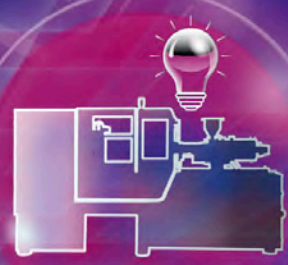




Smart WorkCell



Smart Machine

The Ultimate Guide to Industry 4.0



Smart Production



Smart Service



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**What every injection molder needs to know
about smart manufacturing.**

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As manufacturing evolves, Industry 4.0 presents new opportunities for injection molders. This guide offers practical insights, clear explanations, and real-world examples to help you transition to smarter, more connected production. From assessing readiness to implementing smart tech and cybersecurity, you'll gain the knowledge needed to stay competitive and lead the change in modern manufacturing.



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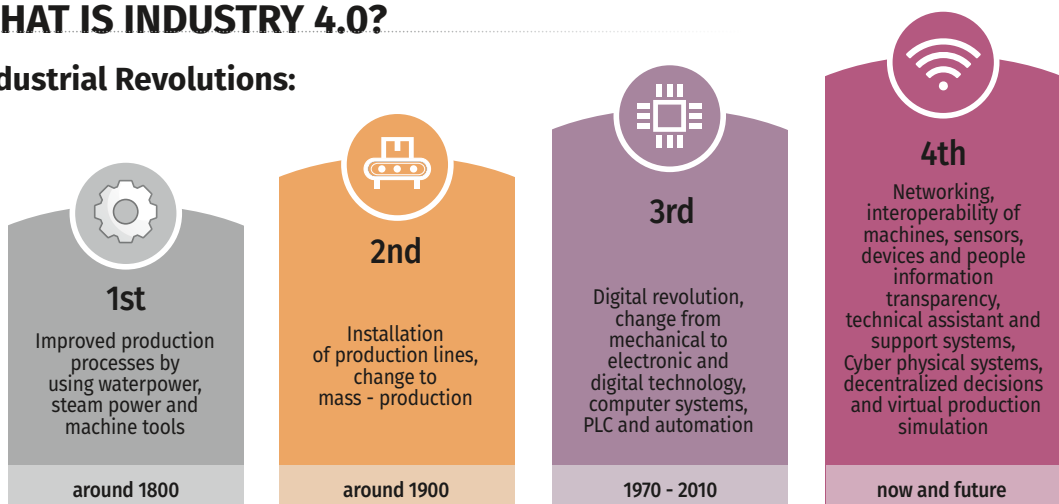
IS IT TIME TO EMBRACE INDUSTRY 4.0?

10 QUESTIONS TO ASK YOURSELF

1. Do you have to reduce unit costs to remain competitive?
2. Do you have to manage more unique products in decreasing batch sizes?
3. Are your processes becoming increasingly complex while quality requirements rise?
4. Do you want to be able to change your auxiliary devices without having to reconfigure your MES system?
5. Do you want to minimize human error and scrap?
6. Do you have a lot of mold changeovers?
7. Do your customers demand traceable production data?
8. Do you need to control production sites anywhere in the world?
9. Could your team benefit from software-supported systems to simplify their work?
10. Do you have a shortage of talented machine operators?

WHAT IS INDUSTRY 4.0?

Industrial Revolutions:



INDUSTRY 4.0 IS CONSIDERED THE FOURTH INDUSTRIAL REVOLUTION



Industry 4.0 is considered the Fourth Industrial Revolution, building on the previous three by integrating smart technologies and data-driven decision-making into manufacturing.

Unlike previous revolutions, which introduced mechanization, mass production and computerization, Industry 4.0 connects machines, systems and people through the Internet of Things (IoT), AI and real-time analytics.

The hallmarks of Industry 4.0 manufacturing and connected equipment include:

- Device networking
- Interoperability of machines sensors, devices and people
- Information transparency
- Technical assistant and support systems
- Cyber-physical systems
- Decentralized decisions
- Virtual production simulation

Technologies like the IoT, artificial intelligence (AI) and advanced robotics are transforming factories into smart, data-driven environments. At the heart of the Smart Factory is the Manufacturing Execution System (MES), the crucial link between enterprise-level systems and the shop floor.

Another aspect of Industry 4.0 is predictive maintenance enabled by condition monitoring

systems (CMS). Smart Machines capture a wealth of data, including data about the health of the equipment. That data is monitored – and equipment damage is prevented. Dozens of sensors can be put on a molding machine to monitor temperature, shock, vibration, humidity, oil quality, voltages, smoke and other parameters. The system can provide non-fatal alerts or actually stop the machinery before catastrophic damage occurs.

WHY DO I NEED INDUSTRY 4.0?



An injection molding processing plant consists of an array of different machines, devices and software products often purchased at different times – often from different suppliers. Operators must control all aspects of such integrated systems. This is important as manufacturers continue to suffer shortages of skilled machine operators. Without a unified system in place, this complexity can lead to inefficiencies, miscommunication

between equipment, and avoidable downtime. Industry 4.0 helps bridge these gaps by standardizing connectivity and enabling centralized data monitoring.

Molders embracing Industry 4.0 experience fewer mistakes. The technology can make for flawless changeover of molds or color changes on every shift and is easy for anyone to plug and produce with ease.

INDUSTRY 4.0 MANUFACTURING SYSTEM

Industry 4.0, at its core, involves using data gathered from primary and auxiliary manufacturing equipment to optimize its performance and increase operational efficiency by producing more parts in spec – thereby wasting less energy and materials.

A properly designed Industry 4.0 manufacturing system will:

- Generate production data.
- Communicate data to a server where it can be stored, compiled and analyzed.
- Present the data, its analysis and conclusions so it can be put to good use.

Achieving the maximum production benefits of digitized and networked manufacturing systems lies in the modular structure of Industry 4.0 solutions. As with production systems, it is also important to tailor communications systems precisely to production requirements.

