

the journal

from Rockwell Automation and our PartnerNetwork™

APRIL 2021

It's This Easy

Industrial analytics help digital transformation leaders uncover scalable, enterprise-level insights and actionable outcomes.



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IMPROVE YIELD & OEE

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It's This Easy



Understanding 4 key industrial analytics trends help digital transformation leaders uncover scalable, enterprise-level insights and actionable outcomes.





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EBOOK

The 2021 Food & Beverage eBook

This resource explains how producers are using smart manufacturing to boost performance and product consistency for food safety, changing consumer tastes and stiffer competition. Download at <http://bit.ly/tj21fbook>.



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**Rockwell
Automation**

FT FactoryTalk
by ROCKWELL AUTOMATION

AB Allen-Bradley
by ROCKWELL AUTOMATION

Confessions of a Regretful Time Waster

I have a confession to make. I haven't made good use of my time during the COVID-19 lockdown that started last March. I didn't begin new hobbies, exercise more, create DIY projects or participate in any other activity that could be perceived as valuable. I did learn the intricacies of Zoom, does that count?

One thing I do know is that you pros in our industry haven't wasted the time as we all faced the need to adapt quickly during this pandemic. That's one of the things I love about our industry: Technology is always advancing, and methods are always improving no matter what the conditions. Good economy or struggling. Social upheaval or not. Plentiful skilled workforce or not. Global pandemic or not.

Smart manufacturing and the IIoT are at the heart of advancements now. That's where we are, and the possibilities are limitless. Systems that deliver data analytics in sensible ways that help you make real-time business decisions are key to uptime and profitability. IIoT innovations and modern infrastructure strategies continue to drive digital transformation, whether in small steps or big leaps, so you can adapt to dynamic market conditions and be agile enough to meet your goals.

The cloud, the edge, virtual commissioning and digital twins, smart sensors and other components, enterprise information systems and so many more technologies keep improving. I love that about industrial automation.

To help you keep up with those technology advances, you'll find all kinds of interesting info about the IIoT and digital analytics in this issue of *The Journal*. Congratulations to all of you who continued to adjust and improve during these recent tough times, and will keep moving forward. **Until next time ...**




Theresa Houck

EXECUTIVE EDITOR



News Noteworthy

Rockwell Automation Earns Top Marks for Equality

Company earns 100% on annual assessment of LGBTQ workplace equality for the ninth consecutive year.

● **R**ockwell Automation announced that it earned a perfect score of 100 on the Human Rights Campaign Foundation's 2021 Corporate Equality Index (CEI), the nation's foremost benchmarking survey and report measuring corporate policies and practices related to LGBTQ workplace equality.

The results of the 2021 CEI showcase how 1,142 U.S.-based companies are not only promoting LGBTQ-friendly workplace policies in the United States, but also for the 57% of CEI-rated companies with global operations who are helping advance the cause of LGBTQ inclusion in workplaces abroad. Rockwell Automation's efforts in satisfying all of the CEI's criteria earned a 100% ranking and the designation as one of the Best Places to Work for LGBTQ Equality.

"At a time where issues regarding equity in the workplace are elevated, we are proud to have been recognized for fostering a work environment and culture where people feel they can bring their authentic selves to work each day," said Becky House, senior vice president, chief people and legal officer at Rockwell Automation, who also serves as the executive sponsor of ROKOut, Rockwell's LGBTQ+ employee resource group. "It is an honor to achieve this award for the ninth consecutive year."



"This year has shown us that tools like the CEI are crucial in the work to increase equity and inclusion in the workplace, but also that companies must breathe life into these policies and practices in real and tangible ways," said Alphonso David, Human Rights Campaign president.

Rockwell joins the ranks of 767 major U.S. businesses that also earned top marks this year.

For more information about the 2021 CEI designation, visit www.hrc.org/cei.



The new EPLAN Partner Network provides a framework for existing and new partnerships to jointly develop and market interfaces.

EPLAN Launches Partner Network

EPLAN Software & Services LLC, a Technology Partner in the Rockwell Automation PartnerNetwork™ program, has launched a new partner network that pools the worldwide knowledge of its cooperation partners to increase the benefits for end users. The EPLAN Partner Network (EPN) provides a framework for existing and new partnerships to jointly develop and market interfaces.

The partnership also supports common binding goals for boosting integration along the value chain. Users profit from this increase in continuity and integration, particularly in the areas of PLM, ERP and PLC as well as simulations. The in-depth interchange amongst the manufacturers makes it easier for end users to integrate the large number of systems used on the market.

Rockwell Automation and members of its own PartnerNetwork™ including Endress+Hauser, Festo and Rittal already are taking part in the initiative.

"A digital thread of data within and across organizations is one of the key requirements to bringing the Connected Enterprise to life. Together with EPLAN, we support companies through their digital transformation by enabling data consistency, improving efficiency of engineering processes and shortening time-to-market," said Tom O'Reilly, vice president, Global Business Development, Rockwell Automation.

A partner area on the Eplan website provides particulars for companies involved in the EPN, information about integrations, contact persons and current news. For more information, visit www.eplan-software.com/partner.

Rockwell Automation Supports COVID-19 Vaccination Efforts

Rockwell Automation announced it is donating its Arena® Simulation Software to nonprofit organizations, governmental organizations and public health partners to plan COVID-19 vaccination clinics in their communities. The software can be used to monitor patient flow, staffing, shift changes, and maintenance of social distancing guidance for patients in queue.

A nonprofit health system is using the donated software to help manage more than 30 vaccination clinics with several planned in Wisconsin and Illinois. The Cuyahoga County Board of Health is using the software to plan future vaccination efforts in northeastern Ohio. Conversations with other healthcare providers are ongoing.

At the start of the pandemic, Northwell Health in New York, and ChristianaCare in Delaware both used Arena to manage COVID-19 inpatient care. The software supports vaccine clinic planning because it helps decision-makers understand the flow of systems and the constraints of resources in an environment where every day might bring a different scenario.



Coalition Addresses Skills Gap

Rockwell Automation and its Strategic Alliance Partner FANUC America have formed a coalition to develop apprenticeship programs. The accelerated work and learn apprenticeship programs are designed to upskill current and future workers for jobs in advanced manufacturing, robotics and automation.

The coalition includes APT, a FANUC and Rockwell Automation systems integrator, and NOCTI Business Solutions, which provides independent assessments of occupational standards and validation using recognized International Organization for Standardization (ISO) process validation methods. Franklin Apprenticeships also is a key partner of the coalition.

The newly developed apprenticeship programs offer people opportunities to gain credentials that include fundamental robotics and automation. The program offers a second level of credentials for robot and PLC technicians.

A third credentialing level called Integration Specialist builds on the fundamental and technical skills that teaches people to operate and troubleshoot integrated FANUC-Rockwell Automation technologies.

The apprenticeship programs aim to help companies rapidly upskill employees at every level from operator to technician to integration system specialist. These programs also will benefit engineers for new automation systems and processes that require new employees trained in the latest automation technologies.

More than 40 companies, including Dana, Magna, Tyson Foods and Flex-N-Gate, have agreed to support and participate in apprenticeships for automation technologies to help their employees receive adequate training.

For more information, visit www.fanucamerica.com/apprenticeships.



The newly developed apprenticeship programs offer people opportunities to gain credentials that include fundamental robotics and automation.



PARTNERNETWORK BRIEF

Domino North America Names Director of Marketing. Rockwell Automation participating Technology Partner Domino North America of Gurnee, Illinois, appointed Nikki Johnson to director of Marketing. For almost three decades, she has cultivated a track record of leadership and success in various marketing and sales roles in the packaging sector. She also has been an active participant in various industry specific associations, such as PMMI (The Association for Packaging and Processing) and the Contract Packaging Association.



Rockwell Automation Earns Ethical Accolade for 13th Time

Ethisphere, a global leader in defining and advancing the standards of ethical business practices, recognized Rockwell Automation as one of the 2021 World's Most Ethical Companies. Rockwell Automation has been recognized 13 times and is one of only two honorees in the Diversified Machinery industry. In 2021, 135 honorees were recognized spanning 22 countries and 47 industries.

The recognition honors companies who understand the importance of leading, making hard but values-based decisions, and commitment to integrity.

"We're honored to once again receive this recognition from Ethisphere," said Blake Moret, Chairman and CEO of Rockwell Automation. "Our commitment to integrity is a foundational element of our culture, ingrained in everything we do. And that culture is shaped by great employees who can and want to do their best work."

"While addressing the tough challenges of 2020, we saw companies lead – above all other institutions – on earning the trust of stakeholders through resilience and a commitment to ethics and integrity," said Ethisphere CEO, Timothy Erlich. "The World's Most Ethical Companies honorees continue to demonstrate an unwavering commitment to the highest values and positively impacting the communities they serve. Congratulations to everyone at Rockwell Automation for earning the World's Most Ethical Companies designation."

Grounded in Ethisphere's Ethics Quotient, the World's Most Ethical Companies assessment process includes more than 200 questions on culture, environmental and social practices, ethics and compliance activities, governance, diversity and initiatives to support a strong value chain. The process

serves as an operating framework to capture and codify the leading practices of organizations across industries and around the globe.

This year, the process was streamlined and the question set expanded to gauge how applicants are adapting and responding to the global health pandemic, environmental, social, and governance factors, safety, equity, and inclusion and social justice.

The full list of the 2021 World's Most Ethical Companies can be found at <https://worldsmoethicalcompanies.com/honorees>.

+ PARTNERNETWORK BRIEF

exida Partners with Sensia. exida, a global supplier of functional safety products, services, and certifications, formed a new business partnership with Sensia, the first fully integrated digital oilfield automation solutions provider. The new partnership will enable Sensia to expand its current process safety lifecycle services in terms of scope of services offered and increased global coverage. exida is a Technology Partner in the Rockwell Automation PartnerNetwork™ program, and Sensia is joint venture between Rockwell Automation and Schlumberger.



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Trends & Advancements in Water Wastewater Flow Monitoring and Control

The water wastewater (WWW) industry must balance the opposing pressures of improving water safety and shrinking budgets – and process complexity is rising. Alan Vance, Industry Manager – Water/Wastewater at Endress+Hauser, answers questions about advancements in electromagnetic flowmeter technology that help plants ensure process efficiency and accuracy, water safety and verifiable regulatory compliance.



