Get Smart

Key considerations for developing smart machines and equipment.
A Smarter Approach

As an OEM, you have the formidable challenge of meeting a range of customer expectations for every project.

And those expectations have perhaps never been higher. As more end users move to a Connected Enterprise, they’re looking for added value beyond your machinery or equipment. They’re also expecting you to help address their most pressing needs, including the following:

- **Global competitiveness**: Keeping business models relevant and moving from mass production to mass customization
- **Workforce needs**: Managing the talent and skills shortages resulting from retiring workers and an influx of new, more connected technologies
- **Changing risks**: Managing security threats and achieving compliance with increasingly complex regulations
- **New technologies**: Merging physical and digital worlds to capitalize on the value at stake in the Internet of Things (IoT)

At the same time, your customers still expect help optimizing asset performance, maximizing product quality and safety, and protecting workers and the environment.

Smart machines and equipment can help you meet all of these challenges, positioning you and your customers for greater success.

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1 Internet of Things Will Deliver $1.9 Trillion Boost to Supply Chain and Logistics Operations, Cisco, April 15, 2015
2 Internet of Things (IoT) Enables $3.88 Trillion in Potential Value to Manufacturers, ARC Advisory Group, March 27, 2014
Rise of the **Smart Machines**

The emergence of smart machines and equipment is completely upending how manufacturing and industrial organizations operate:

- They provide **unprecedented access to data** that has long been trapped inside. This data can be collected, logged and analyzed to help workers make better business decisions.

- When connected via an open and standard network architecture, such as EtherNet/IP™, they provide **greater connectivity**. This enables real-time collaboration and seamless data sharing across all levels of an organization’s enterprise.

- Used as part of a defense-in-depth approach, they support **robust security** to help protect intellectual property, physical and human assets, and the environment.

Delivering the potential of smart machines and equipment while also addressing a customer’s unique range of needs can be a complex and daunting task. To help simplify the process, OEMs should focus on three key ingredients in design:

1. **Processes:** Meeting end users on their journey to The Connected Enterprise and identifying their needs

2. **Technology:** Incorporating the right technologies and capabilities

3. **People:** Building the necessary skill set, both internally and externally

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*Industrial IoT provides original equipment manufacturers with new visibility that enables value-added services, competitive advantage for product design, and revenue growth. Adoption is no longer an option.*

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1 Industrial IoT Enables New Revenue Sources for Equipment Manufacturers, ARC Advisory Group, July 7, 2015
Smart machines and equipment are increasingly essential. However, they are only part of a larger, smart-manufacturing or industrial approach, which begins with The Connected Enterprise.

The Connected Enterprise brings together information technology (IT) and operations technology (OT) systems into a single network architecture. It uses smart machines and an ever-expanding number of IoT technologies to connect an organization’s people, processes and technology.

Every organization’s roadmap to The Connected Enterprise will be unique, based on factors like their operational needs, available resources and workforce availability.

Some organizations are only in the early, planning stages as they try to address issues, such as the security concerns that arise from connecting machines. Others are further along in the process of IT/OT convergence, while a third group is ready to integrate connected machines.

As an OEM, you must be ready to equip these organizations with smart machines and equipment, regardless of their needs or where they are in their journey.

1 The Journey of the Connected Enterprise, Automation World, Nov. 17, 2015
2 The Journey Toward the Connected Enterprise, ARC Advisory Group, Oct. 23, 2015

General Mills now collects more than 700 billion data points across its global enterprise.1

Through operational improvements related to The Connected Enterprise, Rockwell Automation has seen productivity improvements of 4 to 5 percent every year on a $6 billion revenue.2
Meeting customers in their journey

Every journey to The Connected Enterprise will be unique, but it typically includes the following:

- Determining how to connect devices, plants, people, equipment and supply chains
- Examining what data is needed
- Collecting, organizing, contextualizing and leveraging data
- Correlating and analyzing information to maximize work flows and improve collaboration across the enterprise

Communication is key to understanding where customers are in this journey. It also can help you identify opportunities to innovate with the potential of differentiating yourself by creating new market models. You can transform from a traditional equipment-selling model, and move toward a service-based or even performance-based model.

