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Smart pneumatics: Gateway to higher efficiency, productivity

Open and flexible IIoT systems *can pinpoint leaks and faults, reduce downtime, increase throughput and, ultimately, improve the bottom line.*

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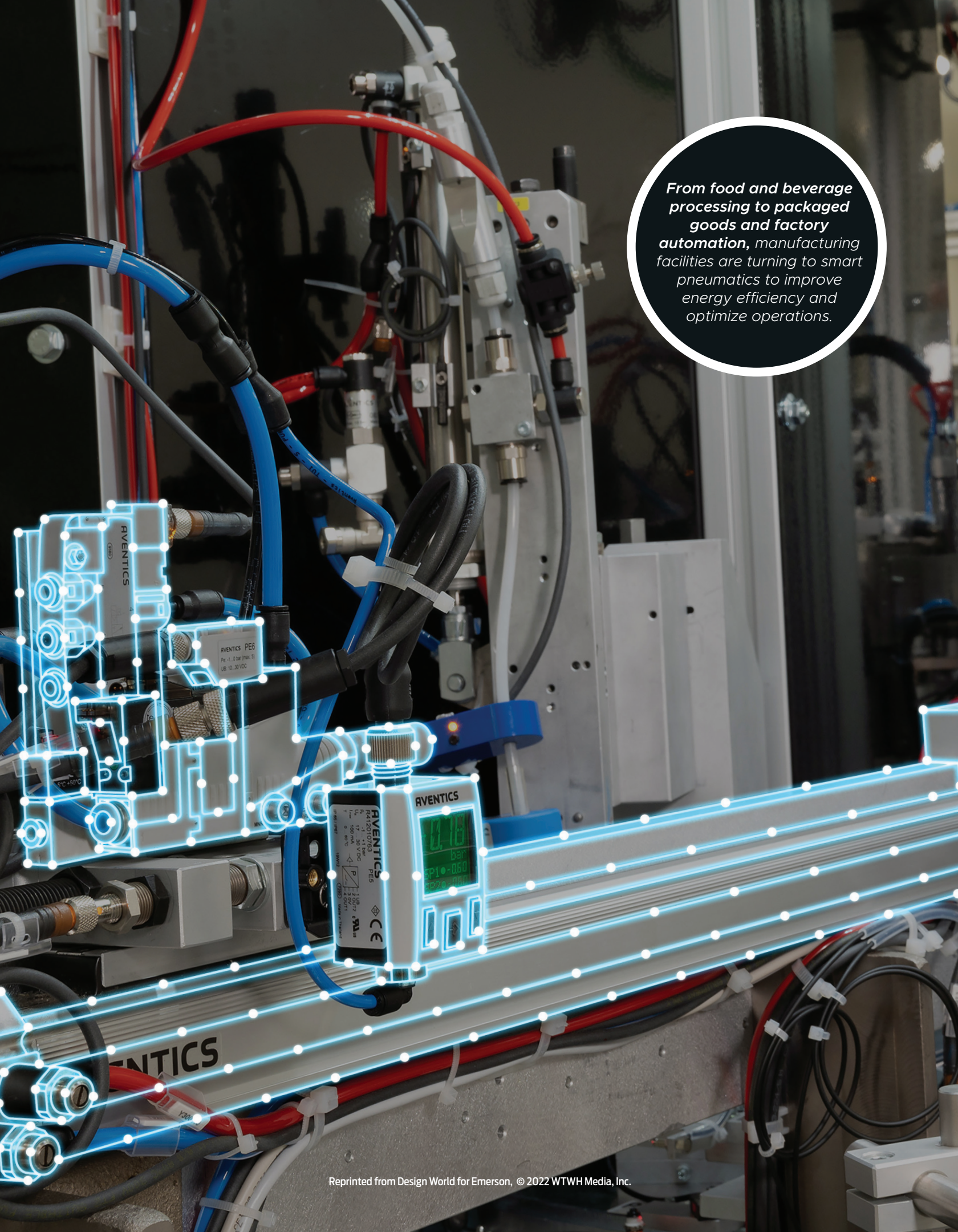
(All images courtesy of Emerson)



From food and beverage processing to packaged goods and factory automation, *manufacturing facilities are turning to smart pneumatics to improve energy efficiency and optimize operations.*

The AVENTICS AF2 flow sensor provides real-time insights on air flow, *while also capturing pressure and temperature data in the feed line.*

From food and beverage processing to packaged goods and factory automation, manufacturing facilities are turning to smart pneumatics for improved energy efficiency. In compressed air systems, improvements of just a few percentage points can mean tens of thousands of energy dollars saved each month.

