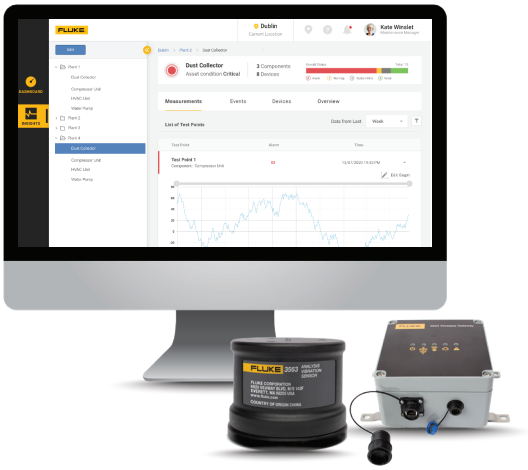
TECHNICAL DATA

FLUKE Reliability

Fluke 3563 Analysis Vibration Sensor

Wireless vibration sensor for machine fault analysis



The Fluke 3563 Analysis Vibration Sensor combines a Piezoelectric high-frequency sensor with advanced software analytics to enable maintenance teams to track and analyze asset vibration readings continuously. It enables the monitoring of an extensive portfolio of production-critical assets.

Vibration data is transmitted wirelessly to the Fluke 3503 Gateway and the cloud via Ethernet or Wi-Fi. The information is viewable in the Live-Asset™ Portal, which displays trending graphs and machine health dashboards. With a single view, you can assess a facility's overall asset health or do a deep dive into the health of a specific asset.

A unique floating architecture, pre-programmed thresholds based on machine type, and alarm notifications combine with the analytical software to identify faults that spur quick action. Early warnings of potential asset malfunction ensure enough time for corrective action before a catastrophic failure. As a result, users are assured 24/7 whether machines are running at high performance, extending their life and reducing operating and maintenance costs.

Using a condition monitoring system in conjunction with this powerful sensor, maintenance teams can build a holistic approach–one that enables them to make decisions and schedule work based on the criticality of the machine and what the data is saying, not just on the calendar.

Rather than dedicating equal time to each asset, condition monitoring systems allow teams to focus on the machines most important to a facility's operations. A maintenance technician or engineer can catch a potential catastrophic failure by continuously monitoring those machines before it occurs.

Key benefits at a glance:

- **Long battery life**

  The Piezo sensor and software combine to produce a unique, smart battery management capability with a user-determined data transmission rate. Users can adjust and extend the sensor battery life while still getting the necessary data.

- **User-friendly experience**

  Users can configure the sensor based on machine type for precise readings without manually entering severity thresholds.

- **Powerful analysis capabilities**

  The Live-Asset™ Portal software application enables users to analyze both banded overall values and narrowband values. With this capability, they can determine the fault causing a problem as well as the root cause of that fault. Users can then evaluate critical next-step actions.

- **Wireless and scalable**

  The wireless gateway possesses dual network connection capabilities—Wi-Fi and Ethernet—so your system can fit your facility.

POWERFUL, HIGH-VALUE ANALYSIS SENSORS

The Fluke 3563 Analysis Vibration Sensor delivers a range of features, from performance tracking to fault analysis.

Leverage pre-defined and customizable thresholds based on machine type to allow your technicians, regardless of experience, to immediately gather insights and take the time-sensitive steps necessary to avoid unplanned downtime.

These powerful, high-value wireless sensors help ensure four essential components of a reliability program:

1. Improved uptime with lower costs;
2. Data collected from the most critical machines;
3. Integration of answers on a common platform shared with everyone on the team;
4. Support from CBM experts to help you start, implement, and maintain your new program.

Simple steps for program success

1. Survey your plant and order initial system components

A little planning and preparation will help you smoothly install the Fluke 3563 Analysis Vibration Sensor. By following the steps in our Deployment Planning Guide, you'll learn how to select your machines and sensor and gateway locations and about your network connectivity options.

