ifm condition monitoring Webinar - Part 1

Wednesday 07 October

14H00 PM

Condition Monitoring - Part 1

New IO Link Vibration sensor with Temperature Monitoring - Easy implementation

Business Development Manager Condition Monitoring

Ralph White

Presenter

New Business Development Manager

Johan van Niekerk

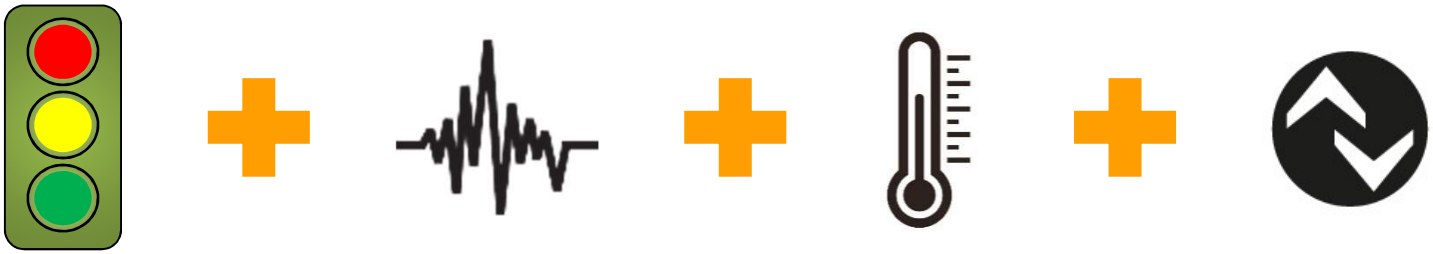
Host

Condition Monitoring – IO Link

VVBxxx Accelerometer range with temperature monitoring

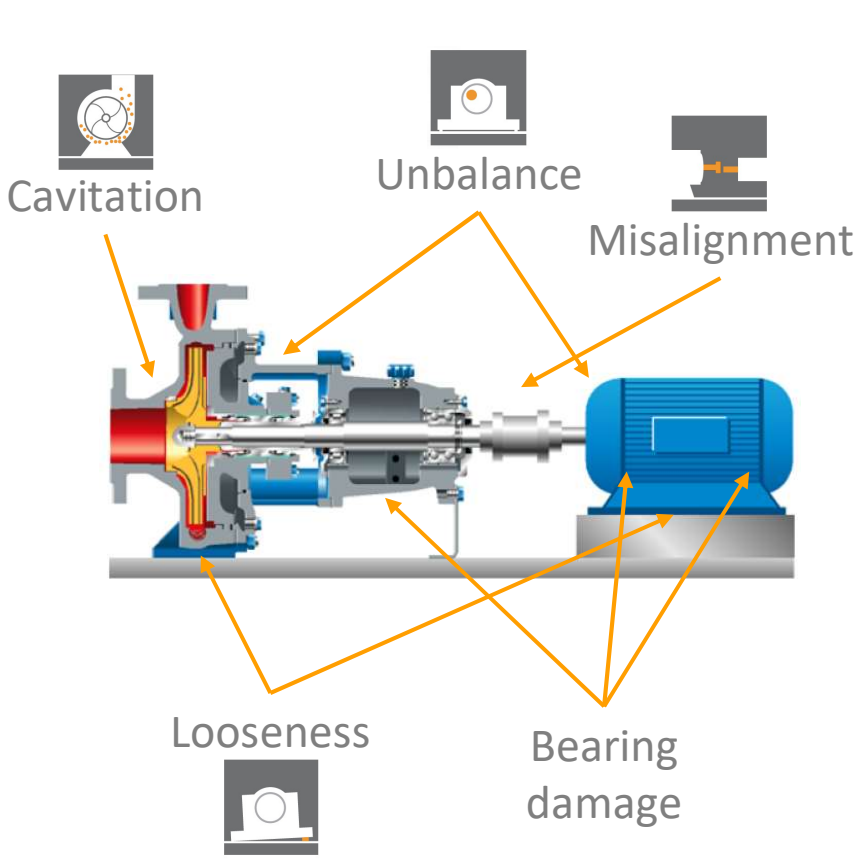
Product group text here

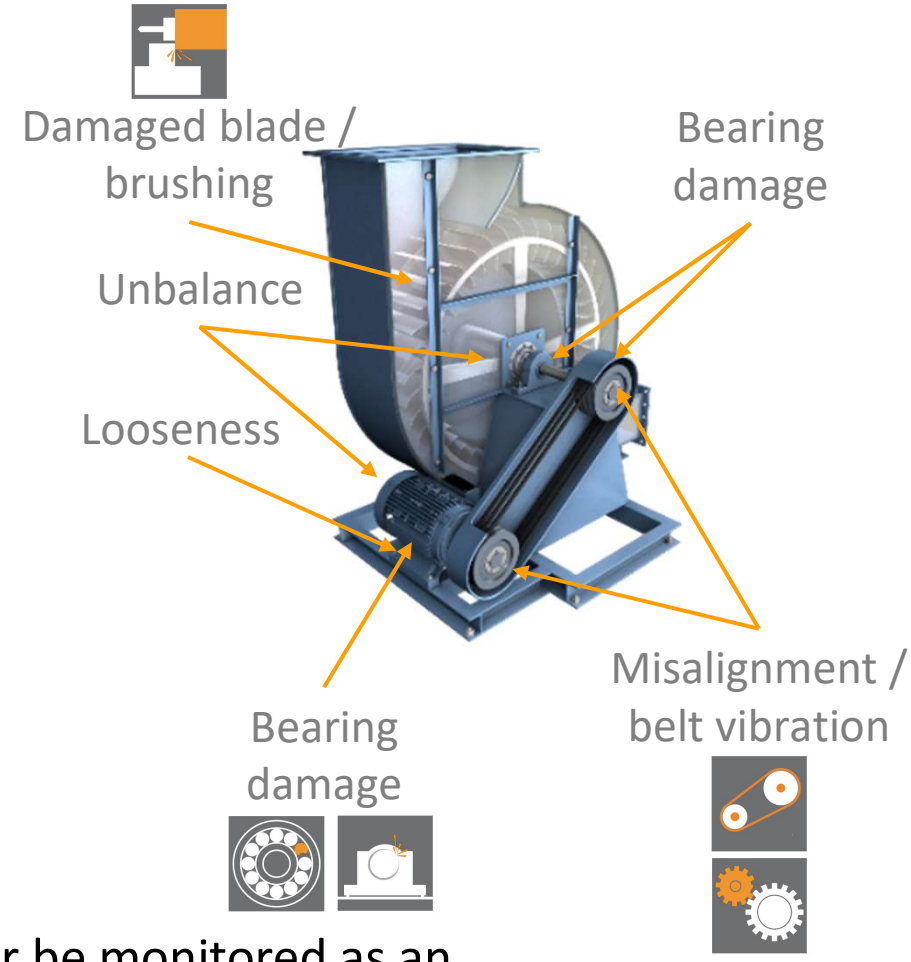
Condition Monitoring with IO-Link



IO-Link – An easy wiring solution

What can machines tell us?





These measurement objects can either be monitored as an

- overall vibration (broadband frequency)
- or a diagnosis (frequency-selective)

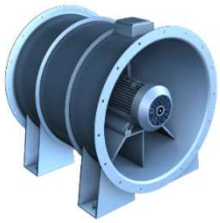
Machine Classification

We distinguish between these machine types based on vibration behavior:

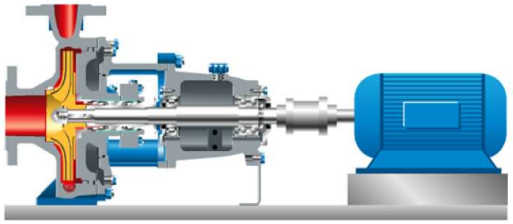
- **Type 1: simple machines**
  - Predominately construction-based excitation (C-forces)
- **Type 2: process machines**
  - Predominately process-based excitation (P-forces)
- **Types 3a/b/c: complex machines**
  - High vibration (high C- and P-forces)
  - Variable operation
  - Low-speed machines and multiple-shaft drives (gearboxes)

VVB Applications: Type 1 - Simple Machines

- Fans



- Pumps



- Motor

Why vibration measurement with IO Link?

- Simple solutions for simple machines
- Simple monitoring approach:
  - Is there something vibrating, rattling or rubbing?
- IO-Link is an interface for:
  - Y-path communication for parametrization and process value transmission
  - Various process values for vibration and temperature
  - Diagnostic functions
- Reduced wiring installation using connections to IO-Link masters in the field

VVB Features

Parameters:
Component fatigue (v-RMS)
Mechanical rubbing (a-RMS)
Mechanical impact (a-Peak)
Crest-factor (a-Peak/a-RMS)
Temperature

