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## PRODUCTIVITY, SUSTAINABILITY &amp; ENERGY CONSERVATION

# Three Real-World Applications for Pneumatics and IIoT

By Enrico De Carolis, Emerson

*The integration of data-driven predictive maintenance with preventive maintenance is one example of how IIoT-enabled pneumatics can solve ongoing challenges.*

► Industrial operations and manufacturers using pneumatics have access to more Industrial Internet of Things (IIoT) technology than ever before, from position sensors on cylinders to system flow sensors and edge gateways that operate independently from the machine controller with globally accepted communication protocols.

However, the rich data these tools produce also presents a challenge for machine builders and OEMs: How do we put the Industrial Internet of Things (IIoT) to work in a way that makes the most of opportunities in a digitized, highly connected world?

Let's explore real-world applications that leverage IIoT-enabled pneumatics to solve fundamental challenges faced on an ongoing basis.

## Improving Safety to Protect People and Equipment

Pneumatics have long provided efficient and cost-effective motion and actuation with reliable technology and a proven record of equipment safety. Now, IIoT technology, along with related European trends like Industry 4.0, creates new opportunities for pneumatics to further improve safety. Additional functional insights also allow users to monitor a

machine's safety characteristics to better protect people and equipment from harm.

Consider a machine using a safety light curtain to disable a pneumatics valve system when an operator is loading or unloading a part to be processed into the machine. Historically, safety applications have relied on statistical calculations to define a safety component's mission time replacement cycle.

Mission time defines the number of cycles when a safety component requires replacement regardless of whether it is functioning or not, in order to keep the calculated statistical safety

function valid. While the valve may seem to be okay according to its rated mission time, there are other measurable factors that may not be considered (for example, changes in valve response time). A response time that changes from 30 to 70 milliseconds could create a serious safety hazard by allowing an operator to move further into the machine's dangerous motion area before a safety response event is triggered.

A system using new IIoT technology would proactively capture, analyze and report the decline in the valve's response time, as well as the corresponding alert response time before the safety function is compromised. This type of actionable safety information creates a safer workplace.

### Improving Predictive and Preventative Maintenance

Dealing with wear and tear is a daily challenge in any manufacturing setting. Predictive and preventive maintenance programs are critical to effectively managing machine lifecycles and maximize Overall Equipment Effectiveness (OEE).

For example, maintenance technicians can analyze appropriate data from IIoT sensors. They can then use that information to predict that a shock absorber at the end of an actuator is deteriorating by sensing a millisecond's increase in its stroke speed. This can trigger predictive maintenance protocols to replace the worn shock absorber. As a result, there are shorter or fewer machine stoppages and a

reduction in unplanned downtime, or complete or unrecognized failures.

In addition, IIoT-enabled pneumatics can monitor functionality at a valve's location. A valve's state of wear can be hard to determine from the outside of a machine. If additional internal sensors are not an option, an IIoT gateway can evaluate valve life by tracking the valve's cycle counts. The user can then enable a cycle counter algorithm to determine how much of the valve's life cycle has been used and to predict how many operating days and hours it has left. This allows machine operators or end-users to plan downtime.

Data-driven insights for predictive maintenance can also help to improve



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## Three Real-World Applications for Pneumatics and IIoT

the scheduling of preventive tasks for pneumatics components. The data can be analyzed and used as information to guide plant management teams as they predict and address issues before they cause injury, damage, failure or production losses.

The integration of data-driven predictive maintenance with preventive maintenance also allows just-in-time part replacements, decreasing the need to purchase and warehouse a full inventory of system-critical, “just-in-case” parts. When pneumatics work together with IIoT, it creates a system that facilitates early detection and prediction of potential issues. Maintenance technicians can place orders to ensure parts are delivered

when they are needed. In the future, this, too, could become an automatic step where the IIoT system itself autonomously sends the order to parts suppliers.

