From vibration monitoring to Industry 4.0

Systems for condition monitoring of machines

www.ifm.com/us
Systems for vibration monitoring – the optimum solution for every requirement
Early detection of potential faults and their causes on the basis of individual vibration characteristics and other influencing factors.  

Monitoring of overall vibration according to ISO 10816. Detect resulting damage at an early stage, avoiding consequential damage and increasing life spans.  

Avoid damage to machine components, tools or workpieces via permanent monitoring and very short response times. The integration into the PLC makes it possible to adjust the vibration monitoring to the process of the machine or the plant.  

The ifm group of companies: our own development and production with high quality standard. The detection and integrated evaluation of vibration signals serves as a basis for the seamless integration of online condition monitoring into manufacturer-independent automation and control systems.
Vibration monitoring – detect damage at an early stage and avoid consequential costs

Simple: Monitoring of the overall status of the machine.

Standardized: Compliant to ISO 10816.

Reliable: Protection against machine damage.

Flexible: Easy integration in the application.

Reliable: Increase of uptime.

Looseness, unbalance

Misalignment

Monitor vibration velocity
The vibration sensor VK monitors online the overall vibration condition of machines and plants according to ISO 10816. The sensor measures the rms vibration velocity on a non-rotating component surface and triggers an alarm if the machine vibrations are too strong.

Detect unbalance and shocks in time.
Machine vibrations can quickly exceed a permissible level due to unbalance, misalignment or bearing damage. The result: unexpected failures and shorter lifetime. With the VN sensor vibrations and shocks are continuously detected, indicated and documented.
Why vibration monitoring?
Every machine generates vibrations during operation. These vibrations can quickly exceed a permissible level due to e.g. unbalance, misalignment or resonances. An increase in the oscillation amplitude has a negative effect on the machine condition. The result: unexpected failures and shorter lifetime.

Solution with efector octavis:
The overall vibration velocity is used in industry standards to evaluate the status of the complete machine. ISO 10816 categorizes machines and recommends limit values for the strain caused by vibrations. efector octavis monitors if the permissible degree of machine vibrations is exceeded. If damage is detected at an early stage, the affected components can be replaced and consequential damage can be avoided.

Basic vibration transmitter type VT
Simple transmitter function, 4...20 mA.

Basic vibration sensor type VK
Switching output and transmitter function. Response delay to avoid triggering at startup.

Intelligent vibration sensors type VN
4-digit alphanumeric display with color change, integrated history memory with real-time clock, analog and switching output or 2 switching outputs.

Acceleration sensors type VSA / VSP
Robust acceleration sensors type VSA or VSP (or intrinsically safe VSP0xA) for connection to the VSE diagnostic electronics.

Diagnostic electronics type VSE
4-channel diagnostic module with additional process value inputs, integrated history memory, networking possible.

Monitor up to 4 measurement points.
With the sensor type VSA / VSP machine vibrations can also be measured at inaccessible places. Up to 4 measuring points can be monitored and documented with the diagnostic electronics type VSE. The Ethernet and fieldbus interfaces simplify networking and remote diagnostics.
Condition monitoring – increase availability, reduce maintenance costs, quality assurance

Reliable:
Permanent condition monitoring of critical machines.

Anticipate:
Machine diagnosis for early damage detection and avoidance of serious consequential damage.

Optimize:
Maintenance actions can be planned.

Long life:
Make optimum use of the residual life of components.

Economical:
Make production processes transparent – meet TCO (total cost of ownership) concepts.

Counter:
Counter function for measurement of times of exposure and for production based on key indicators.

Vibration diagnosis on a mixing tool.
Unplanned standstills of critical machines cause huge cost. Permanent condition monitoring of the whole plant makes it possible to act with foresight and to optimize the process.