The benefits of a finely tuned Industry 4.0 manufacturing environment include:

Increased productivity and efficiency

- Connected equipment reduces downtime through better job scheduling and preventive maintenance.

Mold setup recipes are stored to achieve faster mold changes and more error-free setups.

Increased uptime

- Remote service helps get you up and running faster.
- Move from Reactive Maintenance to Preventive Maintenance

Improved quality and consistency

- Real-time process control collects and analyzes data as it is created to inform current and future production decisions.
- Defect detection systems reduce scrap rates and improve part quality.
- Digital twins, assistance systems and AI-driven optimization predict and correct issues before they hinder production.

Reduced costs and waste

- Energy monitoring optimizes power usage, lowering operational costs.
- Material tracking ensures efficient use of resin, reducing overuse and scrap.
- Data-driven process improvements reduce labor and material waste.
- User-friendly teaching interfaces reduce training time.

Competitive advantage and future-proofing

- Plug-and-produce equipment allows flexibility for easy expansion and adaptation to new technologies.

Ensure overall safety of your process and operator

- Reduces manual workload and provides real-time guidance, minimizing errors—especially beneficial during night shifts.



Watch a demonstration on how much easier a mold setup change can really be with Wittmann 4.0.

HOW TO TRANSITION TO A SMART FACTORY

Industry 4.0 introduces what has been called the “Smart Factory,” in which cyber-physical systems utilize IoT devices to communicate and monitor physical process of a factory and make decentralized decisions – communicating and cooperating both with each other and with humans in real time.

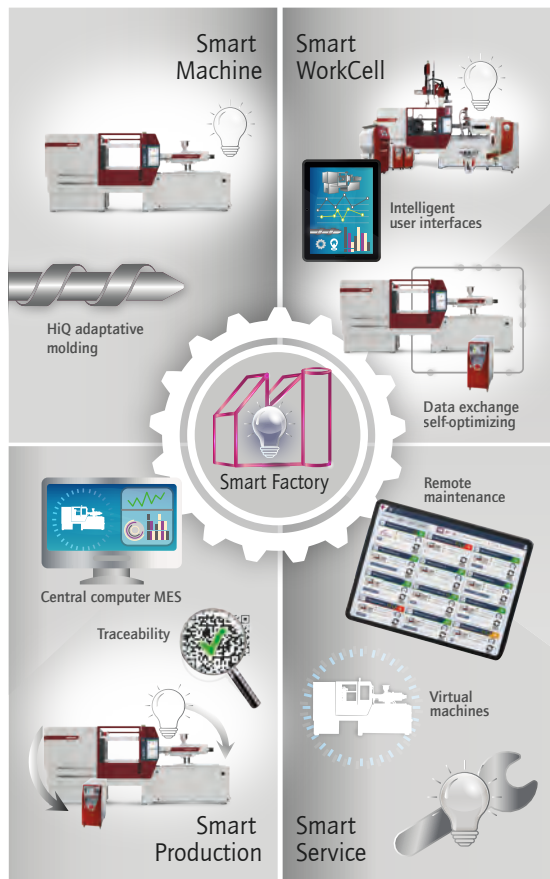
Manufacturers of all sizes, especially small and medium-sized businesses, can leverage this technology to enhance efficiency, reduce environmental impact, and build sustainable, future-proof businesses.

But how does a manufacturer take the initial steps toward acquiring and implementing a properly designed and optimally functioning Industry 4.0 production environment that can grow with the company? The good news is that adopting Industry 4.0 technology does not have to be done all at once – although choosing a vendor like WITT-MANN who is a one-stop-shop for all the required production and connection equipment certainly saves time and implementation headaches.

Processors do not need a comprehensive Digitalization strategy or a large, upfront budget right from the beginning in order to start benefiting from Industry 4.0 functionality. Even small initial solutions offer significant benefits – and can even reduce the time to achieve ROI for an entire manufacturing cell.

First, a manufacturer can employ a Manufacturing Execution System (MES), or at least a Smart Machine that can monitor, control and optimize its own performance in real time with networked sensors and controllers. In fact, Industry 4.0 capabilities have been steadily included in numerous aspects of production over the past 10 years, with flexibly automated and networked turnkey systems and use of machine-assistance systems.

Smart injection molding machines are already ready for digitalization and communicates via the OPC UA platform, which enables defined data exchange between various control systems



via Ethernet networks – irrespective of operating systems or programming languages. Thanks to numerous connectivity modules, a Smart Machine is in constant communication with its environment. It exchanges large amounts of data with other machines, robotic systems, auxiliary devices and MES and SCADA (supervisory control and data acquisition) systems that can be analyzed, archived and traced. In addition, it monitors its own processes and uses autonomous control circuits to keep them in a stable state.

Even with a good number of Industry 4.0-type practices already in place, working backward throughout one’s operation to update older equipment is likely to speed up a manufacturer’s transition to more fully digital manufacturing.

Wittmann 4.0 primary aspects



Training employees on Industry 4.0 equipment can be streamlined with virtual tools for training, simulation, programming and maintenance.

A Smart Factory, per the Wittmann 4.0 model, comprised of four primary aspects:

- Smart Machines
- Smart WorkCells
- Smart Service
- Smart Production

SMART MACHINES

Digital manufacturing begins at the individual injection molding machine. This is where major benefits can often be achieved with just a small investment. Adaptive injection molding machines and auxiliaries conserve resources and achieve the highest precision and absolute repeatability.

Major benefits start with the injection molding machine. The best molding machine can continuously analyze quality-critical process parameters, detect deviations in fractions of a second and adjust them in the same cycle. In this way, a stable process and consistently high quality is achieved even amid fluctuations in ambient conditions, operating resources or raw materials.

