</td>
<td>2 Low noise treatments</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>600111.21</td>
<td>Polyurethane black</td>
<td>d5.7</td>
<td>Low cost with good oil &amp; fluid resistance</td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>600111.01</td>
<td>PVC</td>
<td>d5.7</td>
<td>Low cost with excellent chemical resistance</td>
</tr>
<tr>
<td>42</td>
<td></td>
<td>600052.01</td>
<td>Teflon PFA extruded</td>
<td>d2.0</td>
<td>Low noise treated. RGL196</td>
</tr>
<tr>
<td>51</td>
<td></td>
<td>600101.03</td>
<td>PVC</td>
<td>d2.8</td>
<td>RG 174</td>
</tr>
<tr>
<td>52</td>
<td></td>
<td>600101.04</td>
<td>PVC</td>
<td>d4.95</td>
<td>RG 58 C/U</td>
</tr>
<tr>
<td>53</td>
<td></td>
<td>600101.31</td>
<td>Teflon FEP</td>
<td>d1.1</td>
<td>Miniature coaxial</td>
</tr>
<tr>
<td>54</td>
<td></td>
<td>600101.32</td>
<td>Teflon FEP</td>
<td>d1.9</td>
<td>RG178</td>
</tr>
</tbody>
</table>

#### Customer / Specific application

- **Amphenol, C16-1, 4 gold plated pins (03), Nylon PA6.6**
  - Sealing : IP 67 - Operating continuous : 125 °C
  - Application : Metso sensodec, pulp and paper

- **Lemo, B serie, size 1, Brass nickel plated, gold plated contacts**
  - Sealing : IP 67 - Operating continuous : 250 °C
  - Application : test bench connection of piezoelectric differential accelerometer

---

**Note, wiring :**

- SC : Shield Connected to connector shell
- SNC : Shield Not Connected to connector shell
- PC : Protection (Overbraid or conduit) Connected to connector shell
- PNC : Protection (Overbraid or conduit) Not Connected to connector shell

**Note (Protection)**

- (101) Overbraid AISI 316L
- (151) Conduit AISI 304, PNR 600626.01, d=5mm
- (152) Conduit AISI 304, PNR 600626.02, d=6mm
- (153) Conduit AISI 304, PNR 600626.03, d=7mm
- (154) Conduit AISI 304, PNR 600626.04, d=8mm
- (155) Conduit AISI 304, PNR 600626.05, d=9.5mm
- (161) Conduit AISI 321, leak proof, rugged, PNR 600626.51, d=8.7mm
- (171) Conduit AISI 316L, leak proof, standard, PNR 600626.61, d=9.6mm
<table>
<thead>
<tr>
<th>CC</th>
<th>Type</th>
<th>PNR</th>
<th>Material</th>
<th>T° Dia</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>Spiral</td>
<td>600120.xx</td>
<td>Polyurethane</td>
<td>90°C</td>
<td>Spiral, 4x0.25mm²2 shielded</td>
</tr>
</tbody>
</table>

(1) Diameter in bracket are for cable with overbraid.
(11) For spiral cable, DD is extended length. (Divide by 4 for non extended length).

**DD : Length**

<table>
<thead>
<tr>
<th>DD</th>
<th>Enter length in metres.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard length : 02, 05, 10, 15, 20, 30 metres.</td>
</tr>
</tbody>
</table>

**Note**

**EE** : Deviation suffix
Call us to define your deviation suffix for special stripping, length, engraving, ....

**Ordering example** :
10.01-B01-A01-01-05 Cable assembly, MIL-C-5015, 5 meters Polyurethane cable

**SPECIFICATIONS**

**Electrical**

**Resistance**
- Between leads: >1GOhms
- Between either leads to shield: >1GOhms
- Capacitance: See cable specification

**Environmental**
Temperature
See table above for the temperature rating of each component.

**Physical**
Drawing: See drawing below

**Acceptance, tests performed**

**Resistance (@100VDC)**
- Between leads: >1GOhms
- Between either leads to shield: >1GOhms

**Wiring**
Checked according to the wiring schematic

**Repair**
Call factory for info

**DRAWINGS, ARRANGEMENTS**

- Fig AB01 (MIL-C-5015 2-Pole)
- Fig AC01 (MIL-C-5015 3-Pole)
- Fig AD01 (7/16” 27 UNS)
- Fig AP01 (C16-1)
- Fig AL02 (Lemo FFA.0S.302)
- Fig AL22 (LEMO PCA.0S.302)
- Fig AF01 (BNC, TNC)
- Fig AJ02 (Lemo FGG.1B.302)
- Fig AK02 (Lemo FGG.1K.307)
### DRAWINGS, WIRING

<table>
<thead>
<tr>
<th>CC</th>
<th>N1</th>
<th>N2</th>
<th>N3</th>
<th>N4</th>
</tr>
</thead>
<tbody>
<tr>
<td>01, 02</td>
<td>White</td>
<td>Red</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>03</td>
<td>White (1)</td>
<td>White (2)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>12</td>
<td>White</td>
<td>Red</td>
<td>Black</td>
<td>--</td>
</tr>
<tr>
<td>13</td>
<td>White (1)</td>
<td>White (2)</td>
<td>White (3)</td>
<td>--</td>
</tr>
<tr>
<td>22</td>
<td>White</td>
<td>Blue</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3X</td>
<td>Blue</td>
<td>Black</td>
<td>White</td>
<td>Brown</td>
</tr>
<tr>
<td>C C = 4 X</td>
<td>Shield</td>
<td>Conductor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6X</td>
<td>Green</td>
<td>Yellow</td>
<td>White</td>
<td>Brown</td>
</tr>
</tbody>
</table>

---

**Fig WP11 (C16-1)**

**Fig WP12 (C16-1)**

**Fig WE01 (M12)**

**Fig WF01 (BNC & TNC)**

**Fig WA01**

**Fig WB01 (MIL-C-5015 10SL-4S)**

**Fig WC01 (MIL-C-5015 10SL-3S)**

**Fig WD01 (7/16 27 UNS 2A, Lemo PCA.0S.302, FFA.0S.302, FGG.1K.302)**
4 Channels, Bnc Interface Unit, Model 301

Main Characteristics
- 4 differential channels
- Compatible with all 2 wires sensor
- Din rail mounted (TS35 and TS32)
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC interface unit is a din rail mounted module for permanently installed vibration sensors. Pigtails (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit do not supply sensor excitation. PCB grounding plates are connected to din rail which greatly improve EMC. VibraSens offers enclosure for 1, 2 or 4 modules but it is not mandatory as the module can take place on any TS35/TS32 Din rail.