Connection:
M12 standard

Outputs:
2 digital switch outputs
IO-Link

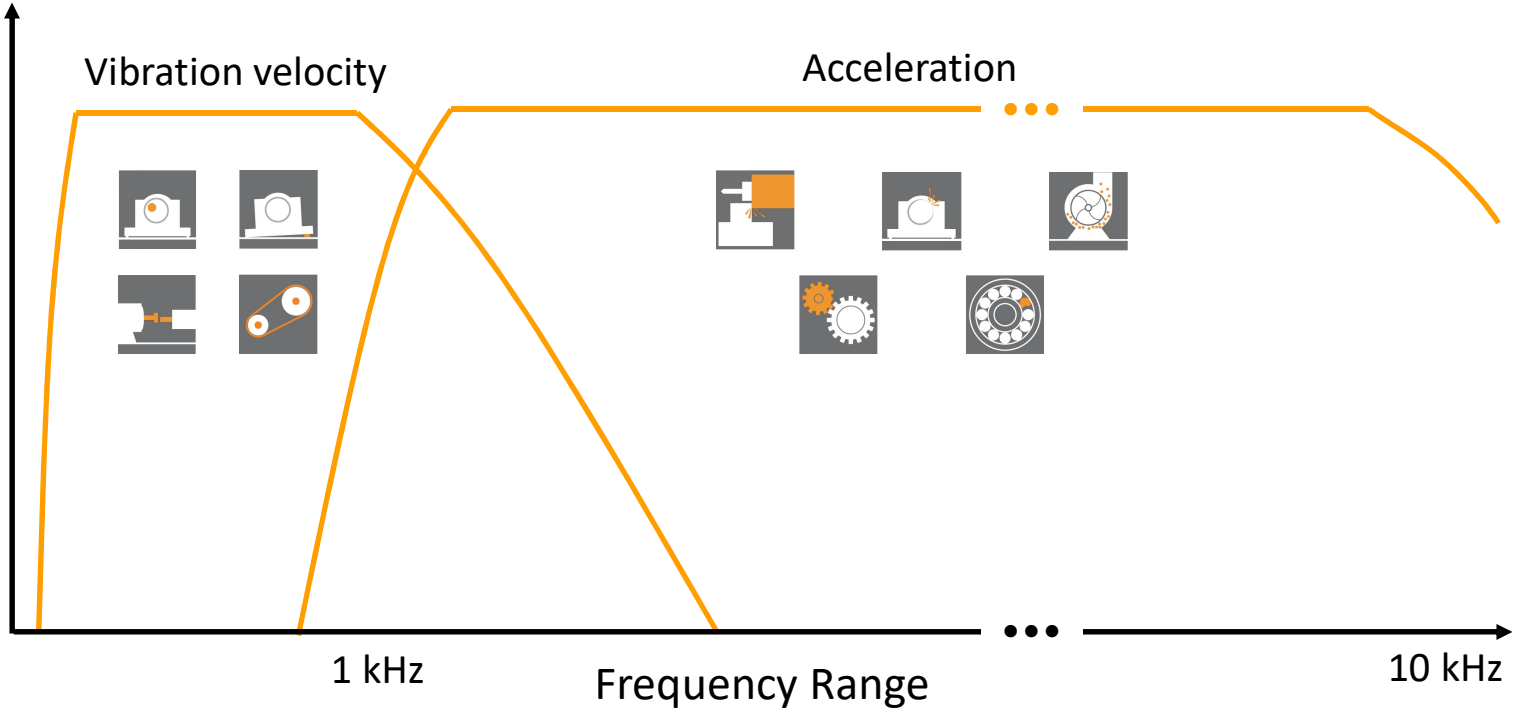
Additional function:
Raw data for analysis via
IO-Link (BLOB)

Protection class:
IP 69k

Mounting:
Grub screw concept
-> M8 and ¼“

Vibration Velocity & Acceleration

Measured quantity	Useable bandwidth	Physical reference	Application	Machines
Vibration velocity	2/10 – 1,000 Hz	Kinetic energy & fatigue	Machine vibrations, ISO10816, etc.	All machine types
Acceleration	0.1 – 10,000 Hz	Dynamic & Shock forces	Mechanical wear, bearing noises, flow noises, cavitation, crash & shocks	All machine types, Structures, etc.

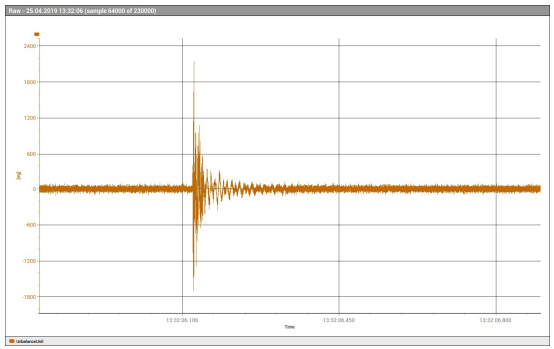


v-RMS -> *“Is anything vibrating?“*

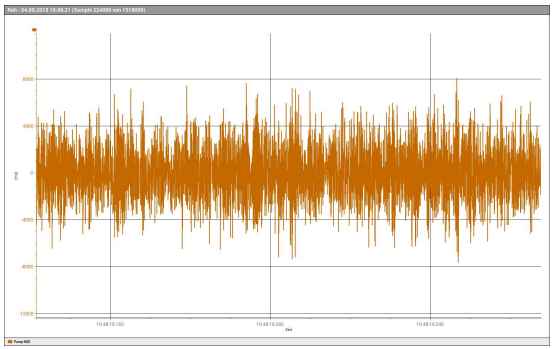
- Monitoring of all stationary forces
- No differentiation between C-, P- and F-forces
- Overall vibration or vibration intensity is compared against a limit value in order to:
  - Protect the machine (e.g. prevent fan from bouncing around on it’s mountings)
  - Avoid or reduce consequential damage
  - Extend the lifetime of the machine
  - Optimise the machine’s operating point
- These are characteristic values of standards, such as:
  - ISO 10816 / 20816
  - ISO 14694

a-RMS -> *“Is anything rubbing?”*

- Monitoring of the root mean square (rms) value of acceleration
  - Transient (one-time event): e.g. in the case of crash monitoring the amplitude will be less than that of the peak reading
  - Permanent vibration: e.g. in the case of lubricant issues or rubbing machine components and glands, etc.
- By using filters, data can be more easily attributed to a certain phenomenon and differentiated from disturbances
  - See IO-Link parameter filters



