SMART MEASURING SYSTEMS FOR THE SMART FACTORY:

Leveraging the Power of
Real-Time Data Visualization

Ken Myers, Solutions Manager
Gene Hancz, CMM Product Specialist
Mitutoyo America Corporation

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Industry 4.0 and Smart Manufacturing

Today's manufacturers are under pressure to be more flexible, reduce downtime and costs and increase efficiencies. In addition to making new investments in production and technology, data-driven manufacturing companies are responding to these pressures by leveraging the capabilities of artificial intelligence (AI), the industrial internet of things, (IIoT), cloud computing technologies and innovations in smart measurement and quality data management systems—resulting in greater visibility into their operations.

AI is already transforming manufacturing by outperforming humans in its ability to provide insights that inform timely, data-driven decisions and productivity improvements. In some operations, AI looks for conditions like idle equipment or scheduled maintenance in order to make decisions about reassigning parts measurement. AI can also leverage inspection results for decisions about pulling parts from the production line.

By 2035, AI-powered technologies could increase labor productivity by up to 40% across 16 industries, including manufacturing.

IIoT devices feature powerful sensors that can collect real-time, second-by-second production data on the shop floor for use in developing valuable insights for improving the efficiency of operations. Manufacturers are already using IIoT technology to help them massively reduce machine downtime and out-of-spec end products. They can also be used to make automated machine tool adjustments when they are trending toward out of tolerance; confirming whether the piece should be pulled for production and sent for rework or to the scrap bin.

Looking to the future, manufacturing promises to be a much more cloud-based reality so that facilities with multiple locations will be better able to leverage networked data storage, management and off-site analysis.

Because it enables optimizations at every step of the production process, quality measurement is critical for operations in the smart factory. Now, all equipment in the plant is connected to the internet, collecting a diverse range of data that can be put to use on the production floor. As a result, new smart measuring systems can now provide real-time information to help factories achieve a new vision for quality assurance and transform their operations into agile, dynamic environments.

By building on the power of real-time data visualization, innovations in smart quality measurement are enabling new insights that can benefit the manufacturing floor—and the bottom line.

When equipment data is captured and analyzed, unplanned downtime is reduced by 15%.
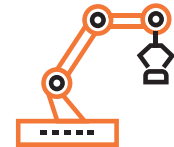
Using IIoT insights for manufacturing process optimization can lead up to 20% higher product count from the same production line.

66% of manufacturing enterprises report using a cloud implementation (among 17 countries).

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# Smart Measuring Systems and the Power of Data Visualization

In the past, measurement equipment would fail with no warning or frequent error codes would lead to service calls and subsequent costly downtime. Understanding the strategic importance of the vast amounts of data available at all stages of the manufacturing lifecycle, manufacturers are now reaping the benefits of capturing that real-time data and converting it into actionable insights.

Real-time data visualization provides critical tools—such as role-based views, real-time alerts and notifications, and remote tracking and monitoring. Now, manufacturers are using these tools to help them keep equipment operating to its full potential and to schedule timely maintenance and minimize production disruption.

Intelligent measurement technology is one of the most important Industry 4.0 innovations for the smart factory. Today's smart measurement systems (SMS) use industrial sensors and state-of-the-art network technology to conduct the measurement of components previously completed by conventional machines that could not learn and adapt to the situation or environment. SMS technology leverages the power of data visualization to enable new capabilities. Now, smart factory operators can remotely monitor the operational status of the machines and key parts being measured, use inspection data to reduce defective parts and enable preventive maintenance by monitoring the condition of the measurement machine.