Typical applications
BNC interface module is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal

Ordering information
To order, specify model number :
301.11 BNC Interface unit, Din rail mounted
Popular model (in stock) : 301.11

Specifications
Electrical
Channels ................................................................. 4
2 Wire sensors ......................................................... ©ICP Piezoelectric accelerometer
................................. Velocimeter
................................. Eddy current proximity sensor
Maximum Voltage .............................................................. 240V
Maximum Current ............................................................. 5A

Physical
Input ................................................................. 3-pole spring cage terminal
AWG 24-14 / 0.2 - 1.5 mm²
Output ................................................................. Isolated BNC
Dimensions ................................................................. see fig 1
Weight gr (oz) ................................................................. 120 gr (4.3 Oz)
Material, Din rail profil ........................................................... PVC Green (UL94)
Material, terminal ............................................................. Polyamid green

Environmental
Temperature : 
Operating continuous .................................... -20 to +55 °C (-4 to 130 °F)

Ratings
Flammability rating ........................................................... UL 94 VO
Drawings

Fig 1: Outline drawing, model 301.11

Fig 2: Wiring
12 Channels, Bnc Interface Unit, Model 300

Main Characteristics
- 12 differential channels
- Compatible with all 2 wires sensor
- Din rail mounted (TS35 and TS32)
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC interface unit is a din rail mounted module for permanently installed vibration sensors. Pigtails (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit do not supply sensor excitation. PCB grounding plates are connected to din rail which greatly improve EMC. VibraSens offers enclosure for 1, 2 or 4 modules but it is not mandatory as the module can take place on any TS35/TS32 Din rail.

Typical applications
BNC interface module is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal

Ordering information
To order, specify model number:
300.01 BNC interface unit, Din rail mounted
300.11 BNC interface unit, Din rail mounted, right angle
Popular model (in stock): 300.11 and 300.01

Specifications

Electrical
Channels: 12
2 Wire sensors: ©ICP Piezoelectric accelerometer
.................................Velocimeter
.................................Eddy current proximity sensor
Maximum Voltage: 240V
Maximum Current: 5A

Physical
Input: 3-pole spring cage terminal
AWG 24-14 / 0.2 - 1.5 mm²
Output: Isolated BNC
Dimensions: see fig 1
Weight gr (oz): XXX gr (XX Oz)
Material, Din rail profil: PVC Green (UL94)
Material, terminal: Polyamid green

Environmental
Temperature: -20 to +55 °C (-4 to 130 °F)

Ratings
Flammability rating: UL 94 VO
11 Channels, Switch Interface Unit, Model 302

Main Characteristics
- 11 channels differential switching unit
- High quality rotary switch with 3um gold plating
- Compatible with all 2 wires sensor
- Din rail mounted (TS35 and TS32)
- Isolated BNC output
- Spring cage terminal block input
- PCB Grounding plate connected to din rail

Description
The VibraSens switch interface unit is a multiple channel connecting centers for terminating and switching the outputs of up to 11 two-wire sensors. Pigtails (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connector. Switch interface unit do not supply sensor excitation. PCB grounding plates are connected to din rail which greatly improve EMC. VibraSens offers enclosure for 1, 2 or 4 modules but it is not mandatory as the module can take place on any TS35/TS32 Din rail. Our module doesn’t include Electrostatic Discharge protection already included in the electronic of our accelerometer.

Typical applications
Switchable interface module is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect the data collector with sensor excitation power to the BNC jack, and position the selector switch (1-11) in the appropriate position to access individual sensor measurement signals.

Ordering information
To order, specify model number:
302.01 Switch interface unit, Din rail mounted
302.11 Switch interface unit, Din rail mounted, right angle

Popular model (in stock) : 302.01 & 302.11

Specifications
Electrical
Channels .................................................................................................................................... 11
2 Wire sensors .......................................................... ©ICP Piezoelectric accelerometer
...................................................................................................................... Velocimeter
...................................................................................................................................... Eddy current proximity sensor
Maximum switching voltage................................................................. 42V
Maximum switching current.............................................................. 0.4A

Physical
Input ........................................................................................................ 3-pole spring cage terminal
..................................................................................................................... AWG 24-14 / 0.2 - 1.5 mm²
Output ................................................................................................... Isolated BNC
Dimensions .............................................................................. see fig 1 & fig 2
Material, Din rail profil ................................................................. PVC Green (UL94)
Material, terminal ........................................................................ Polyamid green

Environmental
Temperature :
Operating continuous -20 to +55 °C (-4 to 130 °F)

Ratings
Flammability rating UL 94 VO
4 Ch. , BNC Termination Box, Model 751

Main Characteristics
- 4 differential channels
- Polycarbonate IP66/67 Box (NEMA 1, 4, 4X,6)
- Compatible with all 2 wires sensor
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC termination box collect data for permanently installed vibration sensors. Pigtauls (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit do not supply sensor excitation. VibraSens offer a large choice of enclosure (polycarbonate, polyester, AISI 316L stainless steel, ..) to be sure it will perfectly fit your application.

Typical applications
BNC termination box is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal.

Box introduction
Enclosures offer protection against the possible splashing of oil, water or corrosive substances encountered in severe industrial environments, such as off-shore or petrochemical application. These splash-proof enclosure are used for the mechanical and environmental protection of our BNC interface unit.

Polycarbonate Box
Polycarbonate enclosures offer the following benefits:
- Better impact resistance than polyester.
- Better corrosion resistance than painted steel or stainless steel.
- Isolation of the electronic circuit preventing earth loop problems.
- Standard industrial environment.

Polyester Box
Polyester enclosures offer the following benefits:
- Better chemical resistance than polycarbonate.
- Isolation of the electronic circuit preventing earth loop problems.
- Recommended for petrochemical application.

Stainless steel Box
Stainless steel enclosures offer the following benefits:
- Better impact resistance than polyester or polycarbonate.
- Good chemical resistance.
- Recommended for pulp and paper application.

Ordering information
To order, specify model number:
751.01 - AA - BB (Suffix) - C 4 CH., BNC termination box
AA : Channels
04 : 4 Channels
BB : Box
02 : Polycarbonate enclosure
Suffix : LH = Left Hinge, TH = Top Hinge, RH = Right Hinge
32 : Polyester
42 : Polyester, ATEX approved
62 : Stainless steel (AISI316L)
99 : To be defined by customer
C : Stuffing glands
0 : Not installed
1 : Installed (indicate diameter and number of cables)

Special engraving
Add Zxx at the end of the part number.
XX is a number supplied by VibraSens.