But smart pneumatics can offer much more than energy savings. By gathering process data from previously "unintelligent" valves, cylinders and air preparation units, a synergistic hardware and software combination can unlock insights that lead to reduced downtime, faster cycle times and higher overall productivity.

Real-world challenges

In a pneumatic system, components are subject to wear that can lead to leakage. Over time, that leakage will increase, resulting in excess energy use, higher operating costs and a larger carbon footprint. In fact, the average manufacturing plant wastes up to 35% of compressed air annually due to leakage, with larger leaks contributing to significant energy loss, more machine downtime and added costs. We've seen some plants lose more than $50,000 per year, per machine!

For many operators, identifying and addressing the losses in a compressed air system can also impact their overall equipment effectiveness (OEE), because air leakage is often a sign of other performance issues.

OEE is a "best practices" measurement of productivity within a manufacturing process. In essence, it identifies the percent of planned production time that is truly productive. OEE can be determined by the following variables:

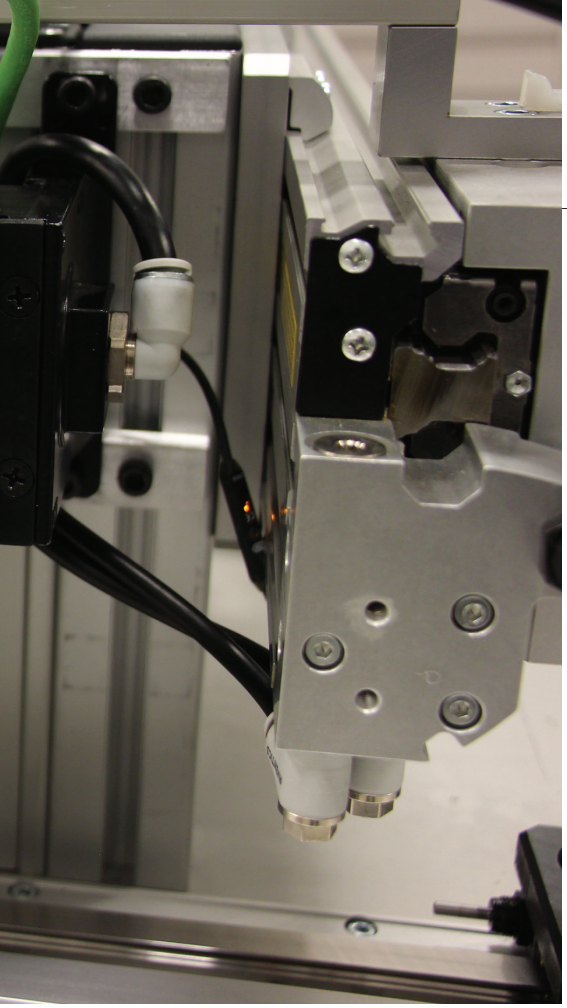
• Availability: This is the uptime of the machine. Is the process running continuously during planned production times?

• Performance: This aspect relates to the speed of the machine. Is the process running as fast as possible, and without slow cycles?

• Quality: This relates to the end product, which can be affected by component wear and poor or erratic machine performance. Is the production free of defects and reworks?

An OEE score of 100% represents perfect production: a machine manufactures only good parts, as fast as possible, with no downtime. Anything less than a perfect mark in availability, performance or quality will reduce the total OEE score. A score of 85% is considered world class, and many manufacturers see it as a suitable long-term goal.

Studies from the pneumatic systems experts at Emerson indicate a typical packaging line's OEE is only about 45% to 55%. The good news: there is ample opportunity for improvement. Clearly those systems operating at or near



design capacity are more energy efficient — and more profitable — than those that don't. But maximizing productivity down to the individual machine level is necessary to truly understand where efficiencies can be gained and costs reduced.

Smart pneumatics opportunities

The Industrial Internet of Things (IIoT) is revolutionizing manufacturing, packaging and related process industries and is bringing digital transformation to pneumatic operations of virtually any size. This transformation allows operators to capture and process data from pneumatic and other machine elements to unlock new production insights.