By leveraging the vast amounts of data generated by IIoT, AI and other technologies, smart measuring systems can provide many of the key capabilities smart factories need. With the ability to monitor the status and current condition of measuring machines and machines and leverage the power of that data collection/analysis, smart factories can improve process efficiencies and ensure product quality.
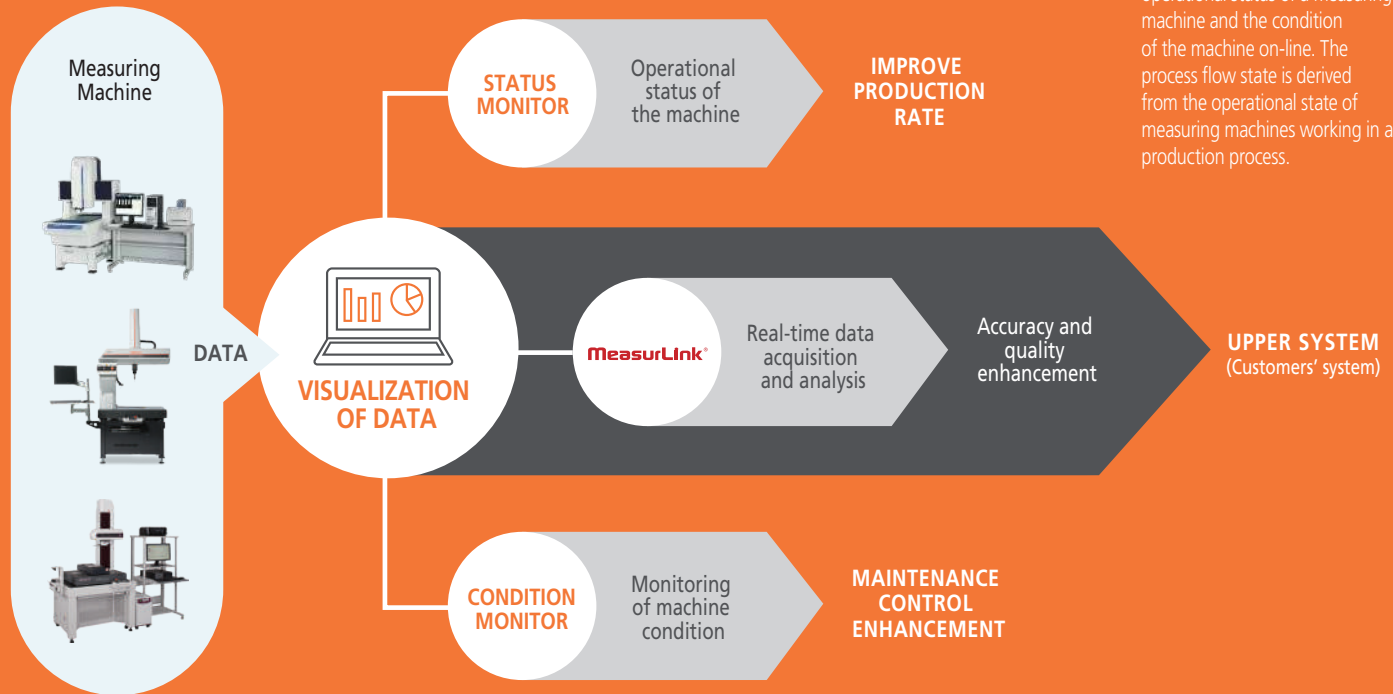
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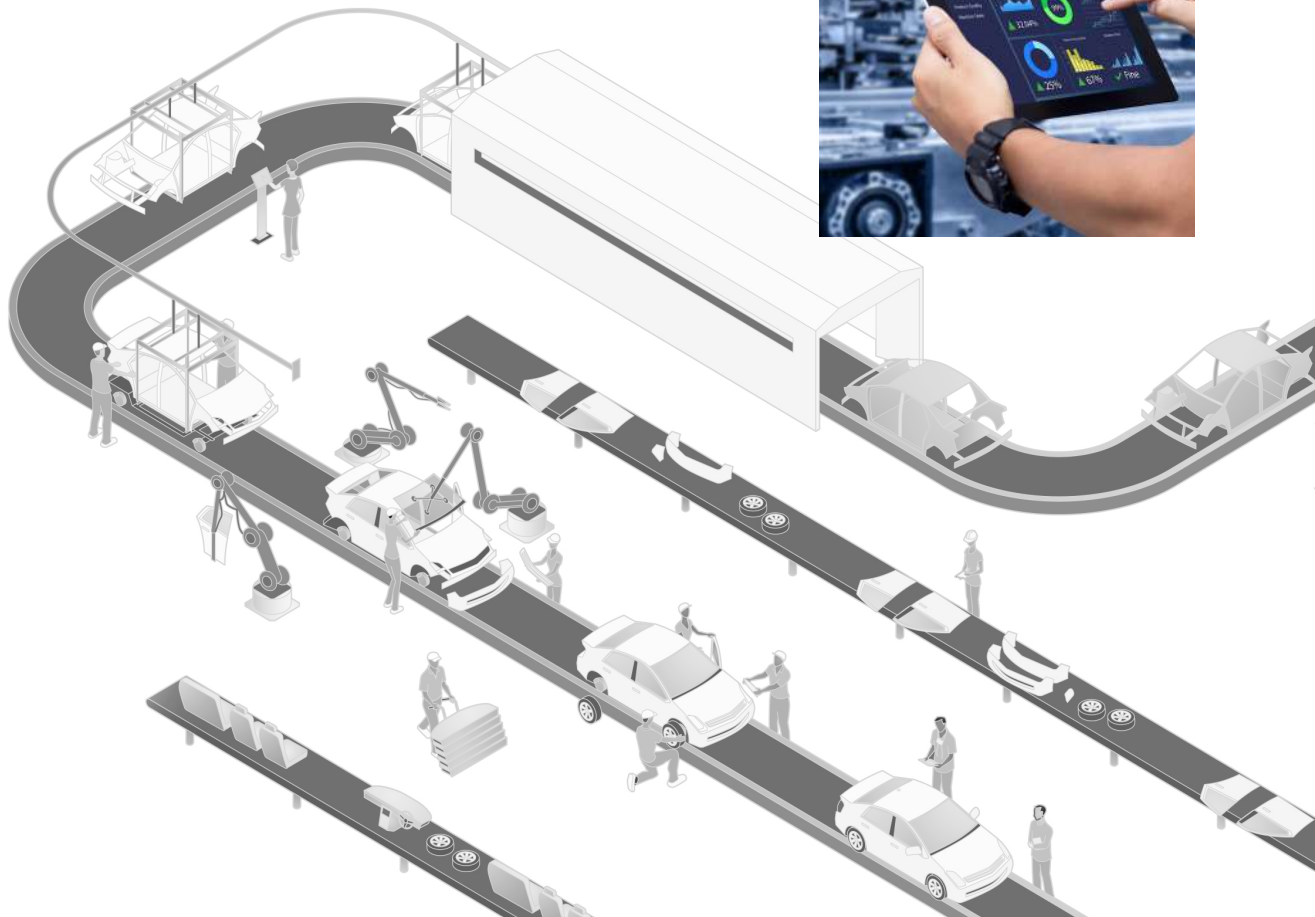
Utilizing Measurement Data