Popular model (in stock) : 751.01-04-02(LH)-1

Ordering example
751.01 - 04 - 02 (LH) - 1 4 CH., BNC termination box,
4 cables dia 5.5 mm

SPECIFICATIONS

BNC Module
See datasheet for model .......................................................................................... 301

Physical
Weight (gr) (oz)
BB=02 .................................................................................................................. 300

Environmental
Temperature :
Operating continuous ......................................................................................... -40 to +85 °C

Enclosure BB=02
Dimensions & Weight
LxWxH mm (inch) ................................................................................................. 130x80x60 (5.1x3.1x2.3) see fig 1
Weight (gr) (Oz) ................................................................................................. 180 (6.4)

Materials
Material ................................................................................................................. Polycarbonate
Base and cover color ............................................................................................ RAL 7035
Cover screw (color) ............................................................................................. Polymide (Grey)
Gasket material .................................................................................................. TPE Polyurethane

Environmental
Temperature :
Operating continuous: -40 to +80 °C (-40 to 175 °F)
Short term: -40 to +120 °C (-40 to 250 °F)
Chemical resistance: Good resistance to sea water, acids, solvents, gasolines and oil
Outdoor use: Yes

**Ratings**
- Ingress Protection (EN 60529): IP 66/67
- Nema Class: 1, 4, 4X, 6 (12 & 13)
- Impact Resistance (EN 50102): IK 08
- Electrical insulation: fully insulated
- Halogen free (DIN/VDE 0472, part 815): Yes
- UV resistance: UL 508
- Flammability rating (UL 746 C 5): UL 94 5V
- Glow wire test (IEC 695-2-1): 960°C

**Certificates**
- Germanischer Lloyd (GL), Underwriters Laboratories, Det Norske Veritas, Fimko,
- Europe EN 50298 1998 / EN 60950, Gost R

**Accessories, spare parts**
- Screw for cover: 711.96
- Hinge (2 pieces & Screws): 711.91
- Mounting foot kit without opening the enclosure: 711.94

**Drawings**

Fig 1: Outline drawing, model 751.01-XX-02 (LH)
8 Ch., BNC Termination Box, Model 750

Main Characteristics
- 8 differential channels
- Polycarbonate IP66/67 Box (NEMA 1, 4, 4X,6)
- Compatible with all 2 wires sensor
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC termination box collects data for permanently installed vibration sensors. Pigtailed (signal, common and shield) sensor cables are attached to spring cage terminal blocks. Data collection equipment with sensor excitation power is mounted to BNC jack connectors. BNC interface unit does not supply sensor excitation. Vibrasens offer a wide choice of enclosure (polycarbonate, polyester, AISI 316L stainless steel, ..) to be sure it will perfectly fit your application.

Typical applications
BNC termination box is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal

Box introduction
See model 751 for help.

Ordering information
To order, specify model number :
750.01 - AA - BB (Suffix) - C 8 CH., BNC termination box
AA : Channels
08 : 8 Channels
BB : Box
02 : Polycarbonate enclosure
Suffix : LH = Left Hinge, TH = Top Hinge, RH = Right Hinge
32 : Polyester
42 : Polyester, Atex approved
62 : Stainless steel (AISI316L)
99 : To be defined by customer
C : Stuffing glands
0 : Not installed
1 : installed (indicate diameter and number of cables)

Special engraving
Add Xz at the end of the part number.
XX is a number supplied by VibraSens.

Popular model (in stock) : 750.01-08-02(LH)-1

Ordering example
750.01 - 08 - 02 (L.H) - 1 8 CH., BNC termination box,
6 cables dia 5.5 mm

SPECIFICATIONS

BNC Module
See datasheet for model..............................................................301

Physical
Weight (oz)....................................................B0-02..............................................................TBD

Environmental
Temperature :
Operating continuous .............................................................-40 to +85 °C
Short term .............................................................-40 to +120 °C (-40 to 250 °F)
Chemical resistance ... Good resistance to sea water, acids, solvents, gasolines and oil
Outdoor use ..............................................................Yes

Model 750.01-08-02(LH)-1

Dimensions & Weight
LxWxH mm (inch)....................................................130x130x75 (5.1x5.1x2.95) see fig 1
Weight gr (Oz) .............................................................TBD (TBD)

Materials
Material .............................................................Polycarbonate
Base and cover color ..................................................RAL 7035
Cover screw (color) ................................................Polyamide (Grey)
Gasket material ......................................................TPE Polyurethane

Environmental
Temperature :
Operating continuous .............................................................-40 to +80 °C (-40 to 175 °F)
Chemical resistance ... Good resistance to sea water, acids, solvents, gasolines and oil
Outdoor use ..............................................................Yes

Enclosure BB=02

Glow wire test (IEC 695-2-1) ...............................................960°C
Flammability rating (UL 746 C 5) ..........................................UL 94 5V
Impact Resistance (EN 50102) ...............................................IK 08
Electrical insulation ...................................................fully insulated
Halogen free (DIN/VDE 0472, part 815)... .....................................Yes
UV resistance .............................................................UL 508
Flammability rating (UL 746 C 5) ..........................................UL 94 5V
Glow wire test (IEC 695-2-1) ...............................................960°C

Certificates
Germanischer Lloyd (GL), Underwriters Laboratories, Det Norske Veritas, Fimko,
Europe EN 50298 1998 / EN 60950, Gost R

Accessories, spare parts
Screw for cover .................................................................711.96
Hinge (2 pieces & Screws) ..................................................711.91
Mounting foot kit without opening the enclosure..........................711.94
Drawings

Fig 1 : Outline drawing, model 750.01-08-02(LH)-1
11/12 Ch., Switch/BNC Termination Box, Model 749

Main Characteristics
- 11/12 differential channels
- Polycarbonate IP66/67 Box (NEMA 1, 4, 4X, 6)
- Compatible with all 2 wires sensor
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC termination box collect data for permanently installed vibration sensors. Pigtauls (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit do not supply sensor excitation. VibraSens offer a large choice of enclosure (polycarbonate, polyester, AISI 316L stainless steel, ..) to be sure it will perfectly fit your application.

Typical applications
BNC termination box is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal

Box introduction
See model 751 for help.

Ordering information
To order, specify model number :
749.01 - AA - BB (Suffix) - C
AA : Channels
11 : 11 Channels (Switch)
12 : 12 Channels (BNC)
BB : Box
02 : Polycarbonate enclosure
Suffix : LH = Left Hinge, TH = Top Hinge, RH = Right Hinge
32 : Polyester
42 : Polyester, Atex approved
62 : Stainless steel (AISI316L)
99 : To be defined by customer
C : Stuffing glands
0 : Not installed
1 : installed (indicate diameter and number of cables)

Special engraving
Add Zxx at the end of the part number.
XX is a number supplied by VibraSens.

