

CYBEROPTICS CORP
Form 10-K
March 14, 2017
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 or 15(d) of the Securities Exchange Act of 1934 for the Year Ended December 31, 2016.

TRANSITION PURSUANT TO SECTION 13 or 15(d) of the Securities Exchange Act of 1934 for the transition period from _____ to _____.

COMMISSION FILE NO. (0-16577)

CYBEROPTICS CORPORATION

(Exact name of registrant as specified in its charter)

Minnesota	41-1472057
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

5900 Golden Hills Drive	55416
MINNEAPOLIS, MINNESOTA	
(Address of principal executive offices)	(Zip Code)

(763) 542-5000

(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Exchange Act: Title of each class: Common Stock, no par value

Name of Exchange: NASDAQ Stock Market LLC

Securities registered pursuant to Section 12(g) of the Exchange Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.

YES NO

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act.

YES NO

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days.

Yes No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files).

Yes No

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

Indicate by check mark whether the Registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See definition of "accelerated filer" or "large accelerated filer" in Rule 12b-2 of the Exchange Act.

Large accelerated filer Accelerated filer Non-accelerated filer Smaller Reporting Company

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act).

Yes No

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State the aggregate market value of the voting and non-voting common equity held by non-affiliates computed by reference to the price at which the common equity was last sold, or the average bid and asked price of such common equity, as of the last business day of the registrant's most recently completed second fiscal quarter: \$100,332,744. As of February 28, 2017, there were 6,909,387 shares of the registrant's Common Stock, no par value, issued and outstanding.

DOCUMENTS INCORPORATED BY REFERENCE:

The responses to Part III items 10, 11, 12, 13 and 14 herein are incorporated by reference to certain information in the Company's definitive Proxy Statement for its Annual Meeting of Shareholders to be held May 11, 2017.

CYBEROPTICS CORPORATION

FORM 10-K

For the Fiscal Year Ended December 31, 2016

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PART I.

ITEM 1. DESCRIPTION OF BUSINESS

Background

CyberOptics Corporation was founded in 1984 and is a leading global developer and manufacturer of high precision sensing technology solutions. Our headquarters are located at 5900 Golden Hills Drive in Golden Valley, Minnesota. Our website address is www.cyberoptics.com. You can access, free of charge, our filings with the Securities and Exchange Commission, including our annual report on Form 10-K, our quarterly reports on Form 10-Q, current reports on Form 8-K and any other amendments to those reports, at our website, or at the Commission's website at www.sec.gov. Proxy materials for our upcoming 2017 annual shareholders meeting to be held on May 11, 2017 will be available electronically via the internet at the following address:

<http://www.idelivercommunications.com/proxy/cybe/>.

We are working to establish CyberOptics as a global leader in high precision 3D sensors. Our objective is to deliver profitable growth by leveraging our 3D technologies in our key vertical markets of surface mount technology (SMT), semiconductor and 3D scanning solutions and services.

Our products and services are used in the SMT, semiconductor and 3D scanning solutions and services markets to significantly improve our customers' manufacturing yields and productivity, and to assist our customers in meeting their rigorous demands for manufacturing quality. Our products use a variety of proprietary technologies such as lasers, optics and machine vision, combined with software, electronics and mechanical design. Our SMT and semiconductor products enable manufacturers to increase production volume, product yields and quality by measuring the characteristics and placement of electronic components and semiconductor packages both during and after the assembly process, or by providing SMT electronic circuit board and semiconductor manufacturers with key metrics related to their manufacturing processes that allow them to improve production volumes and yields. Our 3D scanning solutions and services help manufacturers quickly solve their most complex 3D inspection, analysis and product engineering challenges, allowing them to improve product yields and quality.

The majority of our products (58% of revenue in 2016) are developed and sold for use in SMT electronic circuit board assembly or with equipment used in SMT electronic circuit board assembly. We sell products in these markets both as sensor components that are incorporated into products manufactured by other companies for sale to circuit board assembly companies, and as complete stand-alone inspection systems that are sold directly to circuit board assembly companies.

We manufacture 3D and 2D optical sensors for use in our own proprietary SMT inspection systems and for sale to original equipment manufacturers (OEMs) and other end customers in our key vertical markets and adjacent markets. Our SMT electronic assembly alignment sensor products are sold to manufacturers of pick-and-place machines to align electronic surface mount components during placement on the circuit board and to a solder paste screen printer company to align stencils with circuit boards. We sell high precision 3D sensors to KLA-Tencor for use in systems that inspect back-end semiconductor packaging, and Nordson-YESTECH for the SMT market. We also sell sensors to OEMs for solder paste inspection (SPI) systems. In 2016, we sold high precision 3D sensors to a major new customer for a general purpose metrology application related to the inspection of finished goods.