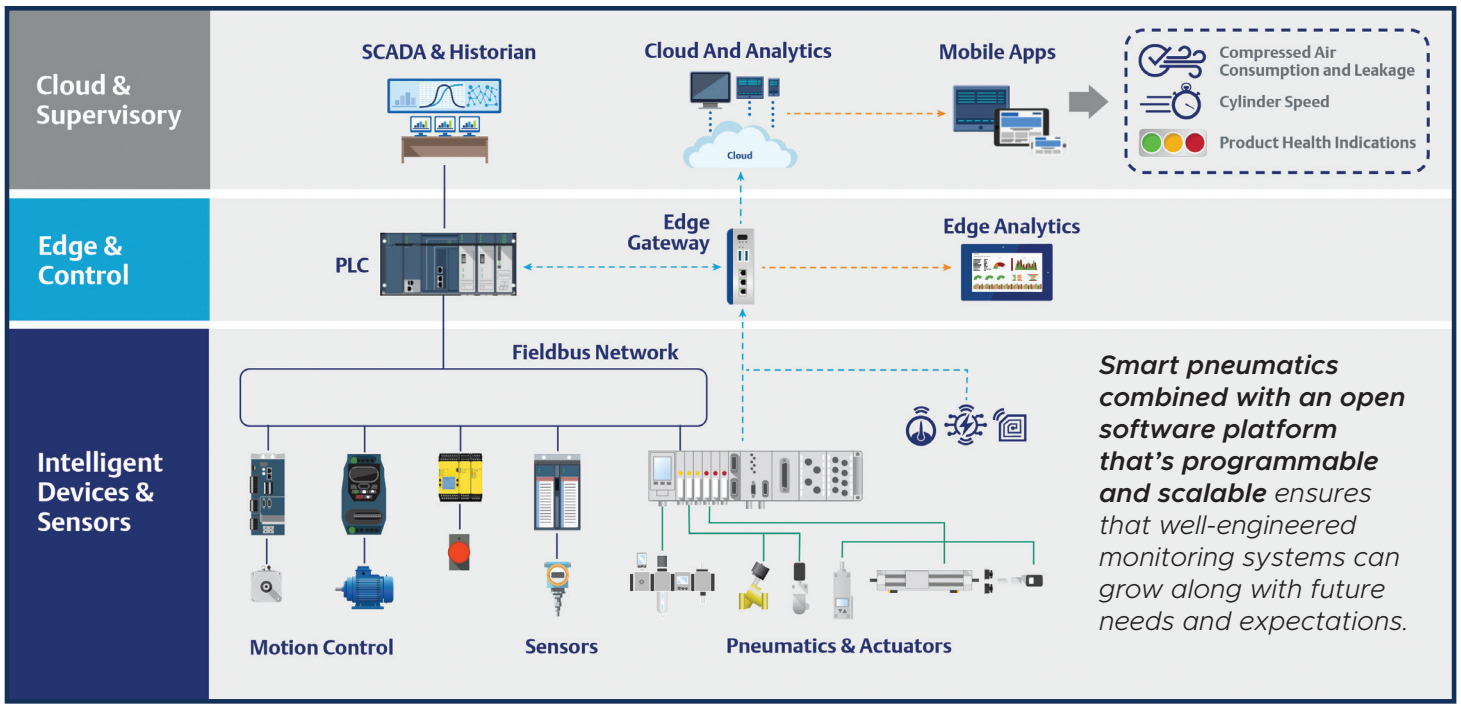
For example, compressed air optimization is an IIoT-powered advancement made possible by continuously monitoring the flow of air in a system to detect leaks in real time, while also capturing other data such as pressure and temperature in the feed line.

Transforming the raw data from a smart pneumatic system into something actionable is the key to reducing downtime, lowering energy costs, enabling faster cycle times and increasing overall productivity. But how can you be sure the machine data you're gathering is actionable? And how can you apply this data to improve shop floor operations and higher-level decision-making?

