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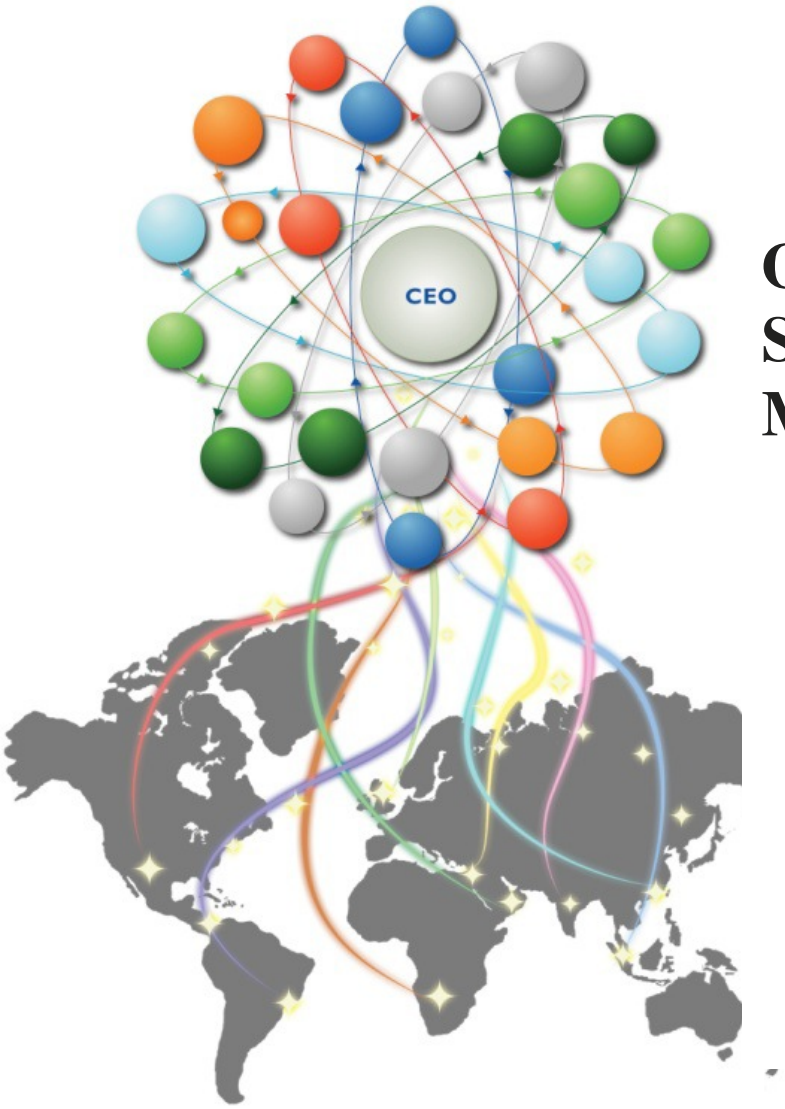

Optical Metrology Solutions: The Future of Metrology

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Global manufacturing has advanced into a highly competitive market, with narrowing margins and competitive pressures from factors not previously considered.

As a result, manufacturing efficiency has taken on new meaning with the role of automation. There are several initiatives undertaken by manufacturers across the globe to achieve 100 percent manufacturing efficiency, thus ensuring productivity and profitability in the global manufacturing industry.

Quality control is an integral aspect of the manufacturing process. To effectively enable the evolution from traditional factories to smart factories, it is critical to substitute incumbent manufacturing and quality inspection technologies with emerging approaches.

Dimensional metrology is one of the key technologies used in the quality control process to inspect accuracy of produced components. This industry is also undergoing major technological developments to empower smart factory automation concepts.

Traditionally, dimensional metrology technologies such as coordinate measuring machines (CMMs) have been used in quality control rooms to inspect geometric features of a manufactured component. CMMs are considered to be the best solution to exhibit high precision results. The main disadvantage of traditional CMMs is that they take longer to measure each point because the process of approaching the surface and withdrawing has to be repeated for each point. For several decades, precise length measurements were dedicated to fixed, structured systems, such as CMMs. There was a strong acceptance that to be accurate, precise, and repeatable, a rigid structure like a CMM was the solution for obtaining high-precision measurement results. That perception has slowly changed in the past 10 years after optical scanners were engineered for dimensional metrology inspection. As a result, the conventional CMMs such as bridge-type CMM, horizontal arm machine, gantry-type CMM, and articulated arm machines are facing fluctuated growth rates across the globe.

Even today, CMM technology continues to dominate the dimensional metrology market. However, over the past 10 years, 3D laser scanners, white-light scanners, and laser trackers have become widely implemented as dimensional metrology solutions by end users. Apart from exhibiting faster and high-precision results, newer optical scanner products continue to capitalize on end user confidence by showcasing flexibility and portability. The need to complete inspection within production cycle is gradually demanding faster technology. As a result, traditional CMMs are being replaced with faster optical metrology products. Optical scanners are faster and cheaper in comparison to the traditional CMMs. As a result, optical scanner products are more widely implemented for smart factories.