Our SMT inspection system products are sold to electronic manufacturing services (EMS) companies and other manufacturers of SMT electronic circuit boards to control quality as in-line systems. These products are used by manufacturers to measure screen printed solder paste, to inspect circuit boards and components after component placement, to confirm proper placement after full assembly of circuit boards and to inspect solder joints on printed circuit boards. Manufacturers of DRAM and Flash Memory also use our inspection system products to inspect assembly of their memory modules both before and after module singulation.

Our semiconductor products assist with yield improvement and tool uptime in the semiconductor wafer fabrication process by providing highly accurate measurements of critical process factors. These measurements are impossible or very difficult to obtain without powering down the wafer fabrication equipment. Customers who use our products have better yields, through-put and tool up-time. Our products are more accurate when compared to the various manual techniques historically used by semiconductor manufacturers to obtain critical wafer fabrication process

measurements.

Our 3D scanning solutions capture surface data for product engineering and inspection. Our 3D scanning services scan, model and inspect objects of all sizes and complexity for customers who do not have their own general purpose metrology equipment.

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Recent Developments in the Business

Our recent and planned product introductions are designed to strengthen our competitive position in our current markets and expand into adjacent markets. We believe 3D inspection represents a high-growth segment of both the electronic assembly market and the semiconductor market. For this reason, we are working to strategically reposition our company as a developer, manufacturer and global leader of high-precision 3D sensors. A key element in our strategic re-positioning is the development of new high precision 3D sensors based on our proprietary Multi-Reflection Suppression (MRS) technology. MRS technology inhibits reflections that can result in measurement inaccuracies, which is particularly critical for inspecting shiny objects.

We believe that MRS is a break-through optical technology for high-end inspection applications, with the potential to expand our markets in the future. In the existing markets for our surface mount technology (SMT), semiconductor inspection and 3D scanning solutions, we are seeing a growing number of opportunities because of our 3D MRS technology platform, and we are introducing new products based on MRS technology that we believe present a significant opportunity for increased revenues.

We have entered into a mutually exclusive agreement to supply KLA-Tencor with high-precision 3D sensor subsystems for its back-end semiconductor packaging inspection systems. We also have entered into an agreement to supply Nordson-YESTECH with high precision 3D sensor subsystems for the SMT market. The sensor subsystems are based on the new MRS technology that we have been developing for the past several years. We intend to expand sales of products based on MRS technology into both the SMT market and adjacent markets that require high precision 3D optical inspection. We also plan to sell products based on our MRS technology to OEMs. During the second quarter of 2016, we received an \$800,000 order for 3D MRS-enabled sensors from a major new customer for a general purpose metrology application related to the inspection of finished goods. We believe this customer could generate significant sales going forward.

We have significantly advanced our MRS-enabled 3D sensor technology as part of a research initiative aimed at applying our 3D MRS technology to front-end semiconductor inspection. Features of 50 microns, including devices with mirror-like finishes, are now being measured in our research lab, and progress is being made toward measuring sub-50 micron features. This is an important milestone in our effort to make MRS-enabled 3D sensor technology applicable to front-end semiconductor inspection in the next two to four years. If this initiative proves to be commercially viable, the available market for our MRS-enabled 3D sensors for front-end semiconductor inspection could be significant.

Our 3D MRS technology has also been deployed in our 3D automated optical inspection (AOI) system, the SQ3000, which is designed to expand our presence in markets requiring high precision inspection. In these markets, identifying defects has become highly challenging and critical due to smaller electronics packaging and increasing component density on circuit boards. We believe the combination of our MRS technology and sophisticated 3D fusing algorithms allows us to offer microscopic image quality at production speeds. We recognized our initial revenues from sales of the SQ3000 in the second quarter of 2015. During 2016, we received SQ3000 follow-on orders totaling approximately \$4.7 million from a key customer that manufactures a next-generation consumer electronics product. As a result of these sales and the competitive advantages offered by our MRS technology, we believe that the future sales potential of the SQ3000 is significant.

