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**SECURITIES AND EXCHANGE COMMISSION**

**WASHINGTON, D.C. 20549**

# FORM 10-K

x ANNUAL REPORT PURSUANT TO SECTION 13 or 15(d) of the Securities Exchange

Act of 1934 for the Year Ended December 31, 2018.

o 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** | |
| **MINNEAPOLIS, MINNESOTA** | **55416** |
| (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, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer", "accelerated filer", "smaller reporting company", and "emerging growth company" in Rule 12b-2 of the Exchange Act.

| | |
|---|---|
| Large Accelerated Filer | Accelerated filer |
| Non-accelerated filer (Do not check if a smaller reporting company) | Smaller Reporting Company<br>Emerging Growth Company |

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standard provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes No

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: $119,485,783

As of February 28, 2019, there were 7,102,075 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 16, 2019.

# CYBEROPTICS CORPORATION

# FORM 10-K

# For the Fiscal Year Ended December 31, 2018

**TABLE OF CONTENTS**

Table of Contents

# PART I.

## ITEM 1. DESCRIPTION OF BUSINESS

### GENERAL

#### 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 2019 annual shareholders meeting to be held on May 16, 2019 will be available electronically via the internet at the following address: http://www.idelivercommunications.com/proxy/cybe/.

As a leading global developer and manufacturer of high precision 3D sensors, our strategy is to leverage our 3D sensor technologies in our three key vertical markets: surface mount technology (SMT); semiconductor; and metrology. A key element of our strategy is to deliver profitable growth through the continued sale and development of high precision 3D sensors and system products based on our proprietary Multi-Reflection Suppression (MRS) technology. We believe that our MRS technology is a breakthrough 3D optical technology for high-end inspection and metrology with the potential to significantly expand our markets. Unlike competing technologies, our MRS technology has the ability to inhibit reflections and provide microscopic quality images at production line speeds.

Our products are used in the SMT, semiconductor and metrology 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 products help manufacturers solve their most complex manufacturing challenges by providing them with key information relating to their manufacturing processes, which allows them to improve production volumes, yields and product quality.

Manufacturing yield challenges, as electronics and semiconductors become more complex, are driving the need for more precise inspection and metrology. As a result, we believe 3D inspection and metrology represent high-growth segments in both the SMT and semiconductor capital equipment markets. We expect a growing number of opportunities in the markets for SMT and semiconductor inspection and metrology, because our 3D MRS technology platform is well suited for many of these applications, particularly with respect to complex circuit boards and semiconductor back-end, mid-end and advanced packaging inspection and metrology applications.

We manufacture 3D and 2D optical sensors for use in our own proprietary inspection system products and for sale to original equipment manufacturers (OEMs), system integrators and end customers in the SMT, semiconductor and metrology markets. Our inspection system products are sold to manufacturers of SMT electronic circuit boards to control quality as in-line systems, particularly with respect to complex circuit boards used in smart phones and other high-end electronic products. 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. We also sell our inspection system products to leading semiconductor manufacturers and outsourced semiconductor assembly and test (OSAT) companies. Manufacturers of DRAM and Flash Memory use our inspection system products to inspect assembly of their memory modules. Increasingly, our inspection system products are being used for various semiconductor related inspection and metrology applications, including advanced packaging.

Our WaferSense® family of products assist with yield improvement and tool uptime in semiconductor wafer fabrication and flat panel display manufacturing by providing highly accurate measurements of critical process factors. These measurements are impossible or very difficult to obtain without powering down the equipment used for wafer fabrication and flat panel display manufacturing. 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. We have continued to invest in our WaferSense® product family and anticipate strong future sales growth for these products.

Our ability 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. There can be no assurance that our strategy will be successful.

Table of Contents

**Multi-Reflection Suppression Technology**

We are developing new high precision 3D sensors and system products based on our proprietary MRS technology. We believe 3D inspection and metrology represent a high growth segment for both the SMT and semiconductor capital equipment markets. Our recent and planned product introductions are designed to strengthen our competitive position in our current markets and expand into adjacent markets.

We have entered into an agreement to supply KLA 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 (a subsidiary of Nordson Corporation) with high precision 3D sensor subsystems for its SMT and wire bond inspection systems. The sensor subsystems are based on the MRS technology that we have been developing for the past several years. We intend to expand sales of products based on our MRS technology in the SMT, semiconductor and metrology markets, including inspection and metrology for semiconductor mid-end, back-end and advanced packaging applications, through new OEM partners, system integrators and direct sales to end-user customers.

Our 3D MRS technology has been deployed in our 3D automated optical inspection (AOI) systems, the SQ3000 and SQ3000™ 3D CMM, which are designed to expand our presence in markets requiring high precision inspection and metrology. In these markets, identifying defects has become highly challenging and critical due to smaller semiconductor and electronics packaging and increasing component density on circuit boards. We believe the combination of our proprietary MRS technology, sophisticated 3D fusing algorithms and precision optics 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. The SQ3000™ 3D CMM, which was launched in the second half of 2017, combines automated optical inspection and metrology functionality in a single product. Manufacturers in a variety of industries, including the SMT and semiconductor markets, can use the SQ3000™ 3D CMM as an in-line or off-line metrology tool to help solve complex manufacturing and product quality challenges.

Challenges with shrinking transistor dimensions has resulted in increased 3D stacking of chips. Accordingly, advanced semiconductor packaging is expected to grow rapidly in the next 5 to 10 years. Micro electromechanical systems devices (MEMS) are now being used for many advanced applications. Yield challenges with these products are driving the need for inspection and metrology, and we believe our 3D MRS technology platform is well suited to conduct the inspection and metrology for many of these applications. We are introducing new products based on our MRS technology that we believe will allow us to capitalize on these opportunities and significantly increase our revenues in the future.

We have significantly advanced our MRS-enabled 3D sensor technology as part of a research initiative aimed at further applying our 3D MRS technology to semiconductor mid-end and advanced packaging inspection and metrology. Our next generation ultra-high resolution 3-micron pixel 3D MRS sensor is capable of measuring feature sizes down to 30 microns accurately and at high speeds, which makes this sensor valuable for many semiconductor mid-end and advanced packaging inspection and metrology applications. We are targeting one micron, three-sigma accuracy, at speeds that would inspect more than 20 300-millimeter wafers per hour. We are currently demonstrating our ultra-high resolution 3-micron pixel 3D MRS sensor to OEMs, system integrators and directly to semiconductor manufacturers and we have already received our first purchase orders for this sensor and subsystems based on this technology. We believe sales of MRS-enabled 3D sensors and systems for semiconductor mid-end and advanced packaging inspection applications represent significant long-term growth opportunities, and we expect sales of these sensors and related systems to ramp up in the second half of 2019 and beyond.

**OPERATIONS AND PRODUCTS**

We develop, manufacture and sell intelligent, non-contact sensors and systems for process control, inspection and metrology. Our product offerings are sold to OEMs, system integrators and end-user customers in the SMT circuit board assembly, semiconductor and general industrial metrology markets. Our OEMs and system integrators incorporate our sensor products into capital equipment serving these markets. We also sell sensors and stand-alone inspection and metrology systems directly to end-users. We provide services for 3D scanning and metrology for those customers who cannot justify the purchase of their own 3D scanning and metrology equipment, 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 and metrology services help manufacturers quickly solve their most complex 3D inspection, analysis and product engineering challenges, allowing them to improve product yields and quality.

Table of Contents

**High Precision 3D and 2D Sensors**

We manufacture high precision sensors for use in the SMT, semiconductor and metrology markets. We sell our sensors directly to OEMs, system integrators and end-user customers. Historically, most of our revenue from sensor sales has come from our alignment sensors. Within the past five years, we began selling 3D MRS sensor subsystems to OEMs for integration into their proprietary inspection system and metrology products serving the SMT and semiconductor markets. We also have integrated our 3D MRS sensor technology into our own proprietary systems for 3D inspection and metrology applications.

We have entered into an agreement to supply KLA with high-precision 3D MRS sensor subsystems for its back-end semiconductor packaging inspection systems. We have an agreement to supply Nordson-YESTECH with high-precision 3D MRS sensor subsystems for its SMT and wire bond inspection systems. We intend to negotiate agreements for sale of these sensors to other OEMs, system integrators and end-users, and to deploy them in our next generation inspection system and metrology products. 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 metrology products to end-users provides us with valuable customer input in the markets we currently serve, and allows us to refine the sensors and sensor subsystems for these markets and adjacent markets. At the same time, sales to OEMs allow us to capitalize on our strengths in optical physics, sensor design and software algorithm development. We believe that the resulting sensor products and subsystems are unique and add significant value to the products of our OEM customers.

***3D MRS Sensors***

Our 3D MRS sensors are used in our proprietary inspection system and metrology products serving the SMT, semiconductor and metrology markets. We also sell our 3D MRS sensors to OEM customers and system integrators serving the SMT and semiconductor markets. Our 3D MRS sensors are particularly well suited for applications in the semiconductor back-end, mid-end and advanced packaging inspection and metrology markets.

Our high precision 3D sensors are based on commercially available cameras, digital light projectors and other hardware components, which are combined with our proprietary MRS technology, 3D fusing algorithms and precision optics. The combination of these elements allows our sensors to capture microscopic quality images at production speeds. Sales of high precision 3D MRS sensor subsystems to OEMs accounted for 12% of our revenues in

2018 and 8% of our revenues in 2017.

***Strobe Inspection Modules (SIM)***

We also design and manufacture 2D sensors based on our SIM technology and proprietary Autonomous Image Interpretation ($Ai^2$) software for automated optical inspection. These sensors are based on a proprietary hardware design utilizing a strobe-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 MX600 system for post-singulation inspection of memory modules. To date, use of the SIM technology has been limited to our own 2D AOI products for the SMT and semiconductor inspection markets. However, our SIM technology could be used for a variety of inspection tasks outside of traditional SMT and semiconductor inspection applications, including inspecting for completeness and accuracy at the end of line final assembly.

***SMT Electronic Assembly Alignment Sensors***

Our SMT electronic assembly alignment sensor products are a family of 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 these sensors into their equipment.

***LaserAlign®.*** Our LaserAlign sensor family of products has accounted for the majority of our sales in the SMT electronic assembly alignment sensor product line. These sensors are primarily sold for incorporation into pick-and-place machines manufactured and sold by OEM customers for use in SMT production lines.

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. 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.

Table of Contents

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 accounted for 13% of our revenues in 2018 and 15% of our revenues in 2017.

***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 4% of our revenues in 2018 and 2017.

***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 AG for use in their SPI platforms. Sales of 3D SPI sensors to Viscom AG accounted for minimal revenues in each of 2018 and 2017.

**Inspection and Metrology Systems**

Our inspection system products are primarily used in the semiconductor and SMT electronic assembly industries for process control, inspection and metrology. These systems are sold to end-user manufacturing customers that use them in a production line or alongside 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.