Alan Vance
Industry Manager – Water/
Wastewater, Endress+Hauser

Q: Monitoring flow and total flow has been important for decades. Do you see that continuing?

A: Yes, monitoring and recording flow rates and total flow is still vital. Demand for clean drinking water and properly treated wastewater is increasing as our population grows, making it essential for municipalities to maintain and grow their WWW infrastructure and incorporate accurate instrumentation and controls, including flowmeters.

Municipalities must account for every gallon of water produced and wastewater treated to meet permitting and regulatory compliance requirements.

Q: Is there one flowmeter technology that seems to be used or accepted more by municipalities than others?

A: Electromagnetic flowmeters, also called mag meters, are the most common flow measurement devices used in municipal process plants. They're widely used because they're accurate, repeatable, bidirectional, have no moving parts, serve a variety of applications, and can easily last for 15 to 25 years.

Other flowmeter types are also found in WWW plants, including clamp-on ultrasonic flowmeters, open channel flowmeters, and types that measure gas or air.

Q: What changes have you seen in this technology over the years, and what important features would a user look for in a magnetic flowmeter?

A: When I look at a magnetic flowmeter, I think of it in two parts: the physical sensor that mounts in the pipeline, and the electronics/customer interface. The sensor measurement function hasn't changed much over the last few decades, though its manufacturing process and quality have greatly improved.

On the other hand, the electronics for signal processing have become sophisticated, especially in how the customer interacts with the device. Today's instruments provide a lot more data, diagnostics, and digital communication options for the customer to consider. Instead of physically hooking up to the mag meters with a handheld device, customers can connect from a smart phone, tablet or plant control system to perform troubleshooting, commissioning or on-board verification.

As a result, more information is pushed out proactively. For example, if an electromagnetic



flowmeter senses buildup inside the sensor, it can push process information and suggested changes to a control room operator or field technician for corrective action.

A recent innovation in electromagnetic flowmeters allows installation with very short or zero straight pipe runs both upstream and downstream of the meter body. This uses either a reduced-bore sensor or multi-electrode sensor, such as the full-bore Endress+Hauser [Unrestricted Mounting OxDN](#). Compared to traditional mag meters that have just one pair of measuring electrodes inside the sensor, this technology leverages multiple pairs of measuring electrodes in the sensor, enabling better averaging of the flow profile, and therefore better measurement accuracy of $\pm 0.5\%$ of rate.

Q: What are the benefits of having a flowmeter installed with no straight pipe run?

A: First, eliminating straight pipe runs, or having just minimal upstream and downstream, saves significant piping materials and installation costs and overall project costs, especially when dealing with larger line sizes (24 in. to 120 in.).

Second, plants designed decades ago often have areas where flow is never accurately monitored because the flowmeters



A recent innovation in electromagnetic flowmeters allows installation with very short or zero straight pipe runs both upstream and downstream of the meter body.

lack a straight pipe run. Now, users can put an electromagnetic flowmeter in an existing installation without having to modify their piping, other than the necessary lay length of the mag meter itself.

Third, instead of diminishing accuracy, like some flowmeters that work with zero straight pipe run, the new technology maintains a highly repeatable $\pm 0.5\%$ of rate accuracy, enabling improved process control, more accurate dosing of chemicals, and more accurate flow totals for billing and regulatory purposes.

Q: Why must municipalities keep their flowmeters calibrated or verified for accuracy, and how is the technology improving?

A: Flowmeter calibration is critical to plant operations. Installed instrumentation must be maintained and verified so that it continues to read within the original wet calibration over time. But a flowmeter mounted in line is difficult to verify because it usually requires stopping the process or implementing a bypass line; taking the meter out of line and replacing it with another meter or a spool piece; sending the flowmeter out for recalibration; and then reversing the process. The costs and time are excessive, and the challenge is compounded for bigger meters.

Alternative methodologies developed over the years can verify the magnetic flowmeters in place, rather than pulling them out of line for actual calibration. Many methods involve carrying external, handheld devices to the flowmeters for hookup and running a program to verify the signals are within the flowmeter's original wet calibration.

However, these portable verification devices can cost thousands of dollars each; travel time and costs are high, particularly when meters are distributed miles away; and the process involves uncovering, unwiring, and in some cases removing the electronics or entire transmitter from an electromagnetic flowmeter enclosure. This introduces safety and accidental damage risks.

Consequently, the trend is moving toward internal verification. Whether in front of the meter or from the control room, a user can run the verification program in place or, directly from the control system, using a Bluetooth or other smart device and standard web server software. It is quick, efficient, safe and less costly than hooking up external devices, and it provides peace of mind that the meters are still functioning within the original wet calibration.

Our solution can complete the verification in seconds with no process interruption and with a 95% confidence factor that the flowmeter is within the original wet calibration. The verification report shows all tests performed, test results, a tolerance band revealing if components are drifting, and proactive information such as how soon to clean the electrodes or replace the power supply board. This provides substantial customer value, especially for WWWW plants running with a leaner workforce. ●



ENDRESS+HAUSER For more information about Endress+Hauser's smart process instrumentation for the WWWW industry and its powerful collaboration with Rockwell Automation, visit <http://bit.ly/ehsmart>.

It's This Easy

Understanding 4 key industrial analytics trends help digital transformation leaders uncover scalable, enterprise-level insights and actionable outcomes.

• **T**he manufacturing industry is at a crossroads. While many organizations are just getting started on their digital transformation (DX) journey, intelligent enterprises have become industry leaders by harnessing the power of their data. Through industrial analytics, these leaders have uncovered scalable, enterprise-level insights and actionable outcomes.

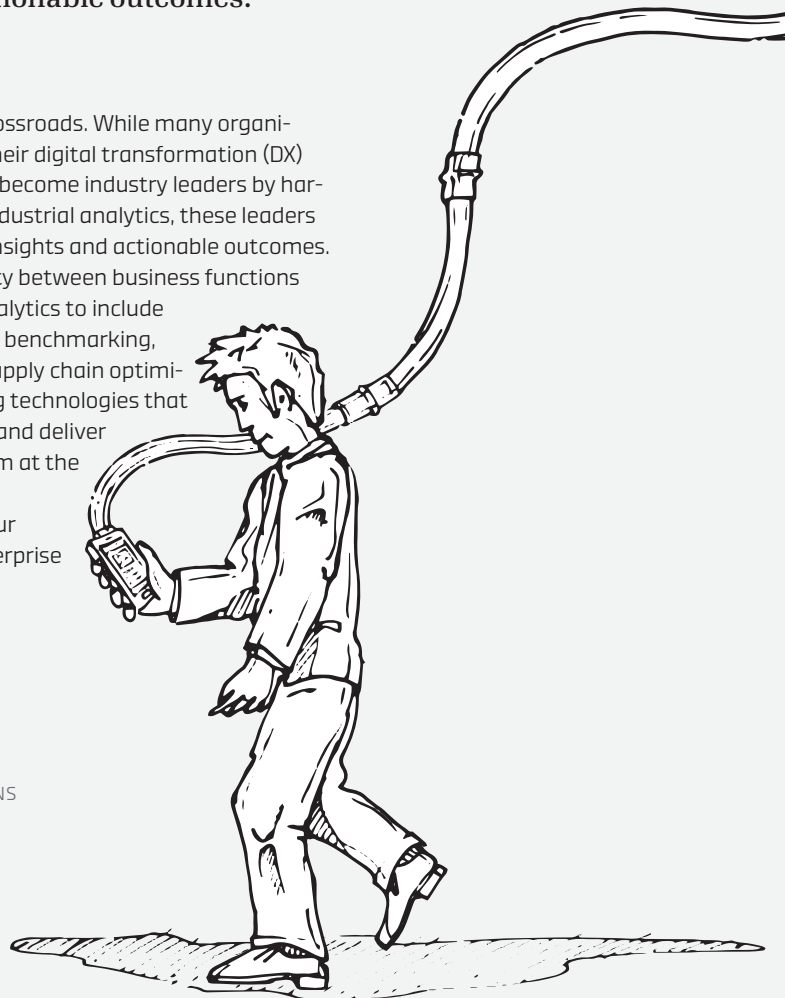
More recently, the increasing connectivity between business functions and systems has expanded the scope of analytics to include enterprise-level use cases such as multisite benchmarking, workforce optimization, and process and supply chain optimization. This expansion is fueled by emerging technologies that provide a holistic view of global operations and deliver insights to the appropriate person or system at the right time.

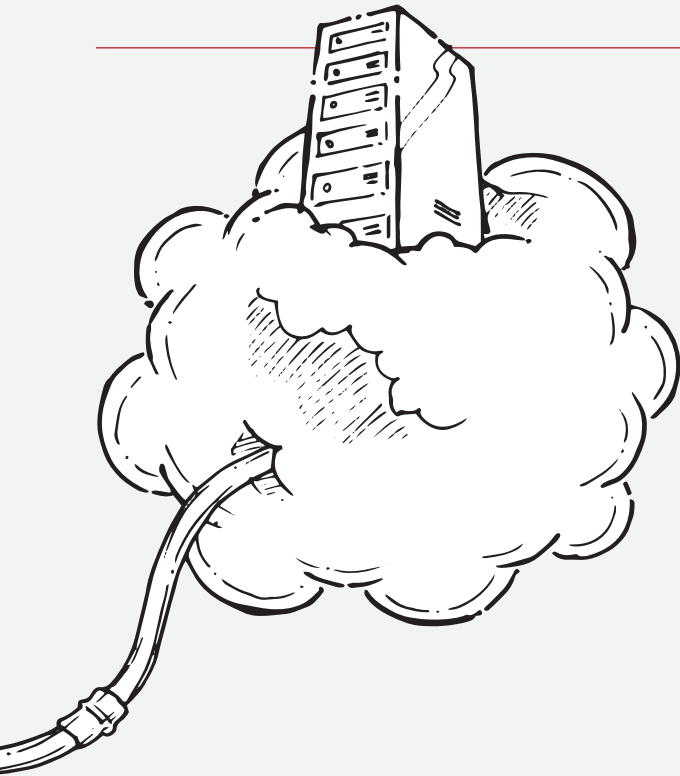
But a relevant question remains: Can your current analytics capabilities take your enterprise to the next level?

