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DIGITALIZATION SOLUTIONS AND BENEFITS
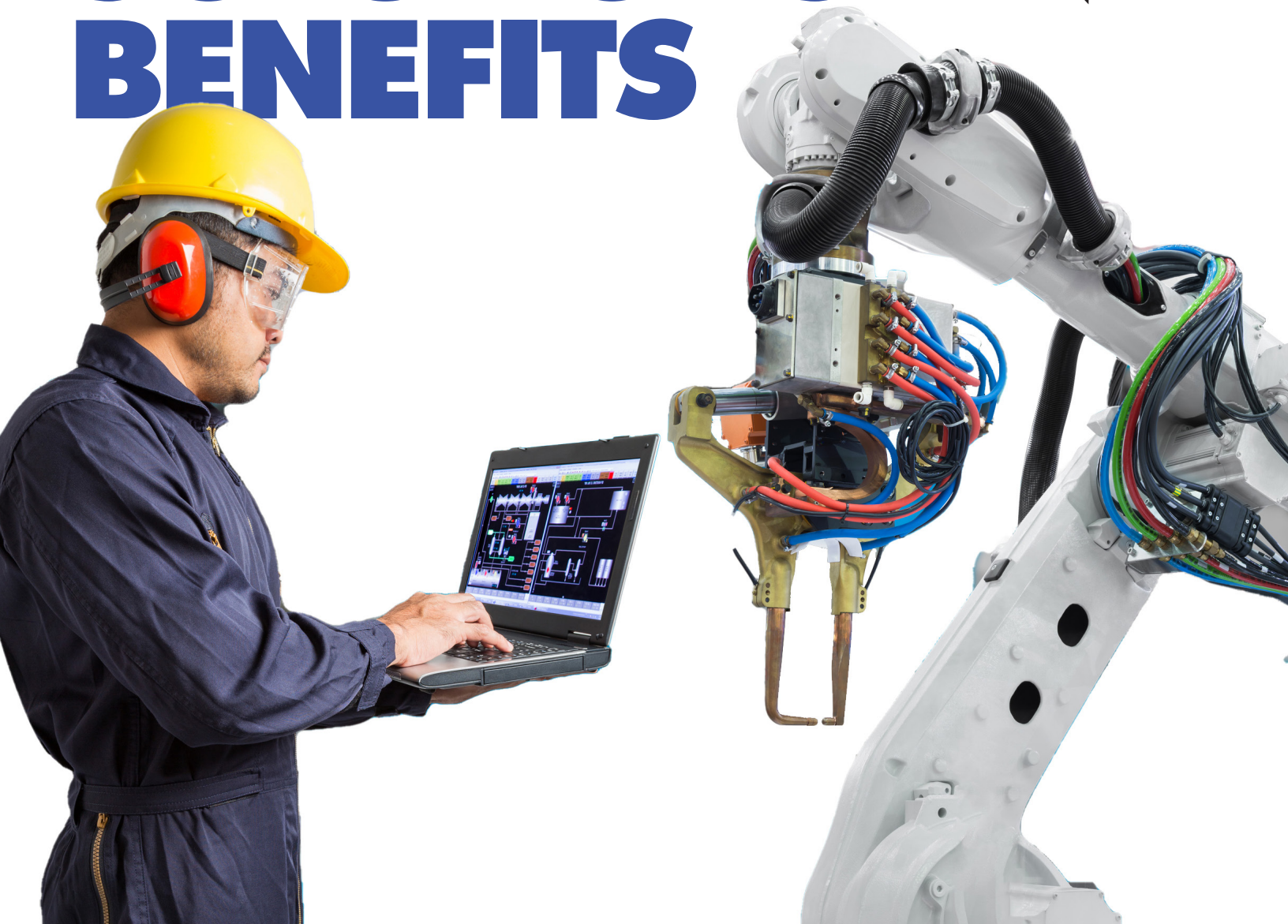
DIGITALIZATION SOLUTIONS AND BENEFITS

Dreamstime_Suwin Puengsamrong

## WHAT IS DIGITALIZATION AND HOW CAN FLUID POWER BENEFIT?

The term digitalization is often used, but not necessarily easily understood nor how it can be applied in various industries such as fluid power. Therefore, we've set out to help define the term for our readers while providing insight on the technologies involved and examples of how digitalization can benefit hydraulic and pneumatic systems.

Today, incorporation of sensors and software into fluid power systems is enabling the collection and processing of performance data which can then be transferred, stored, and analyzed through digital technologies such as cloud computing, machine learning (ML), artificial intelligence (AI) and the Internet of Things (IoT). With these tools better insights can be gained into how components and systems perform in an application as well as enabling the prediction of maintenance needs.

Sara Jensen,
Technical Editor,
Power & Motion

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Dreamstime/Evgeniy Parilov Yuriy Nedopekin
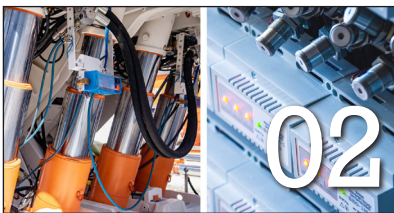
CHAPTER 1:

Understanding Digitalization and its Use in Fluid Power

SARA JENSEN, Technical Editor, *Power & Motion*

Implementation of digital technologies is increasing in hydraulic and pneumatic systems, bringing a range of benefits and the need for more industry education.

Digitalization is making its way into a variety of industries. But what exactly is digitalization and how can it benefit hydraulics and pneumatics?

