INDUSTRY

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

PREDICTIVE MAINTENANCE

General

Ever since the industrial revolution, machines have simplified our lives for the better. Manufacturing companies in particular have felt the benefit of using machinery. However there is one major drawback; machines require maintenance.

Some machine components will wear out quicker than others, depending on the degree and duration of usage and the load they are subject to. Unfortunately, this is something which is not easily detected just by monitoring the machine from the outside. Poorly maintained machines produce reject parts, increase production costs and waste resources. A poorly maintained machine can cause malfunctions, which can result in lengthy downtimes of a product line and even be hazardous for the operator.

In order to avoid malfunctions, machine maintenance is typically carried out at regular intervals in accordance with the manufacturer's guidelines. However in-between scheduled maintenance a problem may go undetected. In our era of digital transformation, big data, Internet of Things and increasing automation, this surely is outdated. Predictive maintenance provides the solution, where machines communicate with us whenever they need to be serviced.

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IIoT and Industry 4.0

The Internet of Things describes the networking, communication and interaction of devices. These devices and the data generated by them lead to new applications. These new applications facilitate automation, smart homes, smart farming and create the foundation for smart cities. Typically, the IoT refers to consumer applications whereas the networking of machines, products and processes in the manufacturing industry is referred to as the IIoT – Industrial Internet of Things.

The IIoT is a central component of Industry 4.0 (the digitization, interconnection and automation of industrial equipment and processes). The IIoT is also necessary for predictive maintenance because measurement data from machines is used to determine the exact maintenance requirement of individual components and machines. The objective of predictive maintenance is to service machines intelligently; applying maintenance only when required, and when appropriate, to maximize production.

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What benefit does this offer?

1. Minimized machine downtimes: If a machine is only serviced as and when required, unnecessary machine downtimes can be avoided.
2. Higher productivity: Maintenance can be scheduled to take place when the machine is not required for production.
3. Increased maintenance efficiency: The data used for predictive maintenance signals that a machine needs servicing and specifies which component requires attention, minimizing the time spent on failure diagnostics.
4. Optimized staff resources: Maintenance only needs to be performed when required, allowing staff to be used more effectively.
5. Optimized material resources: The machine will produce far less rejects and save time by avoiding the repetition of production runs.

In short, predictive maintenance helps to increase efficiency by saving time, material, manpower resources and ultimately also money.

Furthermore, predictive maintenance creates a new business area, an IoT service supplier who facilitates the processing and analysis of machine data.

To take advantage of the benefits that predictive maintenance presents, some challenges have to be overcome. Predictive Maintenance doesn't require big data, but it does need the right data. Therefore, it is important to be able to identify useful data and understand how it can be transmitted. Würth Elektronik offers solutions for a diverse range of applications. The sensors which are used, continuously monitor the condition of machinery and equipment. When it comes to different types of wear, different sensors are used.

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Sensors for detecting imbalance or vibration

Bearing and gear damage, defective shafts, loose anchoring, worn straps or damaged windmill blades and turbine wheels often cause an imbalance or vibration. To detect these we recommend the 3 axis acceleration sensor by Würth Elektronik. It measures the acceleration for each of the three spatial axes. This means that a suitable position within the application does not need to be considered. Any torsion can be compensated with matrix calculations. Depending on the application, it might also be useful to determine the absolute acceleration vector based on the three individual axes.

Any change in vibrational behavior often indicates towards the wear and tear of a mechanical component. This can also be confirmed using the acceleration sensor. To make the acceleration sensor work, output signal of the acceleration sensor is spectrally decomposed, typically by applying Fourier transformation. The above-mentioned types of damage change this spectrum, mostly because several harmonic waves are produced. The relative change of this spectrum and not the absolute values, often predict the beginning of destructive wear and tear.

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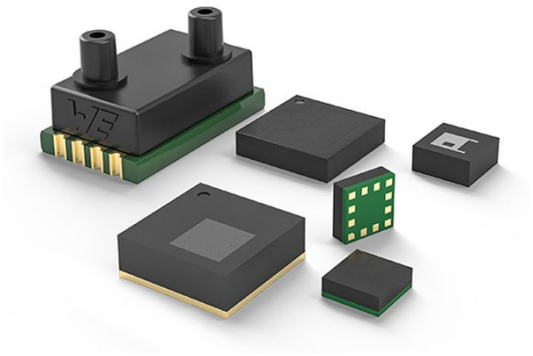
Sensors to detect filter conditions

Pressure sensors can be used in filters to determine the optimal time of replace or cleaning. If particles clog the filter, the dynamic pressure increases, resulting in a pressure difference across the filter. For this purpose, differential pressure sensors can be used to measure on both sides of the filter.

Depending on your application, you might also want to place one absolute pressure sensor before and one after the filter. Then the measured values can be calculated as differential pressure using a microcontroller. For this purpose, the absolute pressure sensor can be used.



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Data transfer without Wi-Fi or cable

Even the finest sensors are useless if the data cannot be transferred for further processing or analysis. Data transfer cables can be cumbersome, and it isn't always practical to transmit the data via Wi-Fi. In this instance, alternative radio standards are required. The IIoT design kit AMBER-Pi offers a simple alternative to equip the Raspberry Pi with long range radio communication. It allows developers to very easily construct and test energy saving sub-GHz radio solutions. In addition to the hardware, the AMBER PI design kit includes the software required for expansion on the Raspberry Pi. The plug-in board is suitable for all Raspberry Pi models that come with a 40-pin layout. A Tarvos III radio module is fitted onto the AMBER PI allowing a proprietary radio communication within the 868 MHz frequency band. Furthermore, it offers two SPI and two I^2C interfaces for the connection of the supplied sensors and other electronic components.

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Assembly

For industrial use the LANMX Connector is perfect due to it´s high mechanical stability.
With WE-LANMX, Ethernet connections are powerful even in tough environments. The screw-type circular connector sockets defy environmental influences such as vibration, dust and water due to their stable and at the same time space-saving design.

Due to the integrated transformers and common mode chokes, the LAN-MX combines high mechanical robustness with excellent signal integrity in one component.

LCP bottom with THR pins and high spacers/standoff (1.4 mm) for optimum air circulation during soldering process

Integrated filter design for 10/100 Base-T Ethernet applications according to IEEE 802.3u

D-coded M12 (IEC61076-2-101) made of high-performance plastic (LCP) for best dimensional stability and temperature stability during reflow

Pick & Place cap for automated placement

Metal housing with internal (M12) and external (PG) thread.

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Further Information

- Application Notes:
  - Single Pair Ethernet for Industrial Applications
  - Designing for success in harsh industrial environments
  - Bluetooth® LE vs 2.4 GHz Proprietary wireless – the right connectivity for your industrial application
- Webinar: Digital silicon-based temperature sensors for industrial applications