ROCKWELL AUTOMATION

Gaurav Verma

MANAGER, DIGITAL TRANSFORMATION SOLUTIONS





It makes sense to offload data processing and analytics at the edge, so that the action can be taken in real-time and closer to the source.

As a DX leader at the helm for leading change in your organization, you need to be prepared — and informed — about industry trends. This is what separates leaders from followers:

- **Foresight of the future trends.**
- **Awareness to factor industry trends into your company's vision.**
- **Positive organizational change through market transition cycles.**

Let's examine prominent themes in the industrial analytics space that are gaining importance and would be valuable to include in your DX analytics strategy.

Use the Power of OT Context for IT/OT Convergence

While IT and operational technology (OT) convergence has been practiced for decades, manufacturing organizations have yet to master it. The core of IT/OT convergence is data, most of which originates on the shop floor.

To glean high-quality insights from the industrial data, IT applications need wider contextual data points around a piece of OT data, such as the time when it was produced, the equipment where it was generated, the pressure or torque at that time, or even the production shift in force then. Additional OT contextual data points like these help data scientists or IT analysts establish causality in a complex production environment and uncover deeper correlations at the enterprise level. Executives and plant managers constantly are striving for this nirvana.

However, it all starts with capturing the right OT data context on the shop floor, where the data is produced. Data scientists spend significant cycles with engineers to get the right OT context — after that fact — while being engaged in the data preparation phase of building analytical models.

But it shouldn't have to be so difficult. Engineers should be able to configure the OT data to be captured at runtime, indicate the frequency of collection, and configure a logical structure or a common information data model for packaging the OT data per the needs of data scientists. While more third-party data could be added to this common information model

per business needs, the key to streamlined IT/OT convergence is that this information model is more conducive to be consumed by IT applications.

With all this in place, it follows that higher quality data with the supporting OT context will lead to higher quality enterprise insights.

Include Edge as Part of Your Analytics Strategy

While cloud got a fair share of its glory in the technology curve, the edge has been relatively underused in crafting the analytics story. And that applies to most organizations.

Today, DX leaders are waking up to the potential of the edge to make their analytics strategy whole. There are many good reasons for this. Several industrial analytics use cases require a response time within milliseconds. Sending the data to the cloud, retrieving the insight back and acting on it then isn't going to be enough, because the network delay costs are too high.

That's why it makes sense to offload data processing and analytics at the edge, so that the action can be taken in real-time and closer to the source. For operational efficiency, this makes all the difference.

For this, DX leaders are increasingly using analytics solutions that can let their engineers write back insights to the control layer in real-time. In addition,

they're looking into deploying intelligent edge gateway solutions as part of their strategy. These edge gateway solutions — either hardware or software — can offer pre-integrated connectors for data aggregation using the latest industry protocols and formats, and process, store and forward data to other applications in the enterprise.

Taking this further, the possibility of deploying machine learning models for targeted use cases on these gateway solutions is certainly within the realm of possibilities. To facilitate scale, DX leaders should have a plan to let their IT administrators control these edge gateway devices/solutions from a centralized location and be able to apply security profiles to them.

Lastly, while machine learning models may be created in a centralized IT location, industrial organizations are also looking for the flexibility to deploy them at the edge or vice-versa.

Empower OT Staff with Simplified Machine Learning Tools

OT engineers interact intimately with plant data, processes and equipment daily. Owing to their unique domain expertise in plant operations, they're best suited to bring out tangible improvement opportunities at the plant floor. However, they lack access to an easy-to-use machine learning solution that can help them support continuous improvement goals with optimized operational performance for targeted manufacturing use cases.

While Artificial Intelligence (AI) and machine learning has been the mainstay of data scientists due to the involved domain expertise, a new crop of

technology-savvy plant engineers and operators is emerging. They're ready to apply their domain OT knowledge to machine learning space in an intuitive or visual manner.

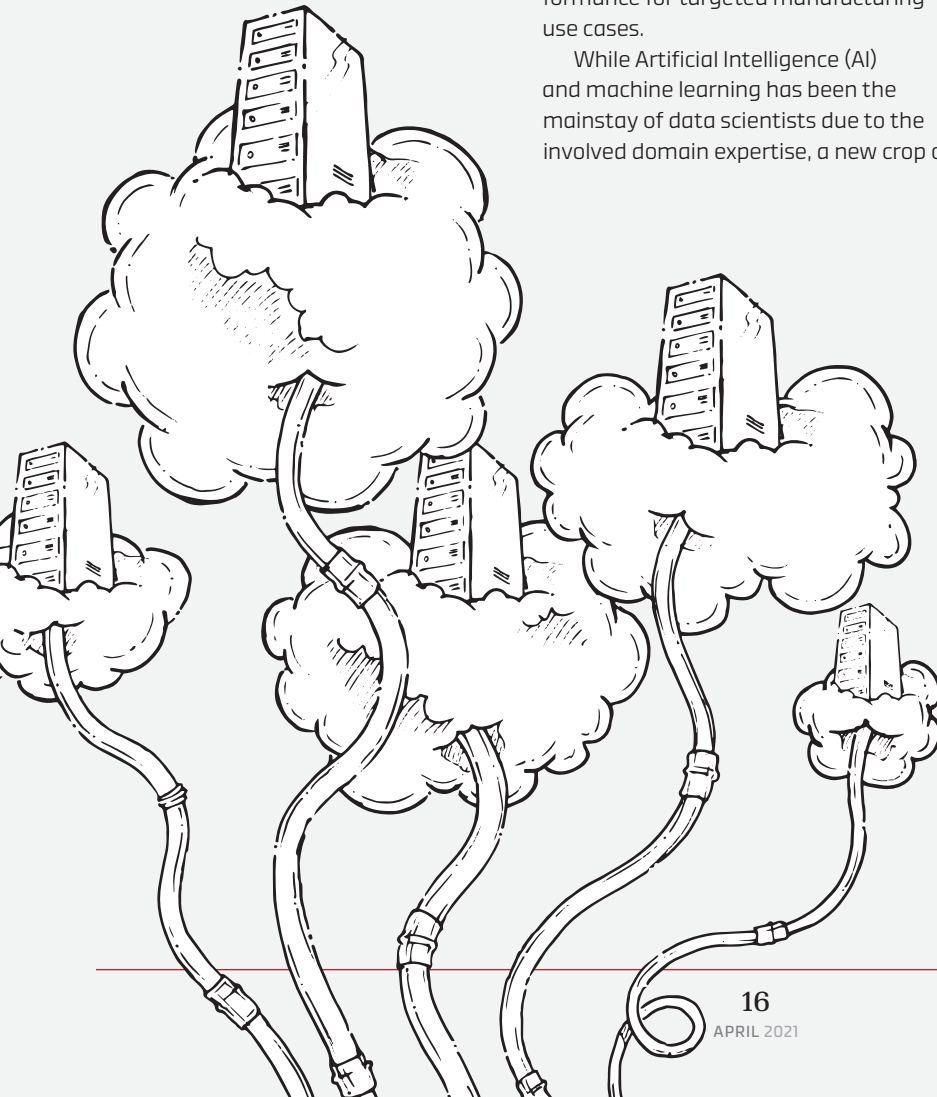
These citizen data scientists are comfortable with the basics of data management and are accessing visual tools for preparing data pipelines, configuring models, deploying them and ultimately scoring them at runtime operational data — all near the plant equipment. The truth is that today, the key machine-learning capabilities can be simplified enough to be put in the hands of the OT professionals who have the right discrete or process manufacturing knowledge.

For example, OT professionals are using ready-to-go hardware solutions that fit into the controller chassis and have embedded machine-learning models for detecting operational anomalies. All they must do is configure the models a bit before starting to use them on live data. These solutions can also help them estimate operational variable values, such as moisture, without causing production scrap and slowing down production yield.

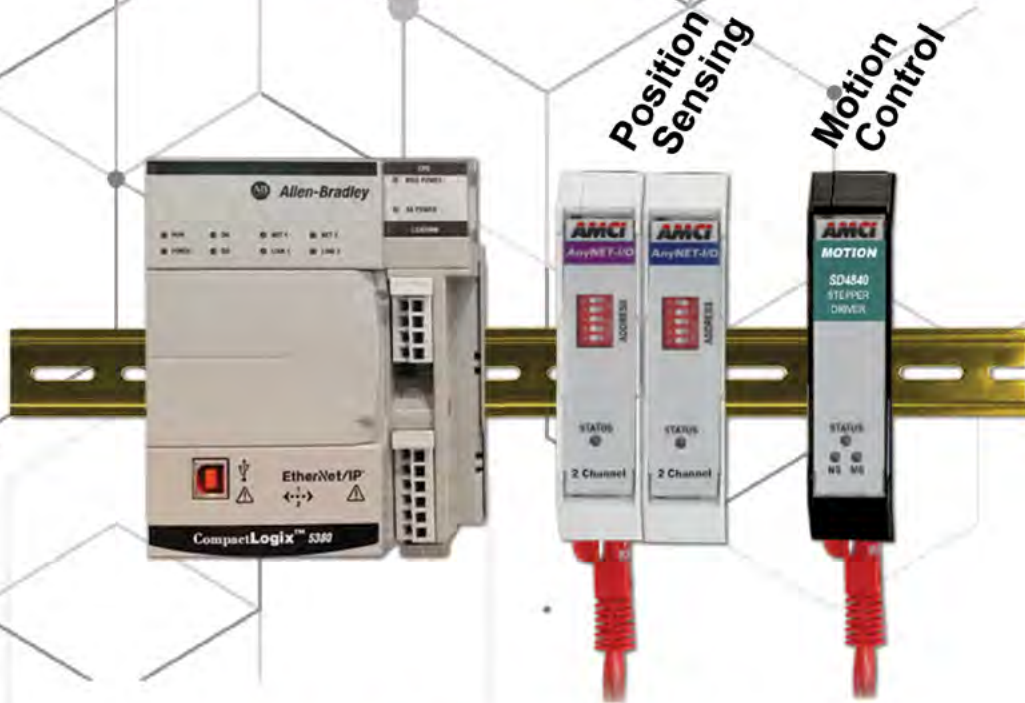
Another example is when OT professionals can bring in their dataset from different sources, and the analytics solution auto selects a machine-learning model that's optimized for the underlying data — thereby doing the heavy lifting.