To get a sense of where the industry currently stands on the subject, *Power & Motion* surveyed its audience – looking at how much is understood about digitalization and to what extent it is being utilized in fluid power systems.
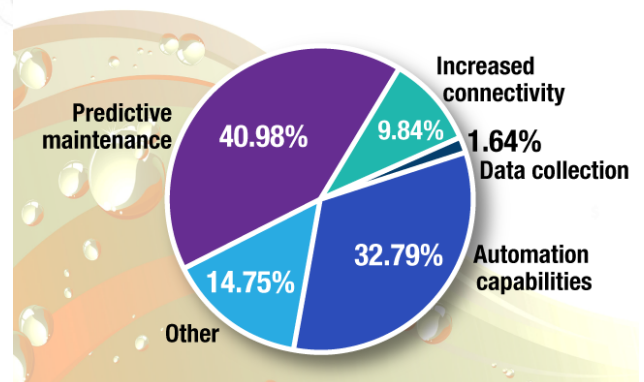
What is Digitalization?

A majority of respondents to the survey said they were either very familiar or somewhat familiar with the term digitalization, the technologies it entails and how it can be applied with the majority, 56.45% responding they were somewhat familiar.

An overwhelming majority, just over 95%, agreed that more education and information on the subject is needed within the fluid power industry.

So to aid with that, it may be important to start by defining digitalization. In a white paper from the National Fluid Power Association (NFPA) – released ahead of the International Fluid Power Exposition (IFPE) 2023 where digitalization was a key trend on display – the term is defined as leveraging digital technologies to enable or improve processes.

This can be achieved through use

What are the key benefits you see digitalization providing?

- Predictive maintenance — 40.98%
- Increased connectivity — 9.84%
- Data collection — 1.64%
- Automation capabilities — 32.79%
- Other — 14.75%

of on-board or centralized processing technologies which can help to collect, analyze and transmit information about the performance of a component or system. NFPA's white paper points to Casappa's Smart Piston Pump, displayed at IFPE 2023, as an example of digitalization in a fluid power application. The pump features an integrated electronic control unit (ECU) and sensors which help to provide enhanced digital control of the hydraulic pump, improving its efficiency.

It should also be noted the term digitalization is different from digitization. The latter refers to making analog information digital which can then enable digitalization. Essentially, digitization can be viewed as the ability to collect and send data and digitalization as use of that data to improve performance or other aspects.

Kevin Vanderslice, Director of Sales, Mobile Machinery at ifm efector inc., spoke at IFPE about the digital transformation currently taking place. A key aspect for OEMs, their suppliers and end users is understanding why digital technologies are important and why anyone should care about the data which can be collected. He said the digital revolution is happening and everyone is at different stages of implementation.

Charts: Endeavor Business Media

Sensors play a key part in digitalization; what percentage of your fluidpower components/ systems now include sensors?

- Less than 10%: 22.58%
- 10% to 25%: 17.74%
- 25% to 50%: 24.19%
- More than 50%: 35.48%
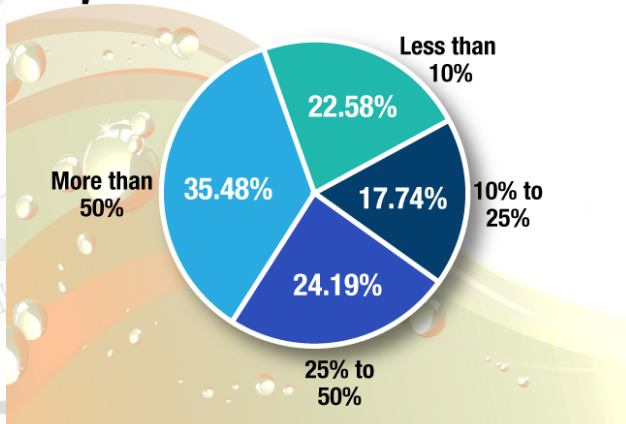
Have you seen the use of software with fluid power systems increase in recent years?

- No: 17.74%
- Yes: 82.26%
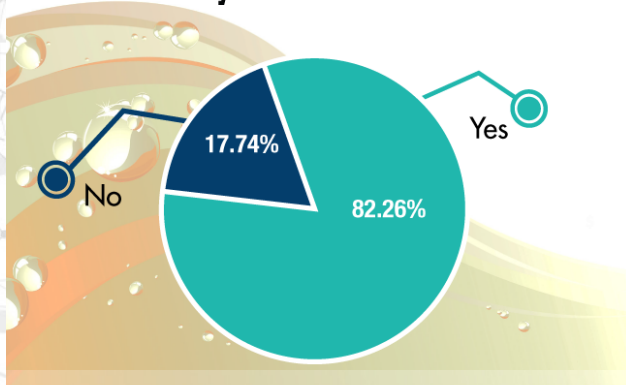
What Technologies are Involved?

Enabling digitalization is the increased integration of electronics, such as sensors, into components and systems. This allows the collection of performance data which can then be analyzed and transmitted.

The majority of survey respondents said their fluid power systems now include sensors, with just over 35% indicating more than 50% of the components and systems they are designing have sensors included. This was closely followed by 24% responding 25-50% of their fluid power components and systems feature integrated sensors.

However, almost 23% said less than 10% of their hydraulic and pneumatic systems include sensors, indicating there is still room for growth in this area.

Of those integrating sensors into their fluid power systems, the majority are using them for performance monitoring and enhancement of precision and control. Several respondents indicated sensors are being utilized for multiple purposes as well.

In an interview with *Power & Motion*, Russ Schneidewind, OEM Sales Manager at HydraForce, said the company is seeing the need for increased precision and control from hydraulic components. As such, HydraForce is among those integrating more sensors into its products. Its new Innercept Digital Proportional Control solution, for instance, features an integrated position sensor and Linear Variable Differential Transformer (LVDT) to improve upon the precision and control of its hydraulic components.

