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OMRON

Creating value with sensing technology

The right sensors can boost equipment longevity, promote flexibility and improve efficiency

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Introduction

For manufacturers in all industries, sensing technology provides the foundation for quality control, predictive maintenance and, in some cases, flexible manufacturing. Robots require sensors to know where parts and pallets are located so that they can perform pick-and-place tasks without requiring every minute detail to be explicitly preprogrammed.

Sensors also capture variations in physical properties of works-in-progress – such as color, size or shape – to determine whether these items are of the required quality and what further actions should be taken on them. Similarly, sensors detect changes in machine function over time that could indicate impending breakdown.

All else being equal, most manufacturers prefer sensors with a lower cost. However, the overall cost of a sensor isn't determined by price tag alone. As an integral part of production line equipment, sensors have a huge impact on the costs associated with equipment longevity, brand protection and nearly every aspect of production. It's crucial to keep this in mind and select sensors accordingly.

This white paper will provide an overview of several ways that sensors can help cut costs and increase value, including the following:

- Advances in quality control and operational efficiency
- Resistance to typical causes of sensor breakdown
- Mounting options to enhance flexibility
- Improvements in predictive maintenance



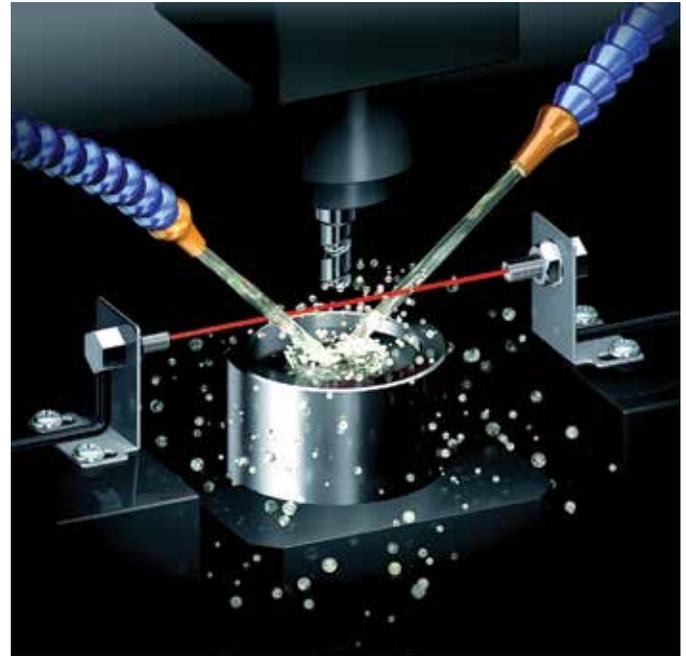
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The importance of considering the total value of ownership

It can be tempting to choose the sensors with the lowest price tag, but the actual cost of something with such a central role in production is never that simple. Thinking in terms of the total value of ownership, or TVO, is essential – even though it's more difficult to quantify. The central idea of TVO is to discern which raw materials, processes, pieces of equipment and actions will produce the most value regardless of their initial cost.

In the case of sensors, TVO takes a holistic look at the impact that using a specific sensor type will have on a company's profitability. Lower quality sensors can have a negative impact on equipment longevity, energy use and more because they break down more frequently. The cost of the negative impact could be significantly higher than the superficial savings provided by choosing less expensive technology.



Omron's oil-resistant IP67G sensors have rugged durability for harsh environments.

What is included in determining TVO?

TVO, or "total value of ownership," considers value drivers that other measures may omit, such as the following:

- Process optimization
- Supply risk reduction
- Carbon footprint reduction
- Increases in working capital efficiency
- Fixed cost structure reduction
- Improved materials sourcing
- Accelerated product design
- Elimination of excess and unnecessary demands
- Long-term revenue increases



Better sensors protect quality and boost efficiency by detecting flaws more accurately

All sensors are not created equal. Those with an advanced design are often much better at detecting their targets than their lower-quality peers, and they are also more reliable. Since sensors are often the first step in catching production anomalies, investing in higher-quality ones significantly lowers the occurrence of production errors and helps protect a brand's reputation.