2. Follow this simple process for a successful setup

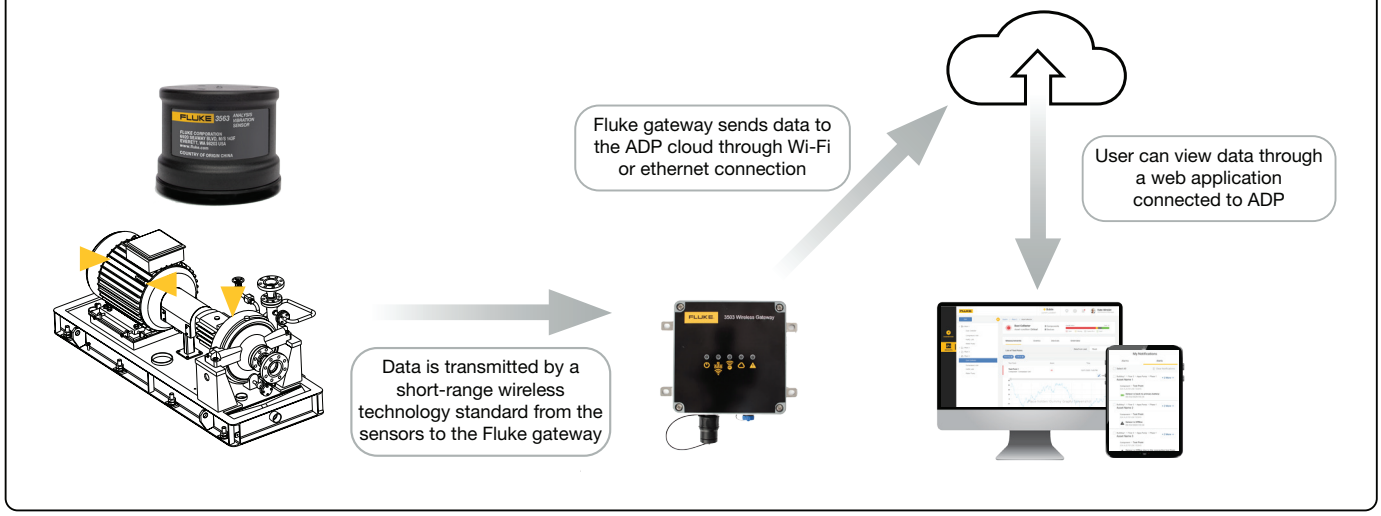
3. Monitor your success and grow the program to cover more assets

Document your saves to get buy-in and support from managers to purchase components for the next implementation phase. This process to start small and grow is a proven method to implement a new program successfully. Remember to use Fluke 3562 Screening Vibration Sensors and Fluke 3563 Analysis Sensors to build a complete condition-based monitoring system.

4. Sustain the reliability program over the years to come

Reliability is a journey, not a destination. Ensure that you continue to document saves and accomplishments and report to upper management so that they will not forget the reason for your success. We need to remind everyone that reliability is an investment in our future, not a cost of doing business.

How the Fluke 3563 works



FLUKE
Reliability

Fluke 3563 Analysis Vibration Sensors

Data Transmission	
Transmission interval	Configurable, minimum default is every 10 minutes
Range	
Frequency range	2 Hz – 10,000 Hz Z (0 Hz – 1,000 Hz X, Y)
Amplitude range	Autorange: +/- 2g, 4g, 16g
Sample range	18.5 – 62.5 kHz
Temperature	
Measurement range	-20°C to 85°C (-4°F to 185°F)
Storage range	-20°C to 85°C (-4°F to 185°F)
Mechanical	
Size	(D x H) 68mm x 53.4mm
Weight	199.5g (145g without batteries)
Ingress protection class	IP67
Shock Limit	5000 g peak
Power	B6 x 3.6 V 1/2 AA Li-SOCI 2 battery Battery life time: At least 1 year (Every 10 minutes overalls / Every 60 minutes 2 sec. TWF)
AD Conversion	24 bit
Wireless communication (sensor to gateway)	
Radio Frequency	2.4 GHz ISM band according to IEEE 802.15.4
Sensor-Gateway Connection	BLE 5.0
Range (line of sight)	100 meters

Fluke 3503 Wireless Gateway

Power supply options	
AC main power	AC input 85-264 VAC, 0.35A/115V, 0.25A / 230V, 47-63 Hz
Power-Over-Ethernet	Compliant with IEEE 802.3af
Wireless communication	
WIFI:	IEEE 802.11 ac/a/b/g/n
WIFI Security:	WPA/WPA2
Ethernet:	10/100/1000 MBits/s
Mechanical	
Ingress protection class	IP67
Temperature	Operation: -30°C to 70°C (-22°F to 158°F) Storage: -40°C to 85°C (-40°F to 185°F)
Size	(L x W x H) 160mm x 160mm x 90mm
Weight	948.5 g

