

# VIM3\* Vibration Sensors

Manual



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# 1 Introduction

## 1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



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**Note**

This document does not substitute the instruction manual.

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**Note**

For full information on the product, refer to the instruction manual and further documentation on the Internet at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

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The documentation consists of the following parts:

- Present document
- Instruction manual
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Additional documents

## 1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

### 1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

#### Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



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#### **Danger!**

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

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#### **Warning!**

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

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#### **Caution!**

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

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#### Informative Symbols



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#### **Note**

This symbol brings important information to your attention.

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#### **Action**

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

### 1.4 Intended Use

The vibration sensor is used exclusively for measuring mechanical vibrations on machines and mechanical systems. Use is only permitted within the specifications stated in the datasheet.

Typical applications are monitoring fans, ventilators, electric motors, pumps, centrifuges, separators, generators, turbines, and similar oscillating mechanical systems. Read through this manual carefully. Familiarize yourself with the device before installing, mounting, or operating.

Some product versions are suitable for use in hazardous areas. The relevant national or international directives and the instruction manual for the product must be followed.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and the plant is guaranteed only if the device is operated in accordance with its intended use.

### 1.5 General Safety Instructions

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Installation and commissioning of all devices may be performed only by trained and qualified personnel.

It is dangerous for the user to make changes and/or repairs. Additionally, doing so voids the warranty and excludes the manufacturer from any liability. In the event of any serious errors, stop using the device. Secure the device against unintended operation. To have the device repaired, return it to your local Pepperl+Fuchs representative or your sales center.

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#### Note

##### Disposal

Electronic waste is dangerous. When disposing of the equipment, observe the current statutory requirements in the relevant country of use and local regulations.

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## 2 Product Description

### 2.1 Use and Application

The vibration sensors of the VIM3\* product family determine the vibration magnitude using the root mean square (RMS) method. This form of quadratic average determination or pre-filtering allows precise statements to be made about trends relating to the status of the application. Depending on the product versions, the vibration magnitude is determined either as the vibration acceleration (in g rms) or as the vibration velocity (in mm/s).

### 2.2 Vibration Monitoring

#### 2.2.1 Vibration Velocity Operating Range

The operating range of the vibration velocity is not constant over the entire measuring range. It always depends on the current frequency at which the vibration sensor is vibrating.

Essentially, the higher the current frequency, the lower the detectable vibration velocity. This can lead to a significantly high frequency, which can then lead to the current operating range of the sensor in this state being smaller than the specified measuring range.

The maximum detectable operating range can be derived from the maximum detectable acceleration. This is 14 g (137.3 m/s<sup>2</sup>) for the entire frequency range.

The maximum measurable vibration velocity results from the following physical correlation:

$$v_{max} = \int a_{max}$$

The following applies to sinusoidal vibrations:

$$v_{max} = \frac{a_{max}}{2\pi f}$$

The following figure depicting the vibration monitoring shows the operating range, which is limited by the maximum measurable vibration velocity in mm/s depending on the frequency. The area above the curve shows the operating range that cannot be measured when recording the vibration velocity, because the frequency is too high. The sensor outputs the vibration velocity value that can only just be detected.

Example for a version with a measuring range of 128 mm/s:

- Assumption: Application vibrates at 80 mm/s at 400 Hz
- Sensor output: 64 mm/s

This is the vibration velocity value that can only just be detected at this frequency.

