



Maxim Integrated  
*Accelerating the Path to Industry 4.0*

# Welcome to the Smart Factory

Close your eyes for a moment and imagine a symphony orchestra. The famous conductor taps his baton, and the violins begin to play. Then the cellos and woodwinds join. The percussion adds tempo and depth to the sound and the trumpets brighten the mood. Together the sound is magnificent.

Now imagine a factory floor full of machines that each have a different function and pace. When in sync, production flows efficiently in manufacturing from one station to another just as the orchestra carries the synchronized melody along. But synchronizing the shop floor is no easy task.

In the 1980s we learned that using the Theory of Constraints can help to solve bottlenecks, improve throughput, and make manufacturing efficient. Today's technology can solve this problem electronically, economically, and instantaneously.

## MAXIM INTEGRATED'S POCKET IO™

Maxim has developed an innovative, inexpensive cyber-physical system development platform that can orchestrate the efficient production and monitoring of the factory floor. The Pocket IO™ programmable logic controller (PLC) development platform addresses the challenges of industrial automation to keep a manufacturing line running 24 x 7. This breakthrough technology can help companies to improve overall production efficiency—key to making the total cost of ownership calculations for reshoring become very compelling.

Cyber-physical systems (CPS) are defined integrations of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa. Pocket IO is CPS hardware.



With Pocket IO, the factory becomes more productive through:

- **Real-time intelligence:** Fast data processing provides the necessary data to make intelligent decisions quickly and effectively to optimize yield.
- **Adaptive manufacturing:** Manufacturing flexibility allows for real-time changes and adjustments to avoid potential downtime.
- **Distributed control:** Ultra-small footprint of less than 10 cubic inches and smart energy consumption brings PLC down to the manufacturing line, re-distributing intelligent control and providing redundancy.

## FAST CHANGE-OVERS

Manufacturing lines can now be monitored and re-configured "on-the-fly" as new products and product changes are planned, resulting in increased productivity and more adaptive manufacturing processes.

Factory managers are often frustrated by the typical length of time required for new model or new product change-over times. When a change-over is required, it means that the machinery must be re-configured, re-programmed, and synchronized for the new production. This may require a team of manufacturing engineers days or weeks to make the changes and adjustments. To be responsive to the market and customer demands, the speed of change-overs can be critical to maintaining business. With fast factory change-overs, product iterations are faster, companies stay competitive, and gain strategic advantage in customer response time.

With the introduction of sensors and controller technology, the changes can be executed electronically and very quickly. Connected machinery with sensors can signal what is happening electronically so adjustments can be made, resulting in significant savings in time and cost. The Pocket IO can control changes electronically so that change-overs can be made centrally and very quickly.

## RESHORING

The term reshoring may also be referred to in manufacturing discussions as nearshoring, onshoring, or backshoring. To reshore means to reintroduce manufacturing to a country where it had previously been removed.

# MAXIM INTEGRATED

Maxim Integrated is a Silicon Valley stalwart. Started in 1983, Maxim's founders focused on developing analog integrated circuits and transmitting data over distance for communications. Maxim analog products are used to convert, condition and process real-world phenomena, such as light, sound, temperature, motion, and pressure into electrical impulse signals. For example, in new model automobiles, analog products are found in lane-changing and backup sensing technology. In the industrial world, high-voltage analog devices help equipment to survive lightning strikes and electrical surges.

Over the last few decades, many American and Western European manufacturers relocated to Asia to take advantage of low foreign wages, cheap raw materials, and low-cost operations. However, since 2015, the number of jobs lost to offshoring is about equal to those returning and newly created in the U.S.

There are many reasons U.S. companies chose to go offshore, but there just as many reasons to bring manufacturing back to America now. Wages in foreign countries have gone up much faster than in the U.S. Quality and intellectual property concerns persist. Inventory carrying costs during global shipping tie up working capital. These are reasons to either deter companies from leaving, or to reshore all or part of their manufacturing.

According to a recent poll by Boston Consulting, 54% of American companies over \$1 billion in revenue are reshoring now or plan to in the near future. But to make reshoring economically feasible, cost must be extracted from the total cost of ownership. Generally this means reducing labor through efficient automation.

## INDUSTRY 4.0, SMART FACTORIES, AND RESHORING

To make reshoring economical, companies must extract costs out of production lines and factory operations. Typically this means reducing the number of workers by introducing automation and reengineering processes to gain efficiency.

But simply replacing people with robots or other machinery won't necessarily make production more efficient. The key is to synchronize, monitor, and adjust the machinery for fast and efficient throughput. Machines have to work at a compatible pace, so connecting them with one another and with a master controller makes the factory "smart." We know that smart factories are efficient, cost-effective and can better compete with low-cost country factories in Mexico and Asia. Reducing costs, extracting labor, and producing as close to the market where goods are sold are important keys to Total Cost of Ownership modeling in reshoring decisions.

Industry 4.0, the next phase in the digitization of manufacturing, is the term widely used for automation and data exchange in manufacturing technologies including cyber-physical systems, the internet of things, and cloud computing. These are technologies important to the development of advanced manufacturing.

## COMPETING WITH CHINA

Increased labor rates in low-cost countries such as China, along with the rising costs of supply chains and energy, have led many American companies to consider the potential of bringing manufacturing back to the U.S. But to reshore production, manufacturing has to become more advanced and efficient. American companies must adopt advanced manufacturing technologies, including cyber-physical systems, very quickly to stay ahead of competing countries.

In a recent McKinsey survey of global manufacturers, only about 9% of Chinese manufacturers are currently working on Industry 4.0 initiatives, vs. 35% in the U.S. and Germany. Very few companies anywhere in the world reportedly have made manufacturing digitization a priority even though sales of industrial robots are growing worldwide. The biggest sales growth in all kinds of automation is in Asia.

Although behind in Industry 4.0 projects, Chinese President Xi Jinping has initiated his "Made In China 2025" program, which will focus on advanced manufacturing. The program calls for enormous Chinese government assistance in developing Chinese advanced manufacturing technologies. The world has experienced how quickly China can catch up, making it imperative for American manufacturers to act now and stay ahead.

***Now tap the baton, and  
orchestrate the possibilities of the  
smart factory.***

Pictured here holding Maxim Integrated's Pocket IO

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## ABOUT MAXIM INTEGRATED

Maxim Integrated develops innovative analog and mixed-signal products and technologies to make systems smaller and smarter, with enhanced security and increased energy efficiency. Maxim Integrated is empowering design innovation for automotive, industrial, healthcare, mobile consumer, and cloud data center customers to deliver industry-leading solutions that help change the world. Learn more at <http://www.maximintegrated.com>.

## ABOUT THE RESHORING INSTITUTE

### Our Vision

The Reshoring Institute is a 501c3 non-profit, recognized as the premier research and support organization for companies considering reshoring their global sourcing and manufacturing. We do this through rigorous research, publishing, and the development of analytical tools.

### Our Mission

The Reshoring Institute has a dual mission:

1. Provides research and support for companies bringing manufacturing back to America
2. Provide experiential education and opportunities for university students to learn about global sourcing and manufacturing

<https://www.ReshoringInstitute.org>