Machine protection and remote maintenance.
The monitoring of wind power gear boxes or pumps in the water supply concerning wear and stress makes it possible for the operator to organize efficient maintenance. Alarm outputs serve to protect the system, to trigger remote maintenance and to facilitate targeted analysis.
Why condition monitoring?
Condition monitoring enables early detection of arising machine damage. So, maintenance can be planned and the residual life of important components can be used accordingly.
Vibrations that influence quality can be detected automatically in order to avoid reject parts.
Counters can be used to determine production variables (operating hours, production hours, good/bad parts, reject rate,...) and factors influencing the components’ lifetime (shock, time of exposure to increased amplitudes, temperature, power, rotational speed,...).

Solution with efector octavis.
eforcer octavis is a vibration monitoring solution which not only detects vibration data, but also carries out signal analysis and machine diagnosis directly on the machine.
The machine condition is determined locally and transferred to the controller / process control level via alarms or as condition values. In addition, the unit features an onboard memory to store the trend history of all diagnostic characteristics.

Intelligent vibration sensors type VN
On board display, history storage for documentation, for rotating machines > 120 rpm.

Acceleration sensors type VSA / VSP
Different types, also for mounting in difficult to access areas. Various measuring ranges with voltage output (100 mV/g) or current loop (0...10 mA). Connection to the VSE diagnostic electronics.

Intrinsically safe acceleration sensor type VSP0xA
For the measurement of vibration in hazardous areas. Connection to the VSE diagnostic electronics installed outside the ATEX zone via a barrier.

Diagnostic electronics type VSE
4-channel diagnostic module with additional process value inputs, integrated history memory, networking possible.

ifm systems for condition monitoring of machines:
Systems for measurement of oil quality complete the solutions for online condition monitoring.
ifm also offers software tools for configuration, visualization and data recording.
Machine protection and process monitoring – reduce rejects and consequential damage

**Dynamic:**
Monitoring of dynamic forces, e.g. in milling processes.

**Fast:**
Response times of 1 ms.

**Reliable:**
Machine, tools and workpieces are protected against expensive consequential damage.

**Preventive:**
Early condition monitoring avoids unplanned failures.

**Integrated:**
Direct connection to the machine control via a fieldbus interface.

Detect unusual vibrations.
The micromechanical acceleration sensor type VSA is screwed into the housing of the spindle and detects even the most subtle changes of the vibration behaviour. The sensor withstands even fast movements and high forces without problems.
Why machine protection and process monitoring?
Faulty settings and process parameters or wrong tools can lead to crash situations between components and tool spindle, to high strain of the spindle (increased wear) or to bad quality. This results in high consequential costs, a shortened lifetime and rejects.

Solution with efector octavis:
The permanent measurement and evaluation of different vibration characteristics enables ideal monitoring and diagnostics of the tool spindle.

Based on the dynamic increase in power, crash situations are detected in time and displayed. The switching output can react to the crash within a millisecond in order to minimize or even avoid consequential damage.

The integration of the vibration monitoring into the machine control via the fieldbus interface enables an ideal adjustment of the evaluation (adjustment of the alarm thresholds, suppression of characteristic values that cannot be evaluated during processing, e.g. spindle bearing) to the current operating status of the machine.

Avoid consequential damage to machine tools.
Changes in the cutting forces such as caused by blunt drilling machines or swarf jam are detected on the basis of the changed vibration characteristics. Each tool can be assigned individual tolerance limits e.g. a warning and switch-off threshold. Damage to the workpiece is reliably prevented.
## Systems for vibration monitoring – suitable products for all applications