Popular model (in stock) :
749.01-11-02(LH)-1 / 749.01-12-02(LH)-1

Ordering example
749.01 - 12 - 02 (LH) - 1
12 CH., BNC termination box, 10 cables dia 5.8 mm

SPECIFICATIONS

BNC Module
See datasheet for model

Physical
Weight gr (Oz)
Boxes Interface Unit

Main Characteristics

- 11/12 differential channels
- Polycarbonate IP66/67 Box (NEMA 1, 4, 4X, 6)
- Compatible with all 2 wires sensor
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to DIN rail

Description

The VibraSens BNC termination box collects data for permanently installed vibration sensors. Pigtails (signal, common, and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit does not supply sensor excitation.

Vibrasens offer a large choice of enclosure (polycarbonate, polyester, AISI 316L stainless steel, ..) to be sure it will perfectly fit your application.

Typical applications

BNC termination box is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal.

Box introduction

See model 751 for help.

Ordering information

To order, specify model number:

749.01 - AA - BB (Suffix)
AA : Channels
11 : 11 Channels (Switch)
12 : 12 Channels (BNC)
BB : Box
02 : Polycarbonate enclosure
01 : Polyester
42 : Polyester, Atex approved
62 : Stainless steel (AISI 316L)
99 : To be defined by customer
C : Stuffing glands
0 : Not installed
1 : installed (indicate diameter and number of cables)

Special engraving

Add Zxx at the end of the part number.
XX is a number supplied by VibraSens.

Popular model (in stock):
749.01-11-02(LH)-1 / 749.01-12-02(LH)-1

Ordering example

749.01 - 12 - 02 (LH) - 1
12 CH., BNC termination box, 10 cables dia 5.8 mm

SPECIFICATIONS

BNC Module

See datasheet for model

Fig 1 : Outline drawing, model 749.01-12-02(LH)-1
22/24 Ch., Switch/BNC Termination Box, Model 748

Main Characteristics
- 8 differential channels
- Polycarbonate IP66/67 Box (NEMA 1, 4, 4X,6)
- Compatible with all 2 wires sensor
- Isolated BNC output
- Spring cage terminal block input
- PCB grounding plate connected to din rail

Description
The VibraSens BNC termination box collect data for permanently installed vibration sensors. Pigtailed (signal, common and shield) sensor cables are attached to spring cage terminal block. Data collection equipment with the sensor excitation power are mounted to BNC jack connectors. BNC interface unit do not supply sensor excitation. VibraSens offer a large choice of enclosure (polycarbonate, polyester, AISI 316L stainless steel, ..) to be sure it will perfectly fit your application.

Typical applications
BNC termination box is installed in a convenient centralized location away from noisy or unsafe environment where portable collector can record the sensor reading. Simply connect a data collector with sensor excitation power to the BNC jack of the sensor channel of interest to access that sensor’s measurement signal

Box introduction
See model 751 for help.

Ordering information
To order, specify model number :

748.01 - AA - BB (Suffix) - C  AA CH., BNC termination box

AA : Channels
22 : 22 Channels (Switch)
23 : 23 Channels (12 BNC + 11 Switch)
24 : 24 Channels (BNC)

BB : Box
02 : Polycarbonate enclosure

Suffix : LH = Left Hinge, TH = Top Hinge, RH = Right Hinge
32 : Polyester
42 : Polyester, Atex approved
62 : Stainless steel (AISI316L)
99 : To be defined by customer

C : Stuffing glands
0 : Not installed
1 : installed (indicate diameter and number of cables)

Special engraving
Add Zxx at the end of the part number.
XX is a number supplied by VibraSens.

Popular model (in stock) :
748.01-22-02(LH)-1 / 748.01-23-02(LH)-1 / 748.01-24-02(LH)-1

Ordering example
748.01 - 24 - 02 (LH) - 1  24 CH., BNC termination box, 18 cables dia 5.8 mm

SPECIFICATIONS

BNC Module
See datasheet for model .......................... 300

Physical

Model 749.01-23-02(LH)-1
Drawings

Fig 1 : Outline drawing, model 749.01-23-02(TH)-1
Contents
Calibration, Vibration Transducer, 501.XX ..............................86
Calibration, accelerometer, earth gravitation, 502.01 .............88
Calibration, accelerometer, base strain sensitivity, 502.11 ......89
Calibration, Dynamic Pressure Transducer, 503.XX ............90

Calibration, Vibration Transducer, 501.XX

Main Characteristics
- Vibration transducer calibration from 10 Hz to 10 kHz
- Calibration of most vibration transducer:
  - piezoelectric charge accelerometer
  - accelerometer with constant current excitation
  - velocimeter
- Back to back method with compensation for:
  - electrical gain
  - reference accelerometer frequency response
  - Traceable to PTB

Introduction
The VibraSens PC based automated accelerometer calibration system provides traceable calibration of most vibration transducer. It consists of a high frequency shaker, a PC and a 12 bit two channels 5 MS/s data acquisition card. Its operational software is based on National Instrument Labview.

Description
This system provides a significant improvement in vibration calibration. High speed data acquisition associated with Labview allow compensation of parameters that were not possible with analog system.

Back to back calibration with substitution.
Our system includes Back to back calibration with substitution. This technique greatly improved the accuracy of the measurement using 2 reference accelerometers with known and traceable sensitivity on the entire frequency range. The computer then corrects for electronic
gain at each frequency. It virtually eliminates uncertainties due to temperature variation and signal conditioner gain on the entire frequency range.

**Filtering technique**

Digital system uses more powerful signal processing to reduce the signal noise ratio. The reference and Unit under test accelerometer are both stimulated with a sinusoidal signal. Unfortunately, the system is poised with noise and harmonic distortion. The power amplifier and the transverse mechanical resonance of the shaker are the main distortions sources. Our calibration is performed in the frequency domain where we apply a cross correlation technique between the input and output signal. This almost removes all signal not correlated with the input signal of the shaker.

**Mass loading**

Mass loading on back to back calibration system can be a high source of uncertainty. At 10kHz with a 200 grammes sensor, the deviation of the curve are well below 0.5%. We have therefore decided to not compensate our system for this effect.

**Data Storage and output**

The system automatically generates a report of the test. The user can then print or saved it in Acrobat PDF format.

