XS770A Wireless Vibration Sensor

Monitoring vibration to detect an equipment's unusual behavior

This application note explains:

- ✓ Examples of using the XS770A for equipment maintenance
- ✓ Equipment diagnosis with vibration monitoring

Sushi Sensor

Yokogawa's ideal equipment maintenance

To ensure the safety and quality of production, it is important to maintain production equipment appropriately.

Mounted on many instruments, Sushi Sensor uses industrial IoT technology to monitor their status. Sushi Sensor can help perform the following tasks for condition-based maintenance (CBM):

- **Identifying the status of the entire equipment in plant and visualizing its soundness**
- **Monitoring the trends and precisely identifying signs of abnormality**
- **Accumulating digital data of instruments and optimizing equipment maintenance plans**

CBM enables customers to optimize equipment inspection (reducing inspectors' workload and improving safety) and reduce the total cost. Yokogawa helps customers achieve CBM and minimize equipment maintenance costs.

Application example

The XS770A is a wireless vibration sensor that detects signs of abnormality, mainly of rotary equipment. Since its release in March 2018, Yokogawa has received many inquiries and the XS770A has undergone field tests in various industries.

Applications

Application of the XS770A to oil and petrochemical plants is being examined. It is also expected to be used in diverse new fields, such as construction and social infrastructure.

▸Industries from which Yokogawa has received inquiries

Oil, petrochemicals, chemicals, electric power and gas, iron and steel, non-ferrous metals, rubber, pulp and paper, foods and pharmaceuticals, cement, construction, maintenance service, rotary machine vendors, printing and publishing, automobile parts, electrical appliances, IT, social infrastructure (roads, bridges, tunnels)

Explosion protected type:
ATEX Intrinsically safe Approval
IECEx Intrinsically safe (approval under pending)

The target of vibration measuring

Vibration measurement is mainly for rotary equipment. It is also suitable for piping because the flow of fluid causes vibration which may cause problems.

▸Examples of vibration measurement

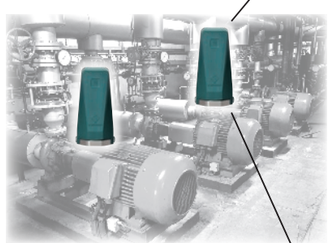
Motors, reducers, bearings, utilities, heat exchangers, cooling towers, mine crushers, expanders, agitators, pumps, centrifugal separators, belt conveyors, cranes, elevators

▸Example of temperature measurement

Piping for hot water circulation, room temperature

Example

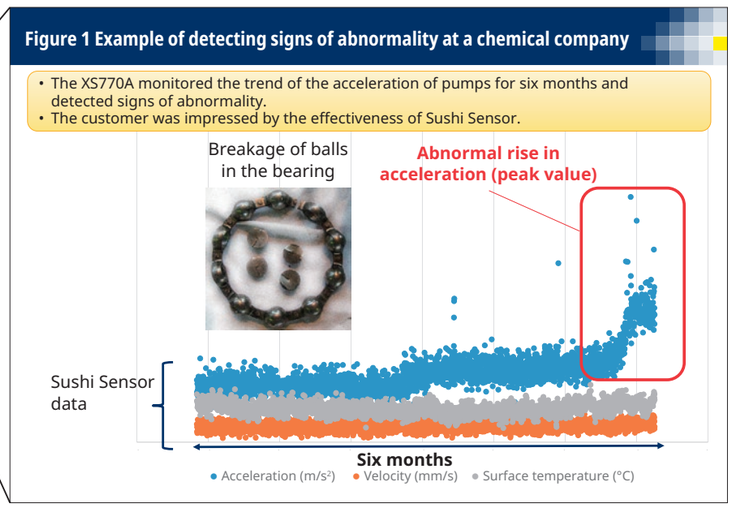
Through hourly measurements, the XS770A detected signs of abnormality in a ball bearing.



The XS770A continuously monitored the acceleration of pumps over six months. Its hourly measurements successfully caught signs of abnormality.