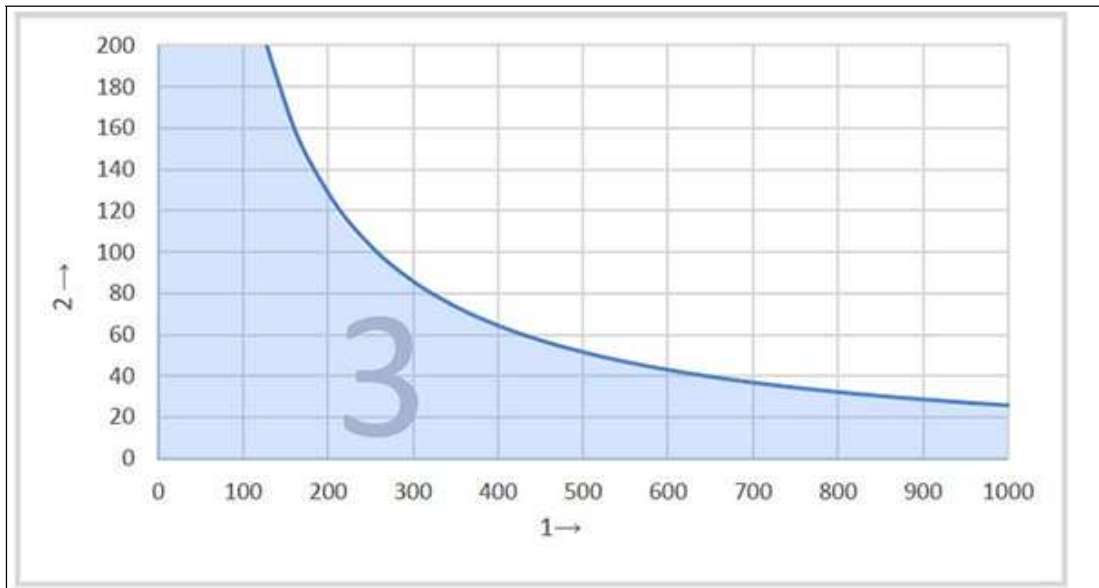


Figure 2.1

- 1 Frequency in Hz
- 2 Vibration velocity in mm/s
- 3 Operating range of vibration monitoring

### Reading Example

Frequency (Hz)	Maximum Measurable Vibration Velocity (mm/s)
250	103
400	64
1000	25

Table 2.1



### 2.2.2 Frequency Response

The typical frequency response of vibration monitoring for two frequency ranges is depicted below.

#### Frequency Response: 10 Hz to 1000 Hz

The cut-off frequencies are 10 Hz and 1000 Hz with -3 dB damping.

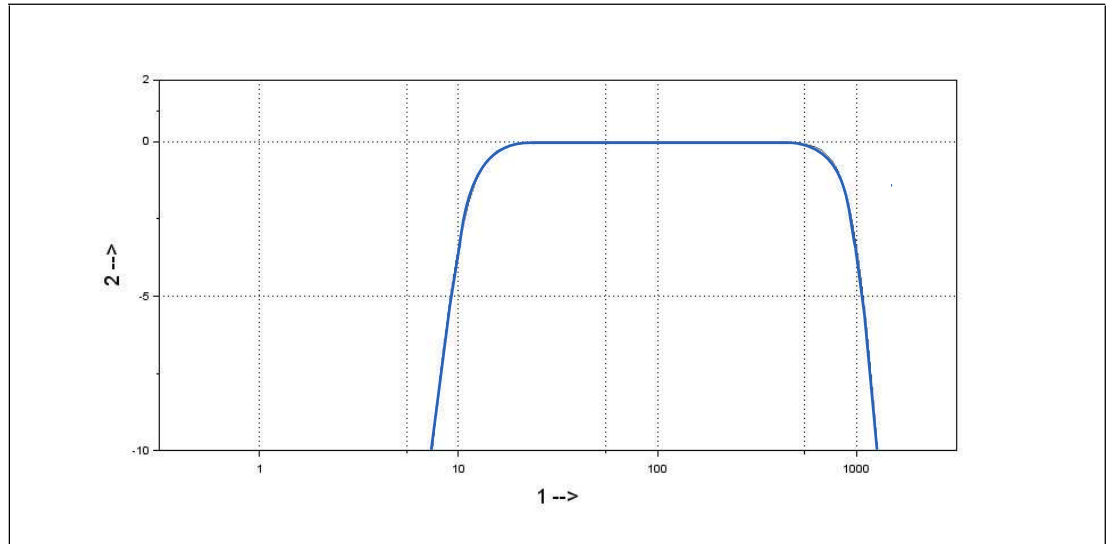


Figure 2.2

- 1 Frequency in Hz
- 2 Gain in dB

#### Frequency Response: 1 Hz to 1000 Hz

The frequency response was recorded using two reference sensors.

The cut-off frequencies are 1 Hz and 1000 Hz with -3 dB damping.