Market Snapshot

Recent Frost & Sullivan analysis indicates the global optical scanners market generated revenue of $430 million in 2014, and predicts the market will grow at a compound annual growth rate (CAGR) of 5.4 percent to approximately $520.0 million in 2019. This includes products such as 3D laser scanners, white-light scanners, and laser trackers. With the proliferation of low-cost scanners, improving technology, and superior features being incorporated into scanners each year, the optical scanner market is expected to continue expanding.

Quasi-Monopoly Structure Defines the Laser Tracker Market

Laser tracker equipment have been in existence for three decades and used widely in the automotive, aerospace, and machine shops sectors for larger volume and high accuracy measurements. For example, key applications in the automotive sector include alignment, profiling, dimensional measurement, and control. The small size of laser trackers, combined with their large volume measurement capabilities, drives their need in the automotive sector. In the aerospace, military, and defense sector, laser trackers are used for inspecting curved surfaces of aircraft wings, part inspection, reverse engineering, and dynamic measurement. Laser trackers are preferred over other metrology solutions because of their portability and speed, along with the need in the aerospace, military, and defense sector for accurate measurement of critical components.

In comparison to other technologies such as coordinate measuring machines, white-light scanners, and vision based products, prices of laser trackers are relatively higher. Typically, mid-sized end users with limited inspection and maintenance budgets may not be able to justify expenses of $110,000 for a laser tracker solution. As a result, customers tend to opt for cost-effective metrology solutions, which further challenges market growth.

Hexagon Metrology, FARO Technologies, and API Sensors together capture about 90 percent of the laser tracker market. Besides these tier-one companies, only a handful of others, such as Shenzen Chenguang Xinyuan Electronio Co.Ltd and Northern Digital Inc, are actively involved in this industry. The quasi-monopoly structure is expected to intensify the competition and challenge the tier-two companies to remain relevant in this industry. In future, competitive pressures are expected to increase the trend toward acquisition of tier-two market participants for enhancing their share in the laser tracker market.

White-light Scanners—Fastest Growing Market Segment

Operating on the basis of white light interferometry, a white light scanner captures a series of data points across the vertical axis. Both the shape and phase of the interferogram are used to determine the object's physical geometrical features. Application of Fourier analysis to the data converts it into the spatial frequency domain, making it possible to create an accurate representation. Unlike CMMs, a main advantage of white light scanners is that the information generated can be used without the need for data handling by experts.

For almost 10 years, white-light scanners have been used in several application areas in the dimensional metrology market. They include measuring of dies and molds, casts, and forged parts. White-light scanners are also used in comparing actual data with nominal data, scanning of design models for further processing of CAD data, documentation and acquisition of data for rapid prototyping. With ever-increasing market awareness and penetration, demand for white-light scanners is significant. Having gained a reputation as one of the most accurate technologies, a period of positive growth is expected. Frost & Sullivan research indicates that Gom gmbH, Steinbichler optotechnik gmbH, Hexagon Metrology, and Aicon 3D have together captured about 82% of the global white-light scanners market in 2014. With the proliferation of low-cost white-light scanners, other noteworthy companies such as Phase Vision Ltd, 3D3 Solutions, and Miic America Inc are gaining increased market visibility.

Increased Price Point Competition Strains 3D Scanners Market

Frost & Sullivan research indicates that the 3D scanners segment generates highest revenue in the global optical scanners market. The basic function of laser scanners is the complete imaging of an object to obtain many coordinate points that are used in the reconstruction of the image in 3 dimensions. The main components include a scan head and a platform for movement along directions that are integrated together by manufacturers. With the

required software, the inspection is performed after mounting the object on a rotary table. Laser scanners can be used alone or in conjunction with fixed CMMs or portable arms.

3D scanners for fixed CMMs and portable arms are quite similar as the key contributors to revenue are industries such as automotive and machine shops. Since the introduction of scanners, customers were keen to have these fast and accurate measuring probes attached to traditional CMMs that were being widely used.

The stand-alone 3D scanners continue to account for a major portion of revenue, but significantly less than the share held by scanners that are attached to CMMs and arms. Research indicates that heritage preservation, medicine, animation, and education are expected to be key end-user industries for standalone 3D scanners that drive growth.

Conclusion

It is evident that optical scanners have made steady penetration in the dimensional metrology market. Leading companies in the optical scanners market such as Hexagon Metrology, Faro Technologies, Gom gmbh, Steinbichler Optotechnik gmbH, Nikon Metrology, and API Sensors have raised the bar in terms of technology and product development for optical metrology products. Their global presence and technology innovation have helped them to consistently stay ahead of their competitors. Furthermore, the competition amongst the leaders enunciates the need for high-accuracy optical scanners that increase measurement flexibility, thereby exhibiting reliable and faster measurement results.

Frost & Sullivan finds that attaining absolute measurement results through optical scanners is the utopian ambition of several dimensional metrology manufacturers. If absolute measurement can be achieved using optical scanners, several industry experts believe that it could be an end to CMM era in the quality inspection process.

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