HydraForce has also partnered with Tan Delta and Elevāt to pair its hydraulic systems with an oil monitoring sensor and telematics. This will allow performance of the system to be better monitored and alerts sent to machine owners as needed if issues arise. Schneidewind sees incorporation of sensors and telematics increasing within the fluid power industry to help better monitor system performance.

As Vanderslice explained during ifm's press conference at IFPE, sensors provide the data and telematics will provide the knowledge to interpret that data.

To enable these performance monitoring capabilities, artificial intelligence (AI) and the Internet of Things (IoT) are often used to interpret collected data and transmit it to maintenance personnel. In some cases this information can be used to predict maintenance needs, helping machine owners improve their operations. Having the ability to better monitor when or if a maintenance issue will occur allows them to be proactive about maintenance needs and reduce the chances of costly unplanned downtime.

In conjunction with the rise of integrated sensors is the growing use of software which can work together with the sensors, AI and IoT to collect, analyze and transmit data. The majority of survey respondents said they have seen use of software increase in recent years and 94% anticipate its role in hydraulic and pneumatic systems increasing further in the coming years.
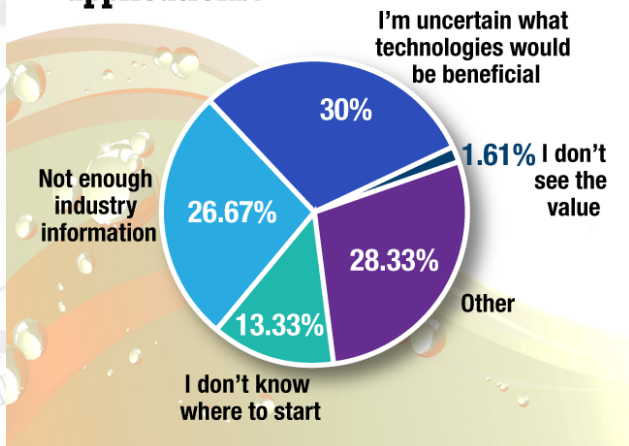
Challenges and Opportunities

While it is clear digitalization is making its way into the fluid power industry, responses to *Power & Motion's* survey showed there is less clarity when it comes to implementing it.

About half of the respondents indicated the top challenges associated with implementing digitalization are a lack of industry information and uncertainty about what technologies would be beneficial. Additionally, some said the amount of software choices and tools for configuration and programming can pose challenges as well.

Multiple respondents noted a resistance to change within the industry and the need to convince management and customers of the benefits. Current approaches not being up to date, the age of equipment, the amount of time needed to implement technologies and costs associated with doing so were also offered as challenges for the industry.

In general though, the majority of respondents see digitalization benefiting the fluid power industry with almost 97% indicating as such. Predictive maintenance was the top choice among the potential benefits of digitalization in hydraulic and pneumatic systems. This was followed closely by the ability to integrate automation into systems.

Energy efficiency, improved performance, failure monitoring and cost savings – likely through the ability to improve maintenance and performance – were also benefits which respondents said could be achieved through the implementation of digitalization.

The overwhelming majority – 98% of survey respondents – foresee further growth of digitalization and its associated technologies in the fluid power industry over the coming years.

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■ **What challenges do you face when it comes to implementation of digitalization and its associated technologies in fluid power applications?**

I'm uncertain what technologies would be beneficial — 30%
1.61% I don't see the value
Other — 28.33%
I don't know where to start — 13.33%
Not enough industry information — 26.67%

■ **Do you anticipate the role of software in fluid power systems increasing further in the coming years?**

5.88% I'm uncertain
Yes 94.12%
No- 0%
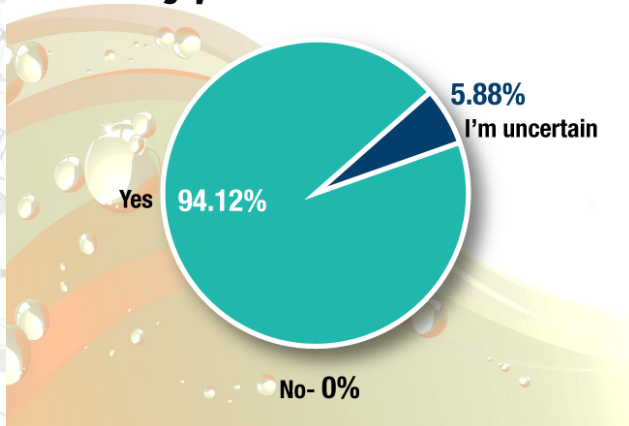
Dreamstime/Ekkasit919

CHAPTER 2:

Smarter Machines are More Competitive

THOMAS BURKE, Global Strategic Advisor, CC Link Partner Association (CLPA)

Implementation of Industry 4.0 technologies is enabling the creation of smarter machines which can be better tuned to meet performance requirements.

ndustry 4.0 and Digital Transformation is a global trend. This trend will have an impact on machines of all types and is creating the opportunity for "smarter" machines.

Today, industry is dominated by legacy machines that are performing their functions as designed and delivered. Developed by OEMs, they run at the speeds, quality, and reliability that they were initially designed for. When they require routine maintenance, it is generally done on a schedule, to avoid maintenance at the point of failure. That maintenance is performed by on-site personnel. Machines of this type perform their functions, but with little opportunity for improvement.

Industry 4.0 refers to the intelligent networking of machines and processes for industry with the help of information and communication technology. There are many ways for companies to use intelligent networking.

Monitoring Products with Digital Networking

Many companies are involved in a step-by-step process to develop and manufacture a product. In being digitally networked, these steps can be better coordinated, and the machine load better planned.