### Improving Machine Efficiency

The real-world value of a certain technology ultimately equates to how well that technology boosts the bottom line and creates a return on investment. IIoT offers significant opportunities to improve pneumatics operations in several ways, including:

#### Regulating upstream/downstream flow:

Combining the traditional strengths of a pneumatics system with IIoT-based technology can maximize process control and monitoring,

particularly for upstream/downstream flow. The result is enhanced OEE and lower Total Cost of Ownership (TCO).

Consider a plant using a system that allows only fully open or fully closed positions on pneumatically actuated gates on a hopper or silo that dispenses bulk material for packaging. Uneven product flow and traffic jams can inundate or starve downstream processing stations. The inability to vary the dispensing gates’ position based on downstream demand creates inefficiencies and bottlenecks throughout the plant. The results range from damages to the bulk material to overtime costs for personnel to make up production quotas.

A retrofit solution, without disturbing the existing controller or its program, can address the issue at a fraction of the cost required for new controller equipment or work process modifications. An intelligent, IIoT-based, closed-loop system, with appropriate sensors on IIoT-enabled pneumatics components, allows each gate’s position to vary from zero to 100% of the opening – not just the two positions of opened or closed. The flexibility results in much better flow control for bulk material, without the need to change the controller program.

By adding additional components, such as an extremely precise pneumatic positioning system for control and IIoT gateway to analyze functionality, the system enables more efficient control of the bulk material, preventing starvation of the packaging system downstream as well as optimizing OEE. In addition, data from the IIoT system can be leveraged for additional system improvements. It could, for example, measure valve life so the operator understands whether a valve is performing to specification and, if necessary, change the component during scheduled maintenance while alleviating any unplanned downtime.



The Emerson RXi2, an edge gateway, allows analysis independent of the controller via local data collection and pre-installed analysis modules.



An intelligent, IIoT-based closed-loop system, including sensors on IIoT-enabled pneumatics components, allows for more flexibility in machine operation positioning.

**Boosting energy efficiency:** Smart energy usage is a key consideration for machine manufacturers and end-users alike. Data generated by IIoT-connected sensors can be converted into actionable information, allowing manufacturers to more fully understand and better manage energy usage.

For example, smart sensors can monitor pressure losses within the system and an IIoT gateway can analyze this data and send alerts when leakage becomes the predominant contributor to energy consumption. Users could then identify excessive leaks caused by a worn seal, for example, and mitigate them before they become a major concern. This functionality can also be achieved without changing the machine controller’s program or process.

Additionally, smart technology can minimize air consumption, not only to save money but also to reduce wear on components. For instance, by monitoring and analyzing compressed air pressure with respect to cycle time, the end-user can reduce the preset system pressure at the point of use to the work side of a cylinder and determine the optimal operating point where the cycle time can be maintained with the least energy consumption. This also decreases component wear by optimizing generated forces and reducing vibrations.

**Enabling manufacturing flexibility:** From product customization to packaging variations, manufacturers increasingly require the flexibility to change equipment without sacrificing quality. Connected components can be engineered to easily and seamlessly supply different pressures for different tooling positions and sequences. A directional control valve system, for example, can support simple, on-the-fly changes and tooling positions for quick product variations and changeovers.

**Build a Path Forward**

Data is only as useful as its ability to provide insights, guide decisions and help justify investment. And while OEMs and end-users understand the potential to capture, aggregate and use sensor data, it’s time to turn that potential into reality.

From creating a safer workplace to predicting failure before it happens and building flexible production lines, IIoT-enabled technology can generate real-world results in pneumatics operations. **BP**

*Enrico De Carolis is Vice President of Global Technology, Fluid Control and Pneumatics at Emerson. Emerson is a global technology and engineering company providing innovative solutions for customers in industrial, commercial and residential markets. Emerson Automation Solutions business helps process, hybrid and discrete manufacturers maximize production, protect personnel and the environment while optimizing their energy and operating costs. Emerson Commercial & Residential Solutions business helps ensure human comfort and health, protect food quality and safety, advance energy efficiency and create sustainable infrastructure. For more information, [www.emerson.com/en-us](http://www.emerson.com/en-us). All photos courtesy of Emerson.*

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