Assessing Your Capabilities
It’s important to assess your technological capabilities and resources to be sure they meet the greater demands for building smart machines and equipment. This can help identify where you need to expand your capabilities or if you should find partners with expertise in areas, such as wireless and mobility, information and visualization, and industrial security.

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**Smart Manufacturing**
- Real-time operational information
- Reduction in supply chain risk and variability
- Inventory reductions
- Production efficiencies

**Production Optimization**
- Improved asset utilization
- Proactive diagnostics
- Collaborative machine management
- Lower total cost of ownership

**Equipment Optimization**
- Safety/warranty
- Reactive support
- Improved troubleshooting
- Cost and time to fix/maintain

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Description
What happened?

Diagnostic
Why did it happen?

Predictive
What will happen?

Prescriptive
What should happen?
Technology: Five Areas of Focus

Being able to deliver on the promise of smart manufacturing and industrial operations requires that you think differently about how you design your machines and equipment.

While there are many considerations to keep in mind, these five guiding principles will help confirm your smart machine or equipment is best aligned to your customers’ needs:

1. Mitigate safety and security risks
2. Design for information availability
3. Support simplified integration
4. Deliver real-time diagnostics and analytics
5. Optimize operational efficiencies

As IoT provides the basis for an increasing amount of automated data acquisition, manufacturers will be able to adapt their processes and their products not just for incremental improvements but also for transformation of the product, service and business model. ¹

¹ Transforming Manufacturing With the Internet of Things, International Data Corporation, May 2015
Mitigate **Safety** and Security Risks

Smart machines and equipment make it easier than ever to support safety compliance while optimizing operations.

Safety-system diagnostics can quickly alert operators to where a safety-related issue is occurring for faster downtime resolutions. Safety data also can be collected over time to identify long-term trends and compare safety performance across multiple sites.

**Integrated safety** solutions can be used in place of lockout/tagout for certain routine, repetitive and integral job tasks to improve productivity. Safe-speed and zone control can enhance how operators interact with a machine, allowing minor adjustments and servicing activities to take place while it is in motion.

By using contemporary safety technology and a rigorous Functional Safety Life Cycle approach, you can harness the inherent value of integrated, safety-system designs.

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**OEM Tackles Safety and OEE in Tandem**

*OEMs are using a combination of modern safety standards, and the latest control and software capabilities to design safety into machinery – something that Paper Converting Machine Company (PCMC) has embraced.*

For example, PCMC can use zone control to remove power and allow maintenance in one zone while keeping the rest of the line up and running. It can also use safe torque off capabilities to remove rotational power from the motor without powering down the entire machine.

PCMC follows a rigorous, systematic design process that includes defining functional safety requirements early on, and then verifying and validating the safety system when it’s complete.

Now, we can design an integrated safety system that reduces machine hazards and associated risks – and improves overall efficiency and productivity.

Jill Thiede, PCMC Strategic Accounts Manager.

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Security needs to be a continuous, evolving component of a company’s overall safety strategy. This means proactive safety management beyond worker safety and into consumer safety.

More connection points on a machine also mean more entry points for security threats, whether those threats are physical or electronic, malicious or unintentional, on-site or remote. As a result, a comprehensive security approach is paramount.

The goal is to secure not only your machine but also to help protect your customer’s intellectual property, physical and human assets, and the environment.

Every manufacturer or industrial operator’s Connected Enterprise journey should include a defense-in-depth (DiD) security approach. DiD assumes any one point of protection can and likely will be defeated, and employs layers of security through physical, electronic and procedural safeguards.

At the machine level, important safeguards include role-based access to the control system and authentication, authorization and accounting software to track application access and changes. Control panels and cabling should also be protected against intrusions, tampering and accidents.

Strong security requires strong collaboration. Work with your customers to incorporate the appropriate security measures that support their unique security approaches.
Design for **Information Availability**

Your customers will have their own Connected Enterprise goals for accessing and capitalizing on their operational, business and transactional data. Your job is to design information-enabled smart machines and equipment that support and help fulfill these goals.