Industry 4.0 systems contribute to sustainability by reducing the energy and raw materials used.

Things to look for in Smart Machines include:

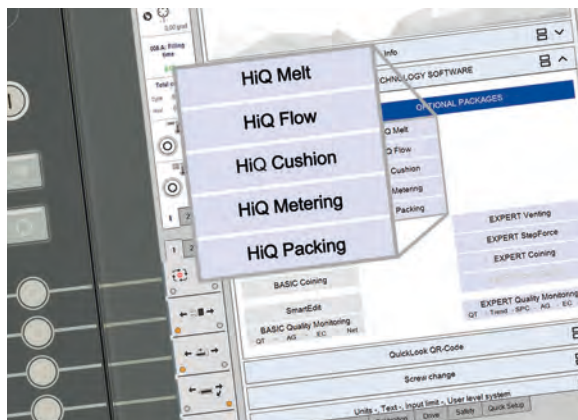
- Smart workspace: One display shows all devices and interactive communication.
- Conversational user interfaces: Virtual network computing (VNC), e-mail function, webcam, remote accessibility, network hub, other apps).
- Autonomous software: Software that "takes over" action choice and responsibility from users and operators.

Examples include:

WITTMANN HiQ and Expert Packages, virtual twin capabilities, programming assistance with interfaces like WITTMANN QuickNew Wizard.

- TeamViewer, MS Teams or other communication platforms via remote control to communicate directly with authorized technicians.
- Future Technology Advancements: AI agents using the reasoning of LLMs (Large Language Models), voice-activated controls, products for DC grids.
- Smart dust: Tiny, wireless sensors that detect and transmit data about their environment, (e.g., equipment health and process data).





Advanced software packages like WITTMANN HiQ offer a range of intelligent control features to ensure quality production.

Some features of WITTMANN's HiQ packages are:

- HiQ Flow: Automatically monitors and adjusts processes according to material batch differences.
- HiQ Melt: Measures the required screw drive work during metering and detects melt viscosity fluctuation
- HiQ Metering: Actively closes screw tip/ valve/check ring.

SMART WORKCELLS



The core operating principle of a Smart WorkCell area is networking that goes beyond internal device control. Standardized interfaces and communication protocols such as OPC UA make it possible to connect all components of a production cell. In this way, injection molding machines, robots, auxiliaries and other systems exchange information to coordinate their work processes and achieve greater overall efficiency.

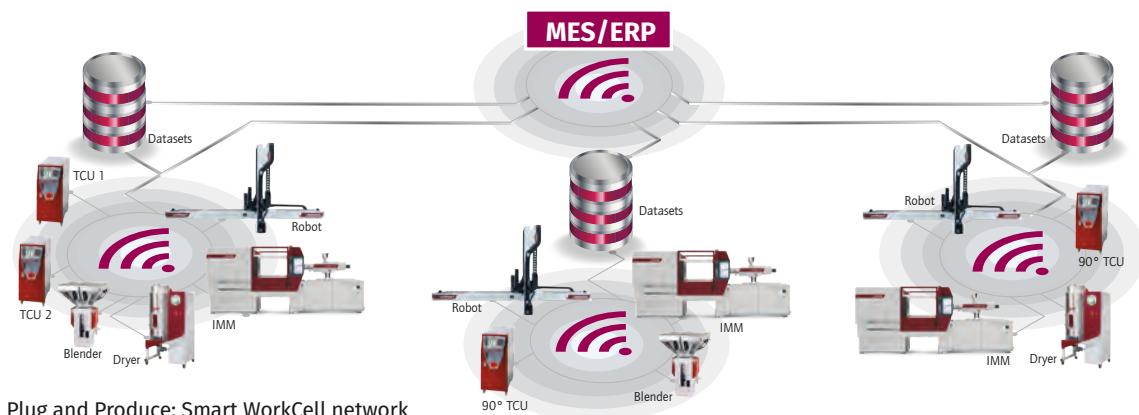
Smart WorkCells are designed to create a “plug-and-produce” environment that runs at optimal

efficiency through data-driven process optimization.

The benefits of Smart WorkCells are:

- Fewer bad parts
- Less material waste
- Less energy use
- Quicker process error diagnoses
- Less production downtime

Networking simplifies seamless data tracking. All equipment in a Smart WorkCell — the primary injection molding machine and the required auxiliary



Plug and Produce: Smart WorkCell network structure using Wittmann's 4.0 technology

equipment – communicates before and during processing, using real-time data to warn of issues with molds, materials and other parameters.

For instance, a special feature from WITTMANN is that all system components are offered from a single source, allowing the efficiency potential to be exploited to a particularly large extent - from pellet preparation and supply, injection molding, mold temperature control and automation to inline recycling and integration of the production cell into higher-level IT systems.

Thanks to complete networking and downstream logic with the help of Wittmann 4.0, plug-and-produce manufacturing is a reality. The basis for this is the digital tool data sheet. The machine already knows the mold data the second time it is set up and sets the stored process parameters – not only on the injection molding machine but also on the robot and all auxiliary devices involved. This greatly reduces setup times and increases the productive time of the work cell. It also reduces the risk of input errors during manual operation.

EUROMAP, the umbrella organization of the European plastics and rubber machinery industry drives creation and implementation of Industry 4.0 protocols. Industry-standard communication protocols EUROMAP 63, 77 (for MES) and OPC UA are the backbone of the communication capabilities of a Smart WorkCell.

U.S.-based molding equipment suppliers provide insights that help ensure OPC UA-based interfaces

are providing data that is useful for molders. Many auxiliary components come already 4.0 ready, such as blenders, color feeders, TCUs and dryers.

The “brains” of a Smart WorkCell include:

- One central gateway.
- OPC UA Server.
- Local IP addresses within the work cell.
- Automatic and logical device connection and setup within the work cell.

