

# Measuring up:

By F. Alan Shirk

Considering the tremendous advances in electronic gaging hardware and software, and its ability to attain the highest levels of accuracy and performance, it's a bit puzzling why some shops and plants are still not taking advantage of this evolving, efficient and cost-effective measurement tool.

"It is surprising to me that with the current technology, people are still writing information on a piece of paper and drawing their own charts. There is a lot of chance for human error with that," said Pat Harkness, product specialist for Mitutoyo America Corporation. "With digital gages, it is virtually impossible to make mistakes. You are saving time; you are seeing real data, you are scientifically proving that parts are within tolerance.

"The other side of the coin is that I find many small shops with a very sophisticated equipment level. And you would be surprised to discover that some really well known large shops are using really old and archaic equipment."

Not only can the right gages help a shop become more productive and profitable, it also is mandatory to meet increasingly tighter tolerances, more changeovers due to smaller runs and the need to provide precise written or digital documentation to customers.

Shop owners have to adapt, Harkness said.

"Not only is the automotive industry undergoing some serious changes, but also a lot of commodity machining — screws, bolts, etc. — has gone overseas.

The work shops are competing for demands greater precision, applications like aerospace and medical," he said. "Regardless, we will work with any customer to help them determine what gaging will keep them competitive."

For Harkness, precision measuring is all dictated by the tolerances. "The type of alloy is not necessarily important. And you want to be able to do measurements quickly."

Mitutoyo, whose best-selling gages are its digital 6" caliper and 0-1"



# Are your gages cutting-edge or cutting profits?

micrometer, manufactures an in-line CNC CMM machine that can measure an infinite number of features, Harkness said.

“Some shops are still using as many as 6 different operators to do such measurements. We all know that calipers are not going away, but our solutions group continues to uncover ways to speed up gaging, mostly building on the technology we have. For example, our U-WAVE wireless communication system incorporates a transmitter and receiver that sends data directly to a PC or outputs it as an Excel file, and complements our MeasurLink Quality Management Software.”

Mark Busha, a technical sales engineer for Carl Zeiss IMT Inc. and a journeyman toolmaker with 25 years experience, said Zeiss is much more focused on the CMM as a flexible gage. Software has come a very long way, he added, and Zeiss runs the gamut from entry-level shop floor gaging to lab gages to an extreme metrology team now exploring nano, X-ray and optical gages.

There are many new and innovative gages that allow shops to attract more high precision work, or to improve existing operations, Busha said. He recommended flexible gages, which can be retooled, reprogrammed and reused.

“Fixed gages are extremely expensive now, especially if they’re sent back to be reset,” he said. “Typically we program all of our gages using process sheets and build on that. Every process sheet I have seen over 35 years has the word ‘preliminary’ on it. If I’m using a flexible gage, any process change is easy as entering a new tolerance or nominal into the program.

“Flexible gages and modern software won’t let bad metrology happen.”

Today’s software is largely responsible for better gages, Busha added, since “in the old days using CMM, there were a lot of ‘best fit’ measurements. For example, in the 1980s, you could measure a bore and determine its ID was an inch. However, when you tried to push a 0.999” pin into it, it would not fit.

“So, the whole exercise of why we do gaging must answer the question, ‘When the customer gets it, will it fit?’”

According to Busha, today’s flexible gages are single pieces of equipment. You can see how big it is, where it is and what it looks like — size, location and form. Carl



*New gaging technology helps speed up the manufacturing process. Photos courtesy of Carl Zeiss Inc.*

Zeiss software is user-friendly and very visual, allowing an operator to quickly see if he is within tolerance. Drop down menus, for example, give quick, real-time size, form and location data using simple pull down menus. This also means quick training.

“The bottom line is doing everything we can to prevent mistakes and allow the operator to save time and focus on other tasks,” he said.

Measuring where you manufacture also means focusing on the simplicity of manual equipment, while still being more accurate and flexible, Busha said. Zeiss developed myCALYPSO for this, measuring software specifically for metrology beginners. Based on the time-tested CALYPSO measuring software, myCALYPSO can be quickly implemented and offers professional functionality to easily replace manual measuring equipment.

“The measuring possibilities of myCALYPSO from simple standard measurements to complex test plans far exceed those of manual measuring equipment and simple gages: combined with a CMM, the software can measure several features. In addition to relative measurements, such as distance, diameter or height, you can perform absolute measurements with myCALYPSO. This means that not only the diameter, but





Wave bore gages embedded with Bluetooth® wireless technology may lower overall inspection and operating costs, improve quality, eliminate gage cables and related maintenance, making operators more productive. Photo courtesy of Marposs.