Omron's proximity sensors, for example, are designed to accurately detect small deviations from optimal production criteria. The offering for both inductive and capacitive proximity sensors includes several with built-in amplifiers to capture small but important variations from the norm. The E2K-L Capacitive Liquid Level Sensor ensures that liquid color has no effect on its ability to accurately sense the presence of a fluid.

Since a single flawed product could result in costly recalls, it's important to take advantage of high-quality sensors and prevent mistakes from getting out into the market.



Omron's E2K-L capacitive proximity sensors are specifically designed for non-contact liquid level sensing.

IP-rated sensors lengthen equipment lifecycles in challenging environments

The service life of sensors varies, and it can be altered significantly by the operating environment. In many industries, including automotive manufacturing and food and beverage production, sensors face a variety of destructive chemicals and processes. Dairy production, poultry processing, beef processing and similar applications use intense washdown treatments to eliminate the growth of bacteria and fungi. These washdowns incorporate harsh chemicals, high heat and high-pressure sprays – all of which can significantly shorten sensor longevity.

Sensors incorporated into food and beverage production machinery must be washdown-resistant, both for the sake of overall longevity and cost-effectiveness and because they – like everything else on the production line – need to be cleaned. If they are too delicate to be washed down, they could begin supporting dangerous levels of bacterial growth. They could also lead to expensive downtime if they fail prematurely.

Omron has developed a number of sensing solutions that ensure longevity and cleanability in the harshest of environments. The IP69K-rated products can withstand both high and low ambient operating temperatures and maintain integrity during washdowns in extreme environments. Their rounded and sealed construction allows for high washdown pressures at any angle and ensures resistance to aggressive cleaning solutions.

In automotive applications and metal cutting, a common cause of sensor breakdown is cutting oil. Omron's oil-resistant IP67G sensors provide rugged durability for harsh environments so that manufacturers who use cutting oil can eliminate oil ingress by any path, minimize unexpected machine downtime and lower the overall cost of ownership of their equipment. These sensors successfully

What is an IP rating?

Short for "ingress protection rating," an IP rating refers to a technology's level of protection against the entry of water, oil, dust and other potentially destructive substances.

Here are a few common examples:

- **IP65** – Protected from total dust ingress and low-pressure water jets from any direction.
- **IP67** – Protected from total dust ingress and waterproof when immersed in 15cm to 1m of water.
- **IP69K** – Protected from total dust ingress and steam-jet cleaning.

keep oil out thanks to fluororesin cable sheaths that provide extra-strong resistance to deterioration as well as extra protection at joints and moving sections.

Other ways in which sensors are designed to withstand environmental pressures include heat resistance, built-in circuit protection and resistance to the accumulation of weld slag and aluminum or iron cutting chips.

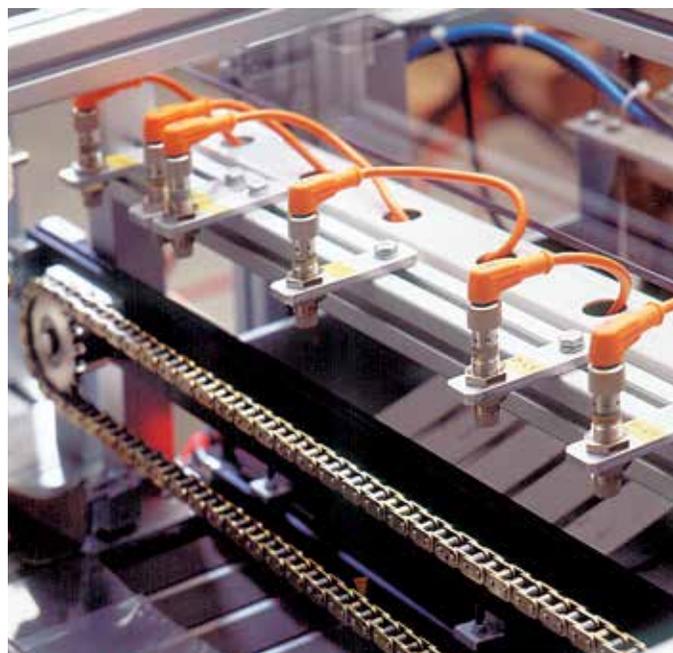
Although robust sensors might be slightly more expensive to purchase, the acquisition cost is small in comparison to extra maintenance, replacement and unplanned downtime. In some industries, downtime can cost several thousand dollars per minute, easily outweighing the cost of IP-rated sensors.