The heart of the system is a router, which often can be tucked in the machine's cabinet along with the required wiring. The router is connected to a waterproof industrial Ethernet hub and automatically communicates to each device via DHCP. IP addresses are assigned to new auxiliary, and once they communicate to each other, each automatically appears on the controller screen.



Watch an in-depth overview of Wittmann's 4.0 plug and produce technology.

Auxiliary equipment connects to the router dynamically according to production requirements. auxiliary devices are automatically identified in the IMM and assigned specific functions.

The router and its dedicated work cell LAN ensure that peripherals are only connected to the machine within their own work cell. This prevents any miscommunication caused by incorrect or global IP address assignments, ensuring that peripherals from one work cell cannot connect to machines in another.



How Smart WorkCells operate?

In smart cell-based manufacturing, robots and downstream automation, temperature controllers, blenders, color feeders, dryers and other devices are assembled in dedicated spaces. A highly functional controller with graphical interface on the IMM can quickly call up a mold recipe that instantly, visually indicates what auxiliaries are to be plugged in and at what operating specifications. Current statuses are instantly relayed, and the entire work cell can be idled until all auxiliaries meet required conditions, like temperature set points.

When logging into the IMM, the controller logs the operator in to each piece of equipment at the same user level. Any error in any piece of equipment shows up on the machine and can also appear on a smart phone via an app. Such instances are logged and diagnostics can be performed from that information. If a auxiliaries device is out of tolerance, the machine won't run until it comes into tolerance. Data can be saved over thousands of shots.

When a mold change is required, an icon on the controller indicates missing auxiliaries. A simple press of a button and relocation of an Ethernet cable satisfies the recipe



requirements and gets the machine back in operation.

Industry 4.0 Smart Factory molding cells comprise some combination of:

- An IMM, robot, and auxiliaries that operate within a clearly bounded network that configures itself automatically.
- Mold setup recipes stored for faster mold changes.
- Web service support.
- MES collection of production data.
- Smart phone apps to know production status or alerts.
- Predictive maintenance monitoring of cell equipment
- Smart molding process solutions.
- Production traceability.
- Remote access and control.

SMART PRODUCTION



Intelligent manufacturing integrates connected equipment, real-time data and advanced platforms to optimize every phase of production in the Industry 4.0 era.

The Manufacturing Execution System (MES) serves as the digital production core, bridging business data with shop floor operations. It monitors production in real time, identifies inefficiencies, enhances transparency and provides key performance indicators like Overall Equipment Effectiveness (OEE). An MES combines user interfaces, databases, rules and procedures working together to coordinate and optimize production.

The MES collects parameters directly from machinery in real time through various communication protocols. These include Euromap 63/77/83 for injection molding machines and cycle-based equipment and OPC UA for multi-vendor device integration.

A significant advantage of MES is its ability to integrate directly with ERP systems, receiving orders, material information, production batches

and scheduled tasks. This real-time data synchronization ensures seamless management of the entire production cycle, providing real-time production status reporting, automatic documentation generation and resource allocation optimization.

The system manages quality checks systematically from planning to result recording, ensuring compliance with required standards while integrating quality data with maintenance and production activities. Its features include automated quality alerts, digital work instructions, and non-conformance tracking.

MES enables complete data traceability to comply with standards like IATF 16949, documenting every production phase through component-level tracking, batch and serial number management, process parameter logging and material lot tracking from supplier to finished product.

Effective planning prevents inefficiencies, delays and waste. The Gantt chart visualizes production phases, identifying time and resource

requirements to coordinate resources and meet deadlines. Advanced planning features include multi-constraint scheduling algorithms and resource allocation optimization.

MES can prevent assigning tools to incompatible equipment, automatically blocking assignments that could cause technical issues, ensuring optimal and safe resource utilization.

TEMI+ by WITTMANN represents the cutting edge of manufacturing execution systems, delivering exceptional functionality designed specifically for modern production environments. This comprehensive solution goes beyond basic MES

performance dashboards monitor OEE, cycle times, production counts and quality metrics with intuitive visual interfaces that highlight opportunities for improvement.

The system provides detailed energy monitoring to track consumption patterns across your entire facility, identifying optimization opportunities and supporting sustainability initiatives. Its sophisticated downtime analysis pinpoints recurring issues with detailed breakdown reports that enable targeted maintenance and process improvements. The mobile-first access puts critical production information in the hands of team



capabilities to offer a complete digital transformation toolset.

TEMI+ distinguishes itself with specialized capabilities including intelligent recipe management that seamlessly downloads and uploads every IMM recipes, enabling operators to access critical parameters instantly. It offers universal machine connectivity to virtually any production equipment regardless of manufacturer or age, creating a unified digital ecosystem. Its real-time

members throughout your facility with responsive interfaces optimized for tablets and mobile devices.

TEMI+ also offers custom report generation to create tailored reports that focus on your specific key performance indicators (KPIs) and business objectives. Companies that embrace intelligent manufacturing solutions gain significant advantages in efficiency, quality, and adaptability. Implementing TEMI+ provides a clear pathway to

manufacturing excellence by reducing production waste and inefficiencies, improving product quality and consistency, enhancing visibility across the entire production process, enabling data-driven decision making at all levels, and providing the foundation for continuous improvement.

Ready to optimize your manufacturing operations? Contact a manufacturing technology specialist today to discuss your specific needs and discover how TEMI+ can help you achieve your production goals.



SMART SERVICE



The advantages of remote tech support and digital service products became particularly clear during the coronavirus pandemic. Tools for remote maintenance and online support experienced a boom. WITTMANN offers access to bundled expert knowledge via web service, regardless of location and time.

For instance, with Smart Service, WITTMANN offers access to bundled expert knowledge via the web service, regardless of location and time. Around 70% of all incoming technical problems with injection molding machines can be solved remotely.