Straightforward approaches

Smart pneumatics monitoring can easily be achieved on the local level — no cloud required — starting with just a few data points. Using components like Emerson's AVENTICS Series AF2 Flow Sensor to measure airflow or the portable AVENTICS Smart Pneumatics Analyzer (SPA), the system can identify any machine exhibiting a problem and create alerts accordingly, presenting easy-to-use dashboards or sending alerts to end users in real time. By starting small on just a handful of

Digital transformation for discrete and hybrid applications



The AVENTICS Smart Pneumatics Analyzer (SPA) *lets customers easily access real-time data to monitor pneumatic system parameters and improve overall equipment effectiveness (OEE).*

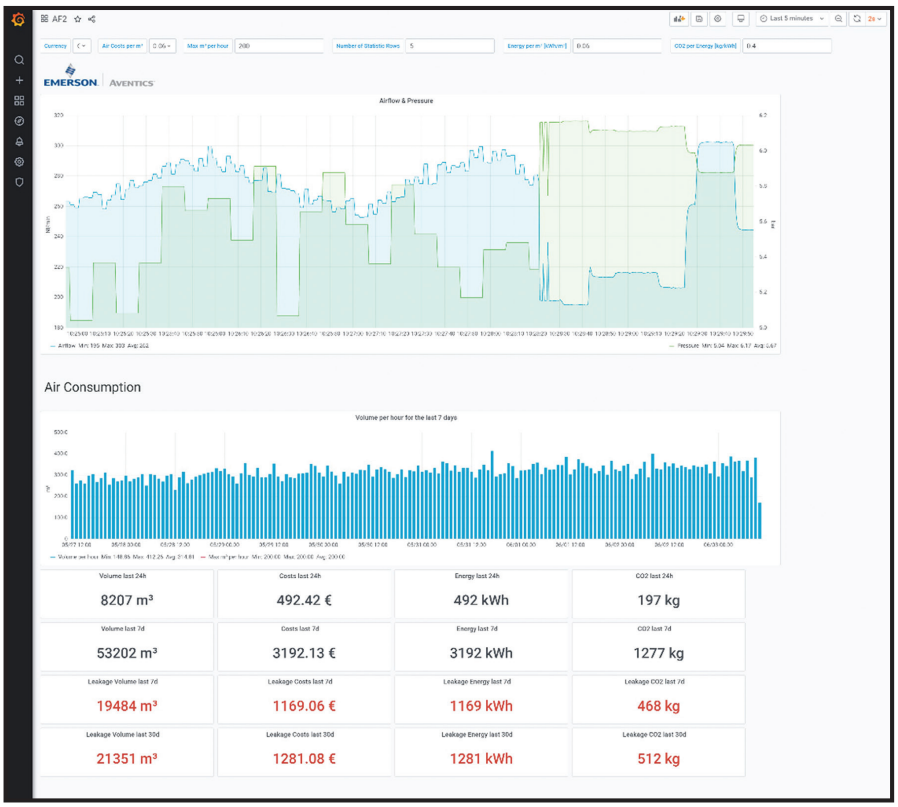
individual parts, operators can obtain actionable insights without the need for heavy data analysis — and very quickly realize a reduction in costs, improved production quality, increased throughput and, in the case of pneumatic systems, reduced energy consumption.

In one recent example, Emerson worked with a packaging machine builder to provide powerful analytics that can help deliver efficient, scalable OEE increases on palletizing and depalletizing equipment. Instead of complicated sets of data, the analytics solution — based on Emerson's PACEdge IIoT platform — pinpoints which specific actuators or valve manifolds are underperforming and provides guidance to address the suspected issues. Easy to develop and implement, this platform can also provide predictive maintenance suggestions based on cycle counts or other parameters. It can provide root-cause analysis in real time, along with a range of warnings or critical alerts. Data is collected and visualized independent of the main machine controller, so it is suitable for legacy or third-party controllers.

By initially focusing on a few machines or on specific pain points, project scope can be defined and the results can be easier to quantify. Meanwhile, it's important to ensure that the chosen monitoring solution is scalable and can grow along with future needs and expectations. A provider with a complete portfolio can help avoid stacking up devices, which adds costs over the long term.

Operators should use caution when considering partners or products that might tie them to specific equipment, gateways, cloud services or other confined ecosystems. Some solutions may also require significant time and up-front capital investment. For example, in one approach, data may be collected and forwarded from the programmable logic controller (PLC) through a gateway to the cloud. Another approach may connect the pneumatics and other modules directly to the PLC. From there, data must still go to the cloud for analytics and visualization. Both scenarios involve passing through the PLC. This may require significant changes to the PLC logic to capture analytics via the cloud by way of the PLC for "local" visualization.