Sensors with more mounting options promote flexibility in manufacturing

Special qualities of industry-ready sensors

Sensors in a variety of applications must resist the harsh environments in factories. Here are some ways they do so.

- Waterproofing
- Oil resistance
- Heat resistance
- Immunity to weld slag accumulation
- Resistance to high-pressure water jets



Small components of the production line like sensors can have a large impact on the overall layout of the equipment. Instead of allowing the wrong sensors that place restrictions on layout design, manufacturers can select sensors that are designed specifically to provide greater flexibility.

Proximity sensors can be “shielded,” or covered on the sides with metal, so that the flux is concentrated at the front surface. These types of sensors can be flush-mounted in metal without being influenced by the surrounding material. Omron provides a wide variety of proximity sensors in both shielded and non-shielded models to give manufacturers more options for a flexible production line.

Another way that sensors enhance flexible manufacturing is through the positioning of the LED indicator. Omron’s E2B Cylindrical Proximity Sensors have a bright, 360° LED indicator that is visible all around, even in dark environments. This ensures that the sensor can be mounted in any direction without impacting the operator’s ability to quickly determine its operating status.



Omron’s E2B cylindrical proximity sensors have a bright, 360° LED indicator that provides all around visibility even in dark environments.

IIoT-ready sensors improve predictive maintenance and minimize downtime

If a machine is starting to have problems functioning, the sensors will be the first to gather any abnormal data that could point to machine trouble. However, if this data isn't properly communicated and analyzed, the deteriorating machine function could easily go unnoticed.

Smart sensors, considered to be a major component of the Industrial Internet of Things (IIoT) or Industry 4.0, help manufacturers keep real-time tabs on machine functionality. Many use a powerful standard known as IO-Link, which facilitates the exchange of three different types of data: process data, service data and events. This means that IO-Link sensors can communicate much more complex data than a simple on/off setting.

By giving more detailed insight into how the system is working, IO-Link sensors can make predictive maintenance much easier and much more effective. Manufacturers can catch problems while they're still relatively easy to fix and avoid long periods of downtime. In industries like automotive manufacturing where downtime can cost \$10,000-\$12,000 per minute, smart sensors can be an extremely cost-effective solution.

IO-Link sensors also make flexible systems much more effective by making analog signals less expensive to handle. An analog signal can provide a range of values (as opposed to a simple on or off), which can be essential in adaptable lines. For instance, a gripper might need to be open at different amounts for different types of parts, so an analog position sensor would enable it to adjust automatically based on the product being assembled.

What types of information do IO-Link sensors provide?

IO-Link, a standard specified by IEC 61131-9, helps sensors communicate more detailed information about equipment, including the following:

- **Process data** – input or output data that shows the sensor's most recent state
- **Service data** – detailed information about the device in question, from basic info like version and serial number to advanced configuration and diagnostics data
- **Events** – unusual occurrences that happen too infrequently to be included in the process data but that could indicate a problem with the machine

Omron offers several varieties of sensors that use the IO-Link standard, including photoelectric, color mark photoelectric, proximity, spatter-resistant proximity and more. GX- and NX-series IO-Link master units collect information from the sensors via a fieldbus network into the host controller. An Omron IO-Link application enables communication within the whole system, provides fault detection for quick recovery, and reduces time required for commissioning and maintenance.

Summary

Manufacturers seeking to control costs and enhance the flexibility of their operations should never overlook sensors as a major factor. When the right sensors are in use, equipment will have greater longevity, quality control will be more effective and predictive maintenance will be much easier.

Sensors with IP ratings, flexible mounting options and IO-Link connectivity can help cut costs, improve quality and make flexible manufacturing simpler to implement.



Omron's IO-Link sensors monitor error detection; reducing downtime, aiding in predictive maintenance and decreasing commissioning time.



Omron oil-resistant IP67G sensors with rugged durability for harsh environments.



Omron's E2K-L capacitive proximity sensors are specifically designed for non-contact liquid level sensing.

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