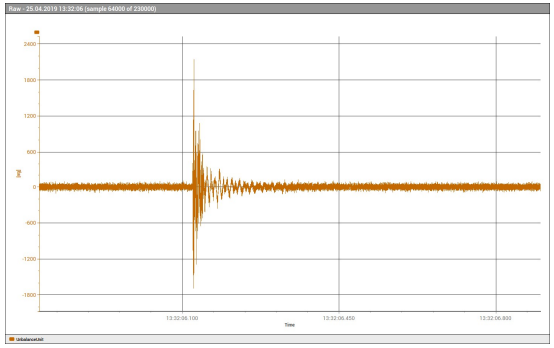
Crash



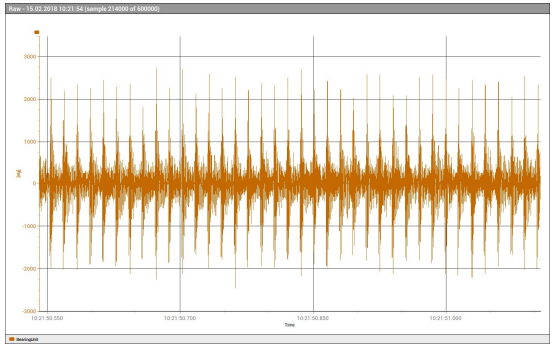
Lubrication / Rub

a-Peak -> *“Is anything rattling?“*

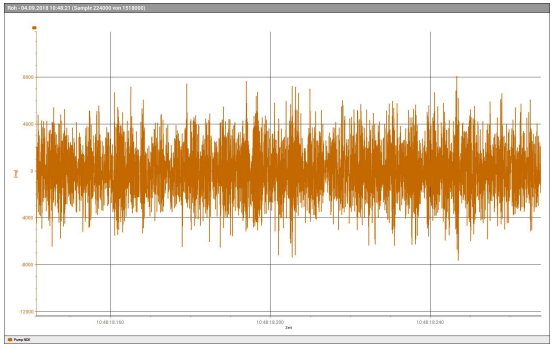
- Monitoring of the maximum acceleration
  - Transient (one-time event): e.g. in the case of crash monitoring
  - Periodic: e.g. in the case of a bearing damage
  - Random: e.g. in the case of cavitation
- By using filters, data can be more easily attributed to a certain phenomenon and differentiated from disturbances
  - See IO-Link parameter filters