Future production lines can be built in modules and be quickly assembled for tasks. Productivity and efficiency would be improved; individualized products can be produced in small quantities at affordable prices.

Consumers and producers will move closer together. The customers themselves could design products according to their wishes—for example, sneakers designed and tailored to the customer's unique foot shape. At the same time, smart products that are already being delivered and in use can send data to the manufacturer. With this usage data, the manufacturer can improve his or her products and offer the customer novel services.

Data on the production process and the condition of a product will be combined and
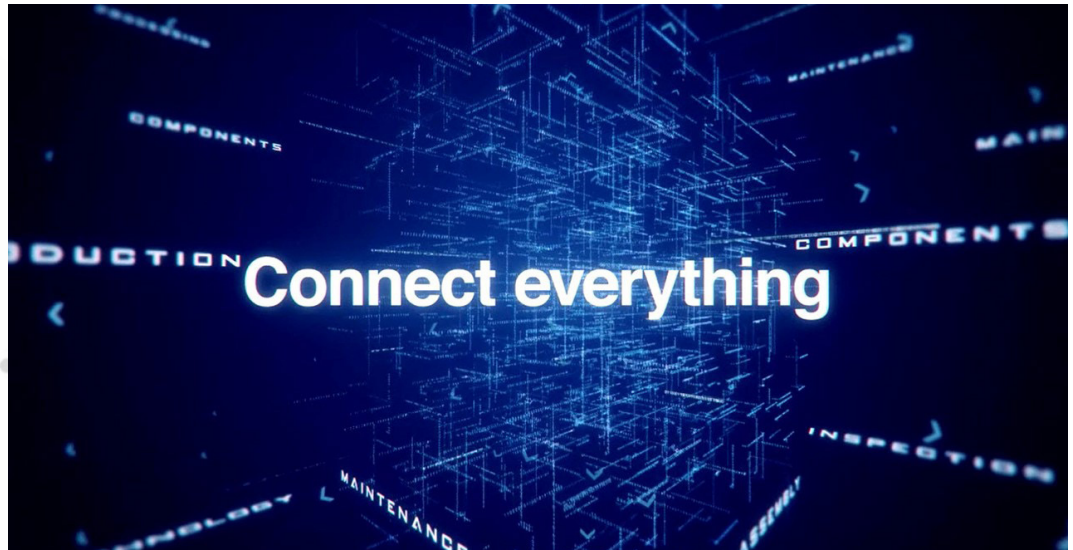
Implementation of Industry 4.0 solutions aids the collection of data and connectivity between assets. CC Link Partner Association (CLPA)

analyzed. Data analysis provides guidance on how to make a product more efficiently. More importantly, it's the foundation for completely new business models and services. For example, lift manufacturers can offer their customers "predictive maintenance": elevators equipped with sensors that continuously send data about their condition. Product wear would be detected and corrected before it leads to an elevator system failure.

The entire lifecycle of a product can be considered with the support of data. The design phase would already be able to determine which materials can be recycled.

Data Convergence and Industry 4.0 for Machine Builders

Today, there is a better way, a way brought about through the data convergence fostered by the Industry 4.0 trend. Industry 4.0 is about leveraging new technologies for the benefit of continuous improvement. While there are close to a dozen Industry 4.0 technologies to leverage such as additive manufacturing and augmented reality, the technologies most related to machine operation would include IIoT (the Industrial Internet of Things), Internet, Cloud, and Artificial Intelligence (AI).

The latter Industry 4.0 technologies are delivering the opportunity for smarter machines, machines that can be monitored and automatically analyzed for performance, quality, and reliability, offering the ability to operate or tune the machine to maximize KPIs to benefit the user.

Designing a smarter machine requires attention to the following:
• Providing external access to all existing machine variables
• Instrumenting a machine with additional sensors to enable greater context and understanding of operation
• Adding new capabilities to deliver a competitive advantage

Each of these three topics is explained in depth below. Considering machine access, utilization of sensors, and adding capabilities provides machine builders better feedback and a better product in the long run.

Leveraging Industry 4.0 technologies such as IIoT and the Cloud is helping to monitor machines and production, leading to improved manufacturing operations.
Image: Dreamstime/SuwinPuengsamrong

Provide External Access to All Machine Variables

In the past, external machine access has been one of the greatest challenges, primarily because communications within a machine fall into various categories and have differing requirements. There is typically a control network and a supervisory network. And there can be a bridge to an external network. Some communications require deterministic performance for processes such as motion control, or high reliability for safety. Other communications are less demanding and are for informational purposes.

Often, the gateway for these communications becomes the controller – PLC, or the operator interface. Ideally, there should be a common backbone for all machine communications. The most common backbone for IT communications is Ethernet. The improvement in Ethernet performance is greatly outpacing that of the niche industrial transports based on the needs of a much larger IT market.

In 2016, Ethernet specifications were expanded to include Time Sensitive Networking (TSN). This was the missing link to enable Ethernet as the complete backbone for machine automation, combining Information Technology (IT) networks and Operational Technology (OT) networks, the combining of control and information communications within a machine. With new products on the market with support for TSN, machine builders can now deliver machines with a common Ethernet TSN backbone, enabling direct data access with the entire machine, from controller to sensors and actuators.

Instrumenting Machines with Additional Sensors to Enable Greater Context of Operation

Greater access to machine data means the opportunity to better understand the machine operation, provided there is enough context to enable an understanding of the data. For

example, a piece of equipment may be running hotter than usual because it is running harder, under greater load, or because the ambient temperature is higher that day. Startup performance will vary based on a cold start or a warm start.

