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Condition monitoring - Predictive maintenance supported by smart feedback encoders with single cable data transmission

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Condition monitoring and **Predictive maintenance** are two concepts that often come up in the context of safety engineering.
Both are related to ensuring permanent availability of safety-critical equipment, with minimal or even zero interruption. In practice, this translates into a need to ensure prompt and efficient maintenance which resolves – or, ideally, prevents – any defect in a timely manner.

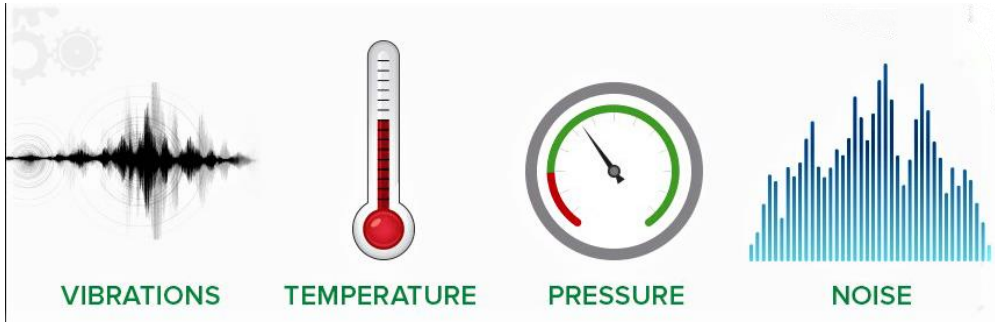
This translates to two basic questions:
what procedures are necessary, and when?

Condition monitoring is one of the most useful methods to provide an answer to these questions.
It refers to the continuous monitoring of the equipment's state and operating parameters, usually through dedicated sensors and monitoring tools.

Exactly which parameters are monitored depends, of course, on application and equipment: they include, for example, temperature and vibration parameters for electrical drives.
Not only can these parameters indicate an impending failure, but they can also indicate which components are most likely to be at fault, thus enabling engineers to plan and target their maintenance operations with more accuracy.

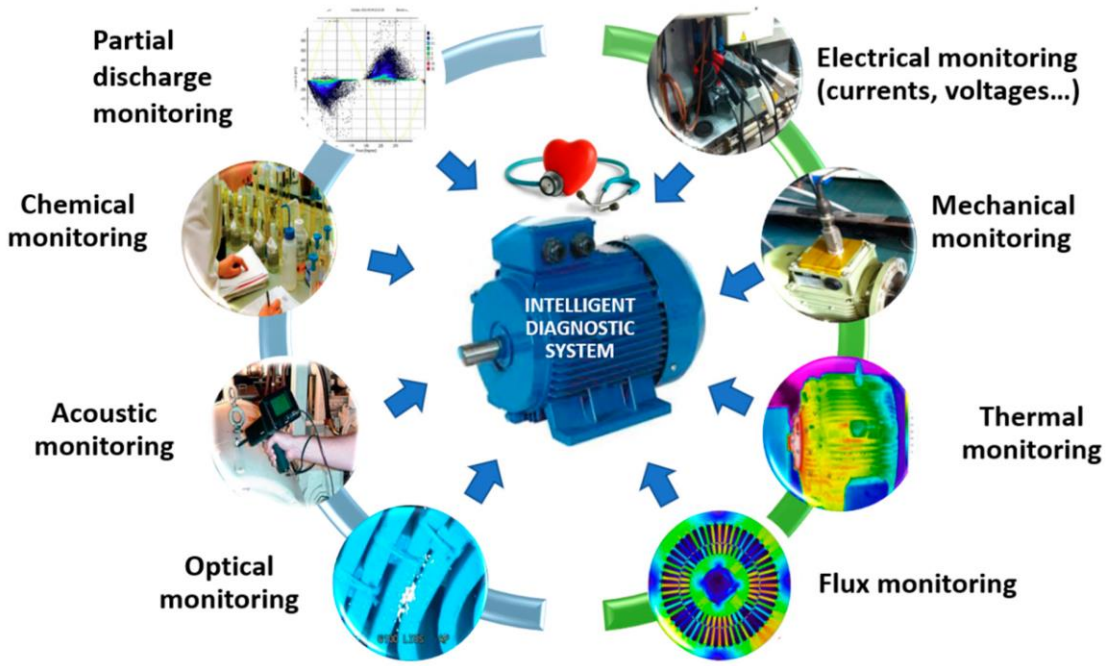
Data obtained through **Condition monitoring** provides valuable information about the **current state of a system**. But its value is not limited to evaluating an equipment's condition at a given time. Its evolution can be used to anticipate how an equipment will perform and how it might degrade, and to schedule maintenance according to these expectations.

This is known as **Predictive maintenance** and it is based on **anticipating the future evolution of a system** – in other words, on anticipating what failures may occur and what maintenance needs to be performed in order to prevent them from occurring.



Examining data from hundreds or thousands of sensors, gathered over months or even years, is well beyond the capabilities of human operators. Furthermore, the mathematical models, which describe an equipment's evolution (and predict potential faults) based on such a wealth of data, are generally prohibitively complex to be used by humans.