Yet another possibility is that OT professionals can just start using off-the-shelf targeted machine learning applications for predictive maintenance, predictive key predictive indicators (KPIs) or anomaly detection use cases for maximizing business outcomes.

In short, empowering OT professionals with powerful, preconfigured and simplified machine-learning tools is a key industry trend that DX leaders can't afford to ignore.



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Apply Machine Learning to Product Lifecycle Intelligence

A key way global manufacturers are looking to remain competitive is by optimizing lead times for product updates. The ability to apply machine learning to Product Lifecycle Management (PLM) systems can help them better understand and drive insights from product data collected over many years.

Product lifecycle intelligence (PLI) is an evolution of PLM that applies artificial intelligence (AI) and automation to help PLM users extract meaningful insights from product data, formulate predictions, recommend improvements, and automate actions within systems. The potential value is immense, because with PLI and machine learning, manufacturers can proactively prevent delays and failures.

PLM can do a great job of managing product data through rapid change, but it's not perfect at putting that data to work through data mining and analytics. For many discrete manufacturers, this means they're sitting on months or even years of untapped research and development (R&D) product data.

By combining PLM with PLI, companies can bridge the gap in PLM analytics capability, allowing managers to understand current performance, historical averages, and the variances across different business units and functions. These insights can help them develop more meaningful customer experiences while driving business and product value. As an organization iterates product development efforts, their database grows more robust, and the value of PLI grows accordingly.

Companies that strive to maximize the value of PLM by pursuing PLM system consolidation, looking for more opportunities to use insights from data using PLI, and expanding the use of apps to augment consolidation strategies will continue to expand the return on investment.

Ahead of the Curve

As they say, knowledge is power. As newer technologies disrupt the status quo and establish new norms in manufacturing, scouting out upcoming industry trends is an important aspect of being a DX leader, which is why manufacturing leaders need to stay informed to stay ahead of the competition. ●



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Universal Industrial Gateway



12 Protocols

- | | |
|---------------------|--------------------|
| 1. EtherNet/IP | 7. DF1-CIP |
| 2. EtherNet/IP-PCCC | 8. PPI |
| 3. Modbus TCP | 9. S7comm (ISOTCP) |
| 4. Modbus RTU | 10. HostLink |
| 5. Modbus ASCII | 11. CCM |
| 6. DF1-PCCC | 12. DirectNET |

- 5 Ports and 12 Protocols all in one Gateway
- 72 Protocol Combinations
- Supports Multiple Protocols Simultaneously
- Browser Based Configuration
- No I/O Tree Changes
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Real-World Examples of How Analytics Provide Value

See how firms in the consumer-packaged goods, life sciences and automotive industries can use industrial analytics to improve manufacturing performance.

Industrial manufacturers thrive because of executive decisions made at the top, which in turn need to be based on plant-level and operational considerations. While plant engineers, line supervisors and plant managers interact with their shop-floor equipment daily, they need visibility into the operational state to meet or exceed their business key performance indicators (KPIs) and share abstract actionable insights to their immediate management.

Industrial analytics play a huge role in generating these insights at the device, equipment, line, plant and enterprise levels. Digital transformation (DX) leaders might recognize the value that industrial analytics implementations could bring to their organizations but need to start with pragmatic use cases they could get started with or expand upon later.

Let's explore some high-impact analytics use cases for manufacturers. The use cases discussed form a solid foundation for involving stakeholders, establishing a common vision for change, and co-creating organizational value for positive change.



Overall Equipment Effectiveness (OEE) and Analytics

Consumer Packaged Goods (CPG). In the CPG industry, manufacturers typically want to sell everything they make and to increase capacity and throughput. Most operate on thin margins and want to increase profitability by gaining efficiencies and reducing scrap.

However, their ability to schedule production volume is negatively impacted by unexpected stoppages, because the just-in-time delivery model causes stock outages for some end customers. Unexpected line stoppages also affect the mean time between failure (MTBF) and mean time to repair (MTTR) KPIs — creating production waste as unfinished product sits in pipes, hoppers and trays, and upstream work in progress (WIP) must be discarded. Interruption in production also leads to labor-related losses as operators sit idle while maintenance people repair the line.

Interruption in production also leads to labor-related losses as operators sit idle while maintenance people repair the line.

Monitoring and analyzing OEE can be an effective weapon against unplanned stoppages. The key to using OEE is to find out what's causing unplanned stoppages, and then plan to reduce the top reason codes for unexpected downtime. The opportunity for OEE optimization is typically in capacity-constrained high-value lines. For this, manufacturers can use a barebones monitoring system to find their biggest challenges.

Then they can go deep in those spots — such as across mixers (batch control), ovens (process control), or downstream packaging systems (discrete control) — to find where OEE optimization can be achieved.

Automotive. In the automotive industry, the assembly line is the place where it all comes together, and the vehicles tend to roll off the end of the line at about one per minute or more. Therefore, one minute of unplanned downtime is one less vehicle produced.

OEE presents a great opportunity for Tier One suppliers, who are required to deliver to the assembly line of larger automotive manufacturers on a just-in-time basis. The reason is that these suppliers tend to have large penalties — \$25,000 to \$50,000 per minute of shutdown — built into their contracts if they cause a shutdown of the assembly line.

So, it's essential for Tier One suppliers to have their lines finely tuned to deliver to the assembly line just-in-time. If a subsystem shuts down assembly, it has a ripple effect through the entire system. On the other hand, manufacturers can focus on either curing presses or tire building machines for optimization, because these are the machines that make tires.

The impact of OEE optimization can be significant. Consider a typical tire plant that produces \$500M of goods a year. Assuming they operate at ~60% OEE, a 1% OEE improvement could be worth \$8M to \$10M, helping them to empower operators to make better decisions on the plant floor and solve issues immediately, reduce manufacturing costs such as overtime and labor costs, and increase product and revenue capacity at the same time.



PHOTO: MIKEDOTTA / SHUTTERSTOCK.COM



Analytics can help CPG companies increase yield by automatically collecting data on raw materials used versus the amount of good product produced in the production process.

An automated OEE solution also can reduce data-management costs by reducing time required to gather and organize data, produce reports and fix manual data errors.

Life Sciences. In the life sciences industry, the need for OEE is predominately in the drug substance, fill finish and packaging areas. While OEE is usually looked at on a process line basis or even machine-by-machine basis, it's generally not examined on an overall plant basis.

Also, while the quality of medication products is an overriding concern, using OEE is still highly applicable whenever commodity medications and treatments are sold out. Implementing an OEE analytics solution can help in improved capacity, reduced manufacturing costs from overtime and labor, and increased quality throughput.

Yield Optimization and Analytics

Consumer Packaged Goods. The global CPG industry must comply with stringent food safety regulations, continually evolving consumer demand, increased competition and thin margins. This has forced manufacturers to take a closer look at their plant data to see how they can optimize production and meet these challenges.

Analytics can help CPG companies increase yield by automatically collecting data on raw materials used versus the amount of good product produced in the production process. It can then provide yield calculations by both product and in which piece of equipment the product was produced. The goal is to help the manufacturer get the highest output of good product from an efficient use of their raw materials and permit them to operate in this fashion repeatedly.

This kind of analytics solution serves both the batch type processes and the discrete packaging side of

manufacturing. In addition, it applies to everything from paper products such as paper towels or toilet paper to food products. Ideally, customers should have the ability to drill into the usage of raw material ingredients.

Some examples of applications include optimizing the number of paper towel rolls from a roll of produced raw material, optimizing the properly filled bags of shredded cheese from a batch of cheese, and optimizing the amount of air entrained in ice cream.

The ingredient optimization aspect of this use case empowers customers to fine-tune the right balance of expensive ingredients to reduce costs. Once an optimal yield is achieved, that output must be repeatable via least process variability to maintain the cost savings gained. For example, one international dairy producer increased production rates by 5% to 15%, increased product yields and improved product quality by 50%.

Life Sciences. Life sciences manufacturers need to maximize the amount of quality product produced from raw materials. Because of the unique nature of life sciences manufacturing, it's critical to achieve maximum yields in a highly controlled and regulated environment.

Additionally, these yield improvements need to be repeatable, so stabilizing the process by reducing its variability is essential to stabilizing the downstream processes of the supply chain.

Analytics can help such manufacturers identify the value of yield and determine what KPIs to track to improve it. Data collected can include raw material usage, product produced and other values to

help identify lots or batches of raw materials for examining yield. Collecting both raw material usage and product produce also could deliver predictive yield calculations.

Ideally, this use case should also provide users with the ability to drill into the usage of raw material ingredients. For example, the customer should be able to see the raw material usage that made the batch of product used for a lot of pills or tablets.

An additional impact of optimizing yield is to provide stability in production that can allow better inventory management at both upstream and downstream portions of the supply chain.

Scale Your Success

No matter what your industry, analytics has a potential to affect manufacturing performance positively and improve profitability. Because industrial manufacturing has nuances per the respective space, the high-impact use cases illustrated here would need to be adopted to the specific needs.

However, the core of each use-case application is automation of relevant data collection, applying specific analytics, and presenting actionable insights to the right stakeholders for value realization. It's important to stay focused on optimizing the value realization from the chosen use case to see tangible return on investment (ROI) from initial investment. After that, it makes sense to gain alignment with key stakeholders and scale the positive impact across lines, facilities, departments and enterprise. That's how to scale your success. ●

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When you sip a perfectly sweetened soft drink or sprinkle a no-calorie sweetener in your tea, you may have just enjoyed the fruit — or the kernel — of one British company's labors. The company provides sweeteners, starches and other ingredients to food, beverage and other industries worldwide.