<table>
<thead>
<tr>
<th>Basic Vibration sensors and transmitters</th>
<th>Vibration sensors and transmitters for permanent monitoring of the overall vibration condition of machines and plants to ISO 10816. The sensors measure the rms vibration velocity on a non-rotating component surface.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent vibration sensors</td>
<td>The compact vibration sensor type VN monitors the overall vibration condition of machines and plants to ISO 10816. It is characterized by easy parameter setting and a local display. Configuration software is not a necessity.</td>
</tr>
<tr>
<td>Diagnostic electronics</td>
<td>6-channel diagnostic system for the evaluation of dynamic signals (e.g. acceleration) and analog inputs. Flexible, detailed monitoring and analysis. Ethernet TCP/IP and fieldbus interface (only VSE15x) for connection to and integration into a higher-level system / the PLC.</td>
</tr>
<tr>
<td>Acceleration sensors</td>
<td>Acceleration sensors measure the dynamic forces at the machine surface and deliver the raw signal for a downstream vibration monitoring or vibration diagnostics e.g. in the diagnostic electronics type VSE.</td>
</tr>
<tr>
<td>Software and accessories</td>
<td>The software VES004 is used for the parameter setting and the online data monitoring of all intelligent vibration sensors and diagnostic electronics. The ifm OPC server software can be used for the connection of the vibration diagnostics to higher-level systems (SCADA, MES, ERP).</td>
</tr>
</tbody>
</table>
OPC is a standard for manufacturer-independent communication in automation technology; it offers high flexibility and an easy implementation.

The ifm software SMARTOBROWSER is a software with many functions for online visualisation, storage and analysis of measured values with the purpose of monitoring the condition of machines and plants. Besides mounting adapters ifm offers an extensive range of connection technology (e.g. cordsets, Y cables) for different operating conditions as accessories.

<table>
<thead>
<tr>
<th>Type</th>
<th>Analog output</th>
<th>Switching output</th>
<th>Fieldbus interface</th>
<th>History Function</th>
<th>Network capability TCP/IP</th>
<th>Signal Inputs e.g., temperature</th>
<th>Diagnostics</th>
<th>Counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT</td>
<td>✓</td>
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<tr>
<td>VK</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>VN</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
<td>VSE002</td>
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<td>VSE100</td>
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<tr>
<td>VSE15x</td>
<td>✓</td>
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<tr>
<td>VSA</td>
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<tr>
<td>VSP</td>
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</tbody>
</table>
### Basic vibration sensor and transmitter

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>List price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration sensor to ISO 10816; RM velocity 10…1000 Hz, analog output 4…20 mA, switching output PNP, response delay and switch point adjustable via setting rings, measuring ranges 0…25 / 0…50 mm/s</td>
<td>VKV021</td>
<td>$245.00</td>
</tr>
<tr>
<td>Vibration sensor to ISO 10816, 10…1000 Hz RM velocity, analog output 4…20 mA, measuring ranges 0…50 / 0…25 / 0…25 mm/s, use in hazardous areas (type VTV12A)</td>
<td>VKV022</td>
<td>$245.00</td>
</tr>
<tr>
<td>Vibration transmitter to ISO 10816, RM velocity, analog output 4…20 mA, measuring ranges 0…25 mm/s</td>
<td>VTV121</td>
<td>$261.00</td>
</tr>
<tr>
<td>Vibration transmitter to ISO 10816, 2/10…1000 Hz RM velocity; measuring range 0…25 mm/s, external input 4…20 mA / 4…20 mA or VNA001 acceleration sensor</td>
<td>VTV122</td>
<td>$267.00</td>
</tr>
<tr>
<td>Vibration sensor to ISO 10816, 2 digital outputs or 1 analog output and 1 digital output, history memory with real-time clock, 4-digit alphanumeric display, data interface USB; RM S velocity 10…1000 Hz, analog output 4…20 mA,</td>
<td>VTV12A</td>
<td>$352.00</td>
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</tbody>
</table>