---

**Specifications**

**Principle**

**Back to back calibration by substitution**

Conform to ISO 5347-3

**Electrical Input type**

Charge for piezoelectric transducers (single ended or differential)  
Voltage with constant current supply (ICP type)  
Current input with constant voltage supply  
Voltage for velocity transducer (velocity coil)  
Voltage for piezoresistive or capacitive accelerometer

**range, acceleration transducer**

Charge: .............................................................. 0.02-5000 pC/g  
Voltage: .......................................................... 1-10000 mV/g  
Current: ......................................................... 0.01 to 100 uA/g  
Range, velocity transducer  
Voltage: .......................................................... 0.5-100 mV/mm/s

**Frequency range**

Accelerometers: .................................................. 10Hz to 10kHz  
Velocimeters: ..................................................... 10Hz to 2.5kHz

**Max transducer weight**

10Hz to 5kHz: ..................................................... 500 g  
10Hz to 10kHz: ................................................... 60 g

**Accuracy**

Absolute errors are as follows:  
10Hz-4kHz: ...................................................... 1.2%  
4-7kHz: .......................................................... 1.8%  
7-10kHz: ......................................................... 2.6%

---

**Ordering information**

To order, specify part number and vibration parameters:

**501.01**, Calibration, Vibration Transducer, single point, (vibration parameter to be defined)

**501.11**, Calibration, Vibration Transducer, sinusoidal sweep, 10Hz to 10kHz, (vibration parameter to be defined)

**Ordering example:**

501.01, Calibration, Vibration Transducer, frequency=160Hz, 5g  
501.01, Calibration, Vibration Transducer, frequency=80Hz, 50mm/s  
501.11, Calibration, Vibration Transducer, frequency=10Hz to 5kHz, 5g  
501.11, Calibration, Vibration Transducer, frequency=10Hz to 1kHz, 5ips
**Calibration, accelerometer, earth gravitation, 502.01**

**Main Characteristics**
- Vibration transducer calibration from 0.1 Hz to 5 Hz
- Calibration of most vibration transducer:
  - piezoelectric charge accelerometer
  - ICP piezoelectric accelerometer
  - piezovelocimeter
  - capacitive accelerometer
  - piezoresistive accelerometer

**Introduction**
The VibraSens PC based automated low frequency accelerometer system provides calibration between 0.1Hz and 5 Hz by earth’s gravitation. It consists of a specifically design testing machine, a PC and a 12 bit two channels 200 kS/s data acquisition card. Its operational software is based on National Instrument Labview.

**Description**
The accelerometer is continuously rotated and is subjected to a sinusoidally varying earth’s gravitation acceleration. A proximator extract the speed signal. The software calculates after filtering the RMS output of the accelerometer which is divided by the earth acceleration.

**Filtering technique**
Filtering technique is important as the signal is low between 0.1Hz and 0.5Hz. We have used the speed signal from the proximator to design a tracking filter that enable us to get a clean signal from the accelerometer.

**Data Storage and output**
The system automatically generates a report of the test. The user can then print or saved it in Acrobat PDF format.

**Ordering information**
To order, specify part number:
**502.01** Calibration, accelerometer, earth gravitation
Calibration, accelerometer, base strain sensitivity, 502.11

Main Characteristics
- Suitable for following vibration transducer:
  - piezoelectric charge accelerometer
  - ICP piezoelectric accelerometer
  - piezovelocitymeter
  - capacitive accelerometer
  - piezoresistive accelerometer
- Conform to ISO 5347-13
- Conform to ISA RP 37.2 -1982 (R1995) para 6.6

Introduction
The VibraSens PC based automated base strain sensitivity system consists of a deflected beam, a PC and a 12 bit two channels 200 kS/s data acquisition card. Its operational software is based on National Instrument Labview.

Description
The accelerometer is mounting at the inboard end of a centilever beam, which produces a radius of 1000 inches and a strain of 250 μinch/inch. The beam is 3 inches wide and 0.5 inch thick with a free length of 57 inches. The natural frequency is close to 4.2 Hz. Four strain gauges in full bridge mode are bonded to the beam adjacent to the accelerometer mounting hole. The system is excited by manually deflecting the free end of the beam. The data acquisition simultaneously record the signal from the accelerometer and from the strain gauge bridge. The accelerometer signal is recorded when the strain is exactly 250 μinch/inch. The base strain sensitivity is found by dividing the above accelerometer output by 250 times the accelerometer sensitivity.

Filtering technique
Filtering technique is important as the signal from the accelerometer is low (5mV typical). We have extracted from the strain gauge bridge signal the natural frequency resonance of the beam to set up a tracking filter that enable us to get a narrow band clean signal from the accelerator.

Data Storage and output
The system automatically generates a report of the test. The user can then print or saved it in Acrobat PDF format.

Ordering information
To order, specify part number and vibration parameters:
502.11, Calibration, accelerometer, base strain sensitivity

Specifications
Principle
Base strain sensitivity with deflected beam

Electrical Input
<table>
<thead>
<tr>
<th>type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge for piezoelectric transducers (single ended or differential)</td>
<td></td>
</tr>
<tr>
<td>Voltage with constant current supply (ICP type)</td>
<td></td>
</tr>
<tr>
<td>Current input with constant voltage supply</td>
<td></td>
</tr>
<tr>
<td>Voltage for velocity transducer (velocity coil)</td>
<td></td>
</tr>
<tr>
<td>Voltage for piezo resistive or capacitive accelerometer</td>
<td></td>
</tr>
</tbody>
</table>

Frequency range
All .......................................................................................................................... 4.2Hz
Calibration, Dynamic Pressure Transducer, 503.XX

Main Characteristics
- frequency from quasi static to 5 Hz
- sinusoidally varying pressure from 0 to 2 Bars
- Calibration of most pressure transducer:
  - piezoelectric charge (single ended or differential)
  - constant current excitation
  - constant voltage excitation
  - Compensation for electrical gain (substitution method)

Introduction
The VibraSens PC based automated dynamic pressure calibration system provides calibration of piezoelectric dynamic pressure transducer. It consists of a sinusoidal air generator, a PC and a 12 bit two channels 5 MS/s data acquisition card. Its operationall software is based on National Instrument Labview. With 2 bars (31 PSI) dynamic, our system provides better signal noise ratio at low frequency than pistonphone used to calibrate microphones and other acoustic sensors.

Description
Piezoelectric pressure transducer cannot be calibrated statically. VibraSens has therefore developed its own calibration system using a periodic sine wave pressure generator. This system provides a significant improvement in dynamic pressure calibration. Data acquisition associated with Labview allow compensation of parameters that were not possible with analog system.

Comparison calibration with substitution.
Our system includes comparison calibration with substitution. This technique greatly improved the accuracy of the measurement using 2 reference pressure sensor. The first one is a piezoresistive pressure sensor calibrated using a dead weight tester. The second one is a stable piezoelectric quartz transducer. The 2 reference pressure transducer are first installed and the system calculates a first transfer function. The Unit Under test is then installed and a second transfer function is calculated. The PC is therefore able to compensate for the difference in the electrical gain of the signal conditioning system. It virtually eliminates uncertainties due to temperature variation and signal conditioner gain on the entire frequency range.