Remote tech support is useful not only for troubleshooting but for training staff. Tools like WITTMANN QuickLook 4.0 and TeamViewer are engineered specifically to serve these functions.

“Data collection ensures greater efficiency in maintenance and servicing.”

Vendors that provide Smart Service offer:
Smart data discovery

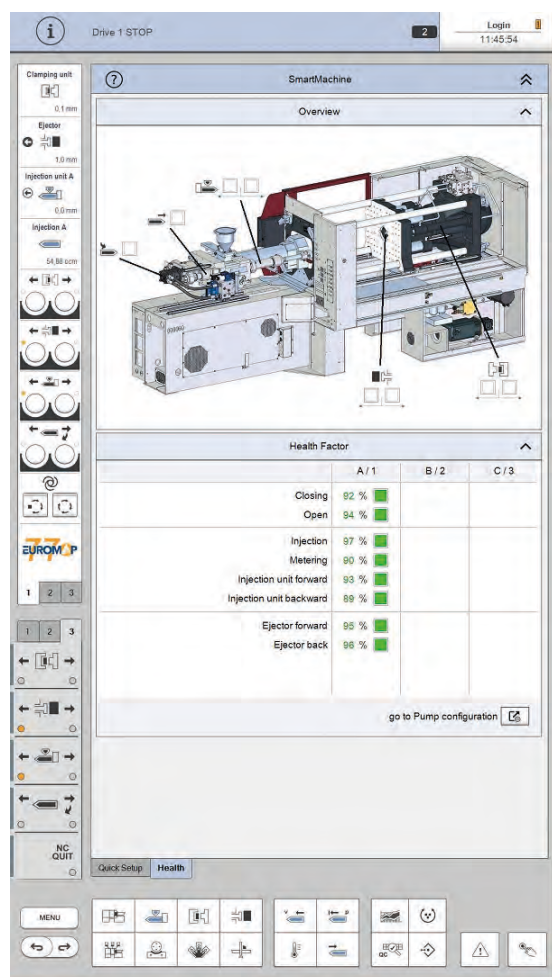
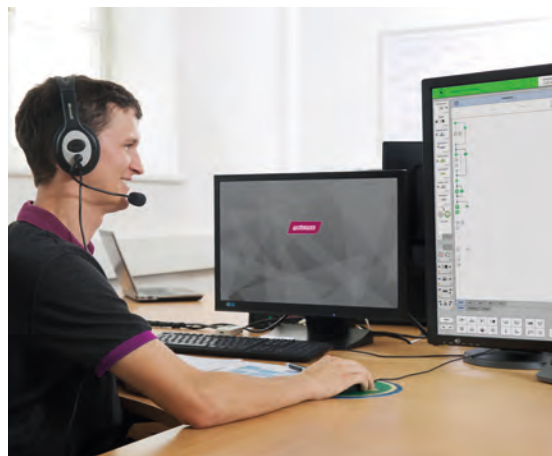
Condition monitoring, maintenance intervals, collecting process data via quality table and statistical process control charts with recommended tolerances.

- Digital services that respond to collected and analyzed data using networks of intelligent technical systems.
- Cross-functional domain expertise.
- Early warnings of potential failures through analysis of real-time machine condition and usage patterns.
- Cloud-based platforms for building and selling data-based services.
- Smart controls that improve navigation, access to essential services, energy efficiency and more.
- IoT-enabled devices and software solutions. Keen understanding of user needs to enhance experiences.

Data collection also ensures greater efficiency in maintenance and servicing. Thanks to condition-based, predictive maintenance, downtimes are minimized. One example of condition monitoring is Health Factor developed by WITTMANN. Health Factor utilizes existing sensors on the molding machine, keeping costs down to the end user but also providing good information regarding equipment health. It functions on a percentage of health and a green, yellow, and red light on the controller to give a visual cue of the health of the equipment.

Determining condition data makes it possible to plan maintenance work and repairs before problems occur. Spare parts can be procured just when they're needed so machine downtime can be scheduled and kept short.

AI is emerging as a game-changing addition to Smart Service capabilities. For instance, WITTMANN's AIM4Help, uses AI as a knowledge-based expert system for technical queries and troubleshooting. AIM4Help is made available as first-level support via a web portal and offers a wide range of options for supportive help with tool settings or sequence programming for robots, for example. WITTMANN AI is trained with documentation, technical documents and error analyses created over the entire history of the company. WITTMANN's software development team has optimized the training data for high efficiency in answering queries and a high hit rate.



“AI is emerging as a game-changing addition to smart service capabilities.”

WITTMANN's Health Factor program delivers real-time insights into the 'health' of key machine functions and assessing against new condition. A tool for predictive maintenance and process optimization.

CYBERSECURITY AND INDUSTRY 4.0



Protecting all your connected, Industry 4.0 digital assets – as well as your organization's overall digital environment – is vital to reduce one's exposure to cyberattacks.

A range of cybersecurity tools help companies follow good cyber hygiene practices and take a proactive stance against cyberattack. They protect organizations' digital presence and significantly lower their likelihood of falling prey to malicious actors.

In manufacturing, cybersecurity requires:

- **Ensuring data privacy:** Manufacturing, robotics and smart systems generate tremendous amounts of data. Good cyber hygiene includes securing the storage and transmission of this data and protecting access to it. It involves secure data handling procedures such as encryption and access controls to protect sensitive information from theft, unauthorized access or modification.

- **Securing automation systems:** Robotics and other automation systems are increasingly becoming indispensable to manufacturing processes. Good cyber hygiene is needed to protect these systems from attacks that can compromise safety, disrupt operations or lead to unauthor-

ized control. Reliable encryption and strong authentication procedures can help secure these technologies, as can regular patching of relevant software and firmware.

