

# VIM3\*-IO-\* 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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**Note**

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search 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
- Functional safety manual
- Additional documents

## 1.2 Target Group, Personnel

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

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling 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.

The vibration sensor provides the data obtained as process data via the IO-Link interface in accordance with the "IO Link Consortium" standard. The vibration sensor is to be integrated into an IO-Link network and should be used only in this way.

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 in the VIM3\*-IO-\* 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. The vibration magnitude is both the vibration velocity and vibration acceleration. The vibration sensor also provides both an output of the peak values of the vibration acceleration ( $t = 1$  sec) and a temperature output. Depending on the product versions, a bearing status parameter is output that is determined and scaled in accordance with DIN ISO 13373.

#### What Is IO-Link?

IO-Link enables seamless communication and digital data transfer from the control panel level down to the sensor level. The intelligent sensors can be used to their full potential with IO-Link, paving the way for Industry 4.0 in automation technology. The internationally standardized interface provides impressive efficiency and sustainable cost reduction from system planning and installation right through operation and maintenance.

Standardized device description files ("IODDs") and parameterization via software tools ensure convenient configuration and integration of IO-Link sensors. Intelligent, transparent parameter management increases application flexibility and minimizes downtimes. Parameters can be customized quickly and easily, even for complex production and batch changes. Transparency right through to the sensor gives users access to a comprehensive range of parameterization options and device diagnostics functions, allowing them to perform predictive servicing.

The technology offers particular benefits during service activities (troubleshooting, servicing, and device exchange), during commissioning (cloning, identification, configuration, and localization), and during operation (job changeover, continuous parameter monitoring, and online diagnostics).

#### Device Description File (IODD)

The device parameters are different for each device. A standardized description of these parameters can be found in the IO Device Description file (IODD). IODDs can be integrated into a control environment to allow IO-Link devices to be used for IO-Link operation. Both programming and exchanging process data can be performed with a PLC. The IODD can be imported into a range of engineering tools from various system providers for programming and diagnostics, provided these tools support IODD.

#### Offline Parameterization

For offline parameterization, IO-Link devices are already configured before mounting. To do this, use the Pepperl+Fuchs IO-Link USB master.

We recommend using the "PACTware" software as an FDT frame application and user interface.

The software components required in each case are summarized in the latest version of the "IO-Link Offline Parameterization Tool" software package. The software package and the documentation on its installation and use can be found online at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

If the "IO-Link Offline Parameterization Tool" software package is used, there is active internet access, and the device is connected via the Pepperl+Fuchs IO-Link USB master, the IODD can be directly integrated into the IO-Link Offline Parameterization Tool via the "IODD DTM Configurator."

The device description file (IODD) required for integration in an IO-Link system and for the parameterization and diagnosis is available online. Visit [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com) and navigate to the relevant product page for the vibration sensor.

### Online Parameterization

When commissioning machines and plants, master and IO-Link devices must be integrated into the appropriate control environment. Depending on the components used, different software is required.

The devices can be configured and parameterized using an IO-Link configuration tool. During operation, the parameters for the IO-Link devices can be checked and status and diagnostic data can be read and monitored. IO-Link data is integrated into an application program using function blocks.

