WHITE PAPER

INDUSTRIAL EVOLUTION:

Bringing QA to the Point of Production

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Challenging the measurement status quo

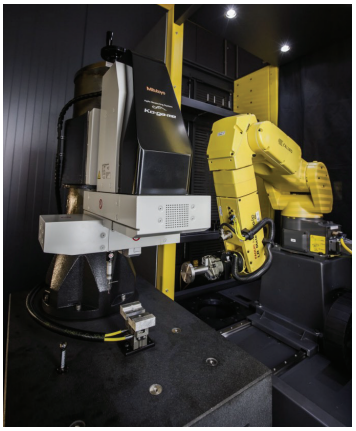
Today's manufactured components are more complex than ever, with more parts diversity, more model year changes and tighter tolerances than ever before. This is driving a need for increased quality control and the implementation of Geometric Dimensioning and Tolerancing (GD&T) and other metrology processes into the manufacturing process. And, with demands to produce parts even cheaper and faster, manufacturers are taking a new look at where the components measurement process should happen.

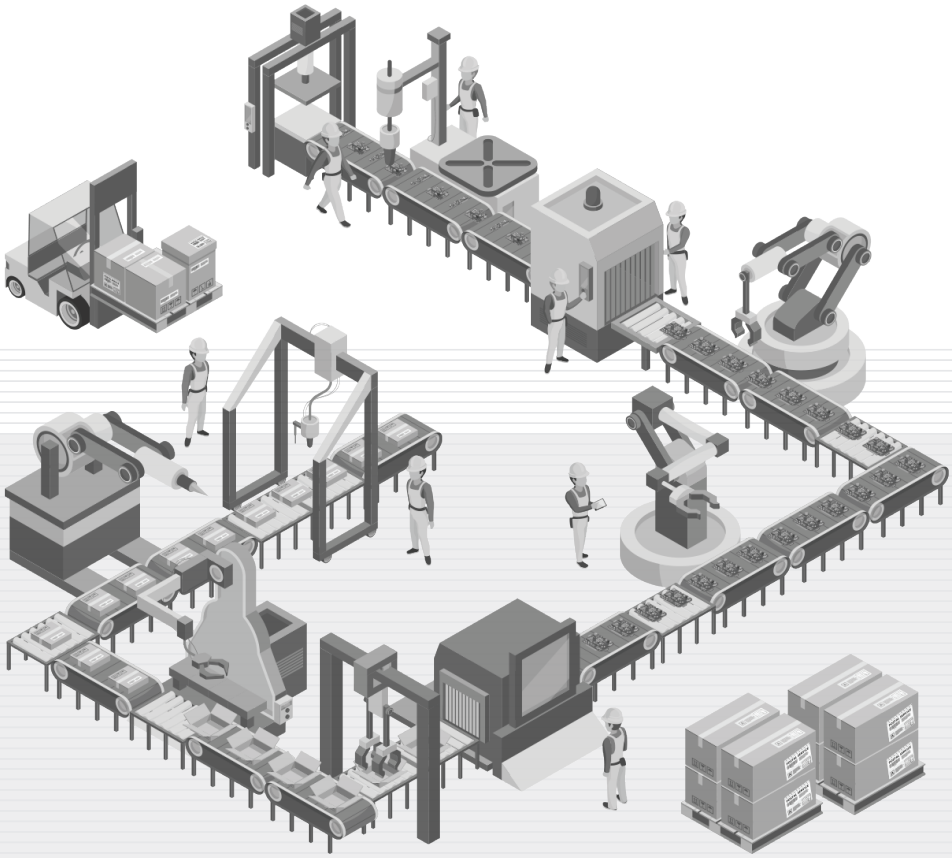
Manufacturers are seeking a more streamlined and speedy measurement process

Traditionally, components manufacturers have relied on a measurement process in which skilled operators use computer-controlled equipment to validate randomly selected parts in batches, usually post-production and offline in a quality laboratory or other controlled environment.

Sometimes referred to as "tailgate measurement," this process can be problematic. When the process includes frequent stops to move parts to the lab for validation, it can create bottlenecks and add significantly to total manufacturing time. On the flip side, less frequent measurements can create waste, as batches of parts that fail validation must be scrapped. It can also create the need for manual adjustments, adding the risk of human error.

Now, with historic shortages of skilled labor and resources—and as the Internet of Things (IoT) brings increased connectivity—manufacturers are seeking a more streamlined and speedy measurement process, one that eliminates the need to move parts away from the production line for verification and reduces the time required for fine-tuning machining.





Moving Inspection to the Shop Floor

The Benefits

The time has come to move quality parts measurement to the production point. The push for this new paradigm originated with aerospace, automotive and medical device manufacturing, industries that need to achieve 100% parts inspection, with real-time feedback for quick corrective actions. Now, nearly every industry is looking to accelerate the manufacturing process to realize these same benefits.

Moving measurement closer to the point of production speeds up the quality assurance process, provides real-time feedback, and provides a foundation for integrating automation and robotics into the process. In fact, the implementation of in-line or near-line measurement is quickly becoming an essential tool for manufacturers, emerging as the new standard for the smart factory.