Fluke 3720 and 3721 Mounting Adaptors

Stud-mount	
Size	(D x H) 68mm x 21mm
Weight	187.9 g
Adhesive mount	
Size	(D x H) 68mm x 21mm
Weight	187.9 g

Fluke Corporation
PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. 856-810-2700
In Europe +353 507 9741
In UK +44 117 205 0408
Email: sales@accelix.com
Web access: http://www.accelix.com

APPLICATION NOTE

FLUKE Reliability

Reveal machine fault causes more quickly with the Fluke 3563

Identify the four most common faults faster and easier with the 3563 Analysis Vibration Sensor

Many vibration sensors enable users to screen critical assets to determine overall machine health. The Fluke 3563 Analysis Vibration Sensor is different because it combines sophisticated piezoelectric technology with robust software to analyze a machine's condition versus simply screening for it.

The 3563 Analysis Vibration Sensor provides:

1. A high-frequency, high-resolution piezoelectric sensor for more in-depth vibration readings and early fault detection
2. A LIVE-Asset™ Portal software application where reliability team members review data and determine critical next steps
3. Expert vibration support to ensure easy, low-risk implementation and the ability to jumpstart and expand a condition-based maintenance program

What is vibration analysis?

Vibration analysis is a process for measuring machinery vibration levels and frequencies and using the data to evaluate the health of assets and their components. Every machine component produces a unique vibration signal. Knowing how to recognize if the signal belongs to a particular piece of equipment can be challenging.

The 3563 Analysis Vibration Sensor enables reliability professionals to generate vibration readings quickly, identify various vibration signals, and act on the information early, ultimately preventing downtime.

- Monitors machinery health constantly at fixed intervals
- Isolates a specific fault
- Identifies the component causing the fault
- Determines the fault severity
- Enables analysis and recommended next steps

What's the best way to identify the four most common machine faults?

Nearly 90 percent of machine faults fall into one of four main categories:

- Imbalance
- Misalignment
- Looseness
- Bearing damage

The more effective way to detect these and other machine faults is by using a analysis vibration sensor such as the Fluke 3563.

Why are narrowbands and motor speed critical to identifying faults?

The speed of the motor shaft is the reference for all analyses. A rotating shaft typically causes the most vibration, and the expression "1X" means the vibration is at the same frequency as the running speed of the machine (or one time the motor shaft speed). The device's other components that rotate in sync with the motor speed produce various other peaks in the spectrum.

Conversion Table		
RPM	Orders	Frequency (RPM/60)
1,775	1x	29.6 Hz
3,550	2x	59.2 Hz
5,325	3x	88.8 Hz
10,650	6x	177.6 Hz
35,500	20x	592 Hz

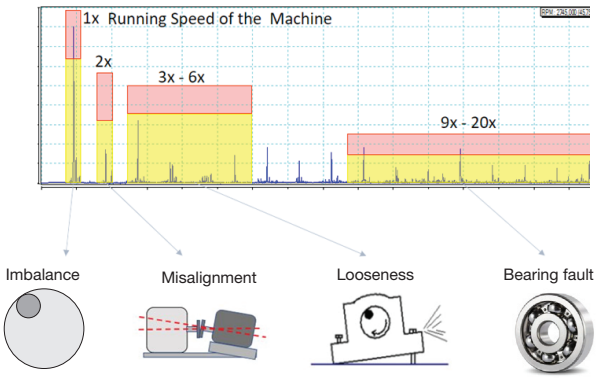
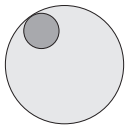
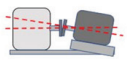
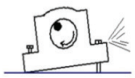


Figure 1. *Depiction of a spectral graphic showing the four most common faults*

A spectrum is a graphical display of the frequencies at which a machine component vibrates. When analyzing vibration data, the first step is to find the significant peaks in the spectrum and associate these peaks with the sources inside the machine.

The 3563 sensor uses narrowband alarming to detect patterns within a particular area of the spectrum, indicating a specific fault, e.g., 1X band = imbalance. Narrowband alarms trigger alerts at particular frequencies and deliver machine diagnostics that offer more precise and insightful information about machine changes.

Below are descriptions, examples, and the fault symptoms for each of the four faults. Having this information helps maintenance teams identify any one of the four common faults within a spectral graph.