Figure 1 Example of detecting signs of abnormality at a chemical company

- The XS770A monitored the trend of the acceleration of pumps for six months and detected signs of abnormality.
- The customer was impressed by the effectiveness of Sushi Sensor.



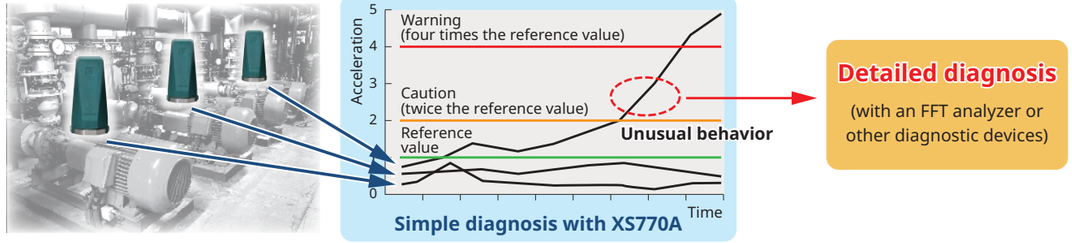
Early detection of abnormality enables maintenance to be performed before any actual failure occurs, preventing unexpected shutdowns that would result in losses.

Equipment diagnosis with vibration monitoring

The XS770A promotes CBM, which requires to grasp any sign of unusual behavior. Thanks to the wireless communication function of the XS770A, operators can remotely monitor the status of equipment.

Simple diagnosis and detailed diagnosis

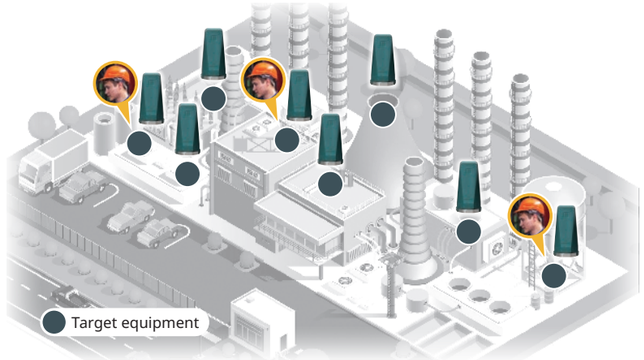
Equipment diagnosis is indispensable for CBM because it is necessary to identify the status of equipment accurately. The figure below shows an example of equipment diagnosis with the XS770A. Conventionally, simple diagnosis is performed in operator rounds to assess whether equipment are operating normally.
When the XS770A detects an unusual behavior in the simple diagnosis, a more detailed diagnosis should be performed with an FFT analyzer or other diagnostic devices.
Ideally, all equipment would be monitored continuously, but in practice monitoring is limited in scope due to costs and installation conditions. Since the XS770A can be easily mounted on rotary equipment, it helps increase the scope of monitoring and reduce the risk of overlooking an unusual behavior.

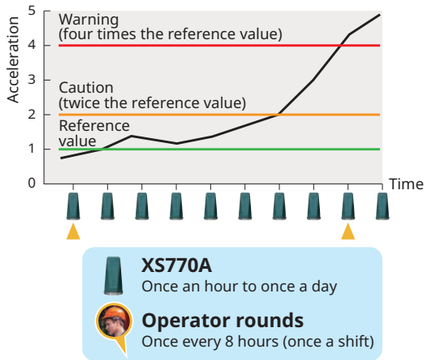


Measurement cycle and measurement point

The objective of simple diagnosis is to detect an unusual behavior. Since this may emerge over several months to several years, measurement once a day is enough to identify the trend. However, a shorter cycle is desirable, and the XS770A monitors equipment typically 24 times a day.

The XS770A is also easy to install and set up, enabling the number of measured objects to be increased without imposing excessive burden on workers. With a shorter measuring cycle and increased number of measurement points, the status of the entire equipment in plant can be grasped and its health visualized.