We have incorporated our MRS technology into a new 3D scanning system, CyberGage@360, which we believe will serve a wide range of inspection applications in the general purpose 3D metrology market. We sold our first two CyberGage360 units in the fourth quarter of 2016. Most customers are taking longer than originally anticipated to evaluate the functionality and benefits of CyberGage360 before adopting it for their engineering and quality assurance programs. After starting slowly in the first half of 2017, we anticipate steadily increasing sales of CyberGage360 by the end of 2017. We believe that the unique performance characteristics of our MRS technology, which inhibit reflections and enable very accurate measurements at fast speeds, combined with ease of use, will give CyberGage360 a competitive advantage in the marketplace for 3D scanning systems.

We also have committed funds to development of our MX600 system for inspection of memory modules at the end of the production line after singulation. In 2016 we recognized \$5.7 million of revenue from sales of this product to one

of the world's top four memory manufacturers. We believe that additional MX600 orders could be received in future periods.

We have continued to invest in our WaferSense/ReticleSense product lines and have recently announced new offerings for advanced particle measurement and a line of multi-purpose sensors that measure leveling, vibration and humidity in an all-in-one wireless real-time device.

Our ability to achieve our forecast and to implement our strategy effectively is subject to numerous uncertainties and risks, including the risks identified in Item 1A of this Annual Report on Form 10-K. We cannot assure you that our efforts will be successful.

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OPERATIONS AND PRODUCTS

We develop, manufacture and sell intelligent, non-contact sensors and systems for process control and inspection and general purpose metrology. Our product offerings are sold to OEMs and end-user customers in the SMT circuit board assembly, semiconductor and general purpose metrology markets. Our OEMs incorporate our sensor offerings into capital equipment serving these industries. We also sell sensors and stand-alone inspection systems directly to end-users. We create value-added solutions for the general purpose metrology market by integrating proprietary software and sensors with other hardware purchased from third parties, and sell these products as complete metrology systems. We also provide services for 3D mapping for those customers who cannot justify the capital cost of a scanning project, or need services for special projects.

Our principal products are used by manufacturers to increase operating efficiencies and yields, and to assist them in meeting rigorous demands for product quality. In addition to proprietary hardware designs that combine precision optics, various light sources and multiple detectors, our products incorporate software that controls the hardware and filters and converts raw data into application specific information. Our 3D scanning solutions and services help manufacturers quickly solve their most complex 3D inspection, analysis and product engineering challenges, allowing them to improve product yields and quality.

Optical Sensors

We manufacture high precision sensors for use in our own products in key vertical markets and for sale into adjacent markets, mainly through OEM relationships. Although most of our revenue from sensor sales has historically come from our alignment sensors, we recently began selling 3D MRS subsystem to OEM's for integration into their own proprietary stand-alone products. In 2016, we sold 3D MRS-enabled sensors to a major new customer for a general purpose metrology application related to the inspection of finished goods. We also have integrated the new MRS 3D sensor technology into our own stand-alone products for 3D AOI and 3D scanning.

In February 2015, we entered into a mutually exclusive agreement to supply KLA-Tencor with high-precision 3D sensor subsystems for its back-end semiconductor packaging inspection systems. We also have entered into an agreement to supply Nordson-YESTECH with high-precision 3D sensor subsystems for the SMT market. The sensor subsystems are based on our new MRS technology. We intend to negotiate agreements for sale of these sensors to OEMs and end-users in other markets. We also have developed a strobe inspection module (SIM) that features extremely fast image acquisition and low false call rates in 2D applications. We use the SIM in our 2D AOI products, including our QX family of products and the MX600 product that is used for post-singulation inspection of memory modules.

We believe that a strategy of developing and selling complete inspection systems and of refining the sensors and sensor subsystems that are part of these complete systems and selling them to OEM customers allows us to have direct end-user customer input as to the features of inspection systems that are most desired and purchased in our markets. At the same time, sales to OEMs allow us to capitalize on our strengths in optical physics and software implementations, such as noise suppression. We believe that the resulting sensor products and subsystems are unique and add significant value to the products of our OEM customers.

SMT Electronic Assembly Alignment Sensors

Our SMT electronic assembly alignment sensor products is a family of alignment sensors that are customized and incorporated into the equipment manufactured by our customers for use in SMT circuit board assembly. We work closely with our OEM customers to integrate sensors into their equipment.