Crash



Bearing damage



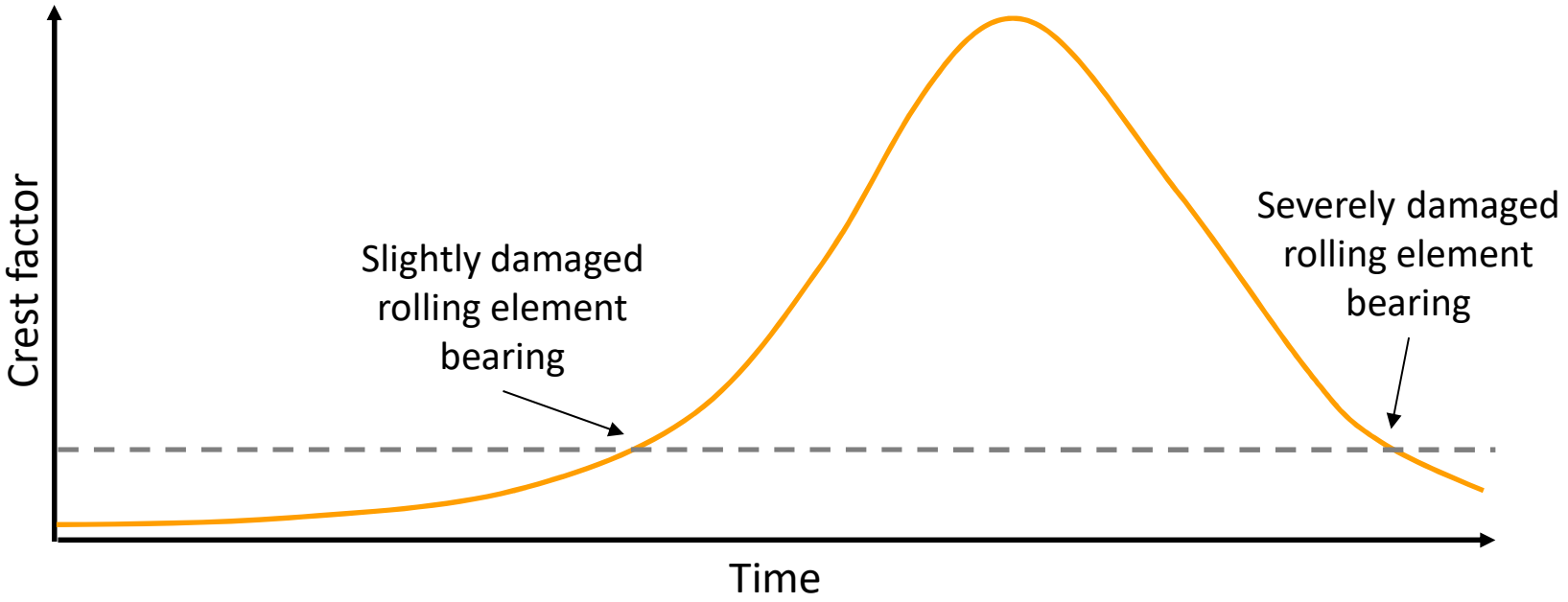
Cavitation

Crest factor

- The crest factor is defined as the ratio between the Peak value and the RMS value: $Crest\ Factor = \frac{a-Peak}{a-RMS}$
- The Crest Factor is a characteristic value in vibration technology meant to filter out the influence of rotational speed (rpm) on vibration behaviour
- The higher the speed, the higher the RMS and Peak values will be. Thus, the ratio between them remains the same. However, if the bearing condition deteriorates, the Crest Factor will increase
- The Crest Factor can however be a bit tricky:
  - a-RMS & a-Peak **low** → crest is **low**
  - a-RMS & a-Peak **high** → crest is **low**
  - In older machines, it can therefore be difficult to define the actual scenario (Are both low or both high?)

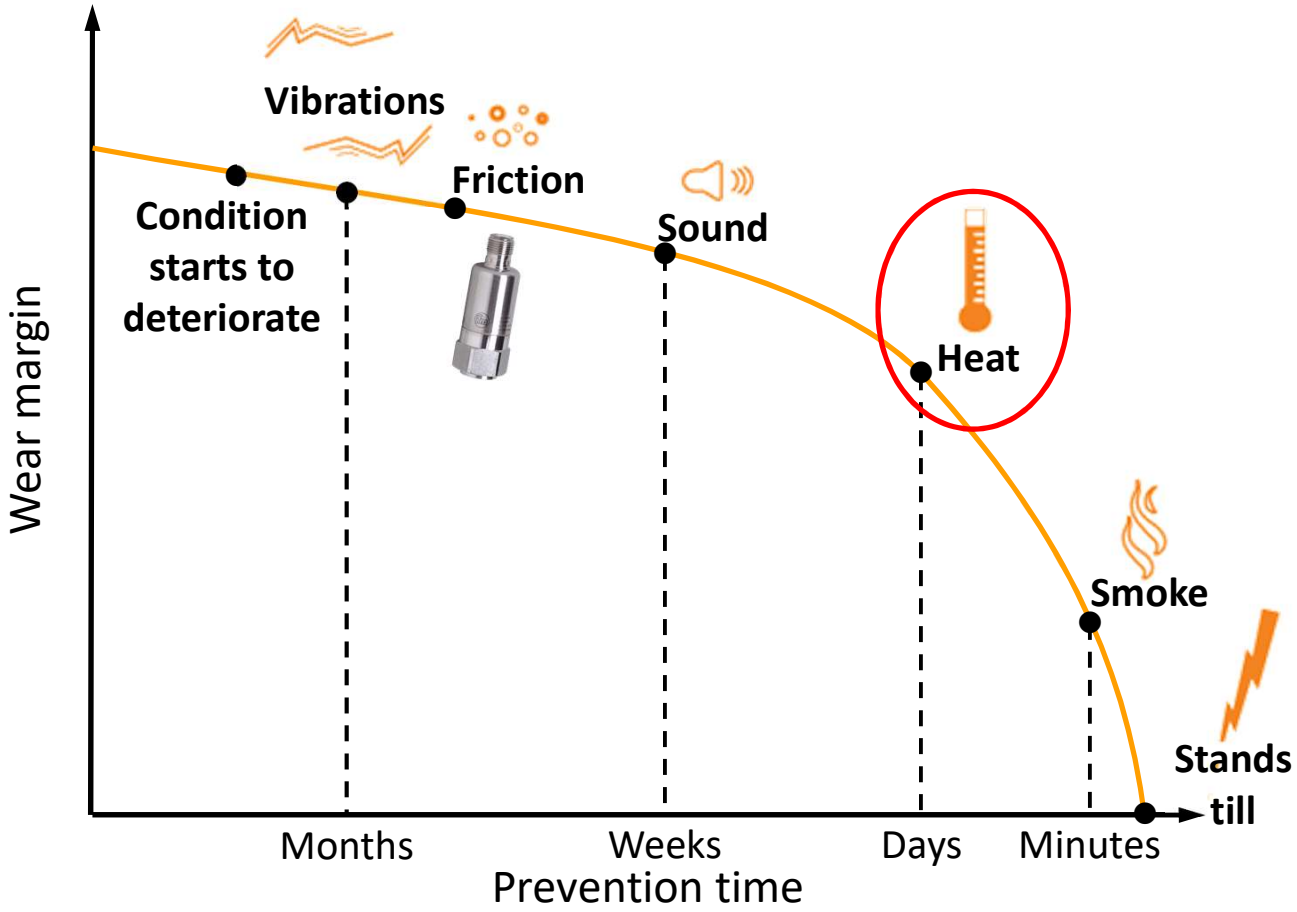
Crest Factor and bearing condition

- Trend development example:



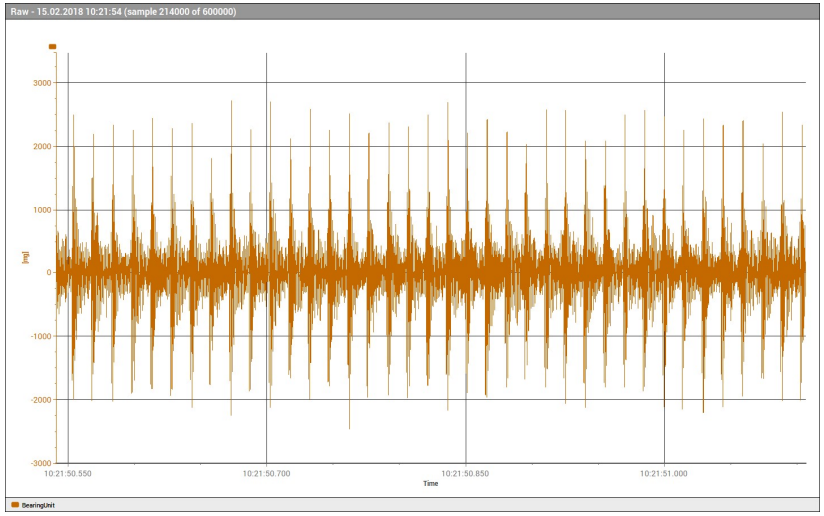
Temperature

- "Typical" development of a machine breakdown



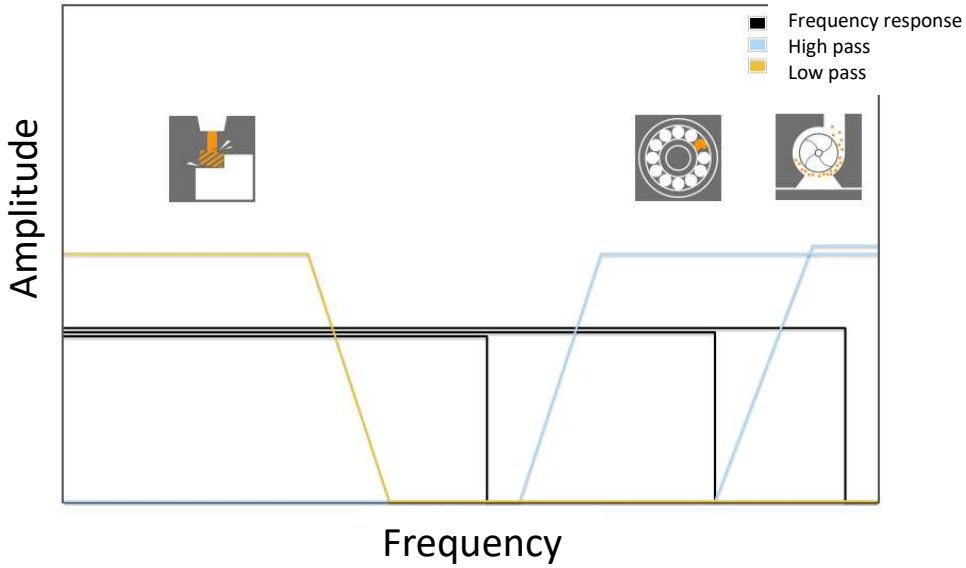
Raw data as BLOB

- Asynchronous read out of raw data
  - Upon the command to record, 4 seconds of raw data is saved to the device
  - The data is then transferred in the binary format (BLOB – Binary Large Object)
  - The data can then be handled in Smart Observer (SMOB) and imported into VES004 software for analysis



IO-Link parameter filter

- Filters can help you optimise your monitoring
- Acceleration filters with bandwidth according to applications:
  - Low pass -> crash detection
  - Band pass -> 3…5 kHz -> lubrication / bearing condition
  - High pass -> 5 kHz -> bearing condition
  - Vibration velocity: filter according to standard such as ISO10816
    - 2…1000 Hz for machine speeds between 120…600 rpm
    - 10…1000 Hz for machine speeds above 600 rpm