If your machine isn't properly instrumented for context, making sense of your data will be more challenging. This also requires a loosening of alarm levels, the early warning system to machine failures. A common backbone will enable the introduction of many more sensors,

With Industry 4.0, more machine data is available which can be analyzed to improve the understanding and performance of machinery. Dreamstime/Ekkasit919
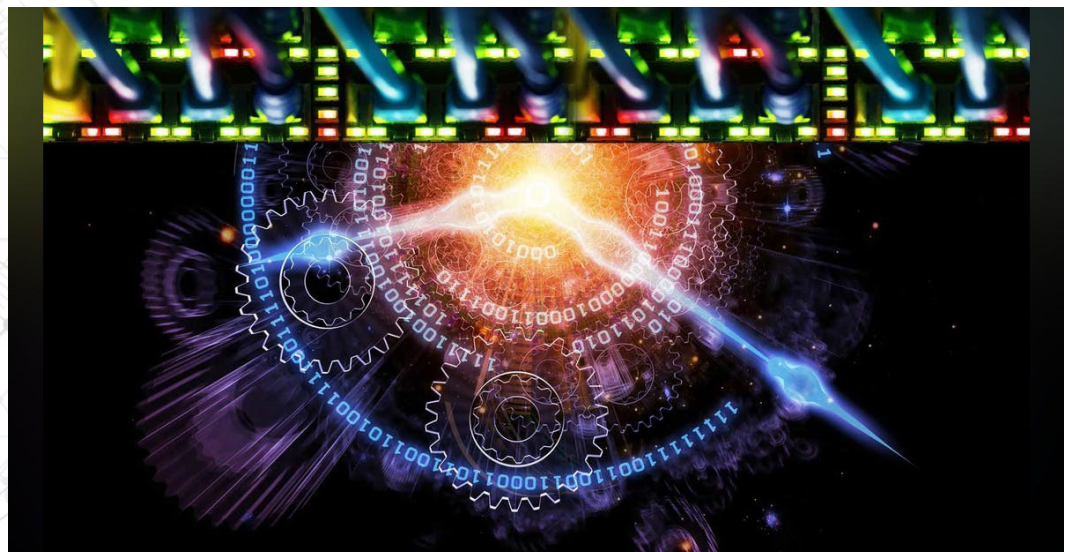
The most common backbone for IT communications is Ethernet which is seeing a vast improvement in performance. CC Link Partner Association (CLPA)

Creation of smarter machines through implementation of Industry 4.0 can provide manufacturers with a competitive advantage. CC Link Partner Association (CLPA)

perhaps completely unrelated to the actual operation of the machine, but critical to understand the context of your machine's operation, to benefit future analysis.

Adding New Capabilities That Can Deliver a Competitive Advantage

As a machine user, your competitive advantage is your product, making it as efficient and of the highest quality. A Smarter Machine will certainly help. But as a machine builder, what is your competitive advantage?

In an Industry 4.0 world, your competitive advantage may very well be in the machine analytics that you can provide. Are you scheduling maintenance based on operations, or a scheduled timespan? Are you able to view similar machines and identify which will provide the best rate of return, and schedule appropriately? Are you able to connect remotely and have access to enough data, and context, to properly troubleshoot a machine, and eliminate the need for travel and coordinated visits? Can you add new sensors that unlock a greater understanding to the operation of your machine, when needed, installing, or accessing video cameras, for example? Are you delivering Digital Twin analytics, modeling machine operations and dynamically adjusting alarm levels based on the current context of operation?

In Summary

Industry 4.0 technologies are unleashing a new wave of innovation that is sure to increase performance, improve quality and reduce costs. With new technology such as Ethernet TSN, we will see machines shift from their original design for purpose delivery to those that can offer quantified performance, quality, and cost metrics, and that will improve over time, based on OEM analytics and feedback.

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DIGITALIZATION SOLUTIONS AND BENEFITS

CHAPTER 3:

Enterprise Software and Automation are Building Blocks to Alleviating Labor Shortages

SARA JENSEN, Technical Editor, *Power & Motion*

Joe Goodrum of Epicor sees ERP solutions as an important tool to helping manufacturers mitigate current labor challenges.

Software can be a vital tool in many aspects of a business — to aid with engineering efforts, manage manufacturing operations and more. Enterprise resource planning (ERP) is one such software tool which can help with managing day-to-day activities such as supply chain operations.

EPR software can help with the automation of various business aspects and free up workers to focus on other tasks, especially important for today's manufacturers experiencing labor challenges.

For over 50 years, Epicor has developed ERP solutions for those in the automotive, building supply, distribution, manufacturing and retail industries. "But Epicor is not just about the ERP software itself – the additional offerings and modules that add to the system is where businesses can leverage the technology that makes most sense to them. For manufacturing specifically, our knowledge of make-to-order, engineer-to-order, and configure-to-order allows us to offer a strong solution for manufacturing in the 'Make' economy," said Joe Goodrum, General Vice President at Epicor, in an interview with *Power & Motion*.

During that interview, Goodrum provided insight on the company's ERP solutions and how they can help manufacturers overcome current labor challenges.

Editor's Note: Questions and responses have been edited for clarity.

Power & Motion (P&M): What aspects of a manufacturing operation can benefit from implementation of software such as that provided by Epicor?

Joe Goodrum (JG): There are many aspects of manufacturing operations that can benefit from implementing enterprise resource planning (ERP) software like Epicor solutions. Most

notably, inventory management can be a high time-to-value advantage for a manufacturer. Automation tools that allow you to manage minimum/maximum and safety settings, send automatic recommendations for inventory stocking levels depending on consumption, or optimize inventory and prevent crucial item stock-out situations, lets manufacturers lean on their software solutions to not only stay organized, but potentially transform their manufacturing business into a data-driven organization.