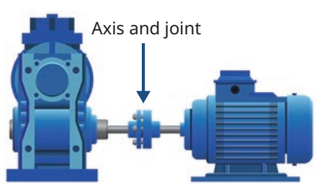
Measurement target and measuring mode

The XS770A has two measuring modes for simple diagnosis of vibration.

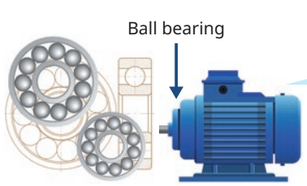
Velocity: For imbalance, misalignment, and a bent axis

Acceleration: For damage to a ball bearing

The XS770A performs continuous monitoring in a suitable mode. When values change, it is assumed that an unusual behavior has occurred. A single XS770A can measure both velocity and acceleration simultaneously.



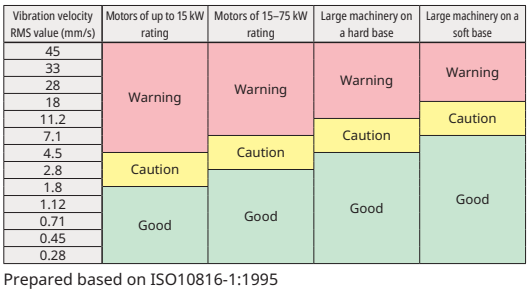
Measuring in speed mode



Measuring in acceleration mode

Q&A

Question	Answer
Why do you measure vibration?	Vibration is a good parameter to identify the deterioration of motors, pumps, and other equipment.
What is revealed by vibration measurement?	Vibration increases as an instrument deteriorates. Quantifying its magnitude helps identify the degree of deterioration.
What can we use the measurement results for?	Maintenance can be performed before any actual failure occurs.
What criteria are used to estimate the need for maintenance?	For example, ISO10816-1:1995 is useful as guideline (Figure 1). Note that there is no absolute standard that applies to all cases because the size of target equipment and the stiffness of mounting bases differ.
In practice, how should we estimate the need for maintenance?	Measure the same place of an instrument continuously and see how much vibration deviates from normal. This method is called relative evaluation (Figure 2), and the XS770A is ideally equipped to implement this method.
Is there any other estimation method?	Compare the vibration of multiple instruments of the same specifications. This method is called mutual evaluation (Figure 3), and can be used when the XS770A is mounted on each instrument.



Prepared based on ISO10816-1:1995

Figure 1 Example of absolute value evaluation

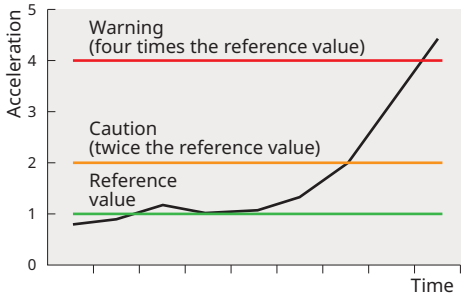


Figure 2 Example of relative evaluation

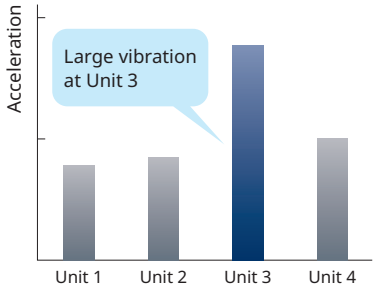


Figure 3 Example of mutual evaluation

What is the difference between simple diagnosis and detailed diagnosis?	When an unusual behavior is detected by simple diagnosis, a detailed diagnosis is performed to identify its cause. It is essential to obtain sufficient evidence to judge whether maintenance is required and when it should be done. Therefore, detailed diagnosis involves elaborate signal processing such as FFT analysis.
Doesn't the XS770A need the FFT analysis function for simple diagnosis?	For simple diagnosis, monitoring the long-term trend of vibration is more effective for detecting an unusual behavior than FFT analysis.
What can we use velocity and acceleration data for?	Velocity data are used for detecting signs of axis imbalance or misalignment. Acceleration data are used for detecting signs of damage in ball bearings. A single XS770A can measure velocity and acceleration simultaneously.

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