## sideTALK

### Seven things to think about

1. Variable gaging involves the actual measurement of a dimensional characteristic. The measurement obtained can be compared to the tolerance limits for that characteristic to determine conformance or variation.
2. Fixed limit gaging sorts parts as either good or bad based on a specific quality or characteristic. It uses Go/No-go gages that represent the maximum limits of the specific characteristic. It only tells you that parts are bad.
3. Always use the "Rule of 10" when choosing a gage. That means the measuring instrument should be 10x as accurate as the characteristic being measured.
4. Air gages are most commonly used to measure size and form of inside and outside diameters.
5. Don't forget the effect temperature can have on measurements.
6. Surface finish is a good indicator of process stability.
7. The ability of a gage to detect variation in manufacturing processes is of the utmost importance for product quality and happy customers.

Source: B.C. McDonald & Co., St. Louis, Mo.; [www.bcmac.com](http://www.bcmac.com) or [www.mesasurenow.com](http://www.mesasurenow.com)

also the position of a borehole on the workpiece is given."

The combination of myCALYPSO software with Zeiss's DuraMax compact scanning measuring machine is ideal for beginners in 3-D measuring technology, Busha added. Together, he said, they quickly provide correction values to ensure machine tool production quality on the manufacturing machines and enable a wide variety of workpieces to be run at a lower cost.

"I absolutely believe there are still a lot of shops that need to be dragged 'kicking and screaming,' to cutting-edge gaging," he said. "Yes, you have to make an investment in new equipment, but it winds up being more cost-effective over the long term, over outmoded methods that we have been using to measure and inspect parts."

Marposs Corp. and its familiar Testar Division manufacture mechanical, electro-mechanical and computer-based handheld gages, mobile gages, gaging benches and machines and attribute gages.

Understanding what the customer's process is, identifying where there are problems or determining how to use measurement to verify the quality of what the customer is producing, is fundamental, said Bob Harman, Testar product manager.

"Gaging is an insurance policy," he said. "We did what you asked and here are the records. Besides, you don't want a truckload of stuff coming back from the customer. Another problem is that a lot of shops are losing staff that has traditionally maintained gages, that knowledge is vital. As a manufacturer, we hope that we can replace what has been lost."

As with many of today's gage system producers, Marposs is very big on custom systems, capable of measuring 100 dimensions in 20 seconds.

"Also our commodity products, which are reconfigurable or retoolable," Harman added. "We make robust gages as well. Some tend to think that a new gage is delicate and has to be coddled."

At Marposs, the simple goal of the gages being sold is to "find the perfect solution to fit the customer's budget and hopefully can be reused," said Gary Sicheneder, the company's manager of Marketing and Business Development.

"We want to put our gaging or inspection equipment where the battle is fought — on the manufacturing floor — rather than something for a lab environment. The key is to be able to perform real-time measurements at the machine," Sicheneder said.

Marposs strives to make gages that will outlive the manufacturing process — 300,000, 400,000 or 500,000 parts, Sicheneder said, or customers making 10 million parts a year.



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Marposs, for example, offers a mechanical gage with repeatability of one micron. Others measure down to a half micron. Naturally, you can't do that with antiquated gages."

According to Marposs, a typical mechanical bore gage may cost \$500. One that can measure tighter tolerances could cost \$1,500.

"It's all about how good the gage is. We are still doing a lot of educating about helping to choose the right gage for the job," Harman said. "We find more and more solutions involve retoolable gaging. It may cost a little more, but can be used over and over. That saves money over the long run. We go into a lot of shops where you go into the back room and find a lot of dedicated gages stored on the shelf, never to be used again and other tooling that isn't being reused."

Sicheneder said Marposs M1 Wave bore gages embedded with Bluetooth wireless technology — introduced three years ago — have helped lower overall inspection and operating costs, improved quality, and eliminated gage cables and related maintenance — all while making operators more productive.

"The speed and bandwidth of Bluetooth technology enables capturing streams of measurement data vs. snapshots. Portability and ease of use of Bluetooth devices offer new inspection possibilities. Operators may obtain measurement information in real time and receive detailed inspection instructions when Marposs Wave and other wireless gages are paired with an intelligent gage computer.

Lightweight and completely portable, the wearable wrist Merlin MOBILE device enables operators to conveniently store, retrieve and manage gage measurement data from locations throughout the shop or plant. The unit's integrated wireless LAN interface can enable wireless connectivity of the gage computer to the plant network. And when used with electronic OD and ID gages with Bluetooth technology, wires and cables can be completely eliminated from measurement and inspection procedures.

Part and tool-setting probes are precision sensors for fast and accurate acquisition of component dimensions and surface data, said Dave Bozich, business manager for machine tool products at Renishaw. For more than 30 years, the company has been a leader in metrology with a range of touch-trigger and scanning measurement systems for CMMs, plus its Renscan5 – 5-axis scanning technology.

A probe is a generic measuring device; all those manufactured by Renishaw are contact. Probing works very successfully with set ups to establish working coordinates.

"Parts or tool-setting probes can be used for set-up or post-process, or to assure that a tight tolerance is being held," Bozich said. "They can do 3-D gaging. Our sensor is used like any other tool on the spindle, typically for grinding, machining and turning operations."