Another area where software can help manufacturers is the lead-to-order cycle. Using add-ons such as Epicor's Internal CRM or Epicor's Automation Studio connectivity tool to connect a best-of-breed system like Salesforce reduces the effort needed to process that opportunity.

P&M: What role can software play in helping to alleviate the labor shortages facing the manufacturing industry?

JG: Through automation, software can alleviate the time and effort needed for tedious tasks such as data entry and help manufacturing businesses do more with limited labor. The areas to take advantage of this are endless; software such as Epicor ERP can offer automation benefits that allow for continued operational efficiency from the shop floor to the top floor critical to the manufacturing industry.

On the shop floor for example, software automation can help when connecting two machines and automating the information gathering process. This can improve efficiency, so more parts can be made with less resources, less machine time, and ultimately, less labor. On the other hand, automation can significantly assist top floor operations, such as onboarding or other tedious tasks, so staff can focus on growth without having to hire

Dreamstime/BiancoBlue

Automation tools that allow automatic recommendations for inventory stocking levels to be sent depending on consumption enables manufacturers to lean on their software solutions to stay organized and become more data driven.

several other people to assist in these efforts.

Additionally, adopting software solutions such as Epicor Kinetic, Epicor's manufacturing-specific solution, can actually bolster businesses' competitive edge when it comes to hiring. As skill gaps and labor shortages continue, positioning yourself and your business as a forward-thinking organization with tools in place to make potential hires' jobs easier can be a deciding factor. Today's high-value candidates are looking for places to work that are rich with technology that is new and intuitive. Enterprise software implementation combined with automation are the technology building blocks manufacturers can put in place to maintain and improve bottom lines while operating with a slimmer workforce.

Automation tools that allow automatic recommendations for inventory stocking levels to be sent depending on consumption enables manufacturers to lean on their software solutions to stay organized and become more data driven.

P&M: What training will be necessary for use of software in manufacturing environments, and how can the industry help to provide it?

JG: With the ongoing skills gap impacting the manufacturing industry, it's more important than ever that the next generation of manufacturers have some sort of software skills in order to navigate the software systems in place in a new role. We've already seen trade schools begin to adopt these practices by offering certifications in various computer programs as part of the curriculum, but with such a variety of enterprise software on the market, these potential hires also need immersive and efficient training once they are on-boarded in a new role. That's why it's important to choose a technology partner who can provide the level of training content needed for a speedy and actionable onboarding.

With the help of built-in training courses and videos, users can learn how to do new tasks. Over the past few years, Epicor has invested in its Kinetic manufacturing product by making training content available on demand and building it into the product itself. Instead of putting all this information on a training site for training and education purposes, we put it all right where the user can get to it whenever they need it. Users can even turn on field-level help at any time. This lets them move their mouse over any field and get help on how to use it.

Overall, it is up to the technology software vendors to abandon clunky and outdated training manuals and replace them with modern, immersive training content and platforms. This practice can over time narrow the skills gap and enable the next generation of manufacturers to perform at an even higher level.

P&M: As manufacturing facilities become more connected, what benefits can be achieved and what role will software play in this connected environment?

JG: The world in which we know is changing so fast it's hard to stay in front of it. Everything is becoming more connected, and the manufacturing industry especially is using software and other technology to make connected factories the norm. A connected factory is when you have fully integrated information systems designed to give the right person the right information at the right time, in an easy-to-read report or dashboard. This enables you and your employees to diagnose and resolve supply chain problems in a timely, accurate manner, whether you're onsite, on the road, or at your home office.

The benefits of a connected factory are endless, but business resilience is the overarching result. With all parties having access to the same critical data, decisions can be made

more confidently and lead to overall growth. Software is what filters this data and makes it digestible and actionable.

At Epicor, we have long had connected functionality. Take our Adv MES products for instance; they directly connect Machine Controllers (PLCs) on machining, molding, and fabricating equipment, or high-speed assembly lines. These links have helped customers collect data for quality control, production throughput, and process improvement. In addition, Epicor's IoT module leverages the power of the Azure IoT hub to connect sensors in products and facilities to better manage assets. This functionality lets customers stay connected to what matters most by tracking assets, triggering system data entry, or forecasting MRO or Field Service activities just to name a few. The benefit of connectivity helps streamline the real-time collaboration between systems, assets, data, and people.

P&M: How do you see the role of software in manufacturing operations continuing to evolve in the coming years?

JG: Automation programs that automate repetitive jobs still have a lot of potential. Employees dislike non-value-added chores. They want to contribute to their company and the future. With software connecting more equipment to process data faster and collecting it more accurately, we'll likely see continued cloud software adoption and ultimately, more data-driven manufacturing businesses who are prepared to pivot at any given challenge. As we connect more and more systems and devices, we collect massive amounts of data, which is the currency of today and the future.

Data is useless until it becomes information. Business Intelligence tools will help turn data into monetizable information inside and outside the firm. The systems of tomorrow will be more of a real-time collaboration system. These systems will provide the data and information you need without having to go search for it. There will be an abundance of data, but with AI and automation it will be able to predict and execute requests without a thought.

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Everythingpossible/Dreamstime

CHAPTER 4:

IoT Enables Better Problem Solving in Fluid Power

SARA JENSEN, Technical Editor, *Power & Motion*

Implementing IoT into hydraulic and pneumatic systems can provide real-time data to help manufacturers improve performance and maintenance.

The Internet of Things (IoT) has made its way into just about every industry, including fluid power. IoT essentially enables communication between physical objects through the integration of sensors, software and processing capabilities to allow the exchange of information between devices.