For manufacturing operations without the desire or infrastructure to support complex cloud scenarios, highly flexible and secure systems like those offered by Emerson can provide productivity and energy savings without requiring a cloud



Emerson's SPA software can be used in combination with a Smart Pneumatics Analyzer and an AF2 Ethernet airflow sensor. *It provides easy-to-read data on flow, pressure, air consumption and leakage, as well as actionable insights into areas like the costs of consumption and leakages, and CO2 footprint.*

environment for real-time visualization of data. Collection modules like sensors or other edge devices can connect directly through a gateway without changing the PLC. This is significant because changing the PLC logic can require considerable time and resource investment, and many operations may not want to change their PLC programming, particularly in brownfield applications. With more flexible options like those offered by Emerson, brownfield operations can have data contextualized either via the cloud or at the local edge device, regardless of the controller being used. And in greenfield applications, a customer can replace the PLC architecture with a versatile edge controller such as Emerson's PACSystems RXi2, which combines the PLC and edge technology in a single unit.

Unlike traditional, consumer-based IoT items, industrial IoT equipment typically offers a high degree of cross compatibility — a factor critical to ensuring smooth coexistence using open software that is programmable and scalable, like the PACEdge platform.

Open communication protocols can be cloud-based, on the premises or integrated into existing software systems. Examples of these include OPC UA and MQTT. The AF2 Series Flow Sensor mentioned previously, for example, is compatible with OPC UA, enabling users to connect directly to upper-level systems or another IIoT gateway for advanced analytics.

Whether local or cloud-based, the best suppliers of IIoT technologies will tailor their systems based on an operator's current infrastructure and then deliver machine insights via gateways, control systems or these open IIoT protocols. A knowledgeable, flexible technology supplier will take a consultative approach to any IIoT implementation and will take the time to fully understand the requirements of an operator's specific needs.

Tangible benefits

In the past, it didn't make sense to invest in monitoring relatively low-cost pneumatic parts — the expense and associated production downtime for replacement were simply accepted as normal business. But now, information has changed the game.

A single, faulty individual actuator may contribute to a larger problem impacting the efficiency of an entire system. When properly leveraged, smart pneumatics

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powered by the IIoT can help manufacturers find things like deficient actuators and more — they can connect islands of automation, unlock trapped machine data and radically increase OEE. Where there are several, perhaps dozens of machines involved in producing a single product, the effect can be profound. An inefficiency in one machine can create a cascading effect across the entire plant. By connecting islands of information, a typical operator can expect ROI to be delivered in several ways:

• Less downtime: Smart pneumatics can help better inform maintenance and production teams of growing issues within the machine by measuring usage and cycle time to monitor wear. Combined with cycle indicators, operators can gain insight into remaining system life and can use predictive maintenance to reduce production downtime.

• Greater savings: With fewer leaks the overall system will require less energy, saving energy costs while reducing the total carbon footprint.

• Increased productivity: Smart pneumatics can provide notifications and alerts that advise of leaks, anomalies or threshold breaches during manufacturing. This, in turn, can help ensure optimal OEE and maximized productivity.

Working with a group that can provide a total approach — from pneumatics to machine control and the application enablement platform — can help operators of any size optimize their processes and unlock new production insights. The knowledge to avoid unplanned downtime, reduce energy costs, improve cycle times and increase overall productivity is all made possible through smart pneumatics and the powerful insights they can deliver through a system like the PACEdge platform. DW

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The versatile Emerson PACSystems RXi2 edge controller combines a *PLC and edge technology in a single unit.*

A close-up look at PACEdge

Emerson's PACEdge IIoT platform combines edge analytics, visualization and advanced application-enablement software that lets end users and OEMs increase visibility into asset/machine health and performance. PACEdge simplifies development, deployment and administration with a modern open-source toolset and intuitive interface to help increase the speed and scalability of digital transformation projects. Combined with Emerson's powerful PACSystems edge computing products, users can take advantage of a single, seamless edge solution with open, industrial connectivity capability that decreases development time and cost.

Emerson's PACSystems RXi2-BP edge computer, RXi2-LP edge gateway and the groundbreaking PACSystems RX3i CPL410 edge controller are all supported and available with the PACEdge IIoT software stack, providing a broad set of solutions for customers' programming, visualization, and analytics needs. In fact, Emerson has recently launched a new version of the AVENTICS Smart Pneumatics Monitor (SPM) based on PACEdge. This new Smart Pneumatics Monitor, using the RXi2-LP edge gateway, has several benefits over the previous SPM. That includes more computing power and data storage, as well as the possibility to connect multiple air flow sensors or valve systems to a single edge device. It also offers more advanced data visualization within the device.