Machine fault	Fault description	Example	Fault symptom
Imbalance 	**Imbalance** – This fault happens when the geometric center of a machine shaft and the center of mass do not coincide. A heavy spot on the shaft causes forces in all radial directions, leading to increased wear of bearings, seals, etc.	Forces from the imbalance show up on one shaft only, i.e., the motor shaft.	• High 1X, one shaft only (motor or pump) • All radial directions (not axial)
Misalignment 	**Misalignment** - When two rotating shafts are not parallel to one another, a misalignment occurs. Machine vibration increases with misalignment and can cause defects in other machine components leading to premature machine failure.	Forces from the misalignment show up on both sides of the coupling, i.e., both the motor and the pump shaft.	Angular • High 1X, axial only • Both sides of the coupling Parallel • High 2X, vertical and horizontal • Both sides of the coupling
Looseness 	**Looseness** – This fault can be caused by a structural defect such as a loose anchor bolt holding a motor to a mount or excessive play in rotating elements such as bearings, impellers, etc.	Forces from the looseness show up on one shaft only, i.e., pump shaft.	• Multiples of 1X, one shaft only (motor or pump) • All three directions
Bearing fault 	**Bearing damage** – Rolling element bearings are present in most rotating machines. Their useful life is affected by many factors, including load, running speed, lubrication, assembly, temperature, and external forces caused by misalignment, unbalance, etc. A piezoelectric vibration sensor increases the ability to recognize and identify a bearing defect.	Forces from the bearings show up on one shaft only, i.e., the pump shaft.	• High non-integer peaks (not multiples of shaft speed), one shaft only (motor or pump) • All three directions • First in the high frequency and then in the low frequency

What happens when the 3563 analysis sensor detects a fault?

Because pre-determined threshold levels are built into the software, a reliability professional is automatically notified if a vibration level is breached. Users can view and analyze the vibration data from a smart device, including a PC, mobile phone, or laptop, to determine if a fault exists.

The sequence of events:

1. The 3563 Analysis Vibration Sensor measures machine vibrations and temperature in three different directions.
2. The data is sent to the Fluke gateway and then to the cloud-based LIVE-Asset Portal.
3. A reliability professional analyzes the data, event, and machine condition via a PC, laptop, or mobile phone.

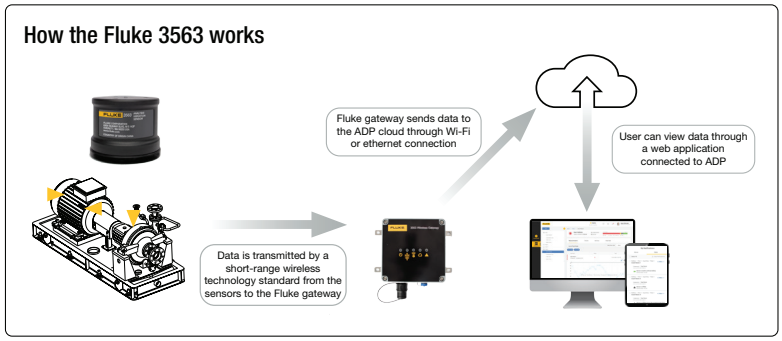
Once a fault is detected, a correction such as these can be applied:

- Balance the machine
- Check the shaft alignment
- Inspect mounting base, grease bearing, replace the bearing, etc.

Early vibration detection gives maintenance teams time to act

The 3563 Analysis Vibration Sensor empowers your technicians and engineers, regardless of experience, to immediately gather insights from the sensor's high-quality data. You have time to evaluate critical next steps for avoiding unscheduled downtime.

When combined with setup and vibration training services and technical support, including configuration, commissioning, and installation, the sensor seamlessly integrates into existing plant operations to increase asset reliability. The result is extended peak operating performance, more effective use of your maintenance team resources, and increased business value from your operations.



Glossary of important terms

- **Detection:** If a measurement value exceeds the programmed alarm limit, the software notifies a reliability professional of a problem.
- **Analysis:** Once a fault is detected, an analyst examines the data gaining insight into the problem and root cause.
- **Narrowband alarms:** Enables users to filter vibration within a narrow frequency band, allowing for better identification of a specific machine fault.
- **Piezoelectric sensor:** A high-frequency, high-resolution sensor that enables more in-depth vibration readings than typical MEMS sensors.
- **LIVE-Asset Portal:** A software application empowering reliability professionals to analyze overall values, velocity, and acceleration band values. With the information, users can determine which fault is causing a problem and access the next steps.
- **Fluke 3503 Wireless Gateway:** This gateway has dual network connection capabilities that connect multiple 3563 Analysis Vibration Sensors to a single gateway.
- **Spectrum analysis:** This technique is used for dividing signals into primary groups in the frequency area enabling pattern recognition. The spectrum peaks are created by components in the machine moving repetitively, such as turning, pressing, pumping, etc., and creating vibrations.