- **Protecting industrial control systems (ICSs):** Manufacturers rely on ICSs to automate and control many processes. Maintaining cyber hygiene protects these systems from cyber threats such as malware and unauthorized access. The integrity of industrial control systems can be safeguarded through secure access controls and network segmentation.

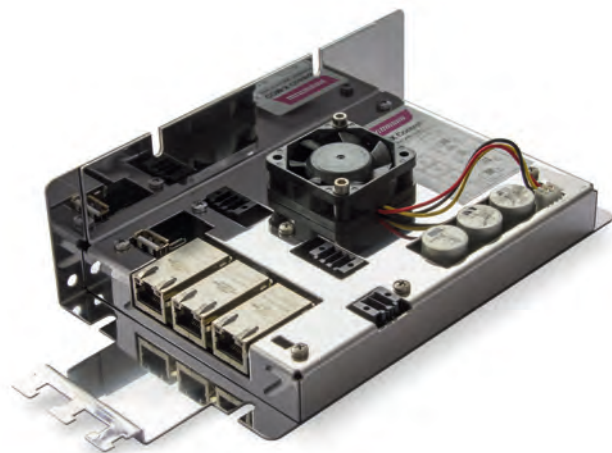
WITTMANN mitigates the risks associated with cyberthreats with its self-developed and security-tested Wittmann 4.0 COM-X router. This router protects critical infrastructures, increases the resilience of systems and protects sensitive data and processes. And to be clear: Equipment suppliers cannot use their remote connection to access all a manufacturer's systems and networks.

The patented Wittmann 4.0 router contributes substantially to data security because only appliances that identify themselves unambiguously to the router by means of a security certificate are granted access to the production cell. The router

is integrated in the injection molding machine and linked with the connected auxiliaries as well as the customer's network.

The Wittmann 4.0 router dispenses with the manual allocation of IP addresses to the individual devices within a production cell automatically. This enables each device to be plugged in and disconnected dynamically even while the equipment is in operation, according to the principle of plug and produce.

Moreover, this results in some advantages for connections to MES or ERP systems and/or access to the injection molding machine, robot or auxiliaries by means of OPC UA. It also provides clear network-topological insight into which peripherals are associated with which work cell and IMM. The safe exchange of information with condition monitoring systems, remote control



or the Windows-based Web-Service 24/7 from WITTMANN is also ensured in this way. Wittmann 4.0 technology opens the door to the world of Industry 4.0 by making a vital contribution to cybersecurity in production plants.

What's next?

In the next phase of Industry 4.0 (which some are calling Industry 5.0), advanced technologies will be further integrated to emphasize collaboration between humans and machines. That phase of Industry 4.0 will be:

- Human-centric.
- Sustainable.
- Resilient.

Building on the automation and data-driven advancements of Industry 4.0, this next phase focuses on deeper collaboration between humans and intelligent systems, creating more adaptable, efficient and sustainable production environments.

AI is at the heart of this evolution, enhancing decision-making, predictive maintenance, and real-time process optimization. As AI evolves, it will improve efficiency, enable greater customization, and resilience in manufacturing.

Companies that embrace these advancements will further their competitive edge – unlocking new possibilities for innovation, sustainability and productivity. Finding ways to take full advantage of AI to stay ahead will be a priority for top-performing manufacturers

For now, manufacturers don't necessarily have to make a large investment to realize some of the easier-to-attain benefits of Industry 4.0. Processors don't have to get rid of the many well-operating machines in their stable to convert to 4.0 advantages – but the smart ones will start their 4.0 journey with education and slowly add new criteria to their new machine and auxiliary purchases. The sooner they move in this direction, the sooner they will reap the rewards of Industry 4.0. Innovations sure can make manufacturing more efficient – and a lot more fun!

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INDUSTRY 4.0 SUCCESS STORY



ITW facility is U.S. leader in use of Insider solutions

With 30 all-electric WITTMANN injection molding machines running 24 hours a day, five days a week, ITW Deltar's automotive headrest manufacturing facility in Lakeville, Connecticut, is the nation's leading user of WITTMANN's Insider automation solutions.

Going all-in on Industry 4.0 injection molding is a big investment that takes a big commitment – and reaps big rewards.

Case in point: the ITW Deltar automotive headrest manufacturing facility in Lakeville, Connecticut. Here, 30 electric WITTMANN injection molding machines (IMMs) run comfortably 24 hours a day, five days a week, with a central drying system and other auxiliaries carefully laid out on the 40,000-square-foot production floor.

Phil Dunn, an ITW manufacturing engineer in his 16th year at the facility, easily rattles off the multiple benefits of the facility's fully integrated setup:

- Fewer bad parts – with about a fivefold decrease in scrap
- Less material waste
- Less energy use
- Quicker process error diagnoses
- Less production downtime

Starting with one machine off the show floor at NPE 2009, Dunn's facility has purchased only WITTMANN IMM's since then and just added two new EcoPower 110s in March.

Before the first WITTMANN injection molding machine (IMM) was even installed, ITW's Lakeville engineering team carefully planned out how every inch of the production floor would be utilized. The facility had already been using WITTMANN robots. Prior to bringing in full-scale automation, the facility would mold parts, then send off-site for final assembly.

Now, six people can staff the facility's entire production process each shift. Mold changes are kept to a minimum, and visual inspection systems spot errors quickly to head off production mistakes.

"This ITW facility's investment in its WITTMANN equipment has made it the U.S. leader in use of WITTMANN's Insider package of automation solutions," said WITTMANN USA President Sonny Morneault. "Many of our customers use it, but not to this scale."

WITTMANN's Insider solution supplies automation in the IMM, integrating the parts removal

robot, conveyor and any other pre- or post-finishing auxiliaries. This allows for a major reduction of production space, no need for an external safety guarding, smaller robot (less costly) and a work cell that comes to the customer safe to operate.