"We are seeing companies who are putting out tens of thousands and hundreds of thousands of deployable sensor systems when building hydraulic machinery," says Jon Prescott, co-founder and CEO of Scante. These sensors are being integrated into individual hydraulic components as well as systems, bringing IoT capabilities to several parts of a machine.

The cost and capabilities of sensors and other necessary technologies have come down over the years, making it more feasible to implement IoT in various applications. Prescott says the ability to now use so many sensors has been a game-changer for mobile hydraulic applications. More information can be collected at faster speeds, enabling manufacturers and their customers to get better data on the performance of machines and components.

Improvements in oil quality sensors is an area in which the hydraulics industry is benefiting, as well, says Prescott. Frequent oil sampling is difficult and an issue the industry has been struggling with for years. "The new areas of oil quality sensing using electrochemistry [and other techniques] are absolute game changers for hydraulic system reliability," he says.

The cloud-based calculations, dissemination of data and the analytics possible with these new sensors and other IoT-related technologies will greatly benefit manufacturers, particularly smaller ones who don't have the expertise required for conducting oil analysis.

"I think one of the leading pieces I find interesting is how IoT can be used to do just-in-time repairs," says Chad Repp, business development manager at HED Inc. This can greatly benefit a manufacturer's end-use customers by reducing their downtime, as repairs can be made before a critical failure instead of after.

While there has been some implementation of this capability, Repp says it has not yet reached its full market potential. But as IoT adoption grows and users leverage its real-time, day-to-day information capabilities, just-in-time repairs will become more common which will help to improve the efficiency and productivity of many operations.

When looking to implement IoT, it is important to ensure the partners chosen—from the gateway manufacturers to the cloud providers to the solution itself—are the right ones to meet the application requirements. It is important to have the right partners because it is not a single component that is being developed but a solution which evolves and grows over the years to continue serving the customer's needs.

"The way we look at IoT is it is just another feature inside the tech stack," says Adam Livesay, co-founder and CRO of Elevāt. "Five or six years ago, IoT was looked at as being the thing that provided the solution to every problem out there, and you could solve everything."

However, that mindset has shifted. "Now, the way we look at it is you are really trying to focus on the business case, and the problems or goals that customer [has], and then work your way back to where you are talking about cloud, mobile, machine learning, edge and IoT all combined. And that's how we approach it," he says. "[IoT] is not really that fancy buzzword anymore as much as it is part of the overall solution."

Repp agrees that IoT and technology in general helps to solve problems. "IoT is more of an enabler of solving problems in the world," he says. "IoT is a way to help with digital transformation and solving the problems that are part of that strategy, and the value proposition behind it all."

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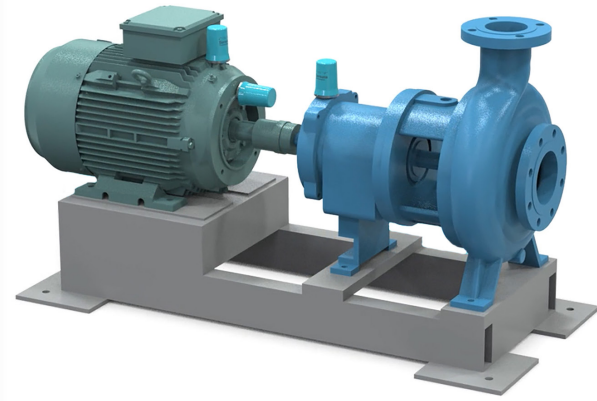
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Image: Sensata Technologies

CHAPTER 5:

Sensata Wireless Sensor Uses AI and Machine Learning to Improve Predictive Maintenance

SARA JENSEN, Technical Editor, *Power & Motion*

The 6VW sensor uploads data to Sensata's cloud-based platform where sophisticated analysis creates deeper insights into potential rotary asset faults.

Sensata Technologies has introduced the new wireless 6VW series IoT (Internet of Things) sensor designed to aid predictive maintenance of rotary assets. The sensor delivers information to the recently launched Sensata IQ platform—a cloud-based platform which uses artificial intelligence (AI) to process data from Sensata IoT devices.

According to Bryan Siafakas, director of Product Management for IoT Solutions at Sensata Technologies, only about 15% of rotary assets are currently monitored in a typical factory today. "This solution is really driving at enabling customers to monitor the remaining 85% of their plant's assets."

This is particularly important with the ongoing skills gap and labor shortages facing manufacturing and other industrial applications. "We're seeing a big exodus of maintenance and plant personnel who had worked [at a facility for] 30+ years that could just walk by a machine and be able to hear it and say something doesn't sound right." Newer employees do not yet have that level of expertise.

With the 6VW sensor, manufacturers can bridge that skills gap by putting the sensor on their machines to measure vibration and acoustics to detect potential faults and optimize maintenance workflows.

A More Flexible, Reliable Wireless Sensor

The 6VW is a wireless sensor capable of operating on cellular, LTE or Wi-Fi. It is a multi-modal sensor which allows collection of various data points beyond vibration due to sensor fusion onboard of several sensors, says Siafakas. The sensor is able to collect temperature, vibration and acoustics information to provide customers with a more accurate picture of the

health of their machine.

Collecting acoustic information is important, says Siafakas, "because it allows you to detect some higher frequency faults such as lubrication faults which a typical vibration sensor is not able to detect."

Essentially, a wider range of faults can be detected, and more alerts sent to the maintenance team so they can plan accordingly. The 6VW sensor can also do electrical detection, expanding upon the types of faults to which it can alert personnel.