Fluke Corporation
PO Box 9090, Everett, WA 98206 U.S.A.

For more information call:
In the U.S.A. 856-810-2700
In Europe +353 507 9741
In UK +44 117 205 0408
Email: support@accelix.com
Web access: http://www.accelix.com

TECH PAPER

Cool technology in the new Fluke 3563 Analysis Vibration Sensor

The Fluke 3563 Analysis Vibration Sensor has a powerful combination of technologies. A piezoelectric high-frequency sensor, MEMS sensors, and advanced software analytics give maintenance teams detailed insights for anything from performance tracking to fault analysis.

What stands out about the Fluke 3563 Analysis Vibration Sensor is its powerful combination of technologies.

It pairs a piezoelectric high-frequency sensor with MEMS sensors and advanced software analytics to enable maintenance teams to track and analyze vibration readings continuously. Detailed insights can be used for anything from performance tracking to fault analysis.

The ability to monitor both production-critical and critical assets gives maintenance teams a way to assess their facility's overall asset health at a glance. Vibration data from the sensors is transmitted wirelessly to the Fluke 3503 Gateway, which has dual network connection capabilities—both Wi-Fi and Ethernet—to work with the existing communication infrastructure of any facility.

A unique set of features in the Fluke 3563

Here are the Fluke 3563 Analysis Vibration Sensor's striking features at a glance:

- **"Floating" sensor architecture:** The podded, or floating, design of the sensor itself means that it collects the best possible vibration data. Because only a tiny mass situated in a larger sensor is directly connected with the machine's metal itself, its resonance doesn't affect the structure it sits on. The sensor, floating in an architecture similar to a life preserver, delivers more precise vibration readings than other designs. The design also shields the sensor from local vibration influence.

- **The blend of piezoelectric and MEMS sensors:** Each Fluke 3563 device features one piezoelectric sensor and two MEMS sensors, offering the best of both worlds. MEMS sensors help give the 3563 its long battery life, while the piezo is highly accurate, dependable, and not susceptible to heat, humidity, or other elements. The combination of piezoelectric and MEMS sensors within an analysis sensor sets the 3563 apart—the sensor can handle both screening and analysis. The concept is similar to a hybrid car, with both a gas engine and a battery.

- **Customized data capture:** You can set predefined data parameters specific to each machine type. However, engineers who wish to can choose to set their parameters. Setup takes just minutes per sensor. Data and insights are generated immediately, based on ISO standards, for screening or analyzing potential machine risks and faults. The customization possibilities of the 3563 mean that maintenance technicians of any experience level can find and use asset insights.

- **Frequency bands:** Once collected by the sensors, the highly precise vibration data is fed into robust software. Frequency bands allow users to pinpoint specific problems better. Within the software, users can analyze banded overall values and narrowband values to determine which fault impacts an asset and analyze the fault. The built-in alarm thresholds are specific to every asset, and users can customize them if desired. This analysis helps teams determine what steps they should take next.

Prime benefits of condition monitoring

Condition monitoring helps maintenance teams reduce unplanned downtime, prevent potentially catastrophic failures from occurring, and dedicate their time and attention to their facilities' most critical assets.

Constant monitoring, alarm notifications, and analytical software ensure early warnings of potential asset malfunctions. Faults can be identified, and corrective action can be taken before failure occurs. Condition monitoring ultimately improves uptime and reduces maintenance and operations costs.

Data collected by sensors such as the 3563 can establish a baseline, document performance, and trends, and identify changes or abnormalities. Data-driven decision-making is only possible when enough relevant data exists, and in the past, it could be cost-prohibitive to monitor every tier of assets. But with solutions such as the 3563, vibration monitoring can be done at scale—helping teams optimize their maintenance and reliability.

Fluke Corporation
PO Box 9090, Everett, WA 98206 U.S.A.

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In the U.S.A. 856-810-2700
In Europe +353 507 9741
In UK +44 117 205 0408
Email: support@accelix.com
Web access: http://www.accelix.com