Sales of our SMT electronic assembly alignment sensor products, including service repairs, to Juki Corporation accounted for approximately 6% of our revenue in 2016 and 10% of our revenue in 2015. Sales of these products, including service repairs to Kulicke and Soffa Industries, accounted for approximately 12% of our revenue in 2016 and 11% of our revenue in 2015. Historically, our revenues and operations have been heavily influenced by the level of purchases from these two customers, reflecting their success in the market for pick-and-place machines, the cyclical nature of the SMT production industry and their ability to accurately forecast production requirements and need for our sensors. We anticipate that our future revenue and operations will be less dependent on these two customers, given the recent success we have had with sales of new MRS-enabled products, including the SQ3000 and 3D sensor

subsystems, and the anticipated future sales of our new CyberGage®360, 3D scanning system. LaserAlign®. Our LaserAlign sensor family has accounted for the majority of our sales in the SMT electronic assembly alignment sensors product line. These sensors are primarily sold for incorporation into pick-and-place machines manufactured and sold by a number of different OEM customers for use in SMT production lines.

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The LaserAlign family of products aligns both large and extremely small surface mount and through-hole components, known as chip capacitors and resistors, during transport on a pick-and-place machine prior to placement. LaserAlign sensors are incorporated into the placement heads of pick-and-place machines to ensure accurate component placement at high production speeds. Various high-speed pick-and-place machines use between one and twenty LaserAlign sensors per machine. LaserAlign integrates an intelligent sensor, composed of a laser, optics and detectors with a microprocessor and software for making specific measurements. LaserAlign enables quick and accurate alignment of each component as it is being transported by the pick-and-place arm for surface mount or through-hole assembly. Using non-contact technology, LaserAlign facilitates orientation and placement of components at higher speeds than can be achieved using conventional mechanical or machine vision component centering systems.

The LaserAlign sensor is offered in several different configurations to satisfy the requirements of the machines on which it is used. Revenue from product shipments of LaserAlign sensors has been a principal contributor to revenue during the past five years and accounted for 12% of our revenue in 2016 and 14% of our revenue in 2015.

BoardAlign Camera (BA Camera). The BA Camera, which is incorporated directly into the placement head of a pick-and-place machine, identifies fiducial markings on a circuit board and aligns the board in the pick-and-place machine prior to component placement. Revenue from shipments of BA Camera sensors accounted for 6% of our revenue in both 2016 and 2015.

InPrinter Inspection Camera. The InPrinter Inspection Camera, which is mounted directly in DEK brand screen printers manufactured by ASM Pacific Technology Ltd., is used to identify fiducial markings on a circuit board to ensure accurate board registration prior to placement of solder paste, as well as to provide an upgraded capability for 2D solder paste and stencil inspection. Revenue from shipments of the InPrinter Inspection Camera accounted for 3% of our revenue in 2016 and 5% of our revenue in 2015.

3D Solder Paste Inspection (SPI) Sensors

We manufacture custom designed 3D SPI sensors for use in our own family of SPI systems. We also sell our 3D SPI sensors to Viscom GmbH for use in their SPI platforms. Sales of 3D SPI sensors to Viscom accounted for less than 1% of our revenue in both 2016 and 2015.

3D MRS Sensors

We initially developed the MRS sensor for application in the SMT industry with our stand-alone inspection systems. However, we have since determined that the MRS sensor has many more potential applications in a broad range of industries. In January 2015, we entered into a mutually exclusive agreement with KLA-Tencor to supply MRS sensor subsystems for its back-end semiconductor package inspection systems. We also have entered into an agreement to supply Nordson-YESTECH with high-precision 3D sensor subsystems for the SMT market. In 2016, we sold 3D MRS-enabled sensors to a major new customer for a general purpose metrology application related to the inspection of finished goods.

Our high precision 3D sensors are based on commercially available cameras, DLP projectors and other hardware components, combined with our proprietary MRS technology and 3D fusing algorithms. The combination of these elements allows our sensor to capture, what we believe, are microscopic quality images, at production speeds. Revenue from shipments of high precision 3D MRS sensor subsystems accounted for 6% of our revenue in 2016 and 4% of our revenue in 2015.

Strobe Inspection Modules (SIM)

We also design and manufacture 2D sensors based on our strobe inspection module or SIM technology and proprietary Autonomous Image Interpretation (Ai²) software for automated optical inspection. These sensors are based on a proprietary hardware design utilizing a strobed based lighting concept for extremely fast image acquisition. We deploy these sensors in our family of 2D AOI inspection systems which, we believe, offer an industry leading level of low false call performance, at fast in-line production speeds. We also utilize this technology in our newly-developed MX600 system for post-singulation inspection of memory modules. To date our use of the SIM technology has been limited to our own 2D AOI offerings for SMT. Our SIM technology can be used for a variety of inspection tasks outside of traditional SMT applications, including inspecting for completeness and accuracy at end of line final

assembly.