Siafakas says the sensor is easy to install; it mounts via a magnet and can be configured within 5 min. using Sensata's mobile app. He explains that users answer a few questions during the configuration process based on information found on the motor to which the sensor is mounted.

He also notes the 6VW is a versatile solution capable of working with a range of rotating assets including fixed speed and variable speed motors, whereas other solutions are not able to work with variable speed motors.

Sensata Technologies

There is a database of bearing knowledge built into Sensata's technology as well. This includes data on the critical frequencies at which bearings operate, allowing for a higher level of confidence in predicting faults says Siafakas.

The reliability of the technology is a key feature, as well. Some industry reports have put fault characterizations at about 60% but Sensata feels its is greater than 95%. "If we say that's a bearing fault, we're greater than 95% confident that actually is indeed a bearing fault," says Siafakas. "That's really important because if you provide false alerts or notifications, the maintenance personnel are going to lose trust in the system and not use it."

The 6VW is a multimodal sensor which can detect vibration, temperature and acoustics to get more accurate data on how rotary assets are performing.

This is also beneficial for ensuring the maintenance personnel come prepared to solve the problem. If they are alerted there is a bearing fault, they can be sure to come with the right tools and spare parts to fix the problem immediately.

Sensata's technology also notifies personnel of a component's remaining useful life. While there may be a fault, knowing how soon that could cause a critical problem enables maintenance personnel to take appropriate action. "If it's three months it's not as critical as something that is going to [fail] in two days," says Siafakas.

All of this helps to reduce unplanned downtime and improve overall equipment effectiveness.

Built-in Intelligence and Cloud Capabilities Improve Analytics

Sensata's new 6VW sensor has intelligence and processing built into it. Siafakas says it is a hybrid of sorts as it utilizes edge computing as well as sends data to the cloud. "By default, it sends data to the cloud [about] four times a day. But if [the sensor] detects an anomaly on

the edge it will upload that data to the cloud for more sophisticated analysis," he explains.

Combining edge computing and analysis in the cloud ensures no faults are missed and the company can provide insights to customers with a high degree of confidence.

When data is sent to the cloud—the Sensata IQ platform—Siafakas says sophisticated analysis can take place to characterize and detect faults through the use of AI and machine learning. Data from other Sensata sensors can also be uploaded to easily monitor data from all of the sensors on an asset in one place.

Alerts can be sent to mobile phones and via email, making it easy for personnel to stay on top of any potential issues. These alerts are configurable, allowing users to set their own thresholds for when they would like to receive an alert.

Siafakas says the AI and machine learning within Sensata IQ—made possible through a partnership with Nanoprecise—can baseline the data it receives from the rotary asset, essentially learning what its normal operation is. And it will continue to learn over time and provide alerts about any deviation from that baseline performance.

Nanoprecise brought its experience with AI and machine learning for rotating equipment which paired well with Sensata's sensor expertise, says Siafakas. "They really allowed us to give a high degree of accuracy of prediction of motor faults and fault characterization."

This technology pairing allows Sensata and its customers to make sense of the sensor data—something customers were looking to get from the company—and give actionable insights to maintenance personnl.

Having the ability to analyze sensor data in the cloud is vital to ensuring a manufacturer's uptime. "If you look at a typical manufacturer, they have about 144 unplanned downtimes a year which cost, for an average plant, about $2.3 million a year," says Siafakas. "So, leveraging solutions like Sensata IQ and the 6VW allows customers to detect those faults before they happen and reduce the associated downtime that happens with them."

In addition, a manufacturer can better streamline their operations and reduce maintenance costs through inventory management. Many will have backup motors sitting on a shelf in

Sensata Technologies
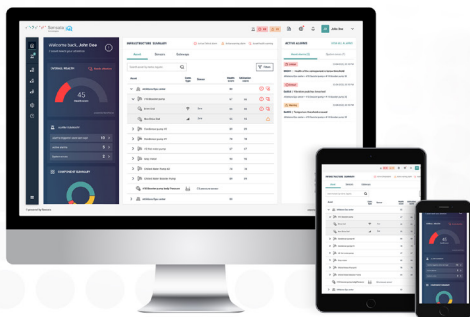
The Sensata IQ platform makes it easy to deploy asset health monitoring to prevent unplanned downtime within manufacturing environments.

case there is a failure, and these can be expensive as well as tie up capital. With these Sensata solutions, personnel can better predict faults and when they will actually need replacement parts.

Growing Need for Digital Predictive Maintenance Tools

Siafakas says the company will continue to evolve the Sensata IQ platform with new features added for which its customers are looking.

"I absolutely see a big need in the market right now for this," he says. Many companies still have a person coming and walking around to monitor assets, or there are assets which are not currently being monitored in real time.

There is an opportunity now to minimize or eliminate the number of manual checks on assets. Technology such as wireless sensors and connectivity has progressed, making a better case for their use in predictive maintenance. "I do see these solutions starting to disrupt that manual way of working," says Siafakas. "I see an increasing reliance on sensors to be able to bridge the skills gap and reduce the manual walking around and report writing."

The ability to utilize technology instead of people will be vital in the coming years to help overcome the labor shortage manufacturing is facing. Older generations are leaving the industry and fewer skilled workers are entering it, which will make it necessary for companies to find an alternative means of replacing the years of knowledge those leaving will take with them. Technologies like Sensata's predictive maintenance solution are seen as a means of doing so.

Return on investment (ROI) will also be a key driver for the uptake of these types of solutions. Current reports show an ROI of less than one year for many of these digital predictive maintenance systems says Siafakas.

As manufacturers see the ROI and other benefits, and transition more toward Industry 4.0 and beyond, "we're going to see a large adoption of these systems in the coming years," he concludes.

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