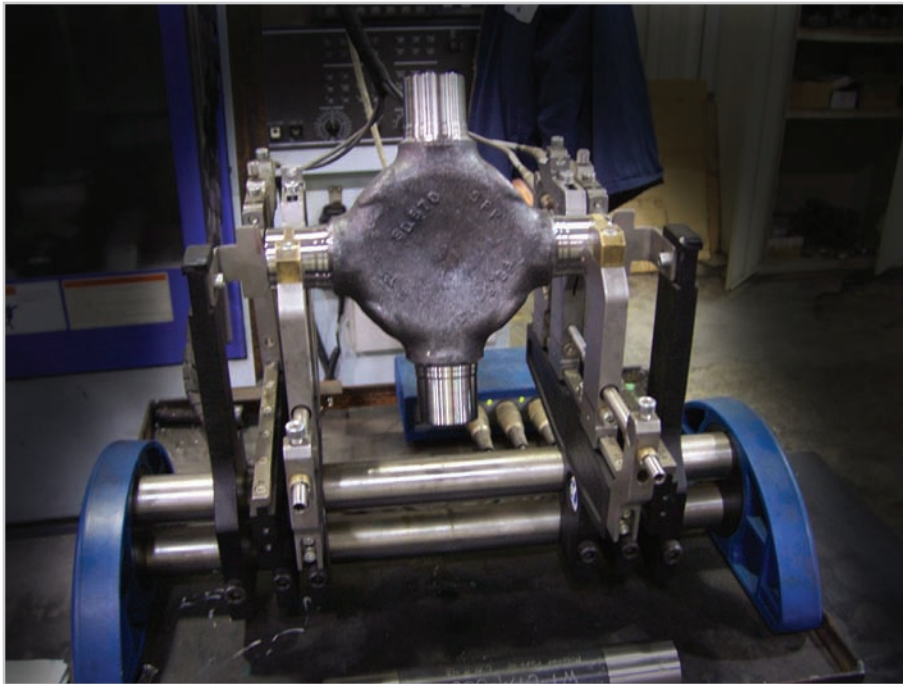
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*Lightweight and completely portable, the unique Merlin Mobile device enables operators to store, retrieve and manage gage measurement data from locations throughout the shop or plant. The unit's integrated wireless LAN interface can enable wireless connectivity of the gage computer to the plant network. Photo courtesy of Marposs.*

"We want our equipment to outlive the manufacturing process. Like-new repeatability of the gage beyond 10 million cycles," he said. "Also, we don't want to sell a bore gage on Jan. 1, 2009, and then our customer has to buy a new one on Jan. 1, 2010.

"We are still finding that Tier 2 and 3 shops may not have the ability to recognize that the gages they have are not adequate to use for more precision applications," Sicheneder added. "A shop owner thinks he can use a dial bore or split gage to measure a part with tighter tolerances and be able to prove it is dimensionally correct. But now he has to provide written data. You can't do that with a dial bore gage.





Different versions of modular Marposs Quick Set benches measure shaft-like or cylindrical parts and can easily be re-tooled. Photo courtesy of Marposs.

There are many applications for probes, Bozich said. For example, probes can be especially effective for large-scale job shops with 10 or 20 spindles that run a variety of parts.

“Providing you can drive the probe to the part, you can do quick and accurate setups eliminating dial tests and edge finders. You can easily achieve repeatability. The operator can focus on other issues instead of the set-up,” he said. “There has been a significant up tick in the use of probes among midsize and smaller shops. They are very easy to use and very user-friendly and can be monitored by clicking on a few icons on the screen.”

Like gaging, shops may not be using probes as much as they should be.

“Some think that cycle time is everything, especially with high volume/low value parts. But in-process probing cut significantly minimize and/or eliminate scrap and rework, actually saving time,” Bozich said. “With high precision medical applications, such as producing hip and knee joints which are usually low volume/high value runs, probes allow you to monitor every part to prevent very expensive mistakes.”

Newer machine tools are equipped with probes, or have an option to install after-market parts or tool-setting probes, he said, while retrofits for part probes can cost upwards of \$10,000, and tool-setting probes can be added for about \$5,000.

“Productivity gains and reduced rejections can make that investment pay for itself quickly,” Bozich added.

And while there are many gages to choose from, Busha said flexible gaging is often the best choice, “especially for consistency in reporting. You are dealing with only one software format, but you can easily repeat that on any network.

“Proper gaging provides the right answer — the all-important functional fit so that it does work when it gets to the customer.” ⚙️

*For more information about Mitutoyo America Corporation, visit [www.mitutoyo.com](http://www.mitutoyo.com); Carl Zeiss IMT Inc., visit [www.zeiss.com](http://www.zeiss.com); Marposs Corp., visit [www.marposs.com](http://www.marposs.com); or [www.shoptalkmag.com](http://www.shoptalkmag.com).*

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