Filtering technique
Digital system uses more powerful signal processing to reduce the signal noise ratio. The reference and Unit under test transducer are both stimulated with a sinusoidal signal. Unfortunately, the system is posed with noise and harmonic distortion mainly due to the system used to generate the sinusoidal wave. Our calibration is performed in the frequency domain where we apply a cross correlation technique between the input and output signal. This almost removes all signal not correlated with the input signal sent to our harmonic air generator device.

Data Storage and output
The system automatically generates a report of the test. The user can then print or saved it in Acrobat PDF format.

Ordering information
To order, specify part number and pressure parameters:
503.01, Calibration, Dynamic Pressure Transducer, pressure parameters to be defined
Ordering example:
503.01, Calibration, Dynamic Pressure Transducer, 2 bars 5Hz

Specifications

Principle
Comparison calibration by substitution
Sinusoidal wave pressure generator

Electrical Input
- type:
  - Charge for piezoelectric transducers (single ended or differential)
  - Voltage with constant current supply (ICP type)
  - Current input with constant voltage supply
- range, transducer:
  - Charge: .............................................................0.02-5000 pC/bar
  - Voltage: .............................................................1-10 000 mV/bar
  - Current: ............................................................0.01 to 100 uA/bar

Frequency range
- pressure transducer: .............................................................0Hz to 5Hz

Pressure range
- Static: ...........................................................................0.1 to 2 bars
- Dynamic: .........................................................................1 to 2 bars

Accuracy
Absolute errors are as follows:
- 1Hz-5Hz: .............................................................................1.5%
Sinusoid, Rms-Average Relation Ships

RMS and AVERAGE EQUATIONS
This is valid for all signal.
Average
\[
\text{Average} = \frac{1}{T} \int_{0}^{T} x(t) dt
\]
Average value gives the DC value of a periodic waveform.

RMS (ROOT MEAN SQUARE)
\[
\text{RMS} = \sqrt{\frac{1}{T} \int_{0}^{T} x^2(t) dt}
\]
RMS value represents the energy content of a signal.
if \( x(t) = \text{DC} + \text{AC} \)

Then
\[
RMS(x(t)) = \sqrt{DC^2 + AC_{RMS}^2}
\]

TRMS : True Root Mean Square devices mean the calculation of the RMS value is based on the RMS formula.
RMS : Root Mean Square devices mean the calculation of the RMS value is calculated by rectifying the signal, averaging it and multiply it by 1.1. This way of doing is exact for sinusoidal waveform only.

Sinusoids applications

Average = 0.637 . peak
RMS = 0.707 . Peak
Peak = 1.414 . RMS
Peak to Peak = 2 . Peak

Crest_Factor= \( \frac{\text{Peak}}{\text{RMS}} \)
Displacement, Velocity, Acceleration, Relationships

D is defined as the peak to peak value
V is defined as the peak velocity
A is defined as the peak acceleration

Typical applications
If the measured parameter is displacement (Eddy current probe), the 2 other parameters can be found through a single and double differentiation of the displacement signal.

\[ d = \frac{D}{2} \sin(\omega t) \]
\[ v = \frac{d}{dt}(d) \]
\[ v = \frac{d}{dt}(D \cos(\omega t)) = V \cos(\omega t) \]
\[ a = \frac{d}{dt}(v) = \frac{d^2}{dt^2}(d) \]
\[ a = -2\pi^2 f^2 D \sin(\omega t) = A \sin(\omega t) \]

Conversion from acceleration to displacement
If the measured parameter is acceleration, the 2 other parameters can be found through a single and double integration of the acceleration signal.

\[ a = A \sin(\omega t) \]
\[ v = \int a \, dt \]
\[ v = \frac{A}{2\pi f} \cos(\omega t) = V \cos(\omega t) \]
\[ d = \int \int a \, dt^2 = \int v \, dt \]
\[ d = \frac{A}{4\pi^2 f^3} \sin(\omega t) = \frac{D}{2} \sin(\omega t) \]

Metric relationships
The following formulas are valid only for a sinusoidal signal. (D) Displacement, (V) Velocity, (A) Acceleration.

<table>
<thead>
<tr>
<th>D (mm p-p)</th>
<th>V (mm/s peak)</th>
<th>A (g peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D (mm p-p)</td>
<td>( D = \frac{1}{\pi} \frac{V}{f} )</td>
<td>( D = \frac{1}{2\pi^2} \frac{A}{f} )</td>
</tr>
<tr>
<td>D (mm p-p)</td>
<td>( D = 0.3183 \frac{V}{f} )</td>
<td>( D = 19.559 \frac{A}{f} )</td>
</tr>
<tr>
<td>V (mm/s peak)</td>
<td>( V = \pi f D )</td>
<td>( V = \frac{g \cdot 10^3}{2 \cdot 25.4 \cdot \pi} \frac{A}{f} )</td>
</tr>
<tr>
<td>V (mm/s peak)</td>
<td>( V = 1560.77 \frac{A}{f} )</td>
<td>( V = 61.44 \frac{A}{f} )</td>
</tr>
</tbody>
</table>

| A (g) | \( A = \frac{2\pi^2 -10^{-3}}{g} f^2 \cdot D \) | \( A = \frac{2\pi -10^{-3}}{g} f \cdot V \) |
| A (g) | \( A = 0.64 -10^{-3} f \cdot V \) | \( A = 16.27 -10^{-3} f \cdot V \) |

English relationships

<table>
<thead>
<tr>
<th>D (inch p-p)</th>
<th>V (ips peak)</th>
<th>A (g peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D (inch p-p)</td>
<td>( D = \frac{1}{\pi} \frac{V}{f} )</td>
<td>( D = \frac{1}{2\pi^2} \frac{A}{f} )</td>
</tr>
<tr>
<td>D (inch p-p)</td>
<td>( D = 0.3183 \frac{V}{f} )</td>
<td>( D = 19.559 \frac{A}{f} )</td>
</tr>
<tr>
<td>V (ips peak)</td>
<td>( V = \pi f D )</td>
<td>( V = \frac{g \cdot 10^3}{2 \cdot 25.4 \cdot \pi} \frac{A}{f} )</td>
</tr>
<tr>
<td>V (ips peak)</td>
<td>( V = 61.44 \frac{A}{f} )</td>
<td>( V = 16.27 -10^{-3} f \cdot V )</td>
</tr>
</tbody>
</table>

g = 9.80665 m/s²(exact value)

Nomogram (Metric)
Conversion Factors, Dynamic

### Displacement

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mm</td>
<td>0.03937 inch</td>
</tr>
<tr>
<td>1 um</td>
<td>0.03937 mil</td>
</tr>
<tr>
<td>1 inch</td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 mil</td>
<td>25.4 um</td>
</tr>
</tbody>
</table>