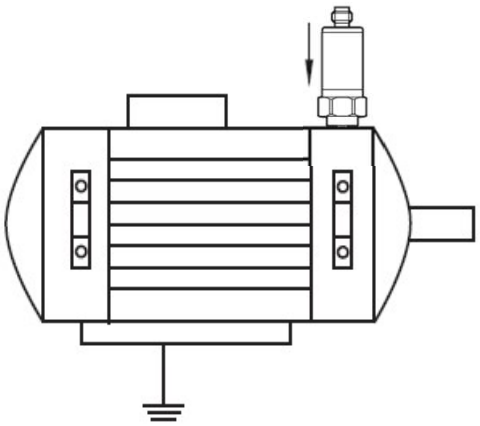


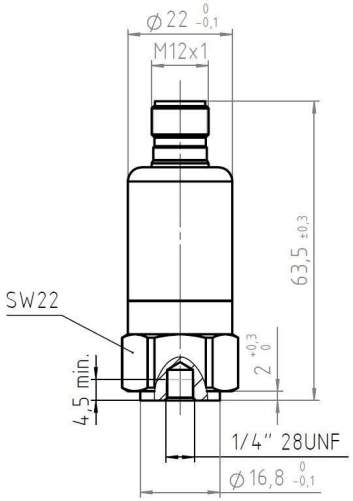
General IO-Link functions

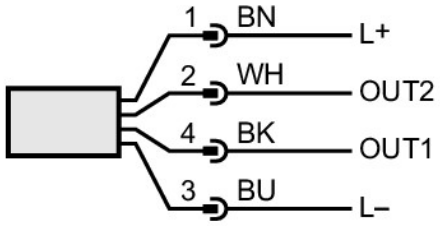
- Self-test of the MEMS measuring cell
- Internally stored values
  - Highest values of all 4 vibration process values
  - Highest and Lowest temperature values
- Event-Bits
  - Device status
  - Alarm status
  - Over-range of measuring range
  - Hardware and parameter errors

Dimensions / Connection / Mounting

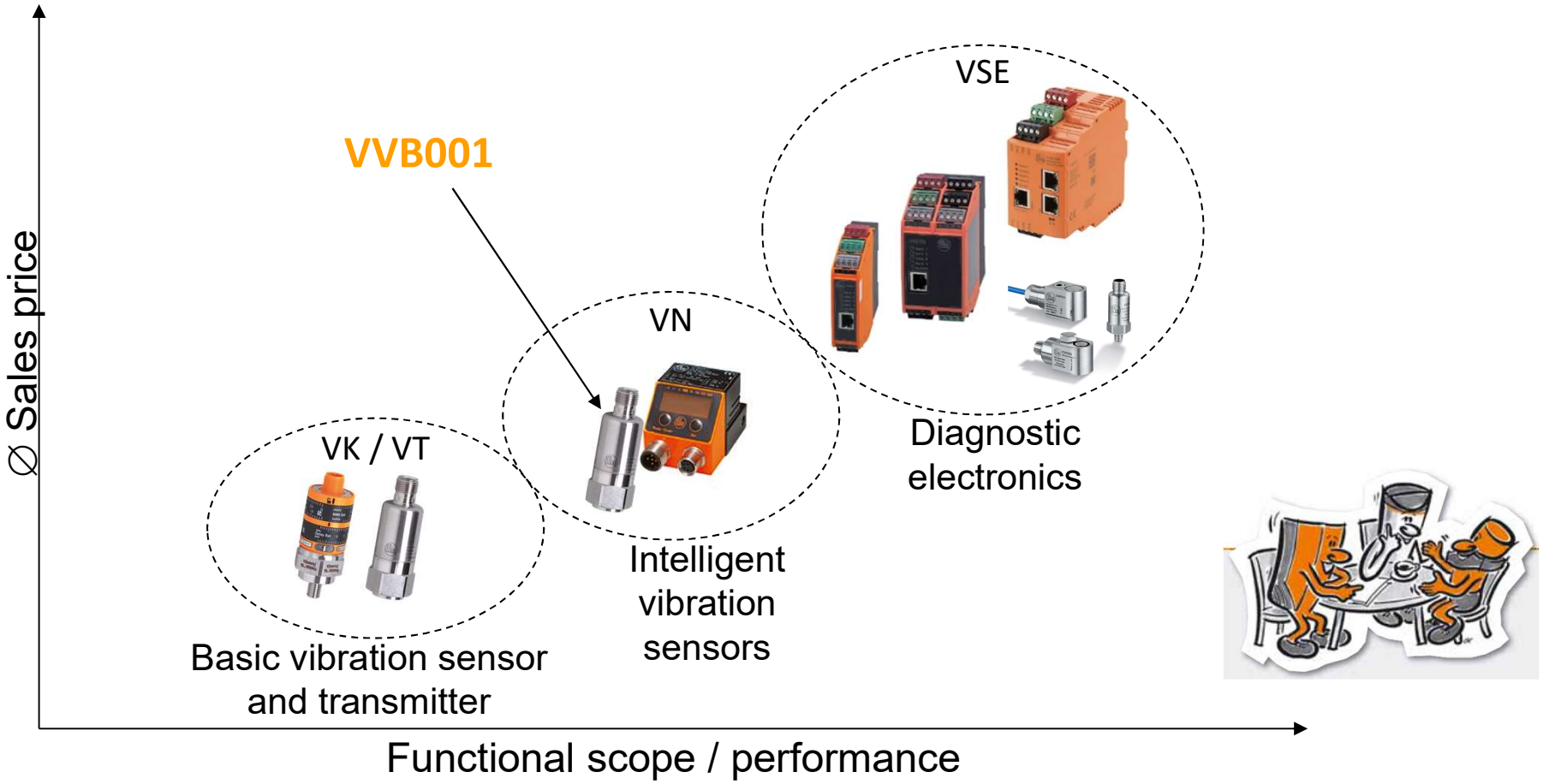
- Bolts to a rigid part of the machine
- Usually, the measurement direction is in a radial direction to the shaft (with the exception of thrust bearings)
- The distance between the sensor and the monitored object is intended to not be more than about 500 mm
- For low-speed applications (< 120 rpm) special care must be taken to mount the sensor in the load zone of the bearing



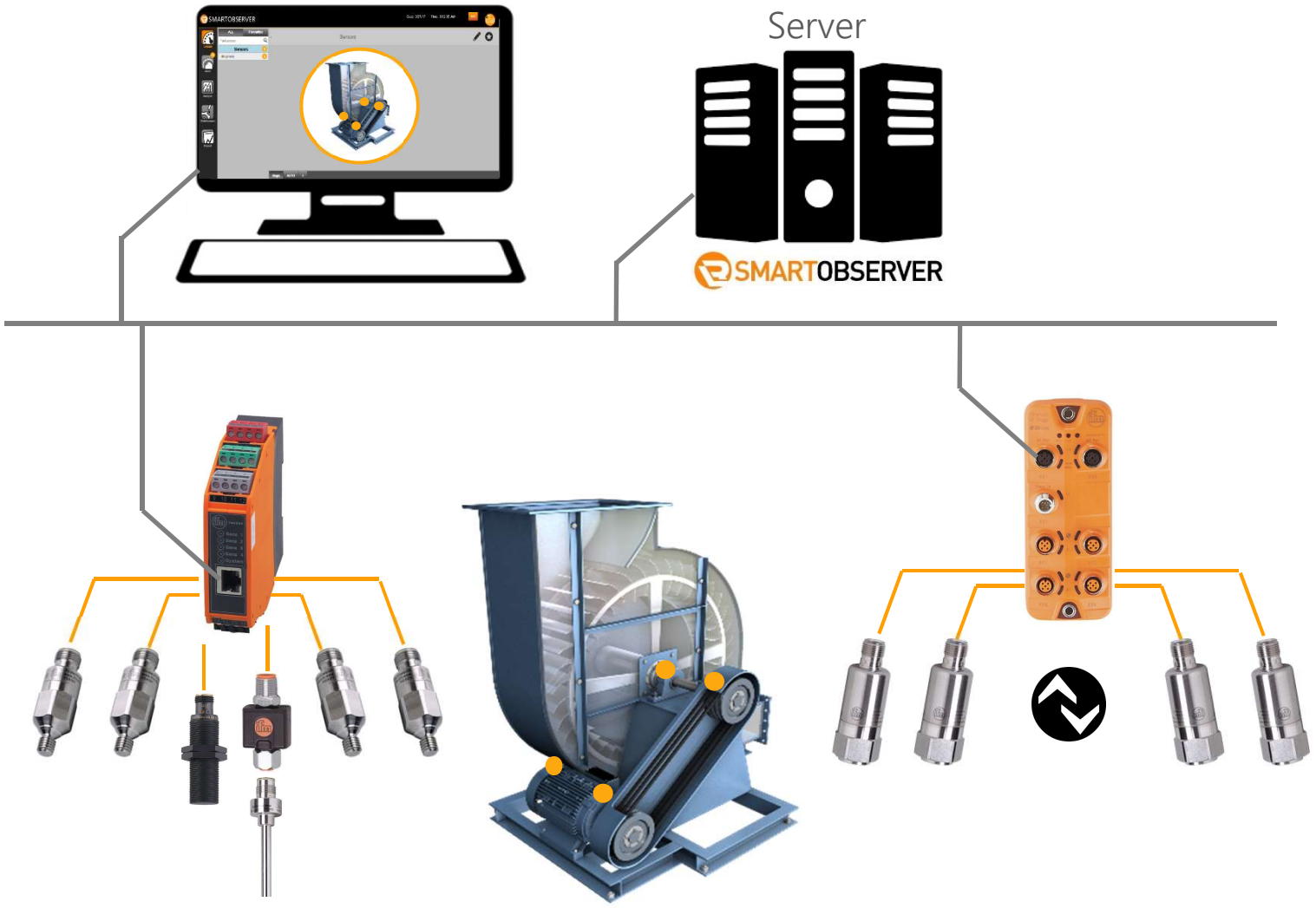




VVB positioning in portfolio



System comparison for 4 measurement points



Questions
&
Answers ?

Webinar Schedule

14 October 2020:

Condition Monitoring - Part 2 new IO Link Vibration sensor with Temperature Monitoring, machine classification

28 October 2020:

PMD Profiler for object profile checking - Round Table Discussion

11 November 2020:

ifm Cooling Circuit Innovative Solutions

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