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SMT Inspection System Products

Our SMT inspection system products are used in the SMT electronic assembly industry for process control and inspection. These systems are sold directly to end-user manufacturing customers that use them in a production line or along-side a production line to maintain process and quality control. Our products incorporate our proprietary 3D and 2D optical sensors, off the shelf, translation or robotics hardware and conveyors and complete computer systems or processors with internally developed software.

Solder Paste Inspection (SPI) Products

We have been selling in-line 3D solder paste measurement machines for over a decade and have continued to develop and evolve our SPI family of products since their introduction.

SE600. The SE600 is an in-line system based on a dual-illumination sensor that measures in 3D the amount of solder paste applied to the circuit board after the first step of the SMT circuit board assembly process. Because of the small size of the components that must be placed on each pad of solder paste and the density of components placed on the circuit board, a significant amount of SMT assembly problems are related to the quality of solder paste deposition. Misplaced solder paste or excess or inadequate amounts of paste can lead to improper connections or bridges between leads causing an entire circuit board to malfunction. The SE600 inspects the height, area and volume of solder paste placed on an entire circuit board at production line speeds and with resolution that allows the SE600 to measure the smallest chip scale packages and micro ball array component sites. The SE600 can be integrated into most SMT production lines, providing real time quality control immediately after a printed circuit board leaves the screen printer and before component placement commences.

SE500ULTRA. The SE500ULTRA is an in-line solder paste inspection system incorporating the same proprietary 3D inspection technology as the SE600, but with a single illumination sensor. The SE500ULTRA inspects at faster speeds than the SE600 and is intended for use in high-volume production environments. Because the SE500ULTRA prioritizes speed, it does not provide the same level of resolution and measurement performance as the SE600. Revenues from shipments of our SPI products accounted for 9% of our revenue in 2016 and 8% of our revenue in 2015.

Automated Optical Inspection (AOI) Products

We have been selling AOI products for well over a decade and have continued to develop and evolve our AOI offerings since inception. These products inspect circuit boards after component placement to determine whether all components are present and have been placed correctly. AOI products can also be used to measure the quality of solder joints after reflow.

SQ3000. Our first 3D AOI system, the SQ3000, is designed to expand our presence in markets requiring high precision inspection. Identifying defects on circuit boards has become highly challenging and critical due to smaller electronics packaging and increasing component density, combined with smaller and more complex solder joints. We believe the combination of our MRS technology and sophisticated 3D fusing algorithms allows us to offer microscopic image quality at production speeds. We recognized our initial revenues from sales of the SQ3000 in the second quarter of 2015. Due to the competitive advantages offered by our MRS technology, we believe the future sales potential of the SQ3000 is significant.

QX600 and QX150i. Our next generation 2D QX600 and QX150i AOI systems feature our SIM sensor technology and advanced Ai² software which, we believe, offer an industry leading level of low false call performance. We have invested in significant software enhancements for all of our AOI products that improve set-up and programming time and ease of use for the customer. Our QX600 is also available in versions that can accommodate dual production lanes and larger circuit board sizes.

QX100i. We market our 2D QX100i AOI system for production lines requiring faster inspection speeds. These products also feature our SIM sensor technology and advanced Ai² software. The QX100i does not offer the resolution capability of the QX600 or QX150i, but instead was designed to provide the fastest AOI inspection times currently available in the market and also an industry leading level of low false call performance.

QX250i. Our new 2D QX250i AOI system features our SIM sensor technology and advanced Ai² software. The QX250i features two sensors that allows for both top and bottom side inspection of a circuit board.

MX600. Our newly-developed MX600 system is based on our 2D SIM module and Ai² software technology and is used for post-singulation inspection of memory modules. In 2016, we recognized \$5.7 million of revenue from sales of this product to one of the world's top four memory manufacturers. We believe that additional MX600 orders could be received in future periods.

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Revenues from shipments of our AOI products accounted for 32% of our revenue in 2016 and 20% of our revenue in 2015.