The company's corn wet-milling process uses every part of the corn kernel to create byproducts, from animal feed to high-fructose corn syrups. But extracting sugar from corn kernels — the sweet spot for one of the company's plants in the U.S. Midwest — requires a complex series of steps. And that multiplies the need for efficiency and flexible controls.

However, the plant's reliance on obsolete parts and the system's inability to easily pinpoint problems made it clear that the site urgently needed a new process control system.

Outdated Controls Lack Efficiency

While the plant's end products have evolved over time to reflect changing consumer tastes and trends, its original process control system hadn't changed in more than 20 years and was showing its age.

"Runtime failures were steadily increasing," explains a principal process control engineer for the company. "At the rate we were going, we could not guarantee acceptable plant uptime in five or six years."

When control components failed, it was increasingly difficult and expensive to locate replacement parts, putting plant productivity in jeopardy. The risk came to light a few years ago when a membrane filter on a skid line failed, forcing the entire production line to shut down.

Operators also had to rely on single-screen stations that lacked visualization capabilities, making

DCS Upgrade Cuts Food Plant's Waste by \$500,000 Yearly

A corn processor migrated from outdated controls to a modern distributed control system that provides tighter controls on the ingredients and chemicals.



“

The PlantPax solution gives us fast access to more data, so I can tell what's happening throughout the system almost instantly.

timely troubleshooting nearly impossible. Without visibility into system devices, programmers needed to identify the programmable logic controller (PLC) code to detect a failed device.

"Anytime an I/O point failed, we had to shut down the entire production line because we had no easy way of identifying the problem, and it wasn't worth the risk of running blindly," the engineer says.

Modernization Sweetens Control, Visualization

The plant's project team recommended to management the [PlantPax® modern distributed control system \(DCS\)](#) from Rockwell Automation. The scalable, plantwide control system offered the

reliability, flexibility and production insights the plant needed to maintain peak productivity.

The team was familiar with Rockwell Automation equipment and had evaluated the PlantPax system at the company's annual [Automation Fair®](#) event.

"I knew it had the features and architecture we wanted for the entire company," contends the engineer.

Before implementing the new system, the team wanted to confirm the system's common EtherNet/IP™ backbone would mesh with the company's IT systems. The company's legacy system hardware did not communicate well with other plants, creating business challenges.

"We used the PlantPax system estimator to research networking scenarios for connecting servers to PLCs," notes the engineer.

The review confirmed that the Ethernet network was the right choice and helped the team develop project timelines.

While all the plant's controls are local, the PlantPax system can transmit production data through a gateway to the business network. This would allow managers to see production and trending across the company's different plants.

"The PlantPax system had the flexibility we were looking for," the engineer elaborates. "All the pieces tied together with our established legacy controls, and we really liked the robustness and reliability of the Logix control platform."

To minimize production disruption during migration, the team kept the legacy system running and built the PlantPax system on top of it. They temporarily created a CLX chassis in place, moved I/O, and used 3D fittings and prototypes to accomplish the replacement.

At system transition time, the team took the legacy DCS offline, secured the chassis and brought the new modern DCS online. The replace-in-place method minimized space requirements and achieved a virtually seamless transition.

During implementation, the project team found great advantage in the PlantPax library of process objects. Its modular programming tools, including virtual image templates, simplified system setup. The system library also helped the project team embed best practices into the system, including rules for system access, alarm management and more. Core system elements such as preconfigured, drop-in templates provide systemwide consistency.

The system's access guides made it easy for the project team to create and assign different access levels, achieving the right balance of security and accessibility.

"Now we can assign each job function — operators, main technicians, controls engineers — with the needed access levels across the plant," the engineer adds.

The company can also easily limit system access to operations personnel with system expertise, and grant



maintenance access and delegate responsibility across teams and shifts. Machine operators will always have the ability to override maintenance controls and authorize continued operations when it would be counterproductive to halt a production line.

The PlantPax system incorporates the visualization capabilities of [FactoryTalk® View Site Edition human-machine interface \(HMI\) software](#) from Rockwell Automation, which monitors and controls distributed-server/multi-user applications. It provides critical visibility when and where operators and other employees need it.

"We were confident that employees of many skill levels would find it easy to use, and that it would ease their concerns over a new system," observes the engineer.

The company also uses the system's process historian, allowing operators to view production trends.

Waste and Downtime Minimized

Today, plant workers worry less about production downtime and obsolete hardware. The plant can produce its own hardware spares and even prevented an extensive production outage at a sister plant by providing spares when 15 of its modules failed.

"The PlantPax solution gives us fast access to more data, so I can tell what's happening throughout the system almost instantly," the engineer says.

The system rapidly processes the plant's control strategies and loops, giving operators ongoing insight into ingredient flow, pressure, temperature and other elements critical to quality, capacity and production line flow.

With precise loop control, the plant is significantly reducing waste. "We've easily saved \$500,000 a year because we have tighter controls on the ingredients and chemicals we use," the engineer explains.

Workers also appreciate the time-saving benefits of improved visualization.

"You can see modes of operation right from the HMI [human-machine interface], as well as visualization of design functions," the engineer says. "When it comes to troubleshooting a device problem, it probably saves 15 minutes per device because operators don't have to find the device's PLC codes."

With about 3,000 devices and 4,800 I/O points, the potential time-savings are vast.

The scalability of the PlantPax system also complements the company's vision for the future. "I have to plan on the future growth of our company," the engineer says. "With the PlantPax platform, we can add new functionality and scale the system as needed. It will be our control system for the next 20 years." ●



LISTEN TO THE PODCAST

How Automating Production-Line Labeling Can Help Prevent Bottlenecks & Recalls

Printing equipment sometimes isn't considered a resource that generates revenue. But if a printer goes down, no product is going out the door. In the The Journal magazine's Automation Chat podcast, "How Automating Production-Line Labeling Can Help Prevent Bottlenecks & Recalls," Executive Editor Theresa Houck is joined by Adem Kulazovic, Director of Product Management at Domino Amjet, to talk about how coding automation can help improve productivity, reduce errors and avoid unplanned downtime.

Coding automation means automating the manual process of ensuring the correct information is printed on the right products and packages, reducing human error in label selection and management, then integrating that data with existing ERP or SCADA systems.

They also chat about the importance of industrial communications standards such as Fieldbus for communication and data sharing, and more.

Listen on your favorite podcast app OR on the web at <https://bit.ly/tj20dominopod>, or watch the conversation on YouTube at <https://youtu.be/vIg1yIGbtsM>.



How IIoT Condition Monitoring is Changing PdM

Many misconceptions and questions abound on the occasional "overpromise" of what the Industrial Internet of Things (IIoT) can deliver. IIoT and its subsequent technologies aren't a one-size-fits-all solution that simply can be dropped into a plant and generate immediate value. If used incorrectly, they can end up being nothing more than an expensive distraction, forcing your team to use another new piece of software and giving you information that requires a team of experts to sift through.

However, a properly architected IIoT solution will add value to your existing control network, provide a platform to help your understaffed maintenance team, and give you plenty of lead time to schedule maintenance activities optimally on your most critical assets.

The reality of IIoT potential is attainable, but you need to have an integration team with you every step of the way. But where is a predictive maintenance (PdM) program infused with IIoT most

A well-architected IIoT solution can enhance your control network, help your understaffed maintenance team, and provide time for scheduled maintenance.

GRACE TECHNOLOGIES, INC.

Nick Schiltz

likely to integrate seamlessly? If you're looking at your annual budget and hoping for a shortcut, an easy button, don't click "add to cart" just yet. There are a few housekeeping items to note.

Establish a Strong Safety Culture

First off, foster your maintenance program with a strong safety culture. If you believe in the potential for zero instances of injury, you must believe in the potential for zero failures and unplanned downtime. That might seem unrealistic, but this is the first step toward aiming high and setting an aspirational goal within any safety culture.

Your operations and maintenance training should be on a par with your safety training; typically, it is not. Getting both reliability and safety to their full potentials requires operational discipline and tenacity in all areas.

One of the most frequent contributors to workplace accidents and unplanned downtime is a lack of planning or analytics. This can lead to a stressful work environment that has

a high demand for productivity, whatever the cost. No task is so urgent it cannot be done safely and reliably, because any injury or equipment failure is preventable.

Employers are responsible for providing a safe and reliable workplace, but everyone is responsible for upholding the integrity of workplace standards to prevent injuries and failures. You can have excellent personnel safety and still have a major accident. Safety is improved by disciplined operating and maintenance practices.

The most common excuse for not investing in safety and reliability is the budget. Most companies assume it will cost millions to get a program in order, but they don't realize they can start small and build Rome not in a day, but over the course of many years.

And there is no safety plateau; you will always need continual improvement. It's a gradual process, but over the course of a year or two, you will start to see results that will change the budget committee's mind. This is about a change in mindset, a change in approach to engage the workforce and set higher disciplinary standards for the workforce itself — higher expectations. You then support employees in meeting those expectations.

Eliminating small day-to-day problems has a much bigger impact on results than focusing on the major failures. Engaged employees are three times more productive than average employees. Most organizations are not aligned with, engaging with or helping their employees do a better job. Focus on the high-level goals and think at a systems level. Develop shared measures between competing groups and partnership agreements so you are more likely to work together. Set clear and reasonably attainable goals.



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2021 Food & Beverage eBook Discusses How to Achieve Better Performance

Our new 2021 Food & Beverage eBook explains how producers are using smart manufacturing to boost performance and product consistency for food safety, changing consumer tastes and stiffer competition. See how one food processor migrated to a modern DCS and cut the factory's waste by \$500,000 yearly. Discover how electrical engineering software is changing the food industry. And learn about PID controller tuning, edge computing, cross-protocol network communication, mitigating packaging-machine hazards and more. Download the free resource at <http://bit.ly/tj21fbebook>.

Strengthen Your Maintenance Program

With these pillars of support in place, you will be more prepared to approach IIoT implementation within your maintenance program. One of the basic starting points is condition-based monitoring, such as motor and rotating equipment vibration analytics. With condition monitoring, we want to understand the equipment degradation process to avoid or minimize the consequence of failure.

