CASE STUDY

OMRON
AUTOMATION & SAFETY

Smart manufacturing is the future – It's already here

Building cars is a capital and labor intensive business, which is why automakers are always trying to increase productivity and reduce costs. Since the 1960s, anecdotal reports and simple measurements have helped to root out waste, but such strategies are not sufficient to fully optimize production processes, according to Masaru Takeuchi, automation systems division HQ senior general manager of Omron.

"The experience and intuition of experts play major roles in improvement activities at production sites," says Takeuchi. "But the improvement points that the experts cannot identify are hidden in bottlenecks, which hinder production efficiency. In order to overcome such situations, we need objective data."

Using objective data to enable smart manufacturing

Until recently, interpreting objective data for these hidden improvement points have been a challenge even when using metrics such as overall equipment efficiency (OEE) and total effective equipment performance (TEEP). But that situation is changing as more affordable and powerful information technologies are entering the market in response to smart manufacturing initiatives.

Smart manufacturing provides a framework for using information technologies to further automate the production process. Its ultimate goal is to create visibility through every stage of the manufacturing process, from the mining of raw materials to the disposal of products at their end-of-life.

Over the long-term, smart manufacturing will enable automakers to minimize downtime while building just enough production capacity, says Michael Sayre, Regional Sales Manager of Omron. "Today, many plants operate near peak capacity," he says. "By capturing specific characteristics, you can calculate when a part will fail and improve utilization while using fewer resources."

Applying smart manufacturing to automobile assembly

Omron is enabling smart manufacturing through introduction of LifeCycle Function Blocks for Predictive and Preventive Maintenance within Omron's Sysmac Studio Library. Each function block is a purpose-built algorithm that integrates with Omron's self-aware devices and NJ Series Machine Automation Controllers.

The function blocks provide plant personnel with objective data that, when displayed as at-a-glance graphs or indicator lights, can be used to determine if a line is operating efficiently or a critical component is about to fail. This information provides situational awareness for optimizing production across lines, identifying failing components, and scheduling maintenance for times that are least likely to adversely impact production.

While predicting points of failure might seem like a small step, this type of proactive and preventative maintenance actually can actually create significant savings. For example, if an automaker can avoid downtime on an engine assembly line, it can usually save between $15,000 to $25,000 per minute. Doing the same thing on process intensive production area such as tire extrusion, can boost the bottom line upwards of $50,000 per minute avoided.

Business Need

Many automotive plants operate at capacity. Omron's LifeCycle Function Blocks for Predictive and Preventive Maintenance technology allows plant personnel to be both preventative and proactive with maintenance while improving utilization while consuming fewer resources.

Unique Challenges

The service life of a component such as a relay is a dynamic variable. Omron's LifeCycle Function Blocks for Predictive and Preventive Maintenance technology allows for adaption to onsite specific conditions like voltage and current as well as mechanical cycles for critical parts such as relays.

Customer Benefits

Omron's LifeCycle Function Blocks for Predictive and Preventive Maintenance technology provides information plants need to implement preventative and predictive maintenance plans. Replacing parts before they fail allows operators to optimize productivity, efficiency, and safety.

Improving uptime with function blocks

The reality is that relays can implement functions that would be costly and/or difficult to implement with solid-state equivalents in an automotive environment. However, detection of relay failures can sometimes be troublesome to detect. As a result, Omron chose to create algorithms for the G2RV electromechanical relay and MY general-purpose relay as part of Omron's initial LifeCycle Function Blocks for Predictive and Preventive Maintenance release. Work is also underway to build additional function blocks to support other Omron components.

The relay LifeCycle Function Blocks for Predictive and Preventive Maintenance algorithms are highly accurate predictive tools because they address not just mechanical life (number of times the device is actuated) but also the relay's endurance curve. Mechanical life alone is not an accurate indicator of unit life since it does not account for load that can accelerate device failure. But endurance curve is quite accurate for calculating the number of operations a device will sustain when voltage and current for example are identified.

By accounted for actuation cycles as well as current and voltage, these function blocks are able to accurately predict when a component, such as a relay, will fail. This can be tied into a maintenance procedure through for example visual warnings on an HMI level through enterprise monitoring within the plant.

Deploying function blocks

To update an existing environment, a programmer only has to drag and drop the relay specific LifeCycle Function Blocks for Predictive and Preventive Maintenance objects within the Sysmac Studio program, associate it with the specific relay, and calibrate the relay's current type (AC or DC and resistive and inductive) and amperage load as it is implemented within the factory automation. The programmer is also able to set warning levels for a user specified percentage of remaining life. Should these inputs need to be changed during the life of the relay due to re-use, these inputs can be re-specified and the function block will dynamically update to the new settings while still taking into account past history. If any inputs are invalid, the function block will alert the programmer.

Once operational, the relay specific LifeCycle Function Blocks for Predictive and Preventive Maintenance tracks current and load and how many times it is actuated or reset. The function block continues to calculate the relay's endurance curve in response to factory conditions. If the life warning is ignored, a fault will be indicated, which remains in effect until the component is replaced and the software is reset. The programmer can chose to tie these warning and faults to peripheral devices, but this is not required for the function block to work. "The function blocks allow for both preventative and predictive maintenance," says Sayre. "By deploying 'self-aware' machines and systems, we are providing users with greater transparency and, ultimately, giving them the objective data they need to improve productivity, efficiency, and safety."

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