In the end, of course, the objective is to improve quality by increasing the frequency of inspections and decreasing the time of inspection throughout the production process. Positioning inspection capabilities in or near the production line enables verification of 100% of components, rather than the sample rate that results from the tailgate measurement process. After all, when parts are inspected more often, there are fewer issues and challenges encountered during the production process. And, a process that provides the ability to detect issues with parts faster—and to correct them quickly—results in fewer parts that are scrapped. With less waste, material costs and delays are reduced.

The more complex the part, the greater the need for flexibility in the measurement process.

Meeting the Challenges with CMMs

While in-line/near-line inspection is fast becoming the new standard, manufacturers are encountering challenges in their efforts to integrate it into their production processes. These challenges include lack of space available for installation of an additional piece of equipment, day-to-day manufacturing floor temperature variances that can affect the repeatable accuracy of the equipment, and vibrations from the constant traffic of port trucks on the shop floor. Dust, debris and other contaminants—another unavoidable fact of life in industrial environments—can also affect the accuracy and reliability of these extremely delicate technical instruments.

Because many production facilities operate around the clock, the ability of the equipment to provide 24/7 uptime for constant measurements is another major concern. Just-in-time manufacturing—in which multiple product types are manufactured simultaneously—adds additional complications.

First is the need to measure multiple parts without slowing down the production line, followed by the challenge of frequent, significant resets.

Today's components are more complex than ever. The more complex the part, the greater the need for flexibility in the measurement process. By bringing these capabilities to the shop floor, manufacturers can more easily and quickly change setup and make design changes to improve the component. Today's flexible coordinate measuring machines (CMMs) can often change setup in a matter of hours.

Many CMMs are now available that can meet the challenge of today's fast production rates. Their smaller footprints make it easy to mount them in challenging locations on the floor—some inside CNC machining center enclosures—or with open-air designs on multiple sides that make it easy to integrate them into parts handling systems and for operators to use.

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How to Get There

With the global market demanding higher quality products—and adherence to ISO 9000/QS-9000 and other standards—moving measurement to the shop floor is the next logical step in the evolution from traditional post-production measurement to real-time inspection and measurement. A successful transition to in-line/near-line inspection and measurement requires planning and execution of a well-thought-out process that includes the following steps.

1 **Examine current inspection methods.**
Take a close look at how parts inspection and measurement is currently being accomplished at your facility—including the steps involved in the process, the staff involved and any frequently encountered issues or challenges.

2 **Determine available space.**
Taking into consideration the flow of components to the measurement equipment, measure the physical space that will be needed for the equipment that will be installed. If space is limited, consider opting for a custom-engineered solution that integrates directly into your line, or even mounted on the machine tool itself.

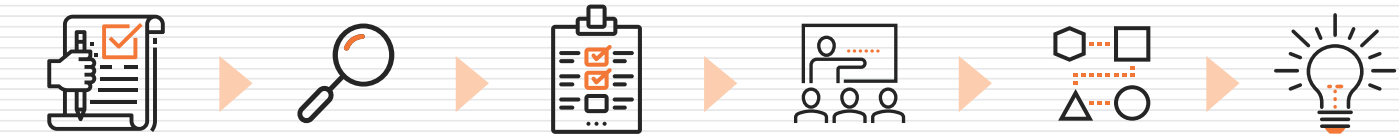
3 **Examine the shop floor.**
Consider environmental factors like ambient temperature changes, protection from debris and excessive vibration. Because temperature variation is one of the most significant sources of gaging error, choosing a highly environment-resistant CMM with a wide temperature accuracy guarantee is an effective way to minimize loss and ensure accuracy as temperatures change.

4 **Determine the need for training.**
If you are moving the inspection and measurement process from a lab staffed by specialists, you may need to provide training for the individuals who will be responsible for using the CMM on the shop floor.

5 **Set up new processes for monitoring and maintaining the measuring system.**
Track use of the equipment carefully to determine whether it is meeting expectations for cycle time and reduced inspection time.

6 **Explore your system's smart manufacturing capabilities.**
It may be possible to fully automate the process of identifying errors, so machine tools will automatically adjust based on inspection outcomes.

From The Lab To The Shop Floor



Finding the Right CMM Solution

Given all the challenges on the shop floor, it is important to carefully consider the construction of the CMM to ensure it will perform effectively in your manufacturing environment. An absolute requirement for a CMM that must operate around the clock in a manufacturing facility is the structural design. Consideration must be given to durability to ensure stable operations and accuracy under a wide range of temperature environments. The machine should also be easy to maintain. Where space allows, an enclosure can help keep contaminants from affecting performance, but machines should also be able to overcome certain levels of contamination.

CMM TYPE	FEATURES	APPLICATIONS
3D Bridge CMM	"Workhorse" CMM, measures object surface, repeats to describe the surface areas of interest	Measuring machined parts with higher tolerances
Cantilever CMM	Provides open access on three sides, can enable automatic loading and unloading	Measuring relatively small parts
Gantry CMM	Later than bridge CMM, requires a substantial foundation, often mounted directly to the floor	Heavy parts can be loaded directly on the floor
Horizontal arm CMM	Plate-mounted or runway-mounted	Measuring large surfaces or difficult-to-reach features

Mitutoyo's shop floor CMM systems are designed to meet today's manufacturing challenges for a wide range of workpieces. The MiSTAR 555, Mitutoyo's newest in-line/near-line measurement solution, features a convenient open-access design and space-saving ergonomic structure for fast, accurate, reliable measurements to a wide range of midsize workpieces.

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