We hear a squeak or a noise that we let that go too long, and it becomes a functional failure. Beyond that, the equipment deteriorates quickly until it is completely broken. That time interval between potential and functional failure is the time to take action — to plan and schedule to mitigate the failure or to avoid the failure altogether.

To be truly transformational, this technology needs to do more than just augment. It needs to change fundamentally the way we approach industrial maintenance. Over the past decade, the promises of IIoT have been great, but we have yet to see a set of products truly rise to meet the level of hype surrounding this space.

There are good reasons for this: this stuff is hard, the technology is young, and it will take some time to perfect it. But that doesn't help you explain to management why your large IIoT expense is not generating any justifiable return on investment yet.

Improve Your Vibration Monitoring

One area in which IIoT is starting to create industrywide value is monitoring vibration in rotating equipment. Any critical piece of equipment in an industrial setting is going to have at least one major rotating component, and these rotating components are subjected to constant mechanical and electrical

loads that lead to strain, friction, fatigue and other sources of potential degradation.

Historically, preventive maintenance programs have turned to trained vibration analysts to perform monthly or quarterly route-based inspections of critical rotating equipment. These inspections typically collect high-frequency vibration data and are used to assess the amount of energy a piece of equipment is spending in various frequency bands. The results of these analyses can serve to detect the early onset of issues such as misalignment, gear tooth chipping or bearing degradation.

When it comes to rotating assets such as fans, blowers, pumps, cooling towers and other equipment powered by AC induction motors, vibration analysis is an effective diagnostic tool. It delivers the granularity required to isolate the root cause of anomalous behavior in a time frame that's useful to industrial maintenance operations. However, the type of vibration sensor should match the rotating asset's characteristics to balance affordability with data accuracy and reliability.

The general types of vibration sensors include displacement sensors, velocity sensors and accelerometers. Accelerometers often are the best choice for most industrial rotating assets, because they're simple, easy to apply and sensitive to the high-frequency vibrations typically generated during force-failure.

Large industrial motors cost a lot of money, rebuilding motors costs a lot of money, and downtime because of a failed motor costs a lot of money. Adding vibration sensors to motors is cheap in comparison and can help detect early signs of motor malfunction. Many motors are in inconvenient, remote, hazardous or difficult-to-access locations. Thus, some motors might go weeks or even months without even a proper inspection.

A completely unmonitored motor is a catastrophe waiting to happen. You need vibration monitoring with provider support on all your equipment, particularly in remote locations where parts may be difficult to find, downtime is expensive, and technicians are scarce.

Vibration-focused IIoT can provide an hourly health check on your most critical assets, intuitive cloud-based IIoT systems can help transfer generational workforce expertise, and a fully connected IIoT network can make advanced insights available to both your smart phone and your PLC.

Remember, IIoT is not some widget you can install tomorrow to solve all your problems. Like your safety culture, it will need continual updates and support, but the payoff will be quantifiable for many years to come. ●



GRACE TECHNOLOGIES, INC. Grace is a Technology Partner in the Rockwell Automation PartnerNetwork™ program. With a distribution network and sales presence in more than 60 countries, the company provides electrical safety products and predictive maintenance solutions, including the GracePort® panel interface connection; the GracePESD® Permanent Electrical Safety Devices; and the GraceSense™ line of IIoT smart devices that combine predictive maintenance technology and personnel safety techniques.



Why Maintenance Work Orders Deserve More Love

Efficiency comes from good maintenance, which relies on good work orders, so managers make critical decisions. But everyone's looking at work orders wrong.

FIXX INC.,
a Rockwell Automation Company

Marc Cousineau

• **T**he average maintenance department handles 45 work orders every week. That's more than 2,200 work orders every year, or a new request every four hours.

In other words, the maintenance team impacts your business almost constantly — and that impact is huge.

For example, the average cost of an unplanned downtime incident is \$17,000, according to an Industry Week interview with Frank Hill, director of manufacturing business development for Rockwell Automation Technology Partner Stratus Technologies. If only 5% of scheduled maintenance work orders prevent downtime — and that's conservative — it would save your company millions of dollars.

There's just one problem: Work orders rarely get the attention needed to realize this potential. Take common work order metrics, such as planned maintenance percentage. They can be useful for maintenance teams, but they don't tell you much about the business impact of work orders. And businesses are suffering because of it.

Managers can't make critical decisions if they don't measure the quality of work being done. They don't know whether they're hiring



AUTOMATICALLY ANALYZE THOUSANDS OF WORK ORDERS QUICKLY

Work Order Insights, powered by Fiix Foresight, is a report that shows you closed work that affected your business and upcoming work that's likely to cause breakdowns, production delays and other issues. Get a list of work orders expected to cause breakdowns and view them by risk and potential impact so you can prioritize and prevent problems.

The report also lets you view your maintenance team's overall performance and work order health by site, to help:

Get the information you need to spend your time and budget where they'll make the most impact.

Identify work that always takes longer than it should and why. Fix the problem and help your team get the job done faster.

Drill down into work orders to find which fields caused extra work, costs or failure, and make sure it never happens again.

Learn more about Artificial Intelligence-driven maintenance at www.fiixsoftware.com/foresight.

the right people. They don't know whether they're overspending on capital expenditures. And they don't know whether they're promising customers the right things.

When you put thousands of work orders together, they tell a bigger story. You can use this story to understand how people and equipment work, what's getting in the way of peak performance and how to fix it. This is how you uncover hard-to-see problems that hold your company back, whether it's a lack of clarity, an outdated process, inaccurate data or something else.

It's time to stop looking at work orders as just a task on a to-do list. It's time we read that story.

Bad Work Orders Are Bad for Business

Broken work order processes are one of the quickest ways for minor maintenance problems to get out of hand. For example, poor work orders led to massive amounts of missing inventory and unnecessary costs at Liberty Oilfield Services, a hydraulic fracturing company.

The team at Liberty was capturing "just a fraction of what really happened," in the words of Jack Featheringill, Liberty's U.S. maintenance manager.

"There was no failure analysis, no context, no insurance for our mechanics," he says.

And for Rambler Metals & Mining, bad work orders were wasting hundreds of hours of labor every year.

"Whoever was finishing up their 12-hour shift would have to write pages of notes," explains Scott Britton, general manager of operations at Rambler.

He adds, "Writing those notes could take up to an hour, and the next person would have to spend the first part of their shift going over the notes."

The issues with poor work orders often spill off the shop floor and into other parts of the business. Consider the problems Liberty and Rambler had to see the potential ripple effects and how it affects a business.

Inaccurate Records and Missing Inventory

When finance, purchasing and maintenance aren't working with the same information (or any information), it could cause:

- **Lower throughput and higher operating costs.** Missing the spare parts you need is the cause of 50% of all unscheduled downtime, and keeping parts you don't need in the storeroom adds an extra 12% to 20% on average to a company's operating costs.
 - **Undershooting on your CapEx planning.** It's easy to miss the warning signs of asset failure if you don't have context around inventory purchases. That leads to some nasty surprises when looking at the final numbers.
 - **Allocating resources to the wrong places.** If you're missing the whole story around parts, failure and performance, you'll never know which sites need more people, money, training or tools.
- **A massive backlog bill.** Spending almost 10% of your shift creating work orders (as Rambler did) means less time on the actual work. The result is deferred maintenance. Every \$1 in deferred maintenance costs \$4 in future capital renewal needs.
 - **Unexpected delays at the worst times.** Spotting bad habits, such as the same part always wearing out, is almost impossible without standardized work orders. Adjusting maintenance plans is difficult, and the results are inevitable: a breakdown during production.
 - **Missed follow-ups and failed audits.** Mistakes and burnout are inevitable when work orders are complicated and time-consuming. Failed preventive maintenance without follow-ups is sure to happen, as are breakdowns, compliance issues, safety risks and increased costs.

Handwritten Notes and Wasted Time

When maintenance processes are broken, it usually causes inefficiencies to pop up across your organization, including:



VIEW THE WEBINAR

Build Smarter Machines Using Machine Data, Analytics and Augmented Reality

In this webinar from Rockwell Automation, see how Rockwell Automation Technology Partner LLumin's READYAsset for Machines, can be used by OEMs to add proactive maintenance into their offerings by incorporating machine conditions, analytics and Vuforia® from Rockwell Automation Strategic Partner PTC. View the on-demand webinar at <http://rok.auto/ptellumin-webinar>.

ROI of Good Work Orders

Enough with the doom and gloom. Good work orders also can have a huge positive impact:

- It took Rambler just three months to increase its productivity by 15% after standardizing its work order process. Technicians were able to spend almost two extra hours every shift doing work instead of writing it down.
- Dredging company Callan Marine reduced downtime (which can cost more than \$1,200 an hour) just 90 days after starting to track maintenance costs and activities in work orders.
- Optimizing work orders led to a 50% average increase in asset performance, according to data collected from Fiix customers.

Creating great work orders and working constantly to improve them makes too much business sense to ignore, according to Stuart Fergusson, the director of solutions engineering at Fiix and a former production line manager at Procter & Gamble.

"There are two main drivers to dollars," says Stuart. "You can either make more or make it cheaper... But buying a new line is a lot more expensive than running the one you have more efficiently. Where are you getting that efficiency? Good maintenance. And how do you do good maintenance? With good work orders." ●



HMI Basics and Their Effect on Efficiency

Learn how a human-machine interface system works, the primary types and applications, and how to implement them into various hazardous environments.

PEPPERL+FUCHS

Aaron Severa

PRODUCT MANAGER FOR HMI AND FIELDBUS

- In recent years, customers increasingly have adopted the use of various types of human-machine interfaces (HMIs) within process automation applications. These HMI implementations have increased the overall efficiency of the process and made day-to-day work easier for the operators and engineers tasked with working with these HMIs. Let's examine some of the types of HMI systems and how to implement them into varying degrees of explosive, hazardous environments.

What is an HMI System?

For starters, what is an HMI? An HMI is a dedicated device that serves as the interface point between human operators and the machine or equipment they're wishing to control. In the past, these may have been physical operator push buttons and small analog gauges.



Figure 1. Operator interface panel HMIs, or graphic terminals, usually run a streamlined, embedded OS and dedicated software program with direct integration into the PLC or DCS being used. They're controlled via a touch interface or keys or push buttons on the panel itself.