Start by identifying your customers’ key performance indicators such as operational efficiency, quality, asset health or energy efficiency. You can then work with them to determine exactly what data needs to be captured and how it should be handled, backed up and transferred to their manufacturing execution system (MES).

Using a cloud-based application, such as FactoryTalk® Analytics for Machines from Rockwell Automation, can help you support your systems by showing how they are used and offering insight into performance, states, events and other relevant activities to your customers.

**Machine Builder Deploys OEE Measurement Solution**

Pulsar Srl produces specialized machinery for the tissue industry. It has recently developed the Reds Platinum System specifically for tissue converting applications, to measure OEE based on KPIs including machine availability, product quality, machine downtimes and transition times. It can take into account the process steps to be controlled, the machines involved and the parameters that must be collected and monitored to calculate the line’s OEE.

*The measurement of production line efficiencies in the manufacture of consumer goods is a major factor toward increased competitiveness. The provision of a platform dedicated to the converting industries will give users a facilitated approach to measuring OEE.*

Angelo Bertini, General Manager, Pulsar Srl

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1 Trigg Technologies Skid Pumps Intelligence Into Hydrocarbon Transfers, Connects Remote Operations to the Enterprise Through the Cloud, Rockwell Automation case study, January 2015
2 Pulsar Deploys FactoryTalk® Software for OEE Measurement Solution, Rockwell Automation case study, 2016
3 Ted Hutto, Co-Owner, Trigg Technologies
In an era where SKU counts are up yet production operations are being consolidated, manufacturers are eager for new opportunities to simplify their automation systems and minimize downtime. Likewise, oil and gas, mining and other industrial operators are seeking less complex systems to keep operations running continuously and at peak efficiency.

Smart machines and equipment can support simplified integration, but first require that you make some key design decisions. Specifically, it’s important that you choose:

- **The Right Network Architecture:** EtherNet/IP can simplify network infrastructure and reduce integration risks. EtherNet/IP offers the real-time performance, resiliency and security of a standard fieldbus solution, and the bandwidth, open connectivity and global acceptance of standard Ethernet.

- **The Right Control Platform:** A Logix-based platform uses a common design environment, one control engine and one network technology, allowing you to integrate all forms of control into one platform. It also supports reusable code to help reduce system complexity and support faster design, commissioning and installation times.

- **The Right Technologies:** Line-control technologies, such as RAPID Line Integration™ from Rockwell Automation, provide a common equipment interface that allows you to install and verify functionality prior to shipping the equipment.

- **On-Machine™ solutions** from Rockwell Automation move industrial controls and hardware closer to the application or onto the machine, minimizing the number of components in the cabinet. This reduces wiring time and results in increased uptime and lower costs.

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1 Most Used Ethernet Protocols, Control Engineering, July 12, 2014
2 Solutions in Action: Eagle Technologies Group, Rockwell Automation case study, 2015
Deliver **Real-Time Diagnostics and Analytics**

After you have identified which data needs to be captured, you can determine how it will be captured and delivered to help **optimize operations**. Key solutions that can help make this happen include the following:

- **Embedded intelligence devices** offer new ways for your customers to increase machinery life cycles and decrease downtime. These devices can use built-in functions, such as vibration monitoring, condition monitoring and torque signatures, to identify issues before they become problems, and to help quickly troubleshoot and repair problems that do arise.

- **HMI faceplates** with systemwide diagnostics and easy-to-understand display screens keep operators informed of system performance and provide early detection of system errors, which can help ease maintenance and troubleshooting.

- **Mobile technology** expands traditional system access to let operators be more productive and collaborative. It empowers manufacturing operators, managers and supervisors to make timely decisions no matter where they are.

- **Remote access** through services such as FactoryTalk Cloud offers you and your customers convenient access to critical machine information.

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**Servicing Equipment in the Field**

**INCO Engineering** offers Transdatic, an advanced, remote-monitoring system, for their mining hoists. The system continuously monitors conditions of selected equipment, and data is securely transferred to INCO’s central service center. If an issue occurs, INCO staff can notify customers immediately – reducing the customers’ maintenance costs. Staff can also analyze the most frequent faults, and help customers make equipment and process adjustments to prevent further occurrences.