### Velocity

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m/s</td>
<td>3.2808 feet/s</td>
</tr>
<tr>
<td>1 feet/s</td>
<td>0.3048* m/s</td>
</tr>
<tr>
<td>1 feet/min</td>
<td>5.080* mm/s</td>
</tr>
<tr>
<td>1 inch/s</td>
<td>0.0254* m/s</td>
</tr>
</tbody>
</table>

### Acceleration

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 g</td>
<td>9.80665* meters/second2</td>
</tr>
<tr>
<td>1 foot/second2</td>
<td>0.3048* meters/second2</td>
</tr>
<tr>
<td>1 inch/s2</td>
<td>0.02540 m/s2</td>
</tr>
</tbody>
</table>

### Frequency

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EU/g</td>
<td>0.1019 EU/ms2</td>
</tr>
<tr>
<td>1 EU/ms2</td>
<td>9.8065 EU/g</td>
</tr>
<tr>
<td>1 EU/ips</td>
<td>0.0394 EU/mm.s-1</td>
</tr>
<tr>
<td>1 EU/mm.s-1</td>
<td>25.4 EU/ips</td>
</tr>
<tr>
<td>1 EU/mil</td>
<td>0.0394 EU/um</td>
</tr>
<tr>
<td>1 EU/um</td>
<td>25.4 EU/mil</td>
</tr>
</tbody>
</table>

### Pressure Sensor Sensitivity

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 EU/mbar</td>
<td>68.9 EU/PSI</td>
</tr>
<tr>
<td>1 EU/PSI</td>
<td>0.0145 EU/mbar</td>
</tr>
<tr>
<td>1 mbar/g</td>
<td>0.0145 PSI/g</td>
</tr>
<tr>
<td>1 PSI/g</td>
<td>68.9 mbar/g</td>
</tr>
</tbody>
</table>

* exact value.

EU: Engineering unit

### Mathematics

#### Decibel Scale (Except Power)

\[
\begin{align*}
\text{dB} &= 20 \cdot \log \left( \frac{V_{\text{out}}}{V_{\text{ref}}} \right) \\
\text{Gain} &= \frac{V_{\text{out}}}{V_{\text{ref}}} = 10^{\frac{\text{dB}}{20}} \\
\text{Gain} &= e^{\frac{\Delta}{\text{Reference}}} = e^{\Delta}
\end{align*}
\]

With \( \log (e) = \log (2.718) = 0.4342 \)

### Conversion Factors

#### Multiple And Submultiple Prefixes

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Prefix</th>
<th>Multi-tiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>tera</td>
<td>(10^{-12})</td>
</tr>
<tr>
<td>G</td>
<td>giga</td>
<td>(10^{-9})</td>
</tr>
<tr>
<td>M</td>
<td>mega</td>
<td>(10^{-6})</td>
</tr>
<tr>
<td>k</td>
<td>kilo</td>
<td>(10^{-3})</td>
</tr>
<tr>
<td>f</td>
<td>femto</td>
<td>(10^{-15})</td>
</tr>
<tr>
<td>p</td>
<td>pico</td>
<td>(10^{-12})</td>
</tr>
<tr>
<td>n</td>
<td>nano</td>
<td>(10^{-9})</td>
</tr>
<tr>
<td>u</td>
<td>micro</td>
<td>(10^{-6})</td>
</tr>
<tr>
<td>m</td>
<td>milli</td>
<td>(10^{-3})</td>
</tr>
</tbody>
</table>

#### Length

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 um</td>
<td>0.03937 mil</td>
</tr>
<tr>
<td>1 m</td>
<td>39.370 * inches</td>
</tr>
<tr>
<td></td>
<td>3.2808 feet</td>
</tr>
<tr>
<td>1 km</td>
<td>0.621 mile</td>
</tr>
<tr>
<td>1 mil</td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 inch</td>
<td>25.4 mm</td>
</tr>
<tr>
<td></td>
<td>1000 mil</td>
</tr>
<tr>
<td></td>
<td>3* feet</td>
</tr>
<tr>
<td>1 foot</td>
<td>0.30480 m *</td>
</tr>
<tr>
<td>1 yards</td>
<td>0.9144 m *</td>
</tr>
<tr>
<td>1 mile (statute)</td>
<td>5280 feet *</td>
</tr>
<tr>
<td></td>
<td>1.6093 kilometers</td>
</tr>
</tbody>
</table>
Appendix

Area

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm²</td>
<td>0.1550 square inches</td>
</tr>
<tr>
<td>1 m²</td>
<td>10.764 square feet</td>
</tr>
<tr>
<td>1 square inches</td>
<td>645.16 mm² *</td>
</tr>
<tr>
<td>1 square feet</td>
<td>144.0 square inches *</td>
</tr>
<tr>
<td>1 acre</td>
<td>4047 m²</td>
</tr>
</tbody>
</table>

Volume

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cm³</td>
<td>0.06102 cubic inches</td>
</tr>
<tr>
<td>1 m³</td>
<td>35.315 cubic feet</td>
</tr>
<tr>
<td>1 inch³</td>
<td>16.387 cm³</td>
</tr>
<tr>
<td>1 cubic foot</td>
<td>1728 cubic inches</td>
</tr>
</tbody>
</table>

Mass

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gram</td>
<td>0.03527 ounces Oz (avdp.)</td>
</tr>
<tr>
<td>1 kilogram</td>
<td>2.2046 ponds (advp.)</td>
</tr>
<tr>
<td>1 ounce (Oz)</td>
<td>28.350 grams</td>
</tr>
<tr>
<td>1 pound (advp)</td>
<td>16* ounces (avdp)</td>
</tr>
<tr>
<td></td>
<td>453.6 grams</td>
</tr>
</tbody>
</table>

Angle

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 degree</td>
<td>0.017453 Radian</td>
</tr>
<tr>
<td>1 radian</td>
<td>57.2958 degrees</td>
</tr>
<tr>
<td>1 Grade</td>
<td>0.900* degree</td>
</tr>
</tbody>
</table>

Force

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Dynes</td>
<td>10E-5 Newton</td>
</tr>
<tr>
<td>1 kilogram force</td>
<td>9.80665* Newtons</td>
</tr>
<tr>
<td>1 Newton</td>
<td>0.1020 kilogram force</td>
</tr>
</tbody>
</table>

Moment Or Torque

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pound (force) inch</td>
<td>0.1130 Newton meters</td>
</tr>
<tr>
<td>1 newton meter inch</td>
<td>8.849 pound (force)</td>
</tr>
</tbody>
</table>

Pressure

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 atmospheres</td>
<td>1.01325* bars</td>
</tr>
<tr>
<td></td>
<td>760.0 mm of Hg</td>
</tr>
<tr>
<td></td>
<td>101 325 k Pa</td>
</tr>
</tbody>
</table>