***Automated Optical Inspection (AOI) Products***

We have been selling AOI products for well over a decade and have continued to develop and improve our AOI offerings since inception. These products are typically used to inspect circuit boards after component placement to determine whether all components have been placed correctly, and to measure the quality of solder joints after reflow. These products can also be used for various semiconductor related inspection and metrology applications, including advanced packaging, and for certain general purpose industrial metrology applications. Revenue from shipments of our AOI products accounted for 27% of our revenues in 2018 and 23% of our revenues in 2017.

***SQ3000 and SQ3000™ 3D CMM.*** 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. The SQ3000 is also available in versions that can accommodate dual production lanes and larger circuit board sizes. The SQ3000™ 3D CMM, which was launched in the second half of 2017, combines automated optical inspection and metrology functionality in a single product. Manufacturers in a variety of industries, including the SMT and semiconductor markets, can use the SQ3000™ 3D CMM as an in-line or off-line metrology tool to help solve complex manufacturing and product quality challenges. We believe there are a growing number of sales opportunities for the SQ3000 and SQ3000™ 3D CMM in the markets for semiconductor inspection and metrology, particularly for advanced packaging applications. We believe our 3D MRS sensor technology is uniquely suited for many of these applications because of its ability to offer microscopic image quality and superior measurement performance at production line speeds.

Sales of the SQ3000 and SQ3000™ 3D CMM accounted for 20% of our revenues in 2018 and 18% of our revenues in 2017.

***QX600 and QX150i***. Our 2D QX600 and QX150i AOI systems feature our SIM sensor technology and advanced $Ai^2$ 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. The QX600 is 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 extremely fast inspection speeds. These products also feature our SIM sensor technology and advanced $Ai^2$ 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 $Ai^2$ software. The QX250i features two sensors that allows for both top and bottom side inspection of a circuit board.

***MX600.*** Our MX600 system utilizes our SIM sensor technology and $Ai^2$ software, and is used for post-singulation inspection of memory modules. In 2018 we recognized $1.1 million of revenue from sales of the MX600 to one of the world's top three memory manufacturers, and our backlog at December 31, 2018 includes

approximately $3.3 million of orders for the MX600. We recognized no revenue from sales of this product in 2017. We believe additional MX600 orders could be received in future periods.

Table of Contents

***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 improve our SPI family of products since their introduction. Revenue from shipments of our SPI products accounted for 5% of our revenues in 2018 and 11% of our revenues in 2017.

***SE3000™.*** The SE3000™ is an in-line system solder paste inspection system based on our 3D MRS sensor technology. The SE3000™ measures in 3D the amount of solder paste applied to a 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 SE3000™ 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 SE3000™ to measure the smallest chip scale packages and micro ball array component sites. The SE3000™ 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.

***SE600.*** The SE600 is an in-line solder paste inspection system incorporating a dual-illumination sensor that measures in 3D the height, area and volume of solder paste placed on an entire circuit board at production line speeds. The SE600 can be integrated into most SMT production lines.

***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 SE3000 or SE600 and is intended for use in high-volume production environments. Because the SE500ULTRA performs inspections at very high speed, it does not provide the same level of resolution and measurement performance as the SE3000 or SE600.

***General Industrial Metrology Products and Services***

***CyberGage®360.*** Manufacturers in a variety of industries use CyberGage®360 as a near-line or off-line metrology tool to capture surface data to help solve complex manufacturing and product quality challenges. Our sales of CyberGage®360 to date have not been significant. There can be no assurance that CyberGage®360 will ever achieve widespread market acceptance.

***Other Metrology Products and Services.*** We also sell 3D scanning and metrology equipment manufactured by other suppliers and provide 3D scanning and metrology services for objects of all sizes and complexity for customers who do not have their own 3D scanning and metrology equipment. Revenue from sales of other metrology products and services accounted for 11% of our revenues in 2018 and 11% of our revenues in 2017.

**Semiconductor Sensors**

Our principal semiconductor products, the WaferSense® family of products, are a series of wireless sensors that provide measurements of critical factors in the semiconductor fabrication process. We designed our WaferSense® family of sensors to be used 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® 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® products. As a result of WaferSense® technology, our customers are able to improve the up-time, through-put and process yield for their semiconductor fabrication equipment. We intend to continue to enhance and expand the WaferSense® family of products 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 accounted for 21% of our revenues in both 2018 and 2017.

***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 showerhead and pedestal in semiconductor process equipment. The amount of gap between the showerhead 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 or etched on semiconductor wafers, impacting quality and product yields.

7

Table of Contents

***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® Airborne Particle Sensor™.*** 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. The APS is designed to be compatible with front-ends, coater/developer tracks, and deposition and etch equipment. ReticleSense® Airborne Particle Sensor allows users to quickly identify geographic particle sources in reticle environments. The ReticleSense Airborne Particle Sensor is compatible with ASML, Nikon and Canon scanners and can travel the entire reticle path to detect in real-time when and where particles occur. The ReticleSense Airborne Particle Sensor helps our customers exceed manufacturing quality and productivity standards in the Photo Lithography scanner environment.

***PanelSense™ Airborne Particle Sensor™.*** The PanelSense™ Airborne Particle Sensor™ (APS-FPD) enables troubleshooting of airborne particles within flat panel display manufacturing equipment by allowing engineers to quickly monitor and identify when and where particles originate in the flat panel display manufacturing process.

***WaferSense® Auto Multi Sensor™.*** The WaferSense® Auto Multi Sensor™ is an all-in-one wireless real-time device that allows engineers to quickly take leveling, vibration and humidity measurements. Humidity measurements are becoming more important as the use of Fin Field Effect Transistor technology increases among semiconductor manufacturers. The ReticleSense® Auto Multi Sensor™ allows users to quickly take leveling, vibration and humidity measurements in reticle environments.

**Markets and Customers**

We sell the majority of our products into the SMT circuit board assembly market and the markets for SMT and semiconductor inspection and metrology. The value of automation is high in these markets because the products produced have high unit costs and are manufactured at speeds too great for effective human involvement. 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. Challenges with shrinking transistor dimensions have resulted in 3D stacking of chips. MEMS devices are now being used for many advanced applications. Yield challenges with these products are driving the need for inspection and metrology. We expect a growing number of opportunities in the markets for SMT and semiconductor inspection, because our 3D MRS technology platform is well suited for many of these applications. Trends in these markets include further efforts to reduce the cost of the manufacturing process, and to limit human involvement through automation.

We sell 3D MRS-enabled sensor subsystems to KLA for use in its semiconductor back-end packaging inspection systems. We are currently demonstrating our ultra-high resolution 3-micron pixel 3D MRS sensor to OEMs, system integrators and directly to semiconductor manufacturers, and we have received our first purchase orders for sales of sensors and subsystems based on this technology. We believe sales of 3D MRS-enabled sensors and systems for semiconductor mid-end and advanced packaging inspection applications represent significant long-term growth opportunities for us, and we expect sales of these sensors and systems to ramp up in the second half of 2019 and beyond. We estimate that the total available market for sales of our 3D MRS sensors to manufacturers of semiconductor inspection and metrology equipment will be approximately $25 million in 2019.

The vast majority of our SMT electronic assembly alignment sensors are sold on an OEM basis to Juki Corporation, Kulicke & Soffa Industries, Inc. and ASM Pacific Technology Ltd. for integration into DEK brand equipment serving the SMT circuit board assembly market. Viscom AG purchases our SPI sensors on an OEM basis for integration into their SPI inspection equipment. We believe our arrangement with Viscom AG will allow us to sell more SPI sensors by better penetrating the European market for SMT inspection equipment. We also have an agreement to supply Nordson-YESTECH with 3D MRS sensor subsystems for its SMT and wire bond inspection equipment. We believe our arrangement with Nordson-YESTECH will allow us to better penetrate the markets for SMT and wire bond inspection equipment with our 3D MRS sensor offerings.

We use our 3D and 2D optical sensors in SPI and AOI inspection equipment that we manufacture and sell on a worldwide basis to many of the leading SMT electronic assembly circuit board manufacturers, end-user customers manufacturing their own circuit boards, semiconductor manufacturers and outsourced semiconductor assembly and test (OSAT) companies. Manufacturers of DRAM and Flash Memory use our inspection system products to inspect assembly of their memory modules. We estimate that our total available market for sales of 3D AOI equipment to the SMT and semiconductor inspection and metrology markets will be approximately $350 million in 2019.

Our semiconductor products, primarily our WaferSense family of products, are used by process and equipment engineers as non-contact precision measurement tools to optimize the process for production of semiconductor wafers and manufacturing of flat panel displays. Most of the world’s largest manufacturers of semiconductors and semiconductor equipment purchase our WaferSense products. We believe the available market for our WaferSense products is potentially significant, and will continue to increase in the future as new product applications are added.

8

Table of Contents

The total available market for general industrial metrology equipment is very large, diverse and growing. Our 3D scanning and metrology services scan, model and inspect objects of all sizes and complexity for customers who do not have their own scanning and metrology equipment.

Export sales totaled $46.4 million or 72% of our total sales in 2018, compared to $38.0 million or 71% of our total sales in 2017. 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. See Note 12 to our consolidated financial statements contained in Item 8 of this Annual Report on Form 10-K for information regarding the percentage of total sales revenue represented by total export sales (sales of products into countries other than the United States, including sales delivered through distributors) by location during the past two years. Most of our international export sales are negotiated, invoiced and paid in U.S. dollars. We manufacture our inspection 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 our products.

Our sales to Juki Corporation and KLA each accounted for 10% of our total revenue in 2018.

**Sales and Marketing**

Our high precision 3D and 2D sensors are sold in all global geographies to OEMs, system integrators and manufacturers by direct sales personnel located in Minnesota and Asia. Some of the global channel partners for our semiconductor products also market our high precision 3D MRS sensors to semiconductor manufacturers and system integrators.

Our AOI and SPI inspection and metrology system products are sold in all global geographies. Sales of these products are more heavily concentrated in Asia where a significant portion of the worldwide production capacity for circuit board assembly and semiconductor manufacturing occurs. Our sales of AOI and SPI systems are sold by direct sales personnel located in Singapore, as well as in the United Kingdom, the United States

and China and through independent sales representatives and distributors. 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 sales and service offices in China and Singapore to serve the markets for SMT and semiconductor inspection and metrology equipment in Asia. We have agreements with 40 independent sales representatives and distributors, which focus on sales and service of our AOI and SPI inspection and metrology system products to end-user customers. These agreements cover North and South America (13), Europe (13) and China and the rest of Asia (14).

We sell our semiconductor products, primarily our WaferSense family of products, to semiconductor fabrication facilities through a separate worldwide sales channel of independent sales representatives and distributors. We also sell our WaferSense products directly to large OEM customers, which are mainly semiconductor capital equipment manufacturers. We currently have agreements in place or in process with 14 independent sales representatives and distributors, which focus on sales and service for our WaferSense products. These agreements cover the United States (4), Europe (3) and the Asia-Pacific (7). Our sales to OEM customers and our worldwide network of independent sales representative and distributors are managed by direct sales personnel located in the United States and Asia.