Now, HMIs most commonly are thought of as digital displays that have some type of processing unit capable of running software that allows operators to complete their tasks and run the equipment in the process. Modern HMI systems typically are interfaced with different types of touchscreens (resistive or capacitive), various types of pointer devices (touch pad, trackball or joystick), and a series of push buttons, or operator keys, or in some cases a dedicated keyboard (QWERTY or annunciator keyboard).

HMIs are used in a variety of applications, but their main goal is to allow the local operators and engineers to have visibility and interaction with their local process. Tasks such as communicating with the programmable logic controller (PLC) or distributed control system (DCS), controlling various input/outputs (I/Os) throughout the plant or monitoring the performance of parts of the process all are tasks that a local HMI system can do to make the process and installation more efficient.

Types of HMI Systems

HMIs can be classified into a handful of different technologies and functions — what I'll call operator interface panels, full PCs, thin clients and zero clients. Each type of technology has its pros and cons. Depending on the application and the philosophy of the installation, some technologies are better suited than others. There is no wrong answer... it's all about the implementation.

Operator interface panels. The first type of technology is operator interface panels, or graphic terminals. These panels usually run a streamlined,

embedded operating system (OS) with direct integration into the PLC or DCS being used. The operator interface panel typically runs a dedicated software program associated with this PLC or DCS and communicates via a bus protocol such as Modbus™, PROFINET® or EtherNet/IP™, among others.

These types of panels typically are smaller — between 4 and 10 in. — and are controlled via a touch interface or keys or push buttons located on the panel itself (see **Figure 1**).

Full PC workstation. A full PC workstation typically is a Windows-based workstation with the necessary processing power and storage to install and run the needed HMI application software locally. Depending on the software being installed, the number of simultaneous applications running and the overall speed requirements, installations typically use either a "low power" or a "high power" PC workstation.

A high-power option includes a faster processor, more RAM and a higher-quality and higher-capacity, solid-state hard drive. A low-power workstation uses a low-power processor, typically less RAM and a lower-speed SSD option.

Every application is unique, and a speed vs. cost comparison needs to be done to determine which system is right for the job. These PCs then are connected to a larger display than the operator interface modules above, normally 15 to 24 in. One thing to note, in process automation applications, is the average useful life cycle of a PC is in the realm of 3 to 5 years.

Thin client. Just like a full PC workstation, a thin client often, although not always, is a Windows-based platform; however, this time, the internal components and OS are optimized with a remote network connection in mind rather than local processing. The simplified goal of a thin client is to establish a remote network connection (Microsoft RDP, for example) back to a host PC or server where the applications and software processing are done.

A PC-based application uses a full OS. In a thin-client installation, a more streamlined or embedded OS often is used with software tools dedicated to helping users establish this remote network connection. Because the thin client itself is performing only relatively minor tasks from a processing point of view, a higher-end processor and more RAM are not needed — thin clients are designed with cost-effective hardware, keeping their overall price tag down.

The same could be said about the size of the hard drive used. While full PCs may incorporate a 256 GB, 512 GB or larger hard drive, a thin client will use a much smaller drive, such as 32 GB or 64 GB. Thin clients also extend the life cycle of a PC and often have a functionality lifespan of more than 10 years.

Zero client. A zero client, from an operation standpoint at least, is much in the same vein as a thin client — the goal is to establish the remote network connection back to the host

PC or server. However, with a zero client, all internal storage is removed, and there is no on-board OS, further lowering hardware cost and simplifying software patching and licensing costs.

Zero clients will run some form of customized firmware, such as Rockwell Automation ThinManager® software, which allows the unit to recognize, and ultimately establish, the network connection to the server and also employs a user interface for initial configuration. Once the client is communicating over the network, the server does all the processing work. Like the thin client, zero clients also have an extended life cycle, and often can be in use for more than 10 years.

Mobility Matters

Almost everyone has a smartphone, many people have tablets, and most companies have migrated to laptops in favor of desktop PCs. In the consumer world, mobility is key. The same can be said, at least in some cases, in the automation world.

Many of the previously mentioned HMI technologies can be deployed in some type of mobile or versatile product, as well. This could be in the form of a trolley or a mobile cart that can be moved to various stages of the process. Alternatively, mobility in the form of a tablet or smartphone can be achieved.

Depending on the exact nature of the process and the application, and the software being used, there is some benefit to the operators and engineers

moving around within the process rather than performing their operations at a fixed HMI workstation.

Hazardous Locations

When installing an HMI in a process automation application, once you clear the hurdle of "what type of technology do I need," the next obstacle is understanding what type of environment the HMI will be installed in. Will it be installed in a graded cleanroom environment? Or maybe it's located on an oil drilling land rig. More commonly, it's somewhere between these two extremes.

Understanding the environment and area your HMI will be installed in helps you select the proper display type, housing and mounting apparatus.

Expanding even further on the installation environment subject, and maybe more important, is the potential presence of any hazardous and explosive gases, dusts or fibers within the area. In the United States, when dealing with an installation where these hazards may be present, the area is classified appropriately into three categories with their design restrictions and safety elements in place:

- **General Purpose.**
- **Division 2 (Class I, Class II and Class III).**
- **Division 1 (Class I, Class II and Class III).**

Within a **general-purpose area**, no flammable gases, dusts or fibers are present. In a Division 2 area, the flammable gases, dusts or fibers aren't likely to exist under *normal* operating conditions, but may be present under *abnormal* conditions (such as a leaking valve or pipe). Last, in a Division 1 area, the flammable gases, dusts or fibers may exist under *normal* operating conditions.

When planning to implement an HMI in an application, pay attention to the installation site's area classification. The more severe the area classification, the more stringent the safety requirements are for any equipment that will be located within the area, including the HMI. And obviously the HMI's cost tends to increase in unison with the hazardous location's severity.

No additional protection methods are required to install an HMI within a general-purpose location. Certainly, you will need to make sure the type of ingress protection rating, housing and overall product specifications match the environment it has been installed in, but typically no third-party certifications are required.

Moving into the **hazardous locations**, within a **Division 2** area, this changes. The HMI product design now must consider the potentially explosive gases or dusts in the atmosphere, and incorporate the required safety elements within. This increases



Figure 2. From the outside, not much appears to be different between a general-purpose HMI system and a Division 2 HMI system for hazardous environments. It's the internal design, wiring connections and rigorous third-party testing that sets the HMI apart and allows one to be used within a Division 2 area.

Figure 3. Purge and pressurization is the only viable protection method for Division 1 HMI solutions, which means a compressor- and instrument-grade air is required to keep the installation safe. Because the internally located components ultimately will be protected by the purge system, they're not required to be certified for Division 1 installations by themselves.



design complexity and the cost, as these items now need to be submitted to third-party nationally recognized testing laboratories (NRTLs) for evaluation and the stamp of approval in the form of the haz-loc certificate.

From the outside, however, not much appears to be different between a general-purpose HMI system and a Division 2 HMI system. If they're installed within an industrial process automation application, they likely will have similar ingress protection ratings, potentially rugged designs and durable touch screens or mouse/keyboards to operate them.

It's the internal design, wiring connections and rigorous third-party testing that sets the HMI apart and allows one to be used within a Division 2 area (see **Figure 2**).

Even more complex HMI solutions are required for **Division 1** locations. For starters, the only suitable protection methods for Division 1 classified areas are intrinsic safety, explosion-proof and purge and pressurization.

However, it isn't feasible to design the HMI-specific components — motherboard, hard drive and memory — using intrinsic safety or explosion-proof protection concepts because of power requirements and temperature considerations. This means that purge and pressurization is the only viable protection method for Division 1 HMI solutions, which means that a compressor- and instrument-grade air is required to keep the installation safe.

However, one benefit of a purged HMI system is that because the internally located components ultimately will be

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protected by the purge system, they're not required to be certified for Division 1 installations by themselves. Often, general purpose-rated equipment, or in some cases Division 2, will be used inside of these purged HMI cabinets.

For these purged Division 1 HMI solutions to function, the system must undergo the proper purge and pressurization process before energizing the HMI (see **Figure 3**). For Class I (gas), Division 1 applications, the solution must complete a full purge cycle in which forced air pushes the hazardous gases out of the enclosure. Once the purge cycle is complete, the system then can provide constant positive pressure inside the enclosure, keeping the hazardous gases out while the system remains energized.

For Class II (dust), Division 1 applications, dust that has accumulated on

the solution's internal electronics must be cleaned manually. After the dust has been cleaned off properly, the system can be pressurized to prevent further dust ingress.

Once the system fully completes the purging process, a series of relays in the purge system design energizes the components within the enclosure and any incoming communication lines (e.g., Ethernet). Now, the HMI system can be operated!

Other considerations in these Division 1 HMI installations are the peripheral devices and interfaces to interact with the HMI. Are the keyboard and mouse protected by the purge system or are they intrinsically safe devices protected by intrinsic safety barriers?

If the HMI has a touch screen, can it be operated safely within the Division

1 area? What about any push buttons, operators, e-stops or bar code scanners? Certainly, special considerations must be taken before implementing and using any of these devices within a Division 1 classified area.

Right HMI for the Job

Regardless of what type of classified area your HMI will be in, what the environment is, what the process is and what type of technology is needed, you have options. Having a high-quality vendor or partner with knowledge about the types of HMI systems, the requirements and limitations that you may encounter in various applications and the ability to answer any questions that come up along the way can help you get the right product for the job. ●

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PRODUCT SPOTLIGHT

SENSOR TECHNOLOGY FOR SERVO COMPONENTS

WITTENSTEIN, a Technology Partner in the Rockwell Automation PartnerNetwork™ program, offers a self-monitoring gearbox featuring new sensor technology, cynapse, that tracks vibration, temperature, acceleration and mounting position of the gearbox. Designed to promote machine uptime and deter line downs, the high-precision servo gearbox includes product identification, threshold monitoring and data logger features.



A digital identification plate contains the product's unique ID. Embedded sensor technology monitors predefined values and thresholds for vibration, temperature, acceleration and mounting position, and sends this info to the IO-LINK Master where it can be shared to the PLC IPC gateway cloud.