### Diagnostic electronics

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>List price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic electronics for evaluation of dynamic signals, e.g., of acceleration sensors type VSA / VSP; panel mounted; frequency-selective machine monitoring of up to 4 measuring points; TCP/IP Ethernet interface; integrated history memory with real-time clock; 2 digital outputs or 1 analog and 1 digital output; counter function; further interfaces: - / 8 digital inputs/outputs / PROFINET/IO interface</td>
<td>VSE002</td>
<td>$684.00</td>
</tr>
<tr>
<td>Vibration sensor to ISO 10816, RM velocity, analog output 4…20 mA, measuring ranges 0…25 mm/s, use in hazardous areas (type VTV12A)</td>
<td>VSE100</td>
<td>$881.00</td>
</tr>
<tr>
<td>Vibration sensor to ISO 10816, 2 digital outputs or 1 analog output and 1 digital output, history memory with real-time clock, 4-digit alphanumeric display, data interface USB; RM S velocity 10…1000 Hz, analog output 4…20 mA,</td>
<td>VSE150</td>
<td>$975.00</td>
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</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>List price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conical washer, 5 pcs., mounting accessories for acceleration sensors type VSA001, VSA101, VSA201, VNA001</td>
<td>E30115</td>
<td>$19.00</td>
</tr>
<tr>
<td>PEEK adapter, mounting accessories for electrical insulation of the sensor, for acceleration sensors type VSA001, VSA101, VSA201, VNA001</td>
<td>E30132</td>
<td>$23.00</td>
</tr>
<tr>
<td>Safety barrier for acceleration sensors type VSP01A, VSP02A</td>
<td>ZB0633</td>
<td>$154.00</td>
</tr>
<tr>
<td>Acceleration sensor for connection to vibration sensor type VN</td>
<td>VNA001</td>
<td>$156.00</td>
</tr>
<tr>
<td>Y cable for vibration sensor type VN</td>
<td>E12405</td>
<td>$31.00</td>
</tr>
<tr>
<td>USB cable for vibration sensor type VN</td>
<td>E30136</td>
<td>$41.00</td>
</tr>
<tr>
<td>Protective cover for vibration sensor type VK</td>
<td>E30094</td>
<td>$9.00</td>
</tr>
<tr>
<td>Cross-over patch cable for diagnostic electronics type VSE, 2 m / 5 m</td>
<td>EC2080</td>
<td>$19.00</td>
</tr>
<tr>
<td>Cordset for acceleration sensors type VSA / VSP, M12, straight, PUR cable, shielded, 5 m / 30 m</td>
<td>EVC527</td>
<td>$24.00</td>
</tr>
<tr>
<td>Cordset for acceleration sensors type VSA / VSP, M12, angled, PUR cable, shielded, 20 m</td>
<td>EVC561</td>
<td>$98.00</td>
</tr>
<tr>
<td>Y cable for vibration sensor type VN</td>
<td>E12405</td>
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<td>$19.00</td>
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<tr>
<td>Cordset for acceleration sensors type VSA / VSP, M12, straight, PUR cable, shielded, 5 m / 30 m</td>
<td>EVC527</td>
<td>$24.00</td>
</tr>
<tr>
<td>Cordset for acceleration sensors type VSA / VSP, M12, angled, PUR cable, shielded, 20 m</td>
<td>EVC561</td>
<td>$98.00</td>
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### Intelligent vibration sensors

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</tr>
</thead>
<tbody>
<tr>
<td>Vibration sensor to ISO 10816, 2 switching outputs or 1 switching output and 1 analog output, history memory with real-time clock, 4-digit alphanumeric display, data interface USB; RM S velocity 10…1000 Hz, analog output 4…20 mA,</td>
<td>VNB001</td>
<td>$483.00</td>
</tr>
<tr>
<td>Vibration sensor to ISO 10816, 2 digital outputs or 1 analog output and 1 digital output, history memory with real-time clock, 4-digit alphanumeric display, data interface USB; RM S velocity 10…1000 Hz, analog output 4…20 mA,</td>
<td>VNB211</td>
<td>$536.00</td>
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</table>

