

OEM APPLICATION NOTE

Machine Condition Monitoring via IIoT

This Arrowhead Systems division is taking full advantage of new IIoT tools that make machine diagnostics readily available and help customers maximize OEE.

WHAT YOU'LL LEARN

Predictive maintenance Optimizing operations



The Alpha Turbo High-Level Bulk Depalletizer is among the machines in the Busse/SJI division that feature a range of new Industrial Internet of Things (IIoT) machine health monitoring capabilities. Included in the smart pneumatics platform are sensors like this AF2 Flow Sensor (below) that can help diagnose broader issues across a plant's compressed air system.

Arrowhead Systems, Inc. is an industry leader in high-speed palletizers and depalletizers, as well as other automated handling systems. Through its Busse/SJI division, the company recently introduced its next-generation Alpha Turbo™ High Level Bulk Depalletizer, which features a range of new Industrial Internet of Things (IIoT) machine health monitoring capabilities to help customers maximize OEE.

What this represents is a digital transformation. To implement it, Busse/SJI worked with **Emerson Automation Solutions** business to add smart pneumatics, edge computing, and an IIoT software platform into its Alpha Turbo, as well as its Viper™ High Level Bulk Palletizer, to provide real-time, actionable data about machine conditions and performance.

Bulk palletizing/depalletizing systems move loads of different dimensions and weights—beverage containers, plastic bottles, soup cans, etc.—on and off pallets at speeds of up to 4,000 containers/min. High throughput and machine uptime are two critical key performance indi-



At the local dashboard for pneumatic and machine monitoring analytics, plant personnel can quickly see Key Performance Indicators when critical limits are reached, and they're provided with pinpoint data and location of specific components for early intervention.

caters used to measure Overall Equipment Effectiveness (OEE) in CPG operations. Tim Krueger, President and COO of Arrowhead Systems, Inc., says Busse/SJI is committed to meeting customer demands by ensuring its equipment utilizes state-of-the-art technology to maintain optimum performance.

“Machine uptime is the most critical element to line performance on a day-to-day basis,” says Krueger. “Deploying technology that allows for real-time data monitoring for today’s production, as well as predicting future needs, helps to eliminate unplanned downtime.”

Pneumatics play a critical role in both the Alpha Turbo depalletizer and the Viper palletizer, powering actuators that perform key functions such as trapping and guiding empty containers into and out of the machines and grabbing, lifting, and placing the slip sheets to help in stacking containers. Using pneumatics is ideal here because it provides efficient motion capabilities without a lot of cost and is less susceptible to changing operating conditions on the packaging line or in the factory. Because pneumatic actuation and gripping plays such a vital role, having real-time insight into the health and efficiency of the pneumatic system was a critical goal for the machines.

As Busse/SJI developed both machines, the company sought to improve its ability to capture basic sensor and performance data from the pneumatic components. Although they started with pneumatics, Busse/SJI became aware that Emerson, a global automation provider, has a full portfolio of smart pneumatics, condition monitoring, edge gateways, and computing that could enhance machine health and support CPG end users to improve their operations.

For the Alpha Turbo depalletizer, Emerson’s solution gives end users real-time data to improve OEE by monitoring critical motion and pneumatic system parameters, including airflow, pressure, vacuum, mechanical actuation speeds, and motor vibration. “Our partnership with Emerson has allowed us to take the Alpha Turbo technology to the next level, with data collection and analysis that allow the preventive monitoring and notification system to predict the future,” says Krueger.

Emerson collaborated with Busse/SJI to document end-user pain



points and requirements for smart pneumatics and condition monitoring. This involved direct engagement with palletizing and depalletizing system operators to identify several critical needs, including:

- Providing earlier notification when equipment such as pneumatic cylinders or actuators begin performing below critical thresholds—signaling potential problems in the components
- Installing pneumatics with sensors and air pressure monitoring to pinpoint which devices or system elements are malfunctioning, rather than spending hours trying to pinpoint an issue
- Providing additional displays and screens that make it easier for personnel—especially less-experienced operators—to view and use the real-time data and respond to issues quickly and efficiently

Emerson’s global resources were instrumental in helping with application development to create interactive content for a machine dashboard, using an open IIoT software platform to pull in data not only for the pneumatics but also for other machine components and data sources such as gearboxes, drives, and servo motors.

