Are All Multisensor Metrology Systems Equal?

The right dimensional metrology systems can ensure product quality. Until recently, individual measurement systems were based on a single-sensor technology. Metrology systems were designed around a particular technology for acquiring information from a part. Today, with the pressure to reduce costs and increase productivity, a new category of metrology system has come along to better meet those needs—multisensor metrology systems.

By adding more sensors to a single-sensor system, you get more functionality at a lower price than you'd obtain by buying two or three separate, single-sensor systems. Because one sensor can make up for the shortcomings of another, a two-sensor system lets you acquire more data from the part, and make more measurements with a single setup. There is no need to move the part from machine to machine, reducing total measurement time. You get the advantages of a common platform with one user interface. This arrangement can reduce your training and support costs. But is it that simple?

Your reputation depends on your quality

In metrology, the most common sensors are video (cameras), touch probes, and lasers. Multisensor systems are available with any combination of these sensors. Today it's possible to buy either a video system with a touch probe or a CMM with a video probe in place of the touch probe. The resulting systems may offer similar functions, but their capabilities can be very different.

Precision metrology requires accuracy. Accuracy is achieved by a design that addresses every variable that can influence the measurement. Such variables include:

- Measurement ranges and tolerances,
- Part sizes and characteristics,
- Sensor requirements and capabilities,
- Mechanical systems that isolate the measurement process from environmental influences that affect the measurements,
- Software that processes the acquired data points, and
- The user interface that determines how you get your measurements.

Traditionally, CMMs use ruby-tipped tactile probes to sequentially collect individual data points from a part. Probes can approach a feature from any of a number of directions, and with the right tip or extension can contact almost any location on the part. A user 'teaches' the probe where to touch the part, creating a program that automatically repeats those steps on subsequent parts. These systems are designed with rigid mechanical structures such as bridges, sometimes made of granite. They allow the probe to access part features anywhere in a large test area without sacrificing accuracy or precision. Drive systems ensure the probe moves at the right speed to the precise point, and software keeps track of all the points and does the dimensional analysis.

Video measuring systems use camera sensors to acquire images of a part that are then analyzed. Unlike CMMs, where the probe moves from feature to feature, video systems require precision stages to move each feature into the imaging field of view. This approach requires accurate stage motion and a rigid structural design to keep track of the spatial relationships of all the features. High-quality optics magnify features enough for valid measurement, without distortion. Autofocus makes sure features present the sharpest image. Because features can be on the edge of the part, or anywhere on the surface, they must be illuminated differently. Edges and through-holes can be backlighted. Video measuring systems employ special software algorithms to identify and measure edges, including powerful weak-edge algorithms to find and analyze faint or subtle features. Video systems are designed to get optimal performance from camera sensors.

A touch probe can be added to a video system, and a video sensor can be added to a CMM. Does that make them equal?

No. Adding a second sensor to an existing platform may require compromises. For example, a video probe on a CMM does not have all the illumination and autofocus capabilities of a video system. It cannot backlight a part. It may not have the zoom range necessary to handle all the features. CMM software normally does not need to analyze multiple datapoints acquired simultaneously, or find and analyze weak edges. A video system with a touch probe, on the other hand, may not have as large a test area as a CMM.

Remember, your reputation depends on your quality. You buy good metrology equipment to make sure your parts are in spec and your processes are under control. Multisensor systems are very attractive—they can save you time and money. But be sure that the additional sensors are capable of meeting your needs.

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