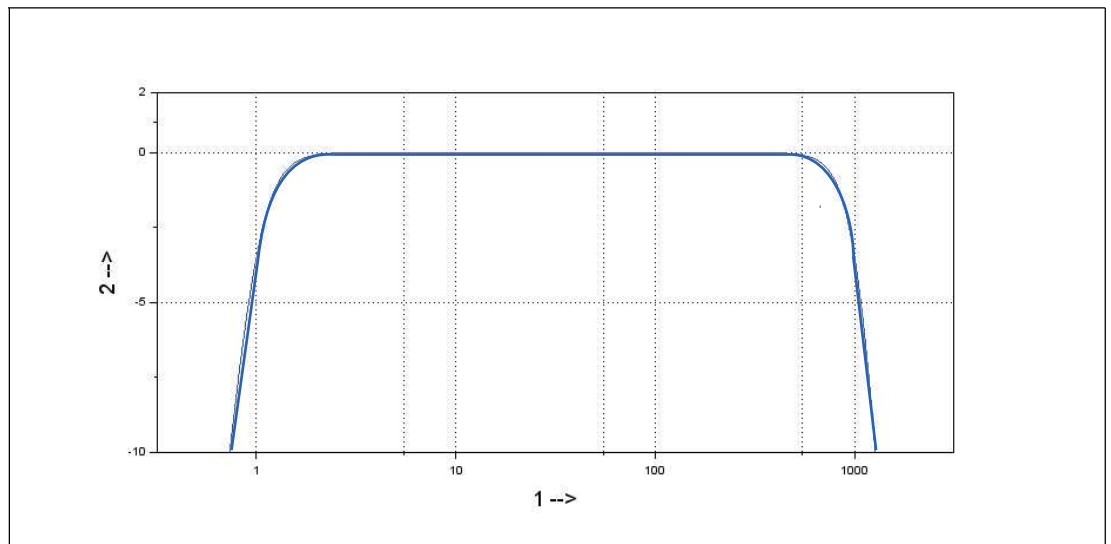


Figure 2.3

- 1 Frequency in Hz
- 2 Gain in dB

## 2.3

## Accessories

**Note**

Various accessories are available for the VIM3\* vibration sensors. These are available online at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com), on the product page for the relevant VIM3\* vibration sensor.

**Available Accessories**

Accessories	Use
Cordset for plug versions	Electrical installation for plug versions
EMC adapter	For insulating the sensor from the mounting point to protect against sources of EMC interference.
Mounting adapter	Adapter with different thread sizes for specific mounting requirements at the mounting point.
Protective rubber sleeve	Flexible plastic cover for additional protection of the sensor against chemical and mechanical influences.

### 3 Installation

#### 3.1 Instructions for Mechanical and Electrical Installation



**Note**

Further installation-relevant information on technical data, mechanical data, and available connection lines for the relevant vibration sensor types can be found in the corresponding datasheet.

Always observe the following instructions to ensure safe operation of the vibration sensor:



**Warning!**

Work must be performed by trained and qualified personnel only.

Commissioning and operation of this electrical device must be performed by trained and qualified personnel only. This means individuals who are qualified to commission (in accordance with safety engineering), connect to ground, and label devices, systems, and circuits.



**Warning!**

Perform work only when the system is de-energized!

De-energize your device before performing work on the electrical connections. Short circuits, voltage peaks, and similar events can lead to faults and undefined statuses. This presents a significant risk of personal injury and property damage.



**Warning!**

Protect cables against interference and damage.

Protect the connection cable and any extension cables from electrical interference and mechanical damage. Always observe the local regulations and instructions.



**Warning!**

Check electrical connections before switching on the plant!

Check all electrical connections before switching on the plant. Incorrect connections present a significant risk of personal injury and property damage. Incorrect connections can lead to malfunctions.



**Caution!**

The housing must be grounded.

The housing of the vibration sensor must be grounded when mounting, either via the machine body or via a separate protective conductor (PE).



**Caution!**

Do not perform any electrical modifications!

It is not permitted to perform electrical modifications on the vibration sensor. If you open or modify the device yourself, you are endangering yourself and others, voiding any warranty, and absolving the manufacturer of any liability.

**Caution!**

Ensure that the data cable and power supply cable are physically separate!

To prevent interference, route the cordset for the vibration sensor so that it is a suitable distance away from power supply cables. Shielded cables must be used to ensure reliable data transfer. A perfect ground connection must be ensured. Always observe the local regulations and instructions.