1 mm of Hg (Torr) = 133.32 N/m²

<table>
<thead>
<tr>
<th>FROM-TO</th>
<th>Bar</th>
<th>mBar</th>
<th>Pascal</th>
<th>kg/cm²</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>1</td>
<td>0.001</td>
<td>0.00001</td>
<td>0.98068</td>
<td>0.068946</td>
</tr>
<tr>
<td>mBar</td>
<td>1000</td>
<td>1</td>
<td>0.01</td>
<td>980.68</td>
<td>68.946</td>
</tr>
<tr>
<td>Pascal</td>
<td>100000</td>
<td>100</td>
<td>1</td>
<td>98607</td>
<td>6894.6</td>
</tr>
<tr>
<td>kg/cm²</td>
<td>1.0197</td>
<td>0.0010197</td>
<td>1.0197E-5</td>
<td>1</td>
<td>0.070305</td>
</tr>
<tr>
<td>PSI</td>
<td>14.504</td>
<td>0.014504</td>
<td>14504E-6</td>
<td>14.223</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: 1 Pascal=1 N/m²

Power

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Horsepower</td>
<td>746.0* watts</td>
</tr>
<tr>
<td>1 BTU/second</td>
<td>1055.9 watts</td>
</tr>
</tbody>
</table>

Energy

<table>
<thead>
<tr>
<th>Unit</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 BTU</td>
<td>1055.9 Joules</td>
</tr>
</tbody>
</table>

Temperature

<table>
<thead>
<tr>
<th>°F</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°F = \frac{9}{5}°C + 32</td>
<td></td>
</tr>
<tr>
<td>1°C = \frac{5}{9}(°F − 32)</td>
<td></td>
</tr>
<tr>
<td>1°K = °C + 273.15</td>
<td></td>
</tr>
</tbody>
</table>

* exact value.

Wire Gauge

<table>
<thead>
<tr>
<th>AWG No</th>
<th>Number of Strands</th>
<th>Conductor Nominal Diameter (mm)</th>
<th>Conductor Area (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Solid</td>
<td>0.015</td>
<td>0.00017</td>
</tr>
<tr>
<td>52</td>
<td>Solid</td>
<td>0.020</td>
<td>0.00031</td>
</tr>
<tr>
<td>50</td>
<td>Solid</td>
<td>0.025</td>
<td>0.00049</td>
</tr>
<tr>
<td>48</td>
<td>Solid</td>
<td>0.031</td>
<td>0.00075</td>
</tr>
<tr>
<td>46</td>
<td>Solid</td>
<td>0.040</td>
<td>0.00126</td>
</tr>
<tr>
<td>44</td>
<td>Solid</td>
<td>0.050</td>
<td>0.00203</td>
</tr>
<tr>
<td>44</td>
<td>7 x 54</td>
<td>0.045</td>
<td>0.00124</td>
</tr>
<tr>
<td>44</td>
<td>7 x 52</td>
<td>0.060</td>
<td>0.00220</td>
</tr>
<tr>
<td>42</td>
<td>Solid</td>
<td>0.063</td>
<td>0.00316</td>
</tr>
<tr>
<td>42</td>
<td>7 x 50</td>
<td>0.075</td>
<td>0.00343</td>
</tr>
<tr>
<td>41</td>
<td>Solid</td>
<td>0.070</td>
<td>0.00396</td>
</tr>
<tr>
<td>40</td>
<td>Solid</td>
<td>0.079</td>
<td>0.00490</td>
</tr>
<tr>
<td>39</td>
<td>Solid</td>
<td>0.093</td>
<td>0.00528</td>
</tr>
<tr>
<td>38</td>
<td>Solid</td>
<td>0.102</td>
<td>0.00795</td>
</tr>
<tr>
<td>37</td>
<td>Solid</td>
<td>0.114</td>
<td>0.0100</td>
</tr>
</tbody>
</table>
### DIN Norms

**Gauge according to DIN 0295, IEC 228**

<table>
<thead>
<tr>
<th>Classe 2 Nbr x Dia (mm)</th>
<th>Classe 5 nbr x Dia (mm)</th>
<th>Classe 6 Nbr x Dia (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.14</td>
<td>18 x 0.1</td>
<td>18 x 0.1</td>
</tr>
<tr>
<td>0.25</td>
<td>14 x 0.15</td>
<td>32 x 0.1</td>
</tr>
<tr>
<td>0.34</td>
<td>19 x 0.15</td>
<td>42 x 0.1</td>
</tr>
<tr>
<td>0.38</td>
<td>12 x 0.2</td>
<td>21 x 0.15</td>
</tr>
<tr>
<td>0.5</td>
<td>7 x 0.30</td>
<td>28 x 0.15</td>
</tr>
<tr>
<td>0.75</td>
<td>7 x 0.37</td>
<td>42 x 0.15</td>
</tr>
<tr>
<td>1.0</td>
<td>7 x 0.43</td>
<td>56 x 0.15</td>
</tr>
<tr>
<td>1.5</td>
<td>7 x 0.52</td>
<td>84 x 0.15</td>
</tr>
</tbody>
</table>

### Color code according to DIN 47100

<table>
<thead>
<tr>
<th>Conducteur N°</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>Brown</td>
</tr>
<tr>
<td>3</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>Yellow</td>
</tr>
<tr>
<td>5</td>
<td>Grey</td>
</tr>
<tr>
<td>6</td>
<td>Rose</td>
</tr>
<tr>
<td>7</td>
<td>Blue</td>
</tr>
<tr>
<td>8</td>
<td>Red</td>
</tr>
<tr>
<td>9</td>
<td>Black</td>
</tr>
<tr>
<td>10</td>
<td>violet</td>
</tr>
</tbody>
</table>

### Acronyms And Abbreviations

**materials**

- **PVC**: polyvinylchloride
- **PE**: polyethylene
- **PU**: Polyurethane
- **FEP**: Fluorinated ethylene propylene
- **PFA**: perfluoroalkoxy
- **PTFE**: polytetrafluorethylene
- **PVDF**: polyvinylidene fluoride
- **Kynar**: is a trademark of Pennwalt
- **Solef**: is a trademark of TBD
- **ETFE**: ethylene-tetrafluorethylene-copolymer
- **Tefzel**: is a registered trademark of Dupont
- **®Radox 125**: polyolefin copolymer cross link (Trademark of Huber&Suhner)
- **SIR**: silicon rubber
technical

<table>
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<tr>
<th>Unit</th>
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<tr>
<td>pC</td>
<td>Pico Coulombs</td>
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<td>cpm</td>
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<td>cps</td>
<td>Cycle Per Second</td>
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<td>RPM</td>
<td>Revolution per Minute</td>
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<td>S</td>
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Vibrasens

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Decimal - Inches

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## Polymer Characteristics

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