A modern transformation

During a tour of ITW's state-of-the-art facility, Dunn recalled ITW's transition from its former Lakeville facility nearby to the current one, his first encounter with WITTMANN's Insider package, and the clear benefits of using WITTMANN's Industry 4.0 technology as the facility simplified its product mix from a range of automotive parts to headrests exclusively for Ford and Toyota.

Not long after NPE 2009, Dunn traveled to WITTMANN USA's Torrington, Connecticut, headquarters to view the company's IMM that had been displayed at the show and that had been equipped with the Insider package.



Phil Dunn demonstrates the space between work cells at the ITW facility, which is one of the biggest benefits of the Insider molding machine package and L-mount robots.

"We were looking for something to reduce the footprint of our molding cells," Dunn said, noting that ITW is always keen to spend capital when modern technology is required. Thus, the first of the facility's 30 WITTMANN IMMs entered the mix.

The fleet, added gradually as part of ITW's model factory initiative, is fully electric with servo-hydraulic ejection and injection unit carriage, with hydraulic core pulls integrated. These hydraulic functions are "on-demand" and only run as needed, making the EcoPower one of the most efficient machines on the market today.

"We took drawings of each one of our molding machines, laid them all out in CAD and laid out our entire production floor in CAD, including the uprights for our cranes, where our stanchions are – where everything is – then laid out how we wanted our floorplan. We had to move every single molding machine in the plant – and we did it all in nine months."

The facility molds polypropylene, several grades of POM, three nylons and one glass-filled nylon. Molding recipes are stored in machine controls, and WITTMANN conveyors bring parts from the molders to the automated assembly functions.

The Industry 4.0 advantage

Everything in the facility's work cells is connected through Wittmann 4.0 technology: robots, water heaters, internal pressure transducers, internal hot runner controls, color mixers.

"All that is integrated and being monitored," Dunn explained. "That cuts down on our scrap costs and bad parts."

With all aspects of part recipes dialed in, many of the facility's work cells are dedicated to a particular task – for instance, molding nothing but black headrest components – for five days a week all year.

The facility's 42 total IMMs are dedicated to specific jobs. Such is the efficiency of Industry 4.0 technology at ITW that each shift requires only six people, including a setup technician, an automation technician to oversee more than a dozen pieces of automation, and four operators.

"The only way we're able to do that is to cut down on the number of changeovers to inline everything and have everything fully automated,"



Dunn said. "The operators don't have to put parts in bowls in any of our cells; that's all done with robots and conveying." Each operator manages eight IMMs and three pieces of automation equipment. Metal components and finished products are the only things that require physical handling and inspection.

Automatically avoiding scrap

Operators can also address machine alarms that indicate process errors, escalating some issues to the shift's automation technician. WITTMANN technicians also have remote access to each machine on the floor.

"The robots communicate with all our automation," Dunn explained. "If the automation is down, it will drop the parts into a backup bin. If it does it for more than a specified number of consecutive shots, the molding machine stops, the barrel backs off, purges it forward and goes back to ready. The technology doesn't allow the system to continue producing scrap."

In such a situation, the molding machine sounds an alarm and an alert shows up on the screen of the robot pendant pinpointing the area of the malfunction "so we know why it went down. The equipment is all integrated, and all the pieces talk to each other."

With this setup, Dunn estimated his facility has reduced scrap from about 10% to about 2%. Prior to setting up the Lakeville facility, Dunn and his crew had to send parts to a sister site in Millerton, New York, and only then would defects be found.

Another way Industry 4.0 technology maintains optimal production is by alerting operators at the start of a production run that a key piece of equipment – for instance, a temperature control unit – isn't turned on.

"You error-proof your startups," Dunn said. "I couldn't tell you how many issues we've had with water not being on, or hot-runner controller temperatures not being set right. Or we might have been purging through a manifold where the temperature was a little high and kept running like that.

"When you call up a recipe now, it sets the hot runner control, the water heater, the robot and the color mixer. All the upper and lower controls limits are preprogrammed. If the water temperature exceeds the specification because the pump isn't on, it immediately shuts the press down and indicates you have a water problem. Before we brought in WITTMANN's technology, we had none of that communication with any of those auxiliaries – and we had a lot of parts out of spec."

New recipes are only loaded onto the machines on which molds are changed, he added. And, if recipes require changes after ITW's initial machine, part and process testing and setup, a revision and authorization process is used to create new ones – which are easily uploaded to the molders.

Sustainability and space gains

Because Industry 4.0 technology has dramatically reduced the facility's scrap rate, less energy is being used and wasted.

"Monitoring energy usage is a high priority here," Dunn asserted. "That's why we went with all-electric molding machines, and we were getting an energy rebate from the utility when they were available. WITTMANN robots are running in eco mode, meaning the robot only runs as hard and fast as required to meet the specified cycle time – saving not only energy but wear and tear.

When an operator selects eco mode, "the robot self-monitors cycle time and adjusts to the proper speed. It's constantly looking at how much time it takes to pull the part, go to the end position and come back within the cycle that you're running."

Meanwhile, the facility's 2-year-old central drying system is another big energy-saver and has allowed ITW to remove old press-side drying and conveying systems. That lets ITW, as they did with the Insider packages from WITTMANN, put even more machines in the space they have – making their facility more efficient than ever.

The bottom line

While WITTMANN's Industry 4.0 technology has elevated his facility's production to an unprecedented level, Dunn said his job requires him to periodically evaluate other equipment on the market.

"I'm constantly challenged with looking at other OEMs, robotics and more to make sure we've got the latest equipment at the best price," Dunn said. "I was walking around NPE last year, and I didn't find any other company with the same one-stop-shop approach or level of connectivity."



Phil Dunn offers insight into how WITTMANN has supported his production goals, from equipment performance to Industry 4.0 integration.