3D Scanning Solutions and Services

We provide 3D scanning systems and services to the global general purpose metrology market. Global demand for 3D scanning, which digitally captures the shape of an object, is growing as this technology is deployed increasingly in markets ranging from automotive and aerospace to medical and consumer electronics.

We have incorporated our MRS technology into a new 3D scanning system, CyberGage®360, which we believe will serve a wide range of inspection applications in the general purpose 3D metrology market. We sold our first two CyberGage360 units in the fourth quarter of 2016. Most customers are taking longer than originally anticipated to evaluate the functionality and benefits of CyberGage360 before adopting it for their engineering and quality assurance programs. After starting slowly in the first half of 2017, we anticipate steadily increasing sales of CyberGage360 by the end of 2017. We believe that the unique performance characteristics of our MRS technology, which inhibit reflections and enable very accurate measurements at fast speeds, combined with ease of use, will give CyberGage360 a competitive advantage in the marketplace for 3D scanning systems.

We sell other types of 3D scanning equipment and computed tomography or X-ray scanning (CT) equipment manufactured by other suppliers. We combine this equipment with a comprehensive offering of training, installation and support services to provide the customer with a complete solution. We also provide services that scan, model and inspect objects of all sizes and complexity for customers who do not have their own 3D scanning equipment, or the in-house capability to scan complex parts. Revenue from sales of 3D scanning solutions and services accounted for 13% of our revenue in 2016 and 17% of our revenue in 2015.

Semiconductor Products

Our principal semiconductor products, the WaferSense® and ReticleSense™ family of products, are a series of wireless sensors that provide measurements of critical factors in the semiconductor fabrication process. We designed our WaferSense/ReticleSense family of sensors to go where wafers or reticles are located in semiconductor fabrication to provide measurements of critical factors that are currently impossible or extremely difficult to obtain without powering down the fabrication process equipment. Because the user is not required to break down semiconductor fabrication equipment when using our WaferSense/ReticleSense products, significant time is saved and accuracy is increased, compared to the manual techniques currently used by many customers when checking the process parameters measured by our WaferSense/ReticleSense products. As a result of WaferSense/ReticleSense technology, our customers are able to improve the up-time, through-put and process yield for their semiconductor fabrication equipment.

Automatic Leveling Sensor (ALS). The ALS is a wireless, vacuum-compatible sensor that can be placed in cassettes, FOUPS, on end effectors, aligners, in load locks and process chambers used in semiconductor fabrication to ensure that all stations are level and coplanar.

Automatic Gapping Sensor (AGS). The AGS is a gapping tool that measures the gap in three places between the shower head and pedestal in semiconductor process equipment. The amount of gap between the shower head and pedestal can affect uniformity when material is deposited on semiconductor wafers.

Automatic Teaching Sensor (ATS). The ATS measures X-Y-Z offset from robotic transfers of wafers to the pedestal in semiconductor process equipment. The amount of gap and offset after robotic transfer of wafers to the shower pedestal can affect film thickness and uniformity when material is deposited on semiconductor wafers, impacting quality and product yields.

Automatic Vibration Sensor (AVS). The AVS measures X-Y-Z acceleration for shock and vibration, which can generate wafer particles, scratches or wafer breakage, that reduce yield.

WaferSense/ReticleSense Airborne Particle Sensors. The WaferSense airborne particle sensor (APS) allows engineers to efficiently detect and classify particles and their exact sources in a process as wafers are transferred, slit valves are actuated and chambers are cycled, pumped down and purged. APS is designed to be compatible with front-ends, coater/developer tracks, and deposition and etch equipment.

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We expanded our particle sensing technology by launching a particle sensor in a reticle shaped form factor. The wireless, real-time capability of the ReticleSense Airborne Particle Sensor (APSRQ) allows users to quickly identify geographic particle sources in reticle environments. Designed and developed specifically for use with scanners in semiconductor fabs, APSRQ has all of the necessary alignment marks and bar codes for compatibility with ASML, Nikon and Canon scanners. The APSRQ can be loaded directly into a scanner and can travel the entire reticle path to detect in real-time when and where particles occur. APSRQ helps our customers exceed manufacturing quality and productivity standards in the Photo Lithography scanner environment. We also recently launched a new offering for advanced particle measurement.