Consequently, in recent years, Predictive maintenance has come to rely increasingly on **Machine learning** techniques. Machine learning refers to **a set of statistical techniques**, which enable computer systems to learn how to identify and classify patterns in large volumes of data and to make predictions based on it.

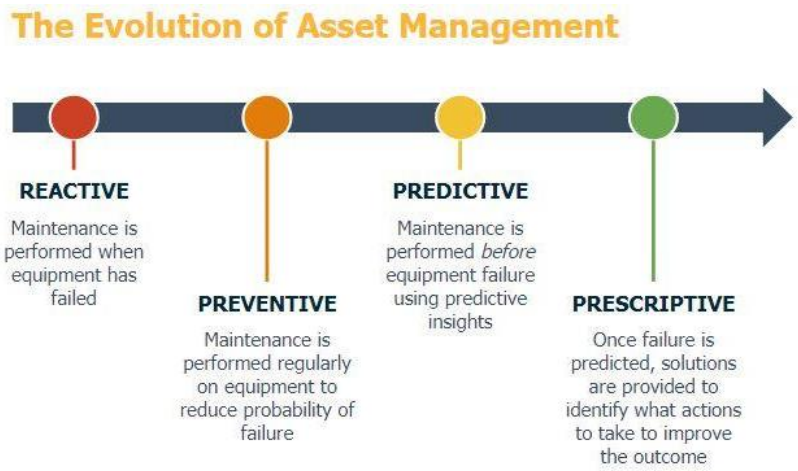


Conclusion

Condition monitoring refers to the process of monitoring a system's state in order to identify changes, which would indicate damage or an impeding failure. It enables operators to identify and correct problems (through repair and maintenance procedures) before they cause equipment to fail.

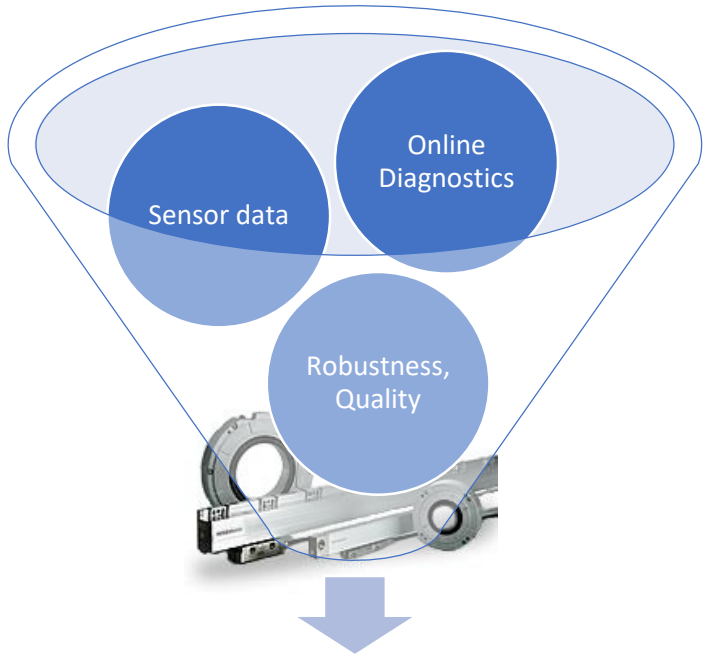
Predictive maintenance refers to planning corrective maintenance based on predictions about the evolution of a system. These predictions are based on data obtained through Condition monitoring, and on system-specific knowledge.

In other words, **Predictive maintenance is one of the ways in which Condition Monitoring can be leveraged**. The two are **complementary** and refer to different ways of using and acting upon sensor data. Both are reliable methods to ensure operational safety at every level, including in hazardous areas. However, it is worth iterating that **both of them depend on the quality and integrity of sensor data**: the quality and safety of the sensors, measurements and transmission chains is critical to their success.



Encoders with integrated sensor (eg. vibration sensor):

- vibration sensor and analysis inside the encoder
- flexibility regarding the application by configuration of encoder on customer side
- no additional costs for cabling, connectors and mounting of sensors
- analysis and compression of sensor raw signals inside the encoder
- combining of measured position and vibration values, preprocessing and calculation inside the encoder
- output of characteristic values over advanced encoder data interface
- lower system costs and efficient cabling due to single cable communication and advanced bus transmission



Encoder diagnosis

- comprehensive
- meaningful
- easily rateable
- easily processable

Encoders from HEIDENHAIN provide an outstanding support when it comes to the topics of online diagnostics and operating status data.

They deliver valuable information for higher-level Condition Monitoring and Predictive maintenance to increase the planning capability for machines.

Sustainable and reliable: they represent intelligent solutions that reduce costs and improve machine performance.

WMK 3010S - AMO spindle encoder with operating status data

- One scanning head for all common spindle sizes
- Extended mounting tolerances (by a factor of 2 in some cases)
- Increased operating temperature range
- Amplitude stability of the 1 V_{PP} signal up to the max. permissible speed
- Operating status data optimized for customer requirements
- Mechanical fault exclusion for scale-tape ring and scanning head
- Spindle speeds up to 62.500 rpm possible
- High ruggedness thanks to inductive scanning method
- Compact dimensions

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