We sell our general industrial metrology products through a separate worldwide sales channel of independent sales representative and distributors. We have agreements in place with 27 independent sales representatives and distributors, which focus on sales and service for our general industrial metrology products. These agreements cover the Americas (15), Europe (6) and the Asia-Pacific (6). We also sell our 3D scanning and metrology products and services to end-user customers through a direct sales staff located in Minnesota.

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 marketing arrangements with certain key customers that serve as highly visible references. We support our sales efforts by utilizing internet-based search engine marketing programs to generate leads from prospects who have expressed interest in obtaining the types of products and services that we offer.

**Backlog**

Product backlog was $13.6 million at December 31, 2018, $11.4 million at December 31, 2017 and $10.2 million at December 31, 2016. Product backlog at September 30, 2018 was $19.7 million. Our products are typically shipped two weeks to two months after the receipt of an order. Sales of some inspection system products may require customer acceptance due to performance or other acceptance criteria included in the terms of sale. For these 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 and semiconductor fabrication industries. However, we are not able to quantify with any level of precision the impact of these practices on our sales in any given quarterly period, and any seasonal cyclicality is often masked by more dramatic changes in demand caused by the normal volatility in electronics and semiconductor markets that are 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.

Table of Contents

**Research and Development**

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

We commit substantial resources to the development of important next-generation technologies that, we believe, will position us to be a global technology leader in high precision 3D sensors and capture additional market share in our key vertical markets of SMT, semiconductor and metrology. We maintain our commitment to research and development and product development even during periods when strong demand in the markets for our products does not exist. During the past two years, research and development efforts have been focused on a number of activities that are critical to our future growth and success, including the following:

- We have developed new high precision 3D sensors based on our proprietary MRS technology. MRS is a high speed metrology grade 3D measurement technology using commercially available components, combined with proprietary algorithms and precision optics. MRS technology solves many of the reflection issues impacting all triangulation sensor technologies. In addition to developing 3D MRS sensors for use in our proprietary inspection system products, we also have developed 3D MRS based sensors for use in semiconductor back-end packaging inspection systems manufactured by KLA.

- We have significantly advanced our 3D MRS-enabled sensor technology as part of a research initiative aimed at applying our 3D MRS technology to inspection and metrology applications for mid-end and front-end semiconductor inspection and the emerging semiconductor advanced packaging market. Our next generation ultra-high resolution 3-micron pixel 3D MRS sensor is capable of measuring feature sizes down to 30 microns accurately and at high speeds, which is suitable for many semiconductor mid-end and advanced packaging inspection and metrology applications. We are targeting one micron, three-sigma accuracy, at speeds that would inspect more than 20 300-millimeter wafers per hour. The ability of our MRS technology to conduct mid-end semiconductor inspections is an important milestone in our effort to make MRS-enabled 3D sensor technology applicable to front-end semiconductor inspection within the next three to five years.

- We have continued to enhance our first 3D AOI system, the SQ3000. This system is designed to expand our presence in markets requiring high precision measurement and 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 our MRS technology provides us with significant competitive advantages due to its ability to offer microscopic image quality at production line speed.

- The SQ3000™ 3D CMM, which was launched in the second half of 2017, combines automated optical inspection and metrology functionality in a single product. Manufacturers in a variety of industries, including the SMT and semiconductor markets, can use the SQ3000™ 3D CMM as an in-line or off-line metrology tool to help solve complex manufacturing and product quality challenges. We believe there are a growing number of sales opportunities for the SQ3000 and SQ3000™ 3D CMM in the markets for semiconductor inspection and metrology, particularly for advanced packaging applications. We believe our 3D MRS sensor technology is uniquely suited for many of these applications because of its ability to offer microscopic image quality and superior measurement performance at production line speeds.

- We have continued development of our WaferSense line of products. We have developed offerings for advanced particle measurement for use in semiconductor fabrication and flat panel display manufacturing. Other new WaferSense products are currently under development.

Research and development expenses were $8.8 million or 14% of revenue in 2018 and $8.0 million or 15% of revenue in 2017. Research and development expenses consist primarily of salaries, project materials, contract labor and other costs associated with ongoing product development and enhancement efforts. Research and development resource utilization is centrally managed based on market opportunities and the status of individual projects.

**Manufacturing**

All of our 3D and 2D optical sensors, SMT alignment sensors and WaferSense semiconductor sensor products are assembled at our Minneapolis, Minnesota headquarters facility. Our inspection systems, including the SQ3000™ 3D CMM product, are assembled in Singapore. Much of our product manufacturing, which is primarily circuit board manufacturing, lens manufacturing and metal parts production, is performed by outside contractors. Our production personnel inspect incoming parts, perform final assembly, calibrate and perform final quality control testing of finished products. We have elected not to make the capital investments necessary for complete internal manufacturing of our products.

Table of Contents

A variety of components used in our products are available only from single sources and involve relatively long order cycles, in some cases up to six months. We believe we have identified alternative assembly contractors for most of our sub-assemblies. Use of those alternative contractors could require substantial rework of the product designs, resulting in periods during which we could not satisfy customer orders. An actual change in such contractors would likely require a period of training and testing.

Accordingly, an interruption in a supply relationship or reduced production capacity experienced by one or more of such contractors could result in the inability to deliver one or more of our products for a period of several months. To help prevent delays in the shipment of our products, we maintain in inventory, or on scheduled delivery from suppliers, components that we believe will be sufficient to meet forecasted demand, often times for a minimum of six months.

**Competition**

We face competition from a number of companies in the machine vision, image processing and inspection systems markets, many of which are larger and have greater financial resources than we do. However, we believe our current and planned products offer advantages from competing products in terms of price and suitability for specific applications.

Our 3D and 2D optical sensors and SMT electronic assembly alignment sensors primarily compete with the sensors and vision systems developed by OEMs using their own design employees for incorporation into their products. We believe our high precision 3D sensors based on our MRS technology are unique in the marketplace based on the ability to offer microscopic quality images at fast production line speeds. Our 2D SIM sensors and SMT electronic assembly alignment sensor products also compete with vision (camera and software based) systems and component libraries available from Cognex Corporation and others. Although advances in vision systems have reduced some of the advantages of our SMT electronic assembly alignment sensor products in some configurations, we continue to believe that our sensors compete favorably based on our ability to custom design products with stringent physical form requirements, speed, flexibility, low cost and ease of use.

The primary competition for sales of our AOI and SPI inspection system products has been from Korean based companies, including Koh Young Technology, MirTec Ltd., and PARMI Co. Ltd. We also compete with Taiwanese based Test Research, Inc. and German based Viscom AG, among others. Sales of AOI systems account for roughly two-thirds of the approximately $800 million total SPI and AOI SMT inspection systems market, with 3D AOI representing the fastest growing segment of this market. The markets for semiconductor mid-end and advanced packaging inspection equipment are fragmented. Our competitors in the market for semiconductor mid-end inspection equipment include Camtek, Inc., STMicroelectronics, Inc. and Rudolph Technologies, Inc., among others. We believe our 3D MRS sensor technology and the $Ai^2$ software used in our SQ family of products differentiates our products from competing products and that our products compete effectively in the AOI market based on cost, ease of use at

rapid production line speeds and the low rate of false calls. We believe that our SQ3000 3D AOI and SQ3000™ 3D CMM products, enabled by our proprietary MRS technology, 3D fusing algorithms and precision optics, offers advantages over competing products and will allow us to gain market share based on our ability to offer microscopic quality images at fast production line speeds.

We believe our WaferSense products are unique to the marketplace and primarily face competition from the manual techniques currently used by most customers to monitor their semiconductor fabrication or flat panel display manufacturing equipment. We believe that our WaferSense products provide more reliable and accurate measurements than these manual techniques. In a semiconductor fabrication environment, we believe that our WaferSense products save significant time because the user is not required to break down process equipment, or pressurize a vacuum chamber, which improves tool up-time, through-put and process yield.

The multi-billion dollar market for 3D scanning and metrology products is highly fragmented. The primary competition for the various metrology products and solutions we sell include coordinate-measuring machines sold by Hexagon, Zeiss and others, and assorted other 3D measurement technology products offering varying combinations of speed and accuracy. The market for 3D scanning and metrology services is dominated by small regional market participants. Our sales of CyberGage®360 to date have not been significant, and there can be no assurance that CyberGage®360 will ever achieve widespread market acceptance.

**Employees**

As of December 31, 2018, we had 178 full-time employees worldwide, including 43 in sales, marketing and customer support, 61 in manufacturing, purchasing and production operations, 58 in engineering, research and development, and 16 in finance, administration and information services. Of these employees, 115 are located at our corporate headquarters in Minneapolis, Minnesota and 63 are located in other offices (5 in the United Kingdom, 7 in other states throughout the U.S., 39 in Singapore, 7 in China, 3 in Taiwan, 1 in Japan and 1 in Korea). Although we have been successful in attracting and retaining qualified technical personnel, there is an ongoing need for more employees with advanced degrees and training in mathematics, optical physics and other key disciplines. There can be no assurance that we will be able to successfully retain or recruit qualified technical personnel in the future. None of our employees is covered by collective bargaining agreements or are members of a union.

Table of Contents

**Proprietary Protection**

We rely on the technical expertise and know-how of our personnel and trade secret protection, as well as on patents, to maintain our competitive position. We attempt to protect intellectual property by restricting access to proprietary methods by a combination of technical and internal security measures. In addition, we make use of non-disclosure agreements with customers, consultants, suppliers and employees. Nevertheless, there can be no assurance that any of the above measures will be adequate to protect our proprietary technology and it is possible that any of our products could be duplicated by other companies in the same markets in which we participate.

We hold 46 patents (26 U.S. and 20 foreign) on a number of technologies, including the technologies used in our 3D optical sensors, MRS technology, LaserAlign products, SIM sensor technology, inspection systems, WaferSense products, CyberGage®360, SQ3000 and SQ3000™ 3D CMM products, and other products. In addition, we have 21 pending patents (10 U.S. and 11 foreign). We protect the proprietary nature of our software primarily through copyright and license agreements, but also through close integration with our hardware offerings. We utilize 33 registered trademarks (14 U.S. and 19 foreign) and have 1 U.S. trademark registration pending. We also have 13 domain names and several common law trademarks. It is our policy to protect the proprietary nature of our new product developments whenever they are likely to become significant sources of revenue. No guarantee can be given that we will be able to obtain patent or other protection for other products.

As the number of our products increases and the functionality of those products expands, we may become increasingly subject to attempts to duplicate our proprietary technology. We periodically receive communications from third parties asserting that our products infringe, or may infringe, the proprietary rights of these third parties or others. These claims of infringement may lead to protracted and costly litigation, which could require us to pay substantial damages or have the sale of our products stopped by an injunction. Infringement lawsuits or claims could also cause product delays, require us to redesign our products, hinder our ability to sell our products, or make the sale of these products more expensive. In addition, although we do not believe that any of our products infringe the rights of others, there can be no assurance that third parties will not assert infringement claims in the future or that any such assertion will not require us to enter into a royalty arrangement or result in litigation.