WaferSense/ReticleSense Auto Multi Sensors (AMS/AMSR). In 2016, we launched AMS and AMSR to measure leveling, vibration and humidity in an all-in-one wireless real-time device. Humidity measurements are becoming more important as the use of Fin Field Effect Transistor technology increases among semiconductor manufacturers. We intend to continue to enhance and expand the WaferSense/ReticleSense product lines in the future. We sell our semiconductor products to both OEM and end-user customers through a network of independent sales representatives. Sales of our semiconductor products constituted 15% of our revenue in 2016 and 19% of our revenue in 2015.

Markets and Customers

We sell the majority of our products into the SMT electronic circuit board assembly and semiconductor markets. The value of automation is high in these markets because the products produced have high unit costs and are manufactured at speeds too high for effective human intervention. Moreover, the trend toward smaller electronic devices with higher circuit densities, smaller circuit paths and extremely small components requires manufacturing and testing equipment capable of extremely accurate alignment and multidimensional measurement, which can be achieved using non-contact optical sensors. Trends in these markets include further efforts to reduce the cost of the manufacturing process, and to limit human intervention through automation.

Our SMT electronic assembly alignment sensors are sold to OEMs serving the SMT circuit board assembly market. The vast majority of our 3D and 2D optical sensors are used in our own SPI and AOI system products that we sell to circuit board assembly manufacturers serving the electronics assembly market or to OEMs which manufacture their own circuit boards. Our AOI and SPI system sales occur in all global geographies. Our sales of inspection systems are more heavily concentrated in Asia where a significant portion of the worldwide production capacity for circuit board assembly occurs. We manufacture all of our sensor products in our Minneapolis, Minnesota headquarters facility. All final assembly and integration for our inspection system products takes place in our Singapore facility.

We sell our SMT sensor and inspection system products worldwide to many of the leading manufacturers of electronic circuit board assembly equipment, manufacturers of semiconductor DRAM and SSD memory and end-user electronic assembly manufacturers, including original design manufacturers (ODMs), electronics manufacturing service (EMS) providers and outsourced semiconductor assembly and test (OSAT) companies, which manufacture cell phones, smart phones, notebook computers, server boards, and other electronic devices. We have sales and service offices in China and Singapore to serve the market for manufacturing production equipment in Asia. Our sales and service office in the United Kingdom serves the European market, and we have sales and service team members based in the United States to serve the Americas market. We have partnered with Viscom, a German distributor with significant sales to the automotive industry, to better penetrate the European market with our SPI sensors. We also have entered into an agreement to supply Nordson-YESTECH with high-precision 3D MRS sensor subsystems for the SMT market. We believe our arrangement with Nordson-YESTECH will allow us to better penetrate the SMT market with our 3D MRS sensor offerings. We intend to expand our global sales and marketing efforts across all geographies.

In January 2015, we qualified as a supplier to KLA-Tencor and entered into a mutually exclusive agreement to supply 3D sensor subsystems for KLA-Tencor's back-end semiconductor package inspection systems. We believe that our MRS technology is a breakthrough 3D inspection technology that can be deployed in a wide range of markets, including the semiconductor package inspection market served by KLA-Tencor, and that selling sensor subsystems to leading manufacturers such as KLA-Tencor will allow us to reach these markets more effectively. We have significantly advanced our MRS-enabled 3D sensor technology as part of a research initiative aimed at applying our 3D MRS technology to front-end semiconductor inspection. If this initiative proves to be commercially viable, the

available market for our MRS-enabled 3D sensors for front-end semiconductor inspection could be significant.

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The market for our semiconductor products, primarily consisting of our WaferSense and ReticleSense family of products, has the need for non-contact measurement tools that enable the production of more complex, higher density and smaller semiconductor devices. Our WaferSense/ReticleSense precision measurement tools are used by process and equipment engineers for process optimization during the production of semiconductor wafers. The world's largest semiconductor manufacturers purchase our WaferSense/ReticleSense precision measurement tools. We sell them directly to semiconductor fabrication facilities or through semiconductor capital equipment manufacturers to semiconductor fabrication facilities.

We sell our high end 3D scanning solutions, including our new CyberGage®360 3D scanning system, in the market for general purpose metrology to a diverse set of customers with a need to capture surface data for product engineering and quality assurance. Global demand for 3D scanning, which digitally captures the shape of an object, is growing as this technology is deployed increasingly in markets ranging from automotive and aerospace to medical and consumer electronics. Our 3D scanning services scan, model and inspect objects of all sizes and complexity for customers who do not have their own general purpose metrology equipment.