Performance data for vibration, temperature, acceleration and mounting position is stored throughout the component's lifecycle. A built-in anomaly detector scans this aggregated data for trends or abnormalities that may occur over time and notifies the control system of potential issues.

Existing drive systems with WITTENSTEIN servo gearboxes can be upgraded with cynapse gearboxes without design modifications to the machine. The design, contour and size of the cynapse gearbox is identical to the original alpha gearbox, allowing for a simple drop-in replacement.

Integrated Service Agreement

Rockwell Automation offers a new way to receive multiple services in one contract for quick, easy access to support. An **Integrated Service Agreement** allows companies to select a package of offerings to simplify their support needs and have just one number to call to access experts and receive priority service.



Companies get 24/7 technical support, repair services, reports and analytics, field services, e-learning and more, all in one integrated contract. This is designed to help improve operational efficiency by providing visibility of contract usage and data for decision-making, and it uses

virtual support tools, learning resources and modern training tools. Users can maximize asset reliability and uptime, reduce total cost of ownership, optimize their installed base investment, and supplement their technical workforce with access to skilled engineers.

Smart Temperature Transmitter



Rockwell Automation Strategic Alliance Partner **Endress+Hauser** launched the iTEMP TMT142B smart temperature transmitter with Bluetooth. The transmitter delivers reliable measurements, wireless communication via Bluetooth, and user-friendly configuration packaged in a single-chamber field housing.

The transmitter's secure integrated Bluetooth interface allows users to wirelessly visualize measured values and NAMUR NE 017 diagnostic information. The device is easy and fast to operate using a phone or tablet and the SmartBlue app. No special tools are required.

A backlit display provides enhanced readability under all environmental conditions, both in the dark and in bright sunlight. The white background turns red to highlight diagnostic messages.

The device is designed for safe operation in hazardous areas as certified by international approvals (ATEX, CSA C/US, IECEx).

PRODUCT SPOTLIGHT

SAFETY LIGHT CURTAIN WITH CIP SAFETY

The Allen-Bradley® **450L GuardShield™ safety light curtains** are designed to improve productivity and increase efficiency while helping provide personnel safety. This light curtain also provides CIP Safety™ over EtherNet/IP™.

CIP Safety over EtherNet/IP achieves smart safety within a Connected Enterprise and provides rich data from the plant floor. The 450L GuardShield light curtains support linear, star and DLR networks and are suited for applications where safe, easy and frequent access to the machine is required.

Unlike traditional safety light curtains, which are based on separate transmitter and receiver units, the 450L's technology allows each transceiver to be used as a transmitter or receiver via a plug-in module. The 450L-E option provides advanced functionality, including integrated laser alignment, cascading, blanking and integrated muting.

The safety light curtains are TÜV certified PL_e, Type 4 IEC 61496-1/-2, SIL CL3 per EN ISO 13849-1 and IEC 62061.



Fully Automated Checkweigher Scale Systems

Technology Partner **Hardy Process Solutions'** new Hardy Caseweigher series are fully automated checkweigher scale systems designed to continuously weigh larger items while in-motion.

The flexible system weighs products in containers, such as cases of cans, bottles, rigid shrink-wrapped packages, bags or pails. Featuring PLC control architecture and a large touch screen HMI display, operators can easily navigate between different product recipes or adjust machine set-up parameters.



Delivering fast, accurate, and stable weight readings, the check weight controller can communicate seamlessly both upstream and downstream across The Connected Enterprise™ when built with an Allen-Bradley® CompactLogix™1769 PLC and PanelView® HMI.

Edge Gateway for ThingWorx

HMS Networks, a member of the PTC Partner Network and a Technology Partner in the Rockwell Automation PartnerNetwork™ program, offers a new extension for its edge gateways. The extension integrates the Ewon Flexy edge gateways, and associated Ewon Talk2M cloud, with PTC's ThingWorx Industrial IoT solutions platform.



The extension has been validated by Rockwell Automation Strategic Partner PTC and has achieved ThingWorx Ready status. ThingWorx Ready program allows technology companies to validate their products' interoperability with the ThingWorx platform. Once confirmed, the product becomes available on the PTC Marketplace of IIoT tools designed to aid solution deployments.

The Ewon Flexy extension for ThingWorx is designed to provide machine OEMs and system integrators easy and secure data integration from Rockwell Automation PLCs over the internet to the ThingWorx platform.

Split EMC Cable Entry

The split EMC cable entry EMC-KEL-DS is based on the KEL-U system from **icotek**, a Technology Partner in the Rockwell Automation PartnerNetwork™ program. The cable entry is designed to achieve EMC tightness while reliably diverting shield- and field-related interference.

The split frame makes it possible to insert preassembled cables and to seal them in accordance with IP55. The split frame and split grommets alleviate the need to cut and rewire preterminated cables.



The system's double chamber includes a grommet in each chamber. The fully conductive cable grommet contacts the cable shield over 360° to divert line-related interference. The additional grommet has a pure sealing and strain relief function. The included conductive flat seal establishes the contact between the cable entry and the conductive housing wall.

Measuring Wheels for Rotary Encoders

Technology Partner **POSITAL FRABA Inc.**'s measuring wheel accessories for its IXARC family of rotary encoders facilitate accurate linear motions and position measurements.



Wheel-equipped encoders can provide precise speed and position controls to synchronize the motion of multiple conveyers in complex material handling systems. The wheel-encoder assemblies make measurements directly from the moving surface, minimizing errors due to gear backlash or hysteresis.

For cut-to-length applications, wheel/encoder assemblies can measure position directly from the surface of solid materials such as fabric, paper, wire, or sheet metal, helping to reduce scrap losses.

Measuring wheels are available in different sizes, with circumferences of 200 mm, 500 mm or 12 in. Four rim treatments are available: knurled aluminum, smooth polyurethane, and two tread patterns for the polyurethane tire.

PRODUCT SPOTLIGHT

CODE READER

The new Allen-Bradley® **48CR code reader** from Rockwell Automation delivers 1D, 2D and Direct Part Marked (DPM) code reading, including barcodes and QR Codes, in a small package. It easily integrates into The Connected Enterprise to deliver data from the plant floor directly into a control system.

With powerful scanning and flexible programming, the 48CR streamlines code reading processes across several applications, including automotive, packaging, material handling, pharmaceutical, and food and beverage industries.

The EtherNet/IP™-supported code reader offers multiple setup options, fitting seamlessly into existing Rockwell Automation systems with the Studio 5000® Add-on Profile or into any other system using embedded WebConnect software.

The device doesn't require additional software or extensive training for operators. Configurations can be saved remotely, allowing personnel on the floor to swap out a code reader without extended downtime to reconfigure or wait for a specialized technician. It also successfully reads damaged and incomplete symbols without slowing down the scanning process.

The code reader is available in a standard model (0.3 MP resolution, fixed focus) and an advanced model (1.2 MP resolution, autofocus). It has speeds up to 60 fps for fixed focus and 42 fps for autofocus.



PRODUCT FOCUS

Updated Intelligent Conveyor System

The **QuickStick® HT intelligent conveyor system** from Rockwell Automation is designed to transport large loads with the intelligence of independent cart technology. The most common applications for the technology are in the automotive industry. However, it is also well-suited for heavy-load material handling, ride conveyance and hazardous material handling, including glove-box applications.

The system's new QuickStick HT 5700 inverter can now achieve velocities of 5+ m/s. Additionally, the update allows for the use of a smaller Kinetix® 5700 power supply, reducing the control cabinet size and saving space on the plant floor. The updated system also includes integrated functional safety. It has hardwired Safe Torque Off and Safe Stop 1 timed, SIL3/PLe.



Updated Reporting Software Connectors

SyTech, a Technology Partner in the Rockwell Automation PartnerNetwork™ program, introduces new connectors to their reporting software XLReporter. Built on the Microsoft Open Office standard, the reporting platform delivers workbook technology to an automated environment. As a result, users design reports with familiar concepts normally found in Microsoft Excel.



For Rockwell Automation users, the new Data Agent connector provides FactoryTalk® View SE users access to live data, file sets (DAT), data logs (ODBC) as well as Historian SE. For devices provided by Rockwell Automation Technology Partners HMS Networks and ProSoft, the new IoT connector provides access to remote data.

With additional connectors to industry standards such as OPC DA and UA, relational database such as SQL Server and basic data such as CSV, raw process measurements are reliably transformed into actionable information to improve efficiency and reduce cost.

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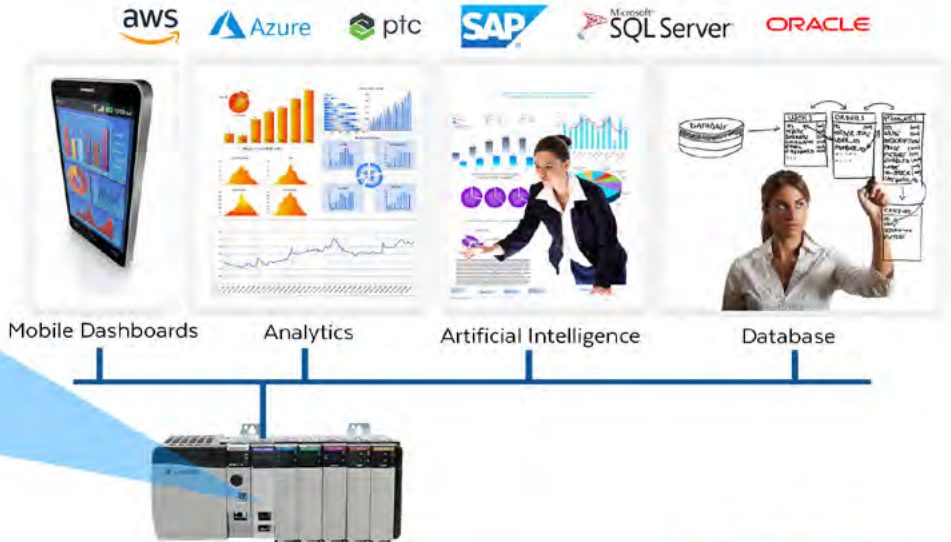
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