Emerson’s AVENTICS™ portfolio of smart pneumatics includes an array of products with integrated sensors and connectivity capabilities that enabled real-time monitoring in Busse/SJI’s system. For example, the AVENTICS ST4 cylinder velocity sensor continuously monitors whether pneumatic cylinders are actuating within thresholds for a

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The Emerson RXi2-LP industrial PC brings all sensor data together for accessibility, historian, visualization, and analysis for primary product packaging machines or complete packaging lines. In addition, real time monitoring and diagnostics capabilities enable better OEE.

given type of container and can alert monitoring systems if thresholds are being exceeded.

Elsewhere in the smart pneumatics platform are sensors that can help diagnose broader issues across a plant's compressed air system. The AVENTICS AF2 Flow Sensor, under consideration by Busse/SJI for future machine builds, can provide real-time insights into airflow, while also capturing pressure and temperature data in the feed line. An increase in air temperature may indicate a compressor problem. Information on the current or cumulative energy consumption can also be passed straight to supervisory systems—with actionable data that plant management can use to address systemic issues that may not directly correlate to specific pneumatic components.

These systems all feature connectivity through IO-Link, independent of upper-level fieldbus systems. Using pneumatics with IO-Link capabilities can streamline how data is captured and reported, making it easier to integrate smart pneumatics functionality into existing automation platforms without burdening the PLC.

In addition, Emerson's AMS vibration sensors can monitor and track vibration levels in the motors, gearboxes, conveyors, blower assemblies, and pneumatic systems. If another component on the palletizer is malfunctioning and generates an abnormal vibration, the sensor can detect and report that anomaly as well.

All of these data sources are brought together by Emerson's PACEdge 2.0 IoT platform running on the PACSystems™ RXi2 Edge Computer. Together, this platform provides a comprehensive IIoT solution for real-time data access, historical performance tracking, and visualization and analysis of the smart pneumatics system. A key advantage of the IIoT platform is the interoperability and scalability it provides to access third-party devices and control systems, like the ones used on the Busse/SJI palletizer and depalletizer, as well as sensors or other data sources. The open connectivity also allows operators to access the asset health data locally, through mobile devices or uploaded to a preferred cloud platform, giving Busse a solution that will allow them to support customers in their digital journey.

"Emerson's ability to work with third-party control systems was the key to success in the partnership," says Krueger. "We have hundreds of machines in operation today, and the ability to adapt new technology to those machines was just as important as advancing our new equipment. This has allowed us to maintain our customers' specification requirements without limiting our ability to stay on the cutting edge of technology for the future."

The joint Emerson and Busse/SJI solution includes powerful analytics that offer the quickest and most scalable way to increase OEE. Drawing from the input of CPG end users, Emerson used its latest PACEdge 2.0 IoT platform as the basis to configure which data was most useful while making it easy for operators to understand.

Instead of presenting complex data graphs, the Emerson analytics package pinpoints which actuators or valve manifolds are most likely causing machine performance issues and provides guidance on steps to take to solve the issues. The advanced analytics also provide data needed to drive effective predictive maintenance programs for components that may need routine maintenance based on the number of cycles or other set parameters. Maintenance can be scheduled instead of worrying about unplanned failures taking equipment down.

According to Krueger, these advanced capabilities were the result of a strong and successful collaboration with Emerson: "Our dedication to cutting-edge technology and partnerships with world-class companies like Emerson ensures that we stay relevant in today's ever-changing environment," he concludes. —*Pat Reynolds*