## 3.2 Mounting

### Prerequisites

Mounting the vibration sensor on the mounting surface:

- The mounting surface must be clean and flat, i.e., free of paint, rust, etc.
- The measuring head surface of the vibration sensor must lie flat on the mounting surface.
- The vibration sensor is fitted with an M8 screw thread as standard. Insert the screw thread into a threaded hole in the mounting surface. If the thread in the hole is different, thread adapters are available as an accessory.

### Mounting the Vibration Sensor

For safe and error-free operation, observe the following requirements during mounting:

- Mount the vibration sensor on the mounting surface correctly to obtain accurate data.
- Avoid mounting the vibration sensor on auxiliary structures. If it is absolutely necessary to use auxiliary structures, make sure these are designed to be as rigid as possible.
- Earth and ground loops are among the most common problems when using measuring setups with sensitive sensor technology. These loops are caused by unwanted differences in potential in the circuit between the sensor and the control interface. As a countermeasure, we recommend our standard grounding concept or, depending on the application, our alternative grounding concept
- Make sure that the ground connection is electrically safe.



1. Screw the vibration sensor into the threaded hole in the mounting surface using a hexagon wrench (SW 24) at a tightening torque of 8 Nm.
2. For plug versions: Connect the connection cable and note that the tightening torque of the connector's M12 union nut must not exceed 0.4 Nm.

## 3.3 Electrical Installation

**Note****Installation Diagram**

Two different grounding concepts are described below. The appropriate concept should be selected for the application. Note that different cable types and other accessories may be required depending on the grounding concept.

**Note**

Various accessories are available for the VIM3\* vibration sensors. These are available online at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com), on the product page for the relevant VIM3\* vibration sensor.

### Grounding Concept 1 (Recommended)

Only applicable for:

- Plug version
- Plug versions with a P+F connection cable accessory
- Assumption: The sensor housing and the cable shield are connected.

Situation/Requirements of the Application	Effects of the Grounding Concept
No EMC faults expected from the machine side, e.g., from the frequency inverter	<ul style="list-style-type: none"> <li>• The machine should be connected to the sensor housing, or there is no effect on the quality of the measurements provided by the sensor.</li> <li>• EMC faults that still directly affect the sensor head can discharge via the machine earth.</li> </ul>
No risk/prevention of earth loops necessary, e.g., when using a long cable approx. 500 m in length.	The earth at the control interface (-> point 4 in Fig.) is integrated.
Coupled interference must be deflected	<ul style="list-style-type: none"> <li>• Deflected via machine earth (-&gt; point 1 in Fig.)</li> <li>• Deflected from earth at the control interface (-&gt; point 4 in Fig.)</li> </ul>

Table 3.1

The following diagram applies to plug versions in combination with a suitable P+F connection cable accessory. This grounding concept is also recommended if no sources for EMC pollution, such as frequency inverters, are used on the machine side. In the standard grounding concept, the sensor cable shield is connected to the sensor housing, and to the earth potential of the control interface. The sensor housing is at the same potential as the machine earth and the earth of the control interface.

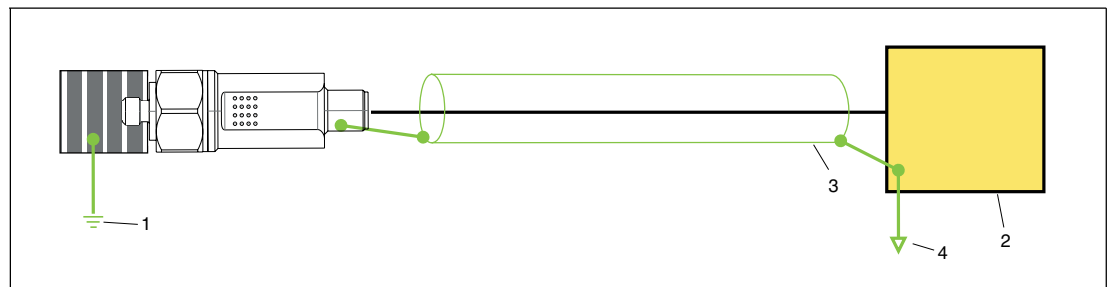


Figure 3.1

- 1 Machine earth
- 2 Control interface (measuring instrument, PLC, etc.)
- 3 Cable shield
- 4 Earth potential for the control interface

## Grounding Concept 2 (Special Case)

Only applicable for:

- Plug version
- Plug versions with a P+F connection cable accessory
- Assumption: The sensor housing and the cable shield are connected.

Situation/Requirements of the Application	Effects of the Grounding Concept
No EMC faults expected from the machine side, e.g., from the frequency inverter	<ul style="list-style-type: none"> <li>• The machine should be connected to the sensor housing, or there is no effect on the quality of the measurements provided by the sensor.</li> <li>• EMC faults that still directly affect the sensor head can discharge via the machine earth.</li> </ul>
Risk/prevention of earth loops necessary, e.g., when using a long cable approx. 500 m in length.	The earth at the control interface (-> point 4 in Fig.) is not integrated.
Coupled interference must be deflected	<ul style="list-style-type: none"> <li>• Deflected via machine earth (-&gt; point 1 in Fig.)</li> </ul>

Table 3.2

The following diagram applies to plug versions in combination with a suitable P+F connection cable accessory. This grounding concept is also recommended if no sources for EMC pollution, such as frequency inverters, are used on the machine side. In this grounding concept, the sensor cable shield has a connection to the sensor housing, but no connection to the earth potential of the control interface. The sensor housing has the same potential as the machine earth.

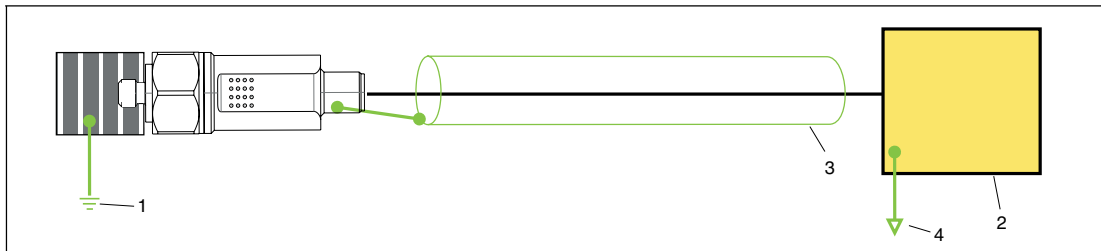


Figure 3.2

- 1 Machine earth
- 2 Control interface (measuring instrument, PLC, etc.)
- 3 Cable shield
- 4 Earth potential for the control interface

In principle, there is a risk that very long cable lengths with a long distance between the machine earth (1) and the earth (4) of the control interface could lead to an earth loop. This would lead to continuous equipotential bonding between the machine and the control interface. To prevent these earth loops, this grounding concept is designed so that the grounding on the side of the control interface is not connected. Therefore, there is no continuous connection between the machine earth (1) and the earth (4) of the control interface. Coupled interference can only be discharged via the machine earth (1).



Connect the vibration sensor to a higher-level electronics / control environment using one of the two grounding concepts discussed above.

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## 4 Troubleshooting

### 4.1 What to Do in the Event of a Fault

In case of a fault, use the following checklist to determine whether a fault with the vibration monitoring can be remedied.

If none of the information provided in the checklist solves the problem, you can contact Pepperl+Fuchs via your sales office with any queries. Have details of the model number and firmware version of the sensor ready if possible.

#### Checklist

Error	Cause	Fault Repair
No measured value	No supply voltage	Check the voltage supply and/or supply lines.
	Interruption in the connection cable	Replace the connection cable.
	Faulty fuse	Replace the fuse in the voltage supply area of the sensor.
	Reversed polarity in the connection	Check the voltage supply and ensure the polarity is correct.
Incorrect measured value	Vibration sensor not mounted correctly	Check that the sensor is mounted correctly. Ensure that the sensor thread is tightened with a tightening torque of 8 Nm.
	Vibration sensor mounted in the wrong position	The vibration behavior can vary depending on the measuring point / mounting point. Therefore, mount the sensor as precisely as possible at the point where you want to estimate/monitor the corresponding vibration behavior.
EMC problems	Earth loops / ground loops	Check the explanations provided in the chapter "Electrical Installation" for the relevant sensor grounding concept (see chapter 3.3).

Table 4.1

## 5 Repair and Servicing

The device must not be repaired, changed, or manipulated. In case of failure, always replace the device with an original device.



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