### Acceleration sensors

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<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>List price</th>
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</thead>
<tbody>
<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…6000 Hz, measuring range ± 25 g / ± 250 g</td>
<td>VSA001</td>
<td>$156.00</td>
</tr>
<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…10,000 Hz, measuring range ± 3.3 g</td>
<td>VSA101</td>
<td>$156.00</td>
</tr>
<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…10,000 Hz, measuring range ± 3.3 g</td>
<td>VSA002</td>
<td>$234.00</td>
</tr>
<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…10,000 Hz, measuring range ± 3.3 g</td>
<td>VSA004</td>
<td>$234.00</td>
</tr>
<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…10,000 Hz, measuring range ± 3.3 g</td>
<td>VSA005</td>
<td>$248.00</td>
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<tr>
<td>Acceleration sensor for connection to diagnostic electronics type VSE, MEMS, frequency range 0…10,000 Hz, measuring range ± 3.3 g</td>
<td>VSA006</td>
<td>$283.00</td>
</tr>
<tr>
<td>Acceleration sensor for use in hazardous areas, group II category 1D/1G, connection via safety barrier, 100 mV/g; frequency range 2…10,000 Hz, measuring range ± 50 g</td>
<td>VSP01A</td>
<td>$491.00</td>
</tr>
<tr>
<td>Acceleration sensor for use in hazardous areas, group II category 1D/1G, connection via safety barrier, 100 mV/g; frequency range 2…10,000 Hz, measuring range ± 50 g</td>
<td>VSP01B</td>
<td>$491.00</td>
</tr>
</tbody>
</table>

### Software

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
<th>List price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter setting software for diagnostic electronics type VSE and vibration sensor type VNB</td>
<td>VES004</td>
<td>–</td>
</tr>
<tr>
<td>OPC server software (OPC DA) for diagnostic electronics type VSE002 and VSE100, licence depending on the number of connections 25 / 50 / 75 / 100 / 1000</td>
<td>VOS001</td>
<td>$490.00</td>
</tr>
</tbody>
</table>
Systems for vibration monitoring – from sensor to ERP

Process control level

- MES
- SCADA
- CMMS

Network (LAN)

- OPC server software
  - VOS00x*
  - Operating and parameter setting software
  - VES004

- Operating and parameter setting software
  - VES004

- Fieldbus

- PLC

- Analog and switching signals

- Vibration sensor VKxxxx
- Vibration transmitter VTVxxx
- Vibration sensor VNBxxx

- Acceleration sensors VSAxxx / VSPxxx
- Zener Barrier

- Temperature sensor TRxxxx

- Compressed air consumption meter SDxxxx

- Diagnostic electronics VSE15x
- Diagnostic electronics VSE002 / VSE100

- ATEX

*not compatible with VSE15x
You can count on our service team to be a reliable partner. That means easy order placement and knowledgeable technical support. Your time is too valuable to waste.

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Cylinder sensors
Photoelectric sensors
Vision sensors
Capacitive sensors
Safety sensors
Pressure sensors
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Temperature sensors
Level sensors
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Power supplies
AS-i bus system
Safety-at-Work
Identification products
Cable assemblies
Mobile controls

ifm people. The ifm team of employees is committed to helping you succeed in your business. We directly service and work with over 20,000 customers in the US.

ifm products. For over 45 years, ifm has developed, manufactured, and marketed sensors to industries that include assembly and robotics, automotive, material handling, packaging, metal forming, plastics, and food and beverage. We offer a complete family of position sensors, fluid sensors, diagnostic systems, networking products, and wiring solutions.

Quality. There can be no compromise in the quality and reliability of sensors that are applied in your production facility. The ifm new product development process incorporates specific testing for sensors and controls to withstand environments with shock and vibration, electrical noise and temperature fluctuations.

Investment in R&D. Developing new products that increase uptime and productivity is a core belief of our company. We apply practical innovation to simplify technology and develop products that can have a positive impact on your production process.

Application know-how. We have over 45 years of experience in working with industrial automation applications. Our knowledgeable team of technical support engineers will work with you to recommend the right solution, the first time.

ifm business philosophy. ifm provides a knowledgeable and courteous service center team to assist with order placement and technical support. We offer an efficient distribution center for accurate and on-time delivery of products. ifm publishes list prices in literature and on our website, and we always stand behind the quality and performance of our products.

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