



Technical information
Starterkit IO-Link sensor VVB
ZZ0809

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Preliminary note

You will find detailed instructions, technical data, approvals and further information using the QR code on the individual devices / packaging or at www.ifm.com.

Items supplied starter kit

- VVB001 vibration sensor
- AL1350 IO-Link master
- EIO330 IO-Link Bluetooth adapter
- moneo configure free– parameter setting software
- E80121 Plug-in power supply unit with M12 connection
- EVC924 connection cable
- EVC041 connection cable



Vibration sensor VVB: experience condition monitoring via IO-Link

Application area

The starter kit is used for condition monitoring for motors of fans, pumps and other simple machines. It contains all the necessary components, is easy to implement and protects your machines from damage.

Advantages

- Automated monitoring with real-time indicators for impact, fatigue, friction and temperature.
- Recording of the actual machine running time using the vibration characteristic value v-RMS.
- Seamless integration via IO-Link directly into the Industrial Ethernet systems.
- Use of the existing control network for process control and real-time maintenance.
- No control cabinets or extensive cable routing required.

Important characteristic values in condition monitoring

v-RMS - the vibration severity

The RMS value of the vibration velocity shows what level of energy is acting on the machine. An increase in the characteristic value can have the following causes

- Increased imbalance due to deposits
- Loosening (loose machine parts, bearings with increased play)
- Misalignment

It is the most common characteristic value in vibration monitoring and is standardised in ISO 10816.

Further characteristic values in detail

Bearing damage, rubbing processes, friction or cavitation generate high-frequency vibrations, especially at an early stage of damage. These vibrations are not covered by the frequency range described in the ISO. Only when the damage is already far advanced will the v-RMS also increase due to increased unbalance or play in the bearings.

For a predictive, condition-based maintenance approach, further characteristic values are therefore necessary.

a-Peak / a-RMS

These characteristic values of the acceleration (a) correspond to an early warning system, which are not covered by the average vibration velocity.

The increase in the characteristic value a-RMS, which usually detects increased friction, can have the following causes:

- Poor lubrication
- Contamination in the oil

The increase of the characteristic value a-peak can have the following causes and leads to "shocks".

- Damage to the raceways or rolling elements of the bearings

These high-frequency vibrations can be measured and evaluated by the acceleration parameters a-RMS and a-Peak.

Temperature

Temperature arises in rotating parts due to friction. In addition, this characteristic value can be an indication of electrical problems.

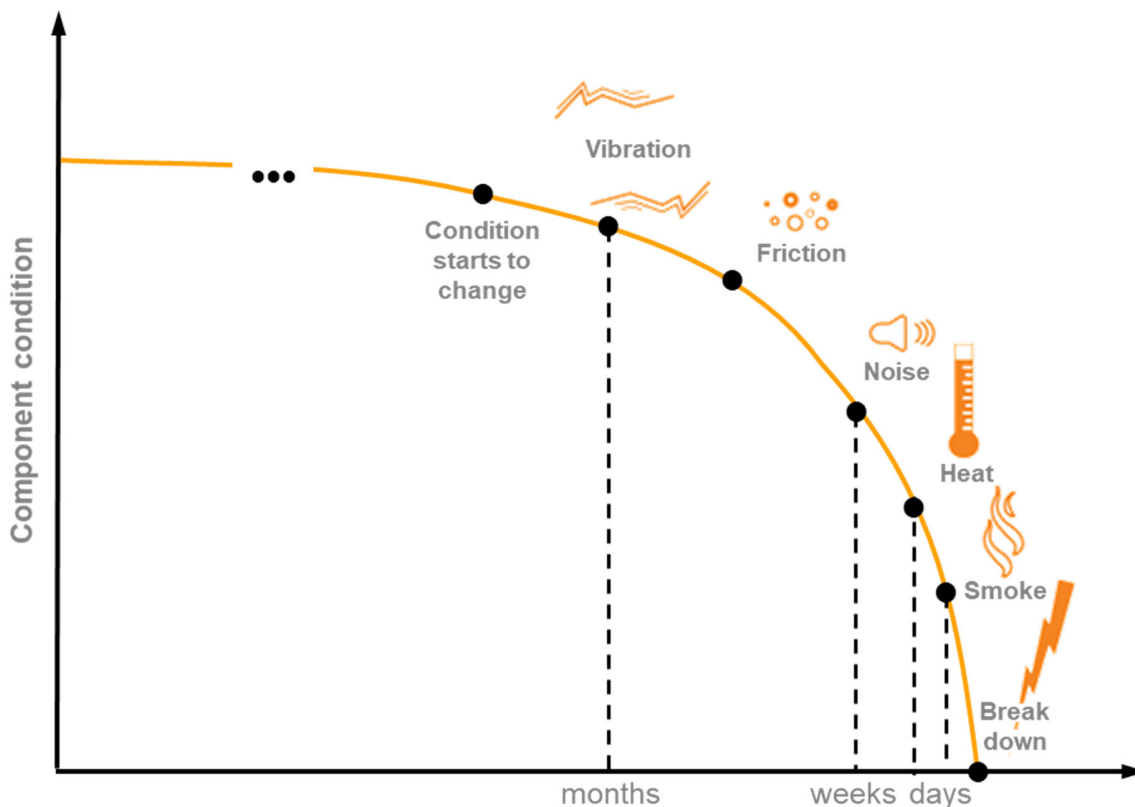
The temperature rise is the measure of energy loss and increased wear.

Crest factor

The crest factor is a dimensionless characteristic value without a physical unit. This is defined as the quotient of the peak value and the RMS: $CF = \frac{a-Peak}{a-RMS}$

The crest factor enables the transfer of knowledge from measuring point to measuring point or from machine to machine.

Let us take the life cycle of a rolling element bearing as an example



Normal operation rolling element bearing

All characteristic values of the vibration sensor are at a normal level.

Incipient bearing damage

High-frequency acceleration peaks with low energy are produced.

→ The a-peak increases and the mean value of the acceleration a-RMS remains almost constant.

Further course of the damage

As the damage progresses, the acceleration peaks reach their highest value and become more energetic (broader) from this point on.

→ The a-peak remains very high and the a-RMS begins to rise.

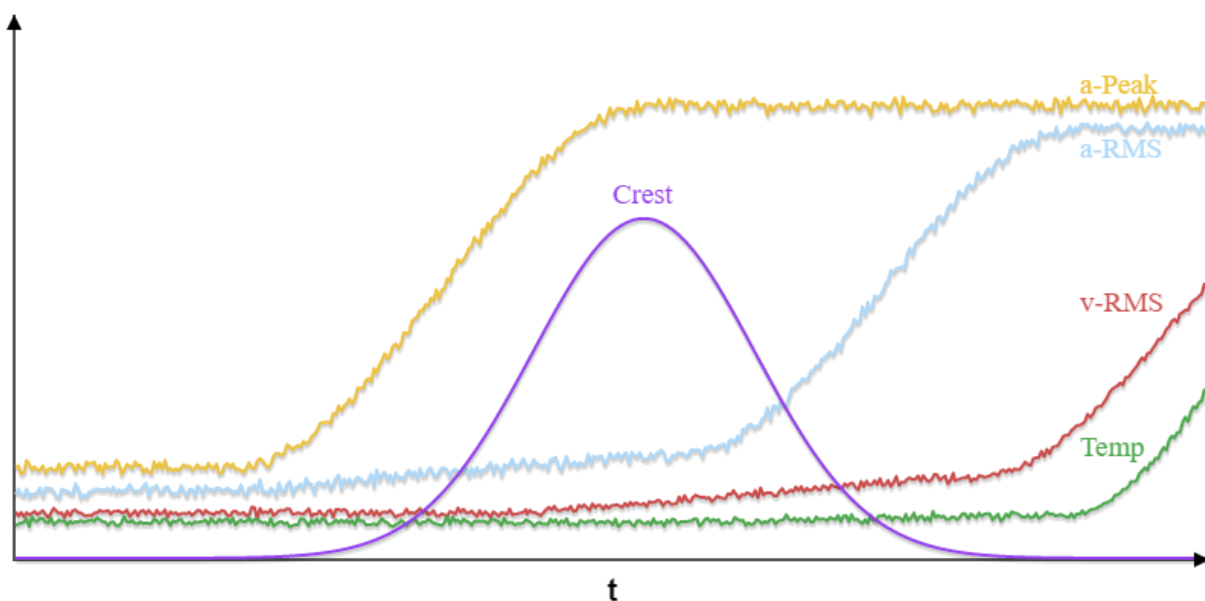
If the damage continues to progress, the ISO value v-RMS will also increase. The bearing has increased play and this unbalance and looseness causes the characteristic value to increase.

Last stage of damage

The rolling element bearing is increasingly becoming a slide bearing.

→ The metallic friction increases more and more, additionally the temperature rises.

The following figure shows the development of the individual characteristic values for progressive bearing damage over time.



Note

The crest factor on a machine with unknown condition can lead to misinterpretation. Since a bearing in the early damage stage leads to a similar value of the crest factor as a heavily damaged rolling element bearing, the crest factor must always be considered in connection with another characteristic value or as a trend.

Root cause analysis for maintenance

Balancing or alignment?

The v-RMS does not indicate which maintenance measure is required. Further analysis is needed here.

For this purpose, the sensor provides the required data without the need for another measuring system. The raw acceleration data can be read out via the IO-Link master and the moneo configure software (file transfer (BLOB)) and can then be analysed via software (e.g. ifm VES004 or moneo RTM-Advanced Vibration Analysis). In addition, the raw data can be triggered via an event at the switching output or the controller.

During the analysis, the frequency pattern can be used to determine the cause and plan the correct maintenance measure.

Test the characteristic values of the condition monitoring in a self-experiment

Connect the sensor according to the diagram on the packaging and connect to the IO-Link Bluetooth plug with the "moneo blue" smartphone app. Switch to the live data display (process values & events) and start the self-test.

1. Hold the sensor in your hand and move it up and down. In this way you approximately simulate an unbalance on the sensor.

Observation

The v-RMS is increased, a-peak and a-RMS are unaffected.

2. Hold the sensor in your hand and rotate with your wrist. In this way you approximately simulate a loosening or misalignment of the sensor.

Observation

The v-RMS is increased, a-peak and a-RMS are unaffected.

3. Hold the sensor in your hand, take a metallic object (screwdriver, wedding ring) and tap rhythmically on the fastening screw of the sensor. Such impacts occur in the event of bearing damage when the rolling elements roll over a pitting (in the case of a cavitating pump or a crash).

Observation

The v-RMS remains low this time, but the a-peak increases significantly and the a-RMS increases a little.

4. Take the sensor and move it back and forth on a rough surface. This is how you simulate increased friction.

Observation

The v-RMS remains low, the a-RMS increases more clearly than with the strokes. The a-peak also reacts clearly.

5. Hold the sensor in your hand and warm it up.
Metallic friction and electrical faults cause heating. At the desk, the sensor will show a higher temperature value due to its own heating and due to the lack of heat dissipation.

Observation

6. All characteristic values of the vibration are unchanged, the temperature increases.

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ifm electronic gmbh • Friedrichstraße 1 • 45128 Essen • Germany