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**OEM Business Benefit**

Remote access offers new opportunities for you to support your customers and create new revenue streams.

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Our customers are asking for more production information out of our older saws … After retrofitting [the control platform] we are able to troubleshoot the saws over the internet and dispatch parts within the same day. We are also able to pull a lot of data from the PLC, which translates into production data that greatly improves our customers’ visibility into their production facility.

Lisa Kvech, president, MetlSaw Systems

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1 Solutions in Action: MetlSaw Systems, Rockwell Automation case study, 2016

2 Solutions in Action: INCO Engineering, Rockwell Automation case study, 2015
Optimize Operational Efficiencies

Using more innovative designs and scalable automation technology, you can deliver more flexible smart machines and equipment that help improve operating efficiencies and:

- Reduce installation and startup cycle times
- Reduce changeover times
- Meet electrical, mechanical and environmental requirements
- Reduce energy costs
- Enhance worker safety and equipment protection

The use of modular and reusable code is one way of doing this. It enables code structuring, tagging conventions, state model implementation, HMI practices and more. You benefit from a building-block design approach that can improve your time-to-market. Your customers benefit from a more consistent programming approach that makes systems easier to operate and maintain.

Mechatronic design tools, such as Motion Analyzer software, also can help you realize the full benefits of a mechatronic design. This includes making it faster and easier to analyze, optimize, simulate and select control systems.

A scalable control platform provides one common framework that is easier to design, install, manage and maintain. It also allows you to right-size the control system for your customer’s application.

During the design phase of their CNCAssembly™ system, Transformix Engineering used Motion Analyzer software with SOLIDWORKS® 3D CAD software to create visual simulations with actual motion profiles to help ensure systems function correctly.2

In recent years, we have been using more Rockwell Automation tools in our design process. For example, we use Motion Analyzer for sizing servo/drive/reducer combinations and calculating loads.

We can spend less time on startup and working through problems – and can get our machines out the door faster. We can pass those savings on to our customers, while providing them with a very sound design and efficient machine.1

Marketing Manager
Schneider Packaging Equipment

1 Solutions in Action: Schneider Packaging Equipment Co. Inc., Rockwell Automation case study, August 2013
2 Solutions in Action: Transformix Engineering, Rockwell Automation case study, December 2015
Your workers need new knowledge and skill sets to design, support and sustain smart machines and equipment – all at a time when skilled workers are increasingly hard to find. Industrial networking training and certification courses can help address these challenges.

At the same time, you don’t have to go it alone. The Connected Enterprise is the realization of a vision that Rockwell Automation has been working toward for decades. We can help you keep pace with the changing nature of manufacturing and industrial operations to be sure you remain relevant with your customers and stay ahead of your competition.

**Expertise for the Job**
We can help address your most pressing smart machine and equipment challenges. Our engineers, safety authorities and security specialists offer a wide range of consultative, design, integration and support services.

**Services That Fill a Need**
Our network and security services include security assessments, reference architectures and software configurations to help you design more secure control systems. Our safety services can help your smart machines and equipment comply with current and emerging standards, and our virtual support engineers can analyze trends and recommend actions to help prevent downtime.

**Partners With a Purpose**
Rockwell Automation Strategic Alliance and Encompass™ Partners give you the strongest technological, competitive and strategic advantages. Our authorized distributors provide simple access to products, services and people so you can focus on your core competencies.
Summary

The emergence of smart manufacturing and industrial operations is driving new priorities for your customers – and redefining what they expect from you. They need smart machines and equipment that can:

- Easily integrate into their facilities
- Provide access to information
- Help them increase efficiencies, improve productivity and support compliance
- Enable agile reaction to changing market demands

Rockwell Automation is your collaborator for developing the smart machines and equipment that your manufacturing and industrial customers need. Contact a Rockwell Automation sales representative or visit our website to learn more about the company’s technologies and services for designing smart machines and equipment.
Rockwell Automation, Inc. (NYSE:ROK), the world's largest company dedicated to industrial automation, makes its customers more productive and the world more sustainable. Throughout the world, our flagship Allen-Bradley® and Rockwell Software® product brands are recognized for innovation and excellence.

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