Visualization by monitoring data collected from measuring machines.
In addition, integrated management enables effective quality improvement of production processes.

SMS Smart Measuring System

The system monitors the operational status of a measuring machine and the condition of the machine on-line. The process flow state is derived from the operational state of measuring machines working in a production process.

Measuring Machine → DATA → **VISUALIZATION OF DATA**

- **STATUS MONITOR** — Operational status of the machine → **IMPROVE PRODUCTION RATE**
- **MeasurLink** — Real-time data acquisition and analysis → Accuracy and quality enhancement → **UPPER SYSTEM** (Customers' system)
- **CONDITION MONITOR** — Monitoring of machine condition → **MAINTENANCE CONTROL ENHANCEMENT**

Status Monitoring

For many years, status monitoring has been used to monitor machine tools on the shop floor. More recently, SMS technology has made it possible to retrieve real-time information about the operational status features of measuring machines and the parts they are measuring. These remote monitoring capabilities make 24/7 measurement possible, significantly improving machine uptime.

Innovative SMS technologies use measurement and instrument functionality data to improve production rates, enhance accuracy and quality, and provide critical, real-time information about the condition and status of production machines. Status monitoring capabilities also improve uptime by enabling timely adjustments when they are needed. New warning systems can alert operators about events, such as machine busy, idle time and scheduled maintenance requirements. By gathering data about machine status, operators are better able to optimize the time that machines are in use and to take advantage of idle instruments for measuring other parts.

Condition Monitoring

Condition monitoring is all about looking for issues with electronics and mechanicals to enable intervention before measurement equipment failure occurs. SMS enables new condition monitoring capabilities that empower smart factory operators with critical knowledge about the current condition of machines. It provides a system for collecting and evaluating operational information—such as recorded measurements, collisions, sensor changes, movement lengths, machine error and probe functions. Operators can use this critical operational data for planning long-term preventive maintenance—to reduce downtime and unanticipated issues.

Measurement Data Monitoring

From the beginning of production of any part, a baseline of measurement data is established. Over time, the mass of measurement data collected becomes invaluable in visualizing the success of a production process, in documenting adherence to industry standards and quality regulations, and in identifying trends in repeated tolerance or out-of-spec issues. New data management solutions enable the collection of data from a wide range of measuring tools and systems in early production stages for a complete view of the quality process.

When a data management system gathers real-time data from across the plant during production and routes it to a central database and analysis platform, manufacturing operations have greater visibility about the operation—and new opportunities for optimizing performance. Now, users can monitor this data from anywhere in the facility or from remote locations and use it to identify and reduce process variation in order to reduce manufacturing defects and improve uptime.

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The Future of Smart Measuring Systems

As the growing manufacturing skills gap continues to drive the need for automation, SMS will be a necessity for manufacturing operations of the future. Increasingly, SMS will make it possible for quality and design engineers, and production managers to monitor machines remotely—to identify potential issues in the measurement equipment or parts and to provide recommendations for preventative and predictive service or replacement of parts before they can disrupt production. In this way, SMS will contribute to the overall reduction of the total cost of quality control.

In fact, agile and dynamic measurement systems will become the new standard, providing the ability to shift measurement tools quickly and seamlessly from one part to another, as needed. There will also be an increased use of hybrid systems capable of conducting measurements of more than one type at the same time.

Cloud computing technology will continue to advance the efficiencies of manufacturing operations, especially those with multiple sites that produce the same part. They will be able to collaborate and share data in the cloud. And operators will be able to measure incoming parts from suppliers before incorporating them into their production processes. Those measurement reports will be stored and shared in the cloud with suppliers for them to track approvals of their parts into production processes.

All of these new capabilities will bring new benefits to the smart factory of tomorrow—including a reduction in quality control unpredictability and dependence on human intervention for monitoring machines and measurements. This will allow factory operators to free up factory staff to move up to higher-skilled, more critical tasks. As the smart factory becomes an ever more achievable goal, smart measurement systems will play ever more critical roles in ensuring manufacturer success.

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Mitutoyo America Corporation

965 Corporate Blvd.
Aurora, Illinois 60502

Phone: (630) 820-9666
Fax: (630) 978-3501

Email: info@mitutoyo.com
www.mitutoyo.com

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