Export sales represent a large percentage of our total sales because a large portion of the global capacity for electronics assembly and semiconductor production occurs outside the United States. In addition, a significant portion of our export sales include SMT electronic assembly alignment sensors and 3D MRS sensors sold to OEM customers located in Europe and Asia.

The following table sets forth the percentage of total sales revenue represented by total export sales (sales for delivery to countries other than the United States, including sales delivered through distributors) by location during the past two years:

	December 31, 2016 2015	
Asia	52 %	39 %
Europe	26 %	29 %
Other export sales (1)	3 %	4 %

(1) Includes export sales in the Americas, primarily Canada, Mexico and Latin America.

See Note 13 to our consolidated financial statements contained in Item 8 of this Annual Report on Form 10-K. Most of our international export sales are negotiated, invoiced and paid in U.S. dollars. We manufacture our SMT system products in Singapore and a portion of our raw material purchases are denominated in Singapore dollars. We also have R&D and sales personnel located in Singapore and sales offices located in other parts of the world. Although currency fluctuations do not significantly affect our revenue, they can impact our costs and influence the price competitiveness of our products and the willingness of existing and potential customers to purchase the products.

Sales and Marketing

A direct sales staff located in Minnesota is responsible for sales of SMT alignment and 3D high precision MRS sensors to OEM customers, and sales of 3D high precision MRS sensors to end-user customers for general purpose metrology.

Our stand-alone SMT inspection system products for end-user customers are primarily sold through independent representatives and distributors managed by direct sales personnel located in Singapore, as well as in the United Kingdom, the U.S. and China. We have agreements with 40 independent representatives and distributors which focus on sales and service of our stand-alone system products to end-user customers. These agreements cover North and South America (12), Europe (15) and China and the rest of Asia (13).

We have established a separate worldwide sales channel for our semiconductor products. We currently have agreements in place or in process with 16 independent sales representatives and distributors which focus on sales and service for our WaferSense and ReticleSense semiconductor products. These agreements cover the U.S. (6), Europe (3) and Asia-Pacific (7). In some cases we sell our WaferSense and ReticleSense products directly to large OEM customers. Our sales to OEM customers and our worldwide network of independent sales representative and distributors are managed by direct sales personnel located in the U.S. and Asia.

We also have a separate worldwide sales channel for our 3D scanning solutions and services. We currently have agreements in place with 13 independent sales representatives and distributors which focus on sales and service for our 3D scanning solutions, including CyberGage@360. These agreements cover the Americas (6), Europe (2) and Asia-Pacific (5). We also sell our 3D scanning solutions to end-user customers through a direct sales staff located in Minnesota. Some of our global channel partners for our SMT inspection system products also have agreed to market CyberGage360.

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We market our products through appearances at industry trade shows, advertising in industry journals, articles published in industry and technical journals and on the Internet. In addition, we have strategic relationships with certain key customers that serve as highly visible references. We support our sales efforts for 3D scanning solutions and services by utilizing an internet based search engine marketing program to generate leads from prospects who have expressed interest in obtaining these types of products and services.

Backlog

Product backlog was \$10.2 million at December 31, 2016, compared to \$15.0 million at December 31, 2015. Our products are typically shipped two weeks to two months after the receipt of an order. Sales of some SMT inspection system products may require customer acceptance due to performance or other acceptance criteria included in the terms of sale. For these SMT product sales, revenue is recognized at the time of customer acceptance. Although our business is generally not of a highly seasonal nature, sales may vary based on the capital procurement practices in the SMT electronics assembly, general industrial manufacturing and semiconductor fabrication industries. For example, production capacity expansion in the SMT electronics assembly industry for anticipated holiday or back to school demands can result in higher levels of sales in our second and third quarters. However, we are not able to quantify, with any level of precision, the impact of these events on our sales in any given quarterly period, and any seasonal cyclicalities is often masked by more dramatic changes in demand caused by the normal volatility in electronics markets that is associated with changes in the economy. Our scheduled backlog at any time may vary significantly based on the timing of orders from OEM customers. Accordingly, backlog may not be an accurate indicator of performance in the future.

Research and Development

We differentiate our products primarily on the basis of customer benefits afforded by the use of innovative and proprietary technology and on our ability to combine several different technical disciplines to address industry and customer needs. In addition, we actively seek ongoing strategic customer relationships with leading product innovators in both our existing and new markets. We actively investigate the needs of, and seek input from, these customers to ensure adoption of current technologies and to identify opportunities to improve manufacturing processes.