Watch Manufacturing Engineering, Phil Dunn, talking about ITW Deltar

INDUSTRY 4.0 SUCCESS STORY

BMI: Single-source Industry 4.0 solution boosts operations



Thanks to the new integrated production cells, BMI has successfully positioned itself as a supplier of ISO FIX elements.

A savvy injection molder in the heart of U.S. auto-making country is reaping great dividends by fully embracing Industry 4.0 technology to manufacture important parts – a commitment the company expects to be a significant advantage in drawing more business.

BMI of Chesterfield, Michigan, has invested heavily in cutting-edge digital manufacturing over the past two years – and they chose WITTMANN because their work cells are fully integrated, from injection molding machines (IMMs) to auxiliary equipment, software and controllers.

BMI, which has been in business for 30 years and employs a workforce of 50, began purchasing WITTMANN IMMs and robots in March 2022 and added its second 240XL machine in March this year. The company expects to purchase an additional 240XL and possibly a 450XL cell, both with Wittmann 4.0 technology. On the company's production floor are:

- Two 240XL SmartPower IMMs.
- A 450XL Macropower IMM.
- Four R9 five-axis robot arms (one for a non-WITTMANN machine).

WITTMANN's 240XL cell in particular "has really exceeded our expectations," enthuses Sam Holdsworth, BMI's director of operations and engineering. WITTMANN's all-in-one Industry 4.0 solutions "streamline set up, and process monitoring ensures delivery of quality finished goods" while also adding "an element of respect and organization to the manufacturing floor. The phone app and accessibility to friendly, knowledgeable WITTMANN team members makes short work of any issues."

Automation and data drive efficiency

Producing parts for the automotive, medical and consumer goods industries, BMI has automated much of its part removal, with robots gently extracting parts from molds. This is particularly essential when producing "A"-surface automotive parts that require superior aesthetics.

"These parts can't get scratched," Holdsworth notes. "They aren't brackets or under-the-hood components. When you sit in your car, you see these components – so for a human to only touch them at the very end of the production process is beneficial to achieving the final quality."

WITTMANN's Industry 4.0 work cells have helped put BMI on the map in producing ISO FIX bezels, Holdsworth explains. ISO FIX bezels feature pad printed images that identify child seat anchor points. BMI also produces seat adjustment handles (decorated and non-decorated), seat rail trim panels, body trim grommets and assorted interior, body and engine compartment fasteners.

"Some years ago, an ISO FIX standard was put in place requiring every tether point in a vehicle that accepts a child seat anchor be identified," Holdsworth explains. "When you were in your car and you could reach down between the seats and find this metal hoop, now that has to be identified and clearly visible. These bezels snap in certain areas, and that metal hoop is in the middle. We were initially decorating the parts with the words ISO FIX on them and eventually started molding them."

In the near future, BMI's five-axis robots will present the two parts of its ISO fix bezel to an as-

sembly cell, where they will be snapped together, Holdsworth says. For an angular car seat component, end-of-arm suction cups will grab the part and gently ease it onto a conveyor that goes to an operator who examines and packages each one.

BMI molds ISO FIX bezels in black, shades of gray and white, and now a new beige color, says BMI Operations Manager Scott Lehman. The Wittmann 4.0 cell helps manage those colors. "We have mixers and blenders that let us add colorant to the resin at prescribed ratios, because we have to adhere to a master color sample. That equipment is incorporated and works seamlessly within our 4.0 cell. If we didn't have the WITTMANN blenders, then we'd be adding colorant in different ways."

The Wittmann 4.0 advantage

Before purchasing its WITTMANN equipment, BMI struggled through purchasing from separate vendors who were reluctant to talk to one another and provided only limited guidance in getting their respective equipment to work well together.

But when a WITTMANN truck packed with a digital manufacturing display pulled up to BMI, Holdsworth and his team began to see the benefits.

"We initially scoffed at the WITTMANN road show truck coming to our facility as a sales pitch," he said. "But when we saw what they demonstrated and heard what they had to say, we learned a lot about how WITTMANN can provide single-source solutions. Instead of having to get answers from different suppliers to any issues, we could deal with just one."

"It really does work," Holdsworth says, "and the proof is when you walk out on the floor and you see all the green LEDs working in concert. When one piece of equipment isn't talking to the others, it turns a different color. To have everything show up on one molding machine screen – you can't say enough about it."

An example of WITTMANN's interface is how it controls BMI's temperature control units (TCU), he continues.



“If the mold has a hot runner system, WITTMANN offers a hot manifold controller. Having that data right on the screen and be able to see if one of your zones goes out” is a much greater value than buying a less-expensive freestanding TCU that doesn’t work within Industry 4.0 protocols.

Another significant value BMI appreciates is WITTMANN’s coordinated approach to onboarding customers, Holdsworth says: “As we moved through the purchase, we had four WITTMANN experts in our conference room, including our molding machine contact and our auxiliary contact – and each one is responsible for making sure everything in the work cell works in concert.”

Among the many benefits BMI reaps from WITTMANN’s integrated Industry 4.0 is more consistent production and fewer bad parts.

“Parts per million rejections are always a key indicator with your customers, so we certainly use that as a selling point. The proof of the pudding is deliveries: Are you delivering parts on time, and are you meeting cost targets? The only way to do all of that is to be able to produce efficiently.”

As BMI continues to hone its Industry 4.0 operations, Lehman says, “we’re gathering data each and every minute, and we can establish baselines – whether it’s a quarterly or an annual measuring stick. We go through those every week, so we’ve got a lot of good data we can use to our advantage down the road.”

Ultimately, embracing WITTMANN and its fully integrated Industry 4.0 solutions “has been an educational process” says Lehman “we have only just begun to explore the potential these tools have to enhance our operations.”

It's all WITTMANN.



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