## 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.

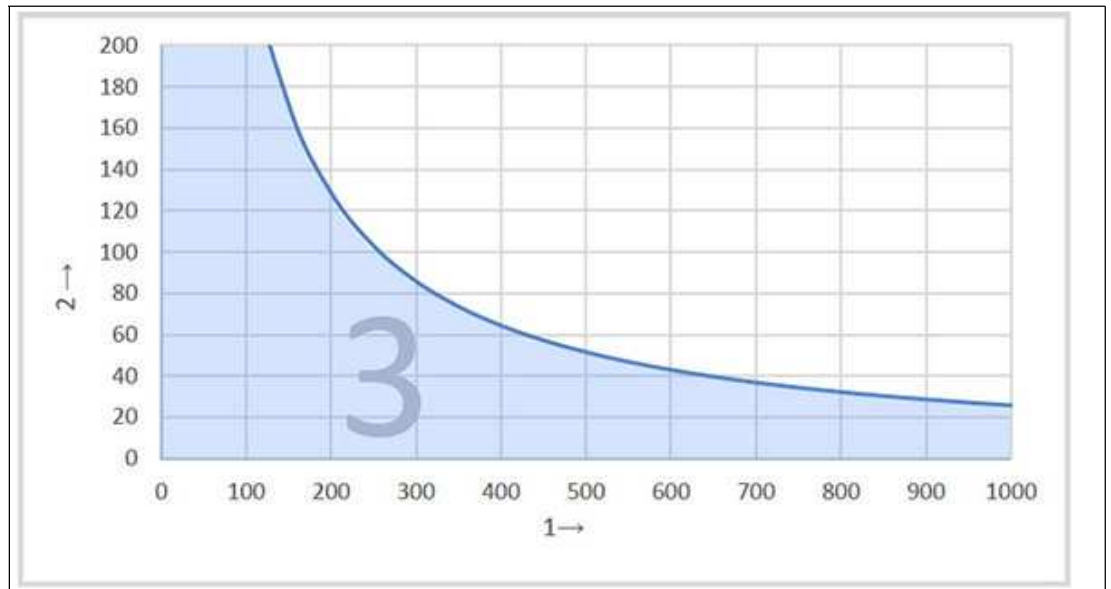


Figure 2.1

- 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.

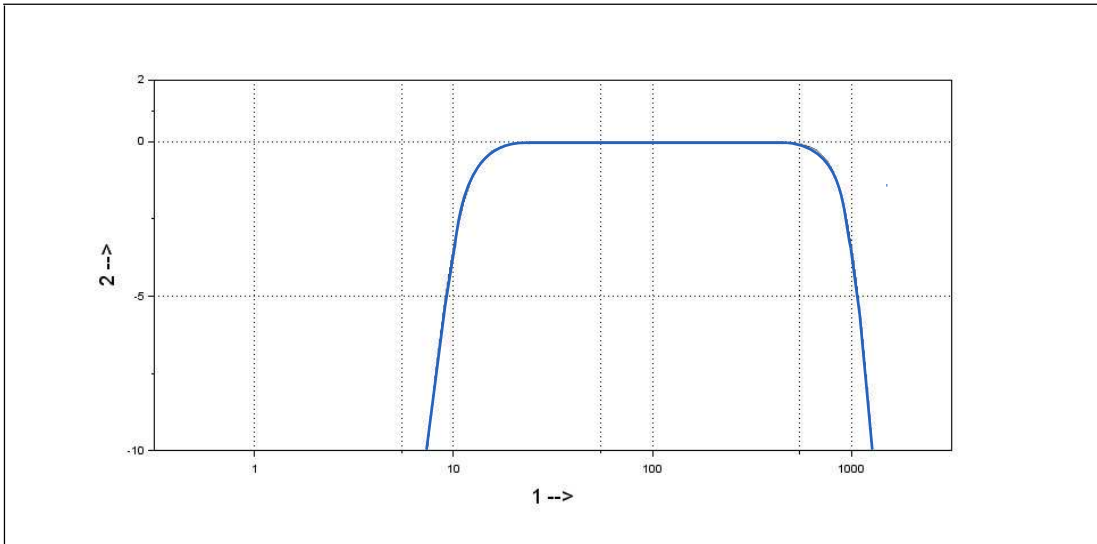


Figure 2.2

- 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.

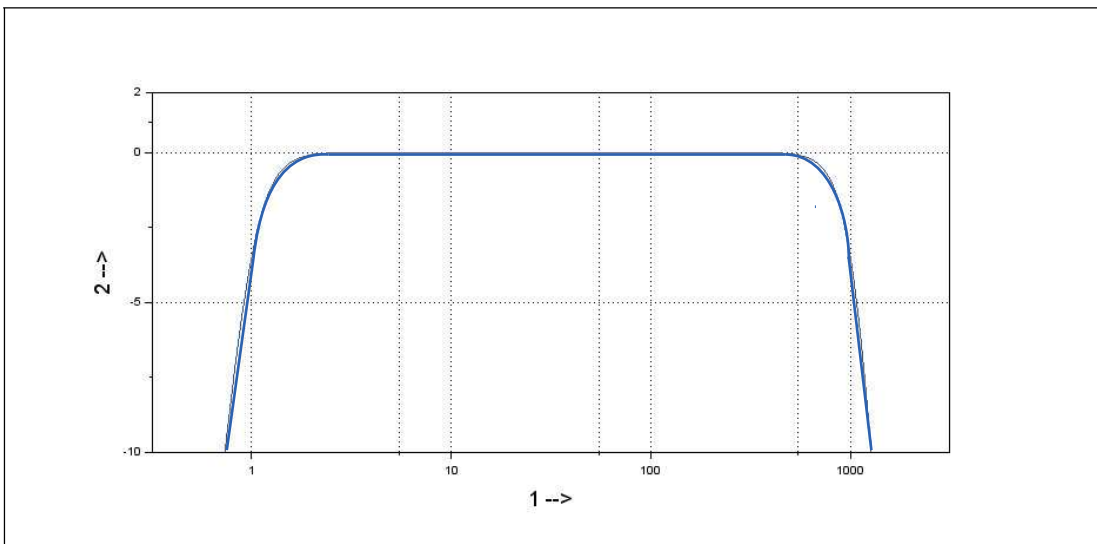


Figure 2.3

- 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 device 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!

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 separated!

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-in thread as standard. Insert the screw-in 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.



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 Connection



### Note

Suitable cordsets can be found at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com). Navigate to the product page for the relevant vibration sensor under "Accessories."



Use a suitable connection cable to connect the rotary encoder to the higher-level control panel, an IO-Link master, or the IO-Link-Master02-USB.

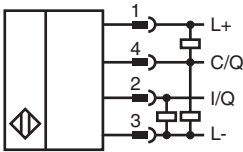
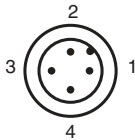
Electrical Connection	Pinout
	

Table 3.1

## 4 Cybersecurity and Decommissioning Information

### Cybersecurity Information

From a security perspective, the following precautions must be taken for the product by the responsible plant operator:

- Physically secure the device against unauthorized access
- Ensure that the IO-Link device communicates with the remote station via a point-to-point connection.

The product features a proprietary Pepperl+Fuchs service interface that uses the existing connection lines. This interface is used exclusively for initially storing and updating the firmware during production. Once switched on, the interface is deactivated after 20 seconds.

### Decommissioning

The device stores adjustable parameter data, temperature information, and the operating time. Parameter data can be deleted by restoring the factory settings.

The operating time counter and temperature information cannot be deleted. To delete this data, the device must be physically destroyed.

### 5 Commissioning with IO-Link on a Control Panel (Online Parameterization)



#### Note

The device description file (IODD) required for integration in an IO-Link system and for parameterization and diagnosis is available online. Visit [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com) and navigate to the relevant product page for the VIM3\*-IO-\* vibration sensor.

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To activate the vibration sensor via IO-Link using a control system, proceed as follows:

1. Check the connection between the vibration sensor and the IO-Link master.
  2. Set the status to "IO-Link" on the corresponding port on the IO-Link master to which the vibration sensor is connected.
- ↳ Once communication has been successfully established, parameterize the vibration sensor with the higher-level application either by using an IO-Link configuration tool or retrieving diagnostic information. The device sends the determined data as process data.

## 6 Commissioning with IO-Link via FTD Framework Program (Offline Parameterization)

### IO-Link Offline Parameterization Tool

An IODD (IO-Link Device Description) file is available to download for parameterizing the vibration sensor via IO-Link and diagnosis. See the product page for the relevant VIM3\*-IO-\* vibration sensor online at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com) or use the IODDfinder at <https://ioddfinder.io-link.com/>.

With offline parameterization, IO-Link devices are already configured before installation. To do this, use the Pepperl+Fuchs IO-Link USB master.

The software components required in each case are summarized in the latest version of the "IO-Link Offline Parameterization Tool" software package. The software package and the documentation on its installation and use can be found online at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

If the "IO-Link Offline Parameterization Tool" software package is used, there is active internet access, and the device is connected via the Pepperl+Fuchs IO-Link USB master, the IODD can be directly integrated into the IO-Link Offline Parameterization Tool via the "IODD DTM Configurator."



#### Note

Suitable cordsets can be found at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com). Navigate to the product page for the relevant vibration sensor under "Accessories."



To activate the vibration sensor via IO-Link using the corresponding IODD, proceed as follows:

1. Make sure that the "IO-Link Offline Parameterization Tool" software package is installed on the computer.
2. Connect the vibration sensor to an IO-Link master with a suitable M12 cordset.
3. Connect the IO-Link master to a USB connection on your PC via a USB cable.
4. Start PACTware.

↳ PACTware automatically communicates with the vibration sensor if PACTware from the "IO-Link Offline Parameterization Tool" is used and the IODD was found automatically online.



## 7 Process Data Structure

Four different measured variables are transmitted as process data by the VIM3\*-IO-\* vibration sensor. These are each transmitted as a Measurement Data Channel (MDC) 1 ... 4. These are Velocity RMS, Vibration Acceleration RMS, Vibration Acceleration Peak, and Temperature. The figure below illustrates the process data structure:

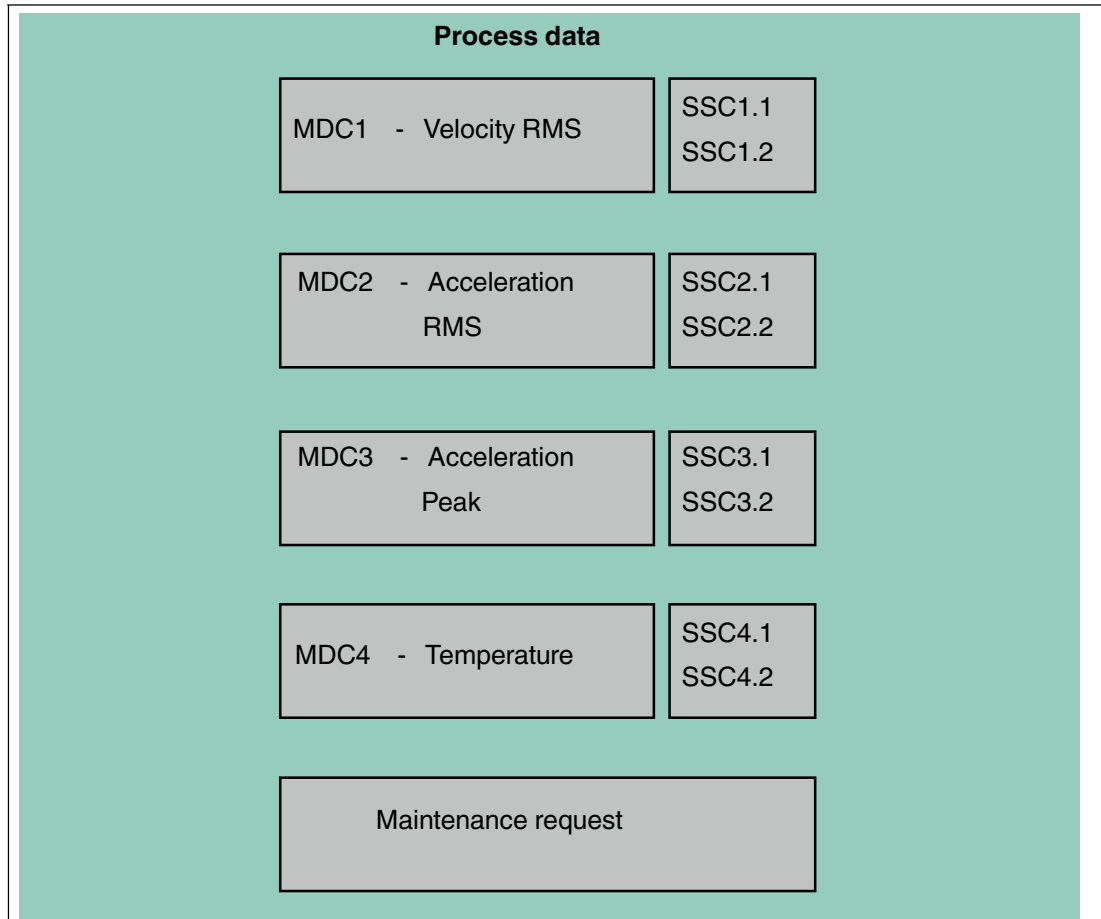


Figure 7.1

Two independent adjustable switching signals (SSC) are transmitted for each measured variable. In addition, adjustable thresholds and data allow a plant maintenance cycle to be defined on the device. The "Maintenance request" switching information displays whether a plant maintenance cycle is necessary.

### 7.1 Parameterizing a Switching Signal (SSCx)

Two independent switching signals (SSC) can be parameterized for each measured variable. The principle for parameterization is the same for each measured variable (SSC).

The figure below illustrates the relationships:

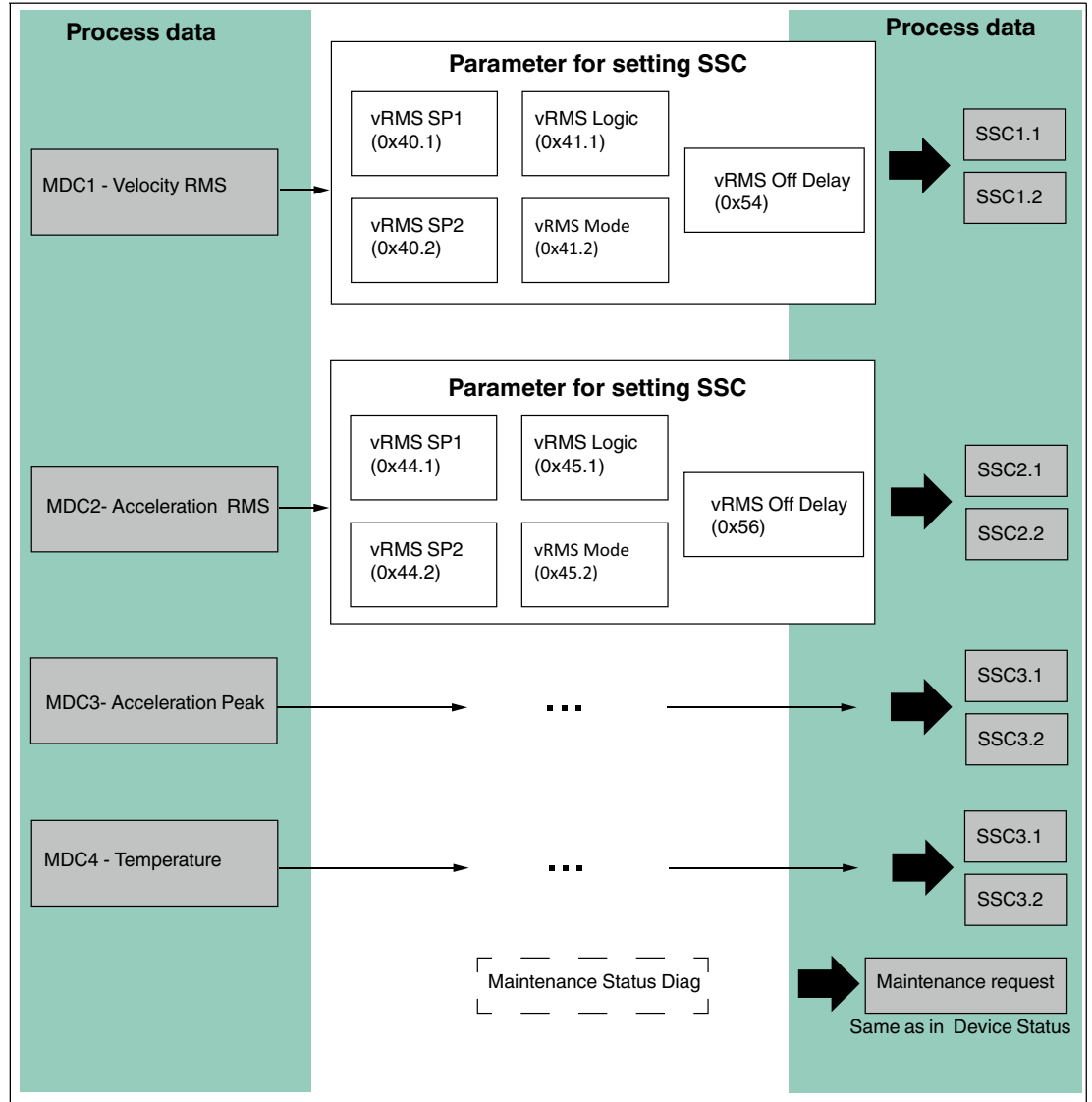


Figure 7.2

For example, the SCC1.1 switching signal can be used to monitor the vibration velocity "Velocity RMS." Two independent measured value limits (SP1 and SP2) can be set for monitoring a measurement range. This mode can also be used to switch between monitoring a measurement range and monitoring an individual point. You can use "Off Delay" to set a delay time for how long the measured value limit can be minimally exceeded before the switching signal responds. This is done to prevent the SSCx switching signal from switching back and forth.

This concept is implemented for each SSCx. The appropriate parameters are available and can be set independently of each other.

## 7.2 Parameterizing a Plant Maintenance Cycle

A plant maintenance cycle can be parameterized by defining the monitored threshold values that correspond to the measured variables of the cyclic process data. The threshold values are independent of the SSCx switch points from the process data. For example, a plant maintenance cycle can be defined by exceeding the vRMS vibration velocity thresholds.

The figure below illustrates the relationships:

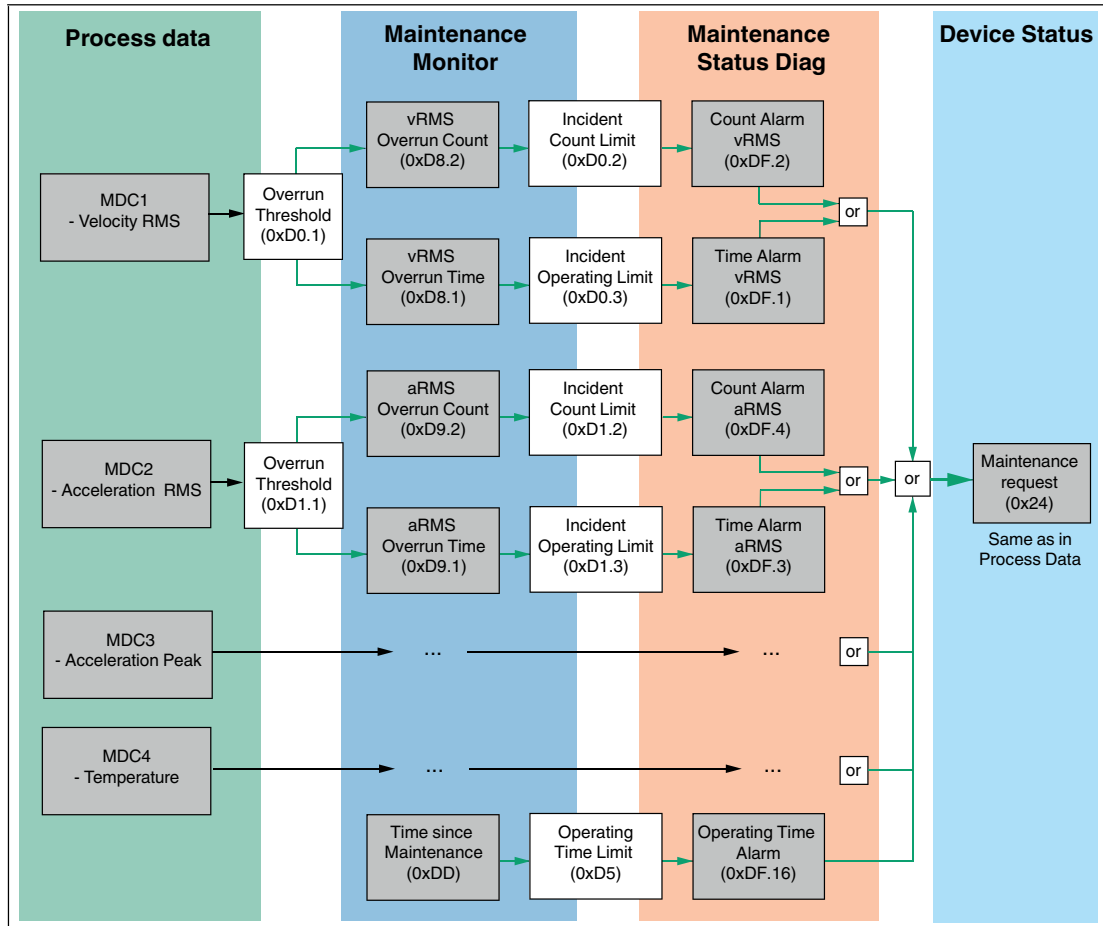


Figure 7.3

When parameterizing a plant maintenance cycle, e.g., using the vRMS vibration velocity, a threshold value is defined in the "Overrun Threshold" parameter. If the set threshold is exceeded, both a counter and a timer are incremented. The counter totals how often the process data measured value has exceeded the "Overrun Threshold." The timer totals how long the process data measured value was above the "Overrun Threshold."

Threshold values for limiting the value of the counter and timer can also be defined. As soon as one of these limits is exceeded, this triggers the binary information "Count Alarm vRMS" or "Time Alarm vRMS." Once an alarm parameter is triggered, the device status is changed to "Maintenance request," which triggers the "Maintenance request" bit in the process data. This concept for triggering the device status to "Maintenance request" can be applied to each available measured variable. An "Overrun Counter" and "Overrun Timer" are therefore available for each measured variable. The sum of these parameters is described as "Maintenance Monitor."

A binary "Count Alarm" and a binary "Time Alarm" are therefore available for each measured variable. The sum of these parameters is described as "Maintenance Status Diag." In addition, triggering based purely on time is possible with "Time since Maintenance." Once maintenance has been successfully carried out on the plant, the "Maintenance Reset" command can be executed on the device. This command only resets all "Maintenance Monitor" and "Maintenance Status Diag" parameters back to zero and a new plant maintenance cycle can begin.

## 8 Troubleshooting

### 8.1 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, 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	Remedy
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 the corresponding vibration behavior should be estimated/monitored.
No IO-Link connection to vibration sensor	The C/Q communication port on the sensor is not connected to the IO-Link master. The data connection between the PC (PACTware), IO-Link master, and the sensor is not working.	Make sure the C/Q communication port is connected to the IO-Link master. Restart PACTware if necessary.
	No voltage supply	Check whether there is a reason for the absence of the voltage supply, e.g., a faulty fuse. Switch on the voltage supply.

Table 8.1

## 9 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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## Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

## Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

### Pepperl+Fuchs Quality

Download our latest policy here:

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