**Government Regulation**

Our business is subject to many foreign, federal, state and local legal and regulatory requirements, including those related to securities, employment, international trade, anticorruption, health, safety and the environment, among other matters. Significant costs may arise from these requirements, or from new, modified or more stringent requirements, which could affect our operations and competitive position.

Table of Contents

# ITEM 1A. RISK FACTORS

Our operations are subject to a number of risks and uncertainties that may affect our financial results, and the accuracy of the forward looking statements we make in this Annual Report on Form 10-K. We make statements regarding anticipated product introductions and performance, changes in markets, customers and customer order rates, expenditures in research and development, growth in revenue and improvement in profits, taxation levels, the effects of product pricing, and competition, all of which represent our expectations and beliefs about future events. Our actual results may vary from these expectations because of a number of factors that affect our business. The most important of these factors include the following:

- **We have recently introduced or are in the process of introducing a number of products based upon our 3D MRS technology and the failure of this technology to perform up to our expectations or gain wide-spread market acceptance would materially adversely affect our future anticipated operating results.** We believe our MRS technology is unique in the marketplace based upon its ability to inhibit reflections and offer microscopic quality images at production line speeds. We have high expectations about the prospect for longer-term growth in sales of products based on this technology. We have incorporated the MRS technology into various products, including our 3D AOI offerings, the SQ3000 and SQ3000™ 3D CMM, CyberGage®360 end products for OEM customers, including KLA, Nordson-YESTECH, and others. We also expect to use this technology in other new products, including next generation sensors and systems for semiconductor back-end, mid-end, and advanced packaging inspection and metrology applications. We believe these new products will significantly increase our revenues in the future. If the MRS technology does not meet our performance expectations, if the products we have introduced or are about to introduce based upon the MRS technology do not operate up to specifications, if the market otherwise does not find this technology attractive, or if we are unable to efficiently identify new customers and new applications for this technology given our current sales channels, our operating results for 2019, and expectations for longer-term growth in revenue, would be materially adversely affected.

- **Our business has been and will continue to be significantly impacted by the global economy and uncertainty in the outlook for the global economy makes it more likely that our actual results will differ materially from expectations.** Economic uncertainties affect businesses such as ours in a number of ways, making it difficult to accurately forecast and plan our future business activities, and negatively impacting our operating results. Economic instability or uncertainty could cause tightening of credit in financial markets, may lead consumers and businesses to postpone spending, and may cause our customers to cancel, decrease or delay their existing and future orders with us. In addition, financial difficulties experienced by our suppliers, distributors or customers could result in product delays, increased accounts receivable defaults and inventory challenges. The OEMs and semiconductor manufacturers that purchase our sensors and the manufacturers that purchase our inspection system products are largely dependent on continued demand for consumer and commercial electronics, including smartphones, tablets and computers. Demand for electronics is a function of the health of the economies in the United States and around the world. Sales of our metrology products and services are also dependent upon the health of the global economy and the competitiveness of the end products manufactured by the customers we serve. Our results would be adversely affected in the future if these economies were to experience recessions, or if the products manufactured by our end customers are not successful in the marketplace.

- **World events beyond our control may affect our operations.** Our operations and markets could be negatively affected by world events that effect economies and commerce in specific countries, such as China, Singapore and

Japan, in which we do business. Natural disasters have affected travel patterns and accessibility in these countries in the past and other natural occurrences could affect the business we do in these countries in the future. Terrorist activity or other armed conflicts that could occur in countries in which we do business, labor disputes that impact complex international shipping arrangements, or other unanticipated actions by local populations could affect our ability to do business in specific geographies. Many of the countries in which we do business can be affected by economic forces that are different from the forces that affect the United States and change the amount of business we conduct.

- **Global trade conflicts may negatively impact our sales and results of operations.** Ongoing trade conflicts with other countries, particularly China, may impact our sales and results of operations. Concerns over the impact of the U.S. and China trade war on the global economy may cause our customers to refrain from making investments in capital equipment, which would negatively impact our sales. We or our suppliers source certain raw materials and components from China. If the United States were to increase existing tariff levels or impose new tariffs, our supply chain and costs would be negatively impacted, resulting in an increase in our cost structure and negatively impacting our operating profits.

- **Our operating results have varied, and will likely continue to vary significantly, from quarter to quarter.** Our quarterly operating results have varied in the past and will likely continue to vary significantly from quarter to quarter. For example, our expectation for sales in the first quarter of 2019 is significantly lower than our sales in the fourth quarter of 2018. Some of the factors that may influence our operating results include the following: changes in customer demand for our sensors, inspection systems and metrology products, which is influenced by economic conditions in our markets and the overall health of the global economy; demand for products that use circuit boards and semiconductors; market acceptance of our products and those developed by our OEM customers; competition; seasonal variations in customer demand; the timing, cancellation or delay of customer orders, particularly our 3D MRS-enabled AOI systems and MX600 memory module inspection systems; the timing of product shipments and related customer acceptances; and product development and other costs, including increased research, development, engineering and marketing expenses associated with our introduction of new products and product enhancements, and ongoing sales and marketing activities.

Table of Contents

- **The markets for capital equipment in the electronics assembly and semiconductor industries in which we operate are cyclical, and we cannot predict with precision when market downturns will occur.** We operate in cyclical markets – the electronics assembly and semiconductor capital equipment markets – that periodically adjust independent of global economic conditions. For example, sluggish conditions in the markets for electronics assembly and semiconductor capital equipment emerged late in the fourth quarter of 2018. In the past, we have not been able to predict with accuracy the timing or magnitude of periodic downturns in these markets. Some of these downturns have severely affected our operations and generated several years of unprofitable operations. Ultimately, we have difficulty determining the duration or severity of any market downturns, the strength of any subsequent recoveries, and the long-term impact that economic conditions may have on our business.

- **Sales of sensors to five OEM customers constituted 30% of our revenue in 2018, and the loss of any of these customers could have a materially adverse impact on our results of operations.** Although we anticipate that our future revenue and operations will be less dependent on any particular customer, given recent success with new products based on our high precision 3D MRS sensor technology, and the anticipated future revenue potential of our other products, including those products we anticipate introducing in the future, if the order rates from these five OEM customers are negatively impacted by global economic events or competitive factors, if they choose sensors manufactured by other suppliers, or otherwise terminate their relationships with us, our results of operations could be adversely affected.

- **We generate over 70% of our revenue from export sales that are subject to risks of international operations.** Our export sales are subject to many of the risks of international operations, including:

  - currency controls and fluctuations in currency exchange rates;
  - changes in local market business requirements and increased cost and development time required to modify and translate our products for local markets;
  - inability to recruit qualified personnel in a specific country or region;
  - difficulty in establishing and maintaining relationships with local vendors;
  - differing foreign technical standards;
  - differing regulatory requirements;
  - export restrictions and controls, tariffs and other trade barriers;
  - reduced protection for intellectual property rights;
  - changes in political and economic conditions;
  - potentially adverse tax assessments; and
  - terrorism, disease, or other events that may affect local economies and our access to markets outside the United States.

**Our development and assembly operations in Singapore, and our sales operations in Asia, are subject to unique risks because of the remote nature of the operations.** Our Singapore development and manufacturing operations, and our Asian sales operations, present a number of risks. These risks relate to the retention of personnel, management of product development and operations, management and access to customer and distributor interactions, control over administrative and business processes, regulatory and legal issues and other matters relating to foreign operations. Our financial performance, ability to serve our customers and ability to manufacture and sell products in Asia could be negatively impacted if we are unable to retain our Asian based employees, if it costs more than expected to retain these employees or hire other experienced employees in a timely manner, if we are unable to manage these employees appropriately, or if we are unable to locate suitable sources of components for our products manufactured in Asia.

Table of Contents

**Exchange rate fluctuations may have a significant negative impact on our revenue and results of operations.** Most of our international export sales are negotiated, invoiced and paid in U.S. dollars. Significant fluctuations in the value of the U.S. dollar relative to other currencies could have a negative impact on the price competitiveness of our products relative to foreign competitors and the willingness of customers to purchase our products.

- A significant portion of our cost of revenues, research and development and sales and marketing costs are denominated in the Singapore dollar. In addition, other sales and marketing costs are denominated in British Pounds Sterling and the Chinese Yuan. Our costs will increase and our results will be negatively impacted in future periods, if the U.S. dollar weakens relative to the currencies of these countries. Fluctuations in the relationship between the U.S. dollar and the currencies of other geographies could have a significant negative impact on our future revenue, costs and results of operations.

**Our products could become obsolete.** Our current products, as well as the products we have under development, are designed to operate with the technology that we believe currently exists or may exist for electronic components, printed circuit boards, memory modules and semiconductor manufacturing markets, including semiconductor back-end, mid-end and advanced packaging inspection and metrology applications. The products we develop to meet customer needs and requirements are subject to rapid technological change and, because it takes considerable time to

- develop new products, we must anticipate industry trends, as well as technological developments, in order to effectively compete. Further, because we do not have unlimited development resources, we might choose to forgo the pursuit of what becomes a leading technology or market and devote our resources to technologies and markets that are less successful. If we incorrectly anticipate technology developments or market trends, or have inadequate resources to develop our products to deal with changes in technology and markets, our products could become obsolete, and our future revenue and operating results would be negatively impacted.

**The market for most surface mount capital equipment has become more mature and price competitive.** The electronics capital equipment market for surface mount technologies is becoming more mature, resulting in increased

- price pressure on suppliers of this type of equipment. Consequently, our SMT electronic assembly inspection systems and alignment sensor products have become subject to increased levels of price competition and competition from other suppliers, which may or may not utilize different technology, including lower cost Asian based suppliers.

- **The market for 3D AOI equipment for printed circuit board inspection has become more price competitive, which has negatively impacted our margins.** Pricing for 3D AOI equipment for inspection of printed circuit boards with less demanding features and complexity has become more competitive, resulting in increased price pressure. In some instances, our SQ3000 3D AOI system competes in the marketplace for inspection of printed circuit boards in which the inspection requirements are less complex and stringent. In this segment of the market, we have experienced competitive pressures that have reduced the sales prices for our SQ3000 3D AOI system, which in turn has negatively impacted our revenue and gross margins. If this level of competition were to increase in the future, our revenue and gross margins would be negatively impacted.

- **Because of the high cost of changing equipment, customers in our markets are sometimes resistant to purchasing our products even if they are superior.** We believe that, because of the high cost of

installation and integration of new inspection equipment into production lines, once an SMT customer has selected a vendor's equipment, the customer generally relies upon that equipment and, to the extent possible, subsequent generations of the same vendor's equipment. Accordingly, unless our systems offer performance or cost advantages that outweigh the expense of installing and integrating new systems, it may be difficult for us to achieve significant sales to a customer that currently uses a competitor's equipment.

- **Our ability to compete in the markets for our products is dependent upon our ability to recruit new capable channel partners and direct sales employees and the sales skills of our channel partners and employees.** In order to generate significant incremental revenue in the future, we need to expand and enhance our sales capabilities by recruiting new, high quality channel partners and sales employees. Our efforts to increase the size and capability of our direct sales team and channel partners will increase our cost structure. If we are unable to successfully improve our direct sales team and sales channel, our future sales will be negatively impacted, and we will not obtain an adequate return on the increase in our cost structure. To the extent our competitors have relationships with stronger channel partners, it may be difficult for us to achieve significant incremental revenue, even if our products are technologically superior.

- **Competitors in Asia may be able to compete favorably with us based on lower production and employee costs.** We compete with large multinational companies when selling our inspection system products. These competitors are able to take advantage of greater financial resources and larger sales distribution networks. We also compete with new Asian based suppliers, many of which may have lower overall production and employee costs and are willing to offer their products at lower selling prices to customers.

- **We are exposed to credit risk through sales to our OEM customers and distributors of our inspection system and metrology products.** We sell our products through key OEM customers, and usually have significant credit exposure with respect to these customers. In addition, we sell our inspection system and metrology products through a network of international distributors. These distributors tend to be small and have limited financial resources and access to capital. Although these distributors do not hold our products in inventory for re-sale, we are exposed to credit risk and would incur losses if they are unable to pay for the products they have purchased from us.

Table of Contents

- **We are dependent upon outside suppliers for components of our products, and delays in or unavailability of those components would adversely affect our results.** We use outside contractors to manufacture the components used in many of our products and some of the components we order require significant lead times that could affect our ability to sell our products if the components are not available. In addition, if these components do not meet stringent quality requirements or become obsolete, there could be delays in the availability of our products, and we could be required to make significant investments in designing replacement components.

- **Breaches of our network security could expose us to losses.** We manage and store on our network systems various proprietary information and sensitive or confidential data relating to our operations and products. There has been an increasing incidence of unauthorized access to the computer networks of various technology companies. Computer programmers and hackers may be able to gain unauthorized access to our network system and steal proprietary information, compromise confidential information, create system disruptions, or cause shutdowns. These parties may also be able to develop and deploy viruses, worms, and other malicious software programs that disrupt our operations and create security vulnerabilities. Attacks on our network systems could result in significant losses, compromise our competitive advantages and damage our reputation with customers.

- **Our efforts to protect our intellectual property may be less effective in certain foreign countries, where intellectual property rights are not as well protected as in the United States.** The laws of some foreign countries do not protect our proprietary rights to as great an extent as do the laws of the U.S., and many U.S. companies have encountered substantial problems in protecting their proprietary rights against infringement abroad. Consequently, there is a risk that we may be unable to adequately protect our proprietary rights in certain foreign countries. If this occurs, it would be easier for our competitors to develop and sell competing products in these countries.

- **We may fail to adequately protect our intellectual property and therefore lose our competitive advantage.** Our future success and competitive position depend in part upon our ability to obtain and maintain proprietary technology for our principal product families, and we rely, in part, on patent and trade secret law and confidentiality agreements to protect that technology. If we fail to adequately protect our intellectual property, our competitors may be able to duplicate and enhance the products we have developed. We own or have licensed a number of patents, and have filed applications for additional patents. Any of our pending patent applications may be rejected, and we may be unable to develop additional proprietary technology that is patentable in the future. In addition, the patents that we do own or that have been issued or licensed to us may not provide us with competitive advantages and may be challenged by third parties. Further, third parties may also design around these patents. In addition to patent protection, we rely upon trade secret protection for our confidential and proprietary information and technology. We routinely enter into confidentiality agreements with our employees and other third parties. Even though these agreements are in place, there can be no assurance that trade secrets and proprietary information will not be disclosed, that others will not independently develop technology substantially equivalent to our proprietary technology or otherwise gain access to our trade secrets, or that we can fully protect our trade secrets and proprietary information. Violations by others of our confidentiality agreements and the loss of employees who have specialized knowledge and expertise could harm our competitive position and cause our sales and operating results to decline as a result of increased competition. Costly and time-consuming litigation might be necessary to enforce and determine the scope of our proprietary rights, and failure to obtain or maintain trade secret protection might adversely affect our ability to continue our research or bring products to market.

- **Protection of our intellectual property rights, or the efforts of third parties to enforce their own intellectual property rights against us, may result in costly and time-consuming litigation, substantial damages, lost product sales and/or the loss of important intellectual property rights.** We may be required to initiate litigation in order to enforce any patents issued to or licensed by us, or to determine the scope or validity of a third party's patent or other proprietary rights. Any litigation, regardless of outcome, could be expensive and time consuming, and could subject us to significant liabilities or require us to re-engineer our products or obtain expensive licenses

from third parties. There can be no assurance that any patents issued to or licensed by us will not be challenged, invalidated or circumvented or that the rights granted thereunder will provide us with a competitive advantage. In addition, our commercial success depends in part on our ability to avoid infringing or misappropriating patents or other proprietary rights owned by third parties. We periodically receive communications from third parties asserting that our products infringe, or may infringe, the proprietary rights of these third parties or others. These claims of infringement may lead to protracted and costly litigation, which could require us to pay substantial damages or have the sale of our products stopped by an injunction. Infringement lawsuits or claims could also cause product delays or require us to redesign our products and these delays could result in the loss of substantial revenues. We may also be required to obtain a license from the third party or cease activities utilizing the third party's proprietary rights. We may not be able to enter into such a license or such a license may not be available on commercially reasonable terms. Accordingly, the patent infringement litigation or claims could hinder our ability to sell our products, or make the sale of these products more expensive.

Table of Contents

- **We have significant deferred tax assets recorded on our balance sheet based on the income tax laws and income tax rates at which they are expected to be utilized in the future. Our ability to utilize these deferred tax assets is dependent on our ability to generate sufficient profits in future periods.** A change in income tax laws or a further reduction in income tax rates in the future could require us to write-down the value of our deferred tax assets. The amount of any write-down could be large and may result in a significant charge against future earnings. Our ability to utilize our deferred tax assets and realize their value is dependent upon our ability to generate sufficient levels of profitability and taxable income in future periods. If we do not generate sufficient profits and taxable income in future periods, we most likely would be required to record a valuation allowance against our deferred tax assets, resulting in a significant charge against earnings.

- **Our stock price is highly volatile.** The trading price of our common stock fluctuates significantly in response to, among other risks, the risks described elsewhere in this Annual Report on Form 10-K, as well as:
  - conditions or trends in the industry in which we operate
  - quarterly variations in our operating results
  - fluctuations in the stock market in general and market prices for the stock of companies that provide sensing technology solutions in particular
  - changes in financial estimates by us or securities analysts and recommendations by securities analysts
  - changes in capital structure, including issuance of additional debt or equity to the public and
  - transactions in our common stock by major investors and certain analyst reports, news and speculation.

- **The absence of significant market liquidity in our common stock could impact the ability of our shareholders to purchase and sell larger blocks, the attractiveness of our stock to institutional shareholders, and the market value of our common stock.** There were 7,100,825 shares of our common stock outstanding as of December 31, 2018. Although our common stock is traded in the NASDAQ Global Market, in part because of the number of shares we have outstanding and available for trading, the daily trading volume in our stock is low, averaging less than 50,000 shares per day. Shareholders wishing to purchase or sell larger blocks of stock may not be able to do so quickly, and disposal by any shareholder of a significant block of stock could adversely affect the sale price in the marketplace. Further, institutional investors often have policies against investment in stock that is illiquid, and many institutional investors may elect not to purchase or hold our stock because of the inability to dispose of it. Lack of institutional interest in our common stock can negatively impact its market price and liquidity.

- **We must attract, engage, retain and integrate key research and development employees in order to be successful, and failure to do so could have an adverse effect on our ability to profitably grow our business.** Identifying, hiring, developing, training and retaining highly-skilled research and development employees is critical to our future, and competition for these types of employees is intense. Failure to successfully hire key research and development employees or the loss of key research and development employees could have a significant negative impact on our ability to create innovative new products, effectively compete in the markets we serve, and on our ability to profitably grow our business.

- **We are dependent on several key employees, including Dr. Subodh Kulkarni, our President and Chief Executive Officer, for new product innovation and much of the sales, marketing and business development activity related to our products (especially our MRS sensors).** These key employees perform a critical role for us

with respect to product strategy and new product development. Also, they have been instrumental in development and expansion of our relationships with key OEM customers, including KLA and Nordson-YESTECH. If the employment of Dr. Kulkarni and other key employees with CyberOptics were to end for any reason, our ability to develop innovative products and achieve sustained long-term revenue growth may be negatively impacted.

Table of Contents

## ITEM 1B. UNRESOLVED STAFF COMMENTS

Not applicable.

## ITEM 2. PROPERTIES

We lease a 61,208 square foot mixed office and warehouse facility built to our specifications in Golden Valley, Minnesota, which functions as our corporate headquarters and primary manufacturing facility for our sensor products, including those used in our inspection system and metrology products. Our lease for the Golden Valley facility expires July 31, 2026, contains a rent escalation clause and one renewal option of five years.

We lease a 19,805 square foot mixed office and warehouse facility in Singapore that serves as a sales, development and final assembly and integration facility for our inspection system products. Our lease for the Singapore facility expires on July 24, 2020 and contains a rent escalation clause and one three-year renewal option.

As of December 31, 2018, we also have operating leases in the United Kingdom and China, which expire in May 2023 and November 2020, respectively.

## ITEM 3. LEGAL PROCEEDINGS

We are not currently subject to any material pending or threatened legal proceedings.

## ITEM 4. MINE SAFETY DISCLOSURES

None.

Table of Contents

# PART II.

## ITEM 5. MARKET FOR REGISTRANT'S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES

Our common stock is traded on the Nasdaq Global Market under the trading symbol "CYBE".

As of February 28, 2019, there were approximately 200 holders of record of our common stock and approximately 3,000 beneficial holders. We have never paid a dividend on our common stock. Dividends are payable at the discretion of the Board of Directors out of funds legally available. Our Board has no current intention of paying dividends.

## ITEM 6. SELECTED FINANCIAL DATA

Not applicable.

Table of Contents

# ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

**Overview**

As a leading global developer and manufacturer of high precision 3D sensors, our strategy is to leverage our 3D sensor technologies in our three key vertical markets: surface mount technology ("SMT"); semiconductor; and metrology. A key element in our strategy is the continued development and sale of new high precision 3D sensors based on our proprietary multi-reflection suppression ("MRS") technology. We believe that MRS is a break-through optical technology for high precision inspection and metrology, with the potential to expand our markets in the future.

Manufacturing yield challenges as electronics and semiconductors become more complex are driving the need for more precise inspection and metrology. As a result, we believe 3D inspection and metrology represent high-growth segments in both the SMT and semiconductor capital equipment markets. We expect a growing number of opportunities in the markets for SMT and semiconductor inspection and metrology, because our 3D MRS technology platform is well suited for many of these applications, particularly with respect to complex circuit boards and semiconductor back-end, mid-end and advanced packaging inspection and metrology applications. We are taking advantage of current market trends by deploying our 3D MRS sensor technology in the following products:

- Our SQ3000 and SQ3000™ 3D CMM AOI systems, which are designed to expand our presence in SMT and semiconductor markets requiring high precision measurement and inspection. In these markets, identifying defects has become highly challenging and critical due to smaller and more complex electronics packaging and increasing component density on circuit boards. The SQ3000™ 3D CMM, which was launched in the second half of 2017, combines automated optical inspection and metrology functionality in a single product. Manufacturers in a variety of industries, including the SMT and semiconductor markets can use the SQ3000™ 3D CMM as an in-line or off-line metrology tool to help solve complex manufacturing and product quality challenges.

- We sell high-precision 3D MRS sensors on an OEM basis to manufacturers of inspection and metrology equipment for the SMT and semiconductor industries. We have entered into an agreement to supply KLA with high-precision 3D MRS sensors for its back-end semiconductor packaging inspection systems. We also have entered into an agreement to supply Nordson-YESTECH with high precision 3D MRS sensors for its inspection systems serving the SMT market.

- Our next generation ultra-high resolution 3-micron pixel 3D MRS sensor is capable of measuring feature sizes down to 30 microns accurately and at high speeds, and is suitable for many semiconductor mid-end and advanced packaging inspection and metrology applications. We are targeting one micron, three-sigma accuracy, at speeds that would inspect more than 20 300-millimeter wafers in an hour. We are currently demonstrating this technology to OEMs and system integrators and directly to semiconductor manufacturers. We believe sales of 3D MRS-enabled sensors and systems

for semiconductor back-end, mid-end and advanced packaging inspection and metrology applications represent significant long-term growth opportunities, and we expect sales of sensors and systems for these applications to ramp up in the second half of 2019 and beyond.

Revenue from MRS based products, including 3D AOI systems, high precision 3D MRS sensors and CyberGage®360, increased by $6.8 million or 47% to $21.1 million in 2018, from $14.3 million in 2017. We believe we will be able to increase sales of products based on our MRS technology in the SMT, semiconductor and metrology markets. In particular, we believe inspection and metrology for semiconductor back-end, mid-end and advanced packaging applications represent significant long-term growth opportunities. We anticipate increasing sales of MRS based products by utilizing new OEM customers, system integrators, and by expanding direct sales to end-user customers.

We have continued to invest in our WaferSense® family of products, because fabricators of semiconductors and other customers view these products as valuable tools for improving yields and productivity. Additional WaferSense applications are currently under development. Strong future sales growth is anticipated for the WaferSense® family of products.

Our backlog was $13.6 million at December 31, 2018, a decrease from $19.7 million at September 30, 2018, but up from $11.4 million at December 31, 2017. Our backlog at December 31, 2018, which includes orders of $3.3 million for MX600 memory module inspection systems, was affected by sluggish market conditions that emerged late in the fourth quarter of 2018. As a result, we are forecasting sales of $14.0 to $15.3 million for the first quarter of 2019, which includes $2.7 million of revenue from MX600 order backlog. We believe that anticipated sales growth of our 3D MRS-enabled products and WaferSense sensors should increase our revenues and net income. We believe that we have the resources required to attain our growth objectives, given our available cash and marketable securities balances totaling $25.3 million at December 31, 2018.

Our ability 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.

Table of Contents

**Revenues**

Our revenues increased by 21% to $64.7 million in 2018, from $53.3 million in 2017. The following table sets forth, for the years indicated, revenues by product line (in thousands):

| (In thousands) | 2018 | 2017 | 2016 |
|---|---|---|---|
| High precision 3D and 2D sensors | $ 21,532 | $ 17,079 | $ 18,797 |
| Semiconductor sensors | 13,606 | 11,059 | 10,061 |
| Inspection and metrology systems | 29,582 | 25,195 | 37,382 |
| Total | $ 64,720 | $ 53,333 | $ 66,240 |

Revenues from sales of high precision 3D and 2D sensors increased by $4.4 million or 26% to $21.5 million in 2018, from $17.1 million in 2017, and decreased by $1.7 million or 9% to $17.1 million in 2017, from $18.8 million in 2016. The revenue increase in 2018 primarily resulted from higher sales of 3D MRS-enabled sensors. Sales of 3D MRS sensors increased by $3.5 million or 80% to $7.9 million in 2018, from $4.4 million in 2017. The revenue decrease in 2017 resulted from lower sales of legacy 2D LaserAlign sensors, following a large increase in 2016 when a longstanding OEM customer experienced a significant increase in sales of its products that incorporate our sensors. Sales of high precision 3D MRS sensors increased to $4.4 million in 2017, from $4.0 million in 2016. Sales of high precision 3D and 2D sensors are dependent on the success of our OEM customers selling products that incorporate our sensors. We believe sales of our new 3D MRS enabled sensors will continue to grow in the future, and will represent an increasing percentage of our total high precision 3D and 2D sensor sales. However, quarterly sales of high precision 3D and 2D sensors are prone to significant fluctuations, both sequentially and on a year-over-year basis.

Revenues from sales of semiconductor sensors, principally our WaferSense® line of products, increased by $2.5 million or 23% to $13.6 million in 2018, from $11.1 million in 2017, and increased by $1.0 million or 10% to $11.1 million in 2017, from $10.1 million in 2016. The sales increases in 2018 and 2017 were due to favorable conditions in the markets for semiconductor equipment and manufacturing, the growing acceptance of our WaferSense® products as important productivity enhancement tools by semiconductor manufacturers, and improved account penetration at major semiconductor manufacturers and capital equipment suppliers. We anticipate that the benefits from growing market awareness and new product introductions will lead to additional WaferSense® product sales in future periods.

Revenues from sales of inspection and metrology systems increased by $4.4 million or 17% to $29.6 million in 2018, from $25.2 million in 2017, and decreased by $12.2 million or 33% to $25.2 million in 2017, from $37.4 million in 2016. The revenue increases in 2018 primarily resulted from higher sales of 3D MRS-enabled SQ3000 3D

AOI systems, including the new SQ3000™ 3D CMM system, and $1.1 million of revenue from sales of MX600 memory module inspection systems. Sales of SQ3000 and SQ3000™ 3D CMM systems increased by $3.4 million or 36% to $12.9 million in 2018, from $9.5 million in 2017. Revenues from sales of inspection and metrology systems declined in 2017 because higher sales of SQ3000 3D AOI products were unable to offset lower sales of legacy systems. In addition, there were no sales of MX600 memory module inspections systems in 2017, compared to $5.7 million of sales from MX600 systems in 2016. Sales of SQ3000 3D MRS-enabled AOI systems increased by $1.3 million or 16% to $9.5 million in 2017, from $8.1 million in 2016. Sales of SQ3000 systems in 2016 benefited from follow-on orders totaling approximately $4.7 million from a key customer that manufactures a next-generation consumer electronics product.

We believe a growing number of companies are transitioning from 2D AOI to 3D AOI systems to meet the increasingly demanding product inspection requirements in the semiconductor, electronics and industrial markets. As a result, demand for 3D AOI systems is growing rapidly. We anticipate sales of 3D MRS-enabled SQ3000 3D AOI systems, including the new SQ3000™ 3D CMM system, will represent an increasing percentage of our total inspection and metrology system sales in the future. Also, we expect that the competitive advantages of our unique 3D MRS technology will provide us with an opportunity to capture a greater share of the 3D AOI systems market.

Export revenues totaled $46.4 million or 72% of our revenues in 2018, compared to $38.0 million or 71% of total revenues in 2017, and $53.5 million or 81% of total revenues in 2016. There was no significant change in export revenue as a percentage of total revenue in 2018, when compared to 2017. Export revenue as a percentage of total revenue was higher in 2016 due to significant sales of inspection and metrology systems. A higher proportion of these systems are generally sold outside the United States as compared to our other products.

Table of Contents

**Cost of Revenues and Gross Margin**

Cost of revenues increased by $7.5 million or 26% to $36.1 million in 2018, and decreased by $8.6 million or 23% to $28.6 million in 2017, from $37.2 million in 2016. Fluctuations in cost of revenues were primarily due to the corresponding fluctuations in revenue levels. Revenue mix also contributed to the changes in cost of revenues. Total revenue increased by 21% in 2018 and decreased by 19% in 2017. Items included in cost of revenues that fluctuate with the level of sales include raw materials, direct labor and factory overhead costs.

Total gross margin as a percentage of revenue was 44% in 2018, 46% in 2017, and 44% in 2016. The decrease in gross margin percentage in 2018 compared to 2017, was mainly due to pricing pressures on 2D and 3D inspections systems sold into the broader SMT market, offset in part by a change in mix of products sold. The increase in gross margin percentage in 2017 compared to 2016, was mainly due to a change in the mix of products sold. Sales of higher margin 3D MRS products and WaferSense® products constituted a larger percentage of our total revenue in 2018, compared to 2017 or 2016.

Our markets are highly price competitive, particularly in the electronics assembly and SMT markets. As a result, we have experienced ongoing pressure on our gross margins. We compensate for pressure to reduce the price of our products by introducing new products with more features and improved performance and through manufacturing cost reduction programs. Sales of many products that we have recently introduced or are about to introduce, including our current and future SQ3000 3D AOI systems, 3D MRS sensors and WaferSense products have, or are expected to have, more favorable gross margins than many of our existing products. Our next generation 3D MRS-enabled sensor and system products are being designed for more complex and demanding inspection applications in the SMT and semiconductor markets. Sales prices and gross profit margins for these applications tend to be higher than margins for products sold in the broader SMT market.

**Operating Expenses**

Research and development (R&D) expenses were $8.8 million or 14% of revenues in 2018, $8.0 million or 15% of revenues in 2017, and $8.0 million or 12% of revenues in 2016. The increase in R&D expenses in 2018 was the result of higher compensation costs due to hiring of employees, pay increases for existing employees and bonus accruals for employees working in R&D. In 2017, lower bonus accruals for employees working in R&D were offset by costs related to pay increases and employee additions. Current R&D expenditures are primarily focused on continued development of our MRS technology, including 3D sensor subsystems and commercialization of our next generation ultra-high resolution 3-micron pixel sensor, and ongoing development of new applications for our WaferSense product line.

Selling, general and administrative (SG&A) expenses were $16.4 million or 25% of revenues in 2018, $15.7 million or 29% of revenues in 2017, and $14.8 million or 22% of revenues in 2016. The increase in SG&A expenses in 2018 was due to higher bonus accruals and commissions paid to outside channel partners, resulting from increases in our sales and profitability, when compared to 2017. SG&A expenses in 2018 were decreased by a $159,000 reduction in our allowance for doubtful accounts, primarily resulting from collection of a receivable that was fully reserved for in a prior period. We do not expect further large reductions in our allowance for doubtful accounts in future periods. The increase in SG&A expenses in 2017 was due to additional investment in marketing programs and additional sales and marketing personnel to better penetrate our targeted markets. The cost increases in 2017 were offset in part by lower incentive compensation expenses due to reduced levels of revenue and profitability.

**Interest Income and Other**

Interest income and other includes interest earned on investments and gains and losses associated with foreign currency transactions, primarily intercompany financing transactions associated with our subsidiaries in the United Kingdom, Singapore and China. We recognized gains from foreign currency transactions of $72,000 in 2018, compared to losses from foreign currency transactions of $177,000 in 2017. We recognized gains from foreign currency transactions of $207,000 in 2016.

**Provision for Income Taxes**

We recorded income tax expense of $752,000 in 2018, compared to income tax benefits of $404,000 in 2017 and $5.2 million in 2016. Our income tax expense in 2018 reflected an effective income tax rate of approximately 21%, which was primarily impacted by the Global Intangible Low Tax Income (GILTI), offset by the favorable benefits from U.S. federal R&D tax credits and excess tax benefits from employee share-based compensation. The non-cash income tax benefit recorded in 2017 was primarily due to a significant change in income tax law contained in the Tax Cuts and Jobs Act, which was enacted into law in December 2017. Prior to passage of the new tax law, we had recorded a $2.7 million deferred tax liability for the outside basis difference related to the undistributed earnings of our Singapore subsidiary. Under the new tax law, the prior system of taxing U.S. corporations on the foreign earnings of their non-U.S. subsidiaries when such earnings were repatriated was replaced with a partial territorial system that provides a 100% dividends-received-deduction for foreign-source dividends received from 10%-or-more owned foreign corporations. The benefit from eliminating the deferred tax liability for the undistributed earnings of our Singapore subsidiary was offset in part by the write-down of our deferred tax assets to reflect the 21% corporate income tax rate in the new tax law. Our income tax benefit in 2017 also includes $227,000 of excess tax benefits from employee share-based compensation. The non-cash income tax benefit recorded in 2016 reflects a $9.6 million reduction in the valuation allowances recorded against our deferred tax assets from utilization of available net operating loss carry forwards and our determination that significant valuation allowances were no longer needed for our U.S. and Singapore based deferred tax assets.

Table of Contents

We have significant deferred tax assets as a result of temporary differences between the taxable income on our tax returns and U.S. GAAP income, research and development tax credit carry forwards and federal, state and foreign net operating loss carry forwards. A deferred tax asset generally represents future tax benefits to be received when temporary differences previously reported in our consolidated financial statements become deductible for income tax purposes, when net operating loss carry forwards could be applied against future taxable income, or when tax credit carry forwards are utilized on our tax returns. We assess the realizability of our deferred tax assets and the need for a valuation allowance based on the guidance provided in current financial accounting standards.

Significant judgment is required in determining the realizability of our deferred tax assets. The assessment of whether valuation allowances are required considers, among other matters, the nature, frequency and severity of any current and cumulative losses, forecasts of future profitability, the duration of statutory carry forward periods, our experience with loss carry forwards not expiring unused and tax planning alternatives. In analyzing the need for valuation allowances, we first considered our history of cumulative operating results for income tax purposes over the past three years in each of the tax jurisdictions in which we operate, our financial performance in recent quarters, statutory carry forward periods and tax planning alternatives. In addition, we considered both our near-term and long-term financial outlook. After considering all available evidence (both positive and negative), we concluded that recognition of valuation allowances for substantially all of our U.S. and Singapore based deferred tax assets was not required at December 31, 2018 or December 31, 2017. Our conclusions regarding the realizability of our deferred tax assets caused us to substantially reduce the valuation allowances recorded against our U.S. and Singapore based deferred tax assets in the fourth quarter of 2016, which resulted in recognition of a significant non-cash income tax benefit.

We file income tax returns in the United States and various state and foreign jurisdictions. Our federal income tax returns for years after 2014 are still subject to examination by the Internal Revenue Service. We are no longer subject to state and local income tax examinations for years prior to 2014. The Inland Revenue Authority of Singapore is reviewing our 2016 and 2015 income tax returns. We anticipate that the outcome of these audits will not have a significant impact on our financial position or results of operations.

**Liquidity and Capital Resources**

Our cash and cash equivalents increased by $2.3 million in 2018. Proceeds of $4.1 million from operating activities, proceeds of $8.6 million from maturities and sales of marketable securities, and proceeds of $621,000 from stock option exercises and share purchases under our employee stock purchase plan added to our cash and cash equivalents. These sources of cash were partially offset by purchases of marketable securities totaling $8.9 million and purchases of fixed assets and payment of capitalized patent costs totaling $2.1 million. Our cash and cash equivalents fluctuate in part because of sales and maturities of marketable securities and investment of cash balances in marketable securities, and from other sources of cash. Accordingly, we believe the combined balances of cash and

marketable securities provide a more reliable indication of our available liquidity than cash balances alone. Combined balances of cash and marketable securities increased by $2.6 million to $25.3 million as of December 31, 2018, from $22.7 million as of December 31, 2017.

Operating activities provided $4.1 million of cash in 2018. The amount of cash provided by operations was favorably impacted by our net income of $2.8 million. Net income was affected by non-cash expenses totaling $3.5 million for depreciation and amortization, recovery of doubtful accounts, deferred taxes, non-cash gains from foreign currency transactions, share-based compensation costs, and gains and losses on our available for sale securities. Changes in operating assets and liabilities providing cash included an increase in accounts payable of $4.3 million and an increase in accrued expenses of $1.8 million. Changes in operating assets and liabilities using cash included an increase in accounts receivable of $4.9 million, an increase in inventories of $2.8 million, and an increase in other assets of $542,000. Accounts payable increased due to the timing of inventory purchases, with more materials being acquired in the later part of the fourth quarter of 2018. The timing of these purchases resulted in a higher accounts payable balance at December 31, 2018. The increase in accrued expenses was primarily due to 2018 bonus accruals that we expect to pay in 2019, and a $541,000 increase in accrued lease incentive resulting from an amendment and extension of the lease for our headquarters and manufacturing facility in Golden Valley Minnesota. Accounts receivable increased due to higher sales levels in the fourth quarter of 2018, as compared to the fourth quarter of 2017. Inventories increased due to a change in the mix of 3D MRS sensors that we offer for sale, an increase in component purchases to support higher sales of 3D MRS sensors originally anticipated for the first quarter of 2019, and the purchase of materials for MX600 memory module inspection systems. The increase in other assets was due to advance payments to a key supplier of materials for the MX600 systems.

Operating activities used $2.4 million of cash in 2017. The amount of cash used in operations was favorably impacted by our net income of $1.3 million. Net income was affected by non-cash expenses totaling $3.0 million for depreciation and amortization, recovery of doubtful accounts, deferred taxes, non-cash losses from foreign currency transactions and share-based compensation costs. Changes in operating assets and liabilities using cash included an increase in inventories of $3.2 million, a decrease in accounts payable of $2.1 million and a decrease in accrued expenses of $1.6 million. Changes in operating assets and liabilities providing cash included a decrease in accounts receivable of $171,000. Inventories increased because materials were purchased to support higher sales of our new products that were originally anticipated in the second half of 2017. Actual sales of these products were lower than anticipated during this six-month period. The use of cash for

accounts payable resulted from the timing of the additional inventory purchases and corresponding payments to suppliers. Accrued expenses decreased due to payment in 2017 of incentive compensation and bonuses accrued in 2016. The accounts receivable decrease was due to lower sales levels in the fourth quarter of 2017, when compared to the fourth quarter of 2016.

Table of Contents

Investing activities used $2.4 million of cash in 2018 and $1.9 million of cash in 2017. Changes in the level of investment in marketable securities, resulting from the purchases, sales and maturities of those securities used $346,000 of cash in 2018 and $544,000 of cash in 2017. We used $2.1 million of cash in 2018 and $1.3 million of cash in the 2017 for the purchase of fixed assets and capitalized patent costs. Our fixed asset purchases in 2018 included $571,000 of leasehold improvements related to a landlord incentive for the expansion and remodeling of our headquarters and manufacturing facility in Golden Valley Minnesota.

Financing activities from stock option exercises and share purchases under our employee stock purchase plan provided $744,000 of cash in 2018 and $636,000 of cash in 2017. Financing activities used $240,000 of cash in 2017 for repurchases of our common stock. Payments for employee tax withholding obligations for shares withheld upon the vesting of restricted stock units and exercises of stock options used $123,000 of cash in 2018 and $35,000 of cash in 2017.

At December 31, 2018, we did not have any relationships with unconsolidated entities or financial partnerships, such as entities often referred to as structured finance or special purpose entities. These entities are established by some companies for the purpose of establishing off-balance sheet arrangements or for other contractually narrow or limited purposes.

In May 2018, we finalized an amendment of the lease for our Golden Valley, Minnesota facility, which functions as our corporate headquarters and primary manufacturing facility for our sensor and semiconductor products. The amendment provides that we will lease 61,208 square feet of space in our current location through July 31, 2026. Prior to the amendment, the lease provided for 50,724 square feet of space and expired on December 31, 2018. The increase in the size of the Golden Valley, Minnesota facility has allowed us to consolidate the operations previously carried out at our Bloomington, Minnesota facility, the lease for which expired on December 31, 2018. Future lease payments due under the amended lease, including estimated operating costs, for the period from January 1, 2019 through July 31, 2026, are approximately $7.9 million. We anticipate that our expenses for rent, facility operating costs and leasehold amortization will increase by approximately $185,000 per year beginning in 2019.

Except for obligations under facility leases and purchase contracts, we had no material commitments for expenditures as of December 31, 2018. Purchase commitments for inventory can vary based on the volume of revenue and resulting inventory requirements.

Our cash, cash equivalents and marketable securities totaled $25.3 million at December 31, 2018. We believe that on-hand cash, cash equivalents and marketable securities, coupled with anticipated future cash flow from operations, will be adequate to fund our cash flow needs for the foreseeable future, including the contractual obligations mentioned above.

**Inflation and Foreign Currency Transactions**

Changes in our revenues have resulted primarily because of changes in the level of unit shipments due to competitive factors and the relative strength or weakness of the worldwide electronics assembly and semiconductor fabrication capital equipment markets. We believe that inflation has not had a significant effect on our operations.

Most of our international export sales are negotiated, invoiced and paid in U.S. dollars. We manufacture our inspection 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 our products.

**Critical Accounting Policies and Estimates**

Our discussion and analysis of financial condition and results of operations is based upon our consolidated financial statements, which have been prepared in accordance with GAAP. The preparation of these consolidated financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent assets and liabilities. On an on-going basis, we evaluate these estimates, including estimates related to revenue recognition, bad debts, warranty obligations, inventory valuation, intangible assets, and income taxes. We base these estimates on historical experience and on various other assumptions that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Our actual results may differ from these estimates under different assumptions or conditions. The estimates and judgments that we believe have the most effect on our reported financial position and results of operations are as follows:

Table of Contents

***Revenue Recognition.***

***Change in Revenue Accounting***

Effective January 1, 2018, we adopted Accounting Standards Update (ASU) 2014-9, *Revenue from Contracts with Customers* and the related amendments (also referred to as Topic 606) using the modified retrospective method. Topic 606 was applied to all uncompleted contracts by recognizing the cumulative effect of initially applying Topic 606 as an adjustment to the opening balance of equity at January 1, 2018. Therefore, the comparative financial information for 2017 has not been adjusted and continues to be reported under Topic 605, *Revenue Recognition* (Topic 605). Our adoption of Topic 606 on January 1, 2018 resulted in a $218,000 decrease in retained earnings to record the cumulative effect adjustment.

Accounting for contracts recognized over time under Topic 606 involves the use of various techniques to estimate total contract revenue and costs. Contract estimates are based on various assumptions to project the outcome of future events that may span multiple years. We review and update our contract-related estimates regularly, and record adjustments as needed.

The adoption of Topic 606 caused changes for (1) the impact of volume discounts that represent a material right which will now be estimated and recognized over the contract life rather than on a prospective basis, and (2) revenue will be recognized over time as the products are manufactured under certain contracts where our product is customized rather than at shipment. These changes increased our revenues in 2018 by $81,000, when compared to revenue recognition under Topic 605. Adoption of Topic 606 increased our net income in 2018 by $64,000, or approximately $0.01 per share.

***Revenue Accounting - Topic 606***

Under Topic 606, revenue is measured based on consideration specified in the contract with a customer. A performance obligation is a promise in a contract to transfer a distinct good or service to the customer and is the unit of account in Topic 606. Revenue from all customers, including distributors, is recognized when a performance obligation is satisfied by transferring control of a product or service to a customer. Amounts billed to customers for shipping and handling are included in revenue. Taxes collected from customers and remitted to governmental authorities are excluded from revenue on the net basis of accounting. Accounts receivable are due under normal trade terms, typically 90 days or less.

Sales involving multiple performance obligations typically include the sale of an inspection system or metrology product, installation and training, and in some cases, an extended warranty. When a sale involves multiple performance obligations, we account for individual products and services separately if the customer can benefit from the product or service on its own or with other resources that are readily available to the customer and the product or service are separately identifiable from other promises in the arrangement. The consideration is allocated between separate performance obligations in proportion to their estimated stand-alone selling price. If the stand-alone selling price is not directly observable, we use the cost plus margin approach to estimate stand-alone selling price. Costs related to products delivered are recognized in the period revenue is recognized; including product warranties for periods ranging from 1 to 3 years.

Our performance obligations are satisfied at a point in time or over time as work progresses. Revenue from products and services transferred to customers at a point in time in 2018 totaled $60.6 million, which represented 94% of our total revenue in 2018. Revenue from these contracts is recognized when obligations under the terms of the contract with our customer are satisfied; generally with the transfer of control upon shipment. Sales of some products may require customer acceptance due to performance or other acceptance criteria that is considered more than a formality. For these product sales, revenue is recognized upon notification of customer acceptance.

Revenue from products and services transferred to customers over time in 2018 totaled $4.1 million, which represented 6% of our total revenue in 2018. Periodically, sensor product arrangements with our original equipment manufacturers (OEM's) will create an asset with no alternative use and include an enforceable right to payment. For these arrangements control is transferred over the manufacturing process; therefore, revenue is recognized over time utilizing an input method based on actual costs incurred in the manufacturing process to date relative to total expected production costs. For certain longer duration 3D scanning service projects, we progress bill as the services are performed. These arrangements create an asset with no alternative use and include an enforceable right to payment. For these arrangements, control is transferred over the hours incurred to complete the scanning project; therefore, revenue is recognized over time utilizing an input method based on actual hours incurred relative to total projected project hours. For maintenance and extended warranty contracts, revenue is recognized over time on a straight-line basis over the term of the contract as the customer simultaneously receives and consumes the benefits of the coverage.

***Revenue Accounting - Topic 605***

Revenue from all customers, including distributors, is recognized when all significant contractual obligations have been satisfied and collection of the resulting receivable is reasonably assured. Generally, product revenues are recognized upon shipment under Ex-works terms, and include shipping and handling costs. Revenue from services is recognized as work is performed. Taxes collected from customers and remitted to governmental authorities are excluded from revenue on the net basis of accounting. Estimated returns and warranty costs are recorded at the time of sale. Sales of some inspection system products may require customer acceptance due to performance or other acceptance criteria included in the terms of sale. For these inspection system product sales, revenue is recognized at the time of customer acceptance. Our multiple deliverable arrangements typically include the sale of an inspection system or metrology product, related installation and training and, in some cases, an extended warranty. Revenue from

installation and training are recognized as the services are provided. Revenue from extended warranties is recognized ratably over the warranty period.

Table of Contents

When a sale involves multiple elements, revenue is allocated to each respective element at inception of an arrangement using the relative selling price method. The selling price is determined based on a selling price hierarchy, consisting of vendor specific objective evidence (VSOE), third party evidence or estimated selling price. Management's best estimate of the selling price of inspection system and metrology products is based on the cost of the product and a reasonable margin based on geographic location and competitive market conditions. We use VSOE to establish fair value for extended warranty, installation and training services. If VSOE is not available to establish fair value for extended warranty, installation and training services, we estimate a selling price based on the cost-build-up for the particular service and a reasonable gross margin. Costs related to products delivered are recognized in the period revenue is recognized. Cost of revenues consists primarily of direct labor, manufacturing overhead, materials and components and excludes amortization of intangible assets.

***Allowance for Doubtful Accounts.***

We maintain allowances for doubtful accounts for estimated losses resulting from the inability of our customers to make required payments. In making the determination of the appropriate allowance for doubtful accounts, we consider specific accounts, historical write-offs, changes in customer relationships and credit worthiness and concentrations of credit risk. Specific accounts receivable are written-off once a determination is made that the account is uncollectible. If the financial condition of our customers were to deteriorate, resulting in an impairment of their ability to make payments, additional allowances may be required. The allowance for doubtful accounts was $314,000 at December 31, 2018 and $473,000 at December 31, 2017.

***Allowance for Warranty Expenses.***

We provide for the estimated cost of product warranties at the time revenue is recognized. While we engage in extensive product quality programs and processes, including actively monitoring and evaluating the quality of components provided by suppliers, warranty obligations do arise. These obligations are affected by product failure rates, the costs of materials used and service delivery expenses incurred in correcting a product failure. If actual product failure rates and material or service delivery costs differ from our estimates, revisions to the estimated warranty liability are required and could be material. The allowance for warranties was $789,000 at December 31, 2018 and $767,000 at December 31, 2017.

***Inventory Write Downs.***

We write down inventory for estimated obsolescence or lack of marketability equal to the difference between the cost of inventory and the estimated market value based upon assumptions about future demand and market conditions. We formulate our assumptions regarding future demand and market conditions based on order trends and input from customers regarding their future requirements. If actual market conditions are less favorable than those projected, or if

in the future we decide to discontinue sales and marketing of any of our products, additional inventory write-downs may be required. Excess and obsolete inventories were written down by $718,000 at December 31, 2018 and $748,000 at December 31, 2017.

***Valuation of Intangible and Long-Lived Assets.***

We evaluate the carrying value of goodwill annually on December 31st, and more frequently if management believes indicators of impairment exist. We assess the impairment of identifiable intangible assets, long lived assets and related goodwill whenever events or changes in circumstances indicate the carrying value may not be recoverable. Factors we consider important, which could trigger an impairment review and that we consider when performing our annual goodwill impairment assessment, include the following:

- Significant under-performance relative to expected historical or projected future operating results.
- Significant changes in the manner of our use of the acquired assets or the strategy for our overall business.
- Significant negative industry or economic trends.
- Significant decline in the price of our common stock for a sustained period, and the size of our market capitalization relative to our net book value.
- For intangible and long-lived assets, if the carrying value exceeds the un-discounted cash flows from such asset.
- For goodwill, if the carrying value of our net assets (net book value) exceeds fair value.

Table of Contents

When we determine that the carrying value of intangibles, long-lived assets and related goodwill may not be recoverable based upon the existence of one or more of the above indicators of impairment, we measure any potential impairment based on a projected discounted cash flow method using a discount rate that we believe is commensurate with the risk inherent in our current business model. We utilize the income approach to estimate our fair value. The income approach is a valuation technique under which we estimate future cash flows using financial forecasts. Future estimated cash flows are discounted to their present value to calculate fair value. When determining fair value, we also give consideration to the control premium in excess of our current market capitalization that might be obtained from a third party acquirer. These assumptions require significant judgment and actual results may differ from assumed or estimated amounts.

At December 31, 2018 we had goodwill of $1.4 million. Our recent analysis performed as of December 31, 2018 indicates that our goodwill is not impaired. However, our conclusion could change in the future, if our assumptions about future economic conditions, revenue growth or profitability change. Any resulting impairment charge could have a material effect on our financial position and results of operations in the future.

***Income Taxes.***

Significant judgment is required in determining worldwide income tax expense based upon tax laws in the various jurisdictions in which we operate. We have established reserves for uncertain tax positions by applying the “more likely than not” threshold (i.e., a likelihood of occurrence greater than fifty percent). The recognition threshold is met when an entity concludes that a tax position, based solely on its technical merits, is more likely than not to be sustained upon examination by the relevant taxing authority. Those tax positions failing to qualify for initial recognition are recognized in the first interim period in which they meet the more likely than not standard, or are resolved through negotiation or litigation with the taxing authority, or upon expiration of the statute of limitations. De-recognition of a tax position that was previously recognized occurs when an entity subsequently determines that a tax position no longer meets the more likely than not threshold of being sustained. All tax positions are analyzed periodically and adjustments are made as events warrant modification, such as the completion of audits or the expiration of statutes of limitations, which may result in future charges or credits to income tax expense.

As part of the process of preparing our consolidated financial statements, management is required to estimate income taxes in each of the jurisdictions in which we operate. This process involves estimating the current tax liability, as well as assessing temporary differences arising from the different treatment of items for financial statement and tax purposes. These differences result in deferred tax assets and liabilities, which are recorded on our consolidated balance sheet.

We have significant deferred tax assets as a result of temporary differences between taxable income on our tax returns and U.S. GAAP income, research and development tax credit carry forwards and federal, state and foreign net operating loss carry forwards. A deferred tax asset generally represents future tax benefits to be received when temporary differences previously reported in our consolidated financial statements become deductible for income tax

purposes, when net operating loss carry forwards are applied against future taxable income, or when tax credit carry forwards are utilized on our tax returns. We assess the realizability of our deferred tax assets and the need for a valuation allowance based on the guidance provided in current financial accounting standards.

Significant judgment is required in determining the realizability of our deferred tax assets. The assessment of whether valuation allowances are required considers, among other matters, the nature, frequency and severity of any current and cumulative losses, forecasts of future profitability, the duration of statutory carry forward periods, our experience with loss carry forwards not expiring unused and tax planning alternatives. In analyzing the need for valuation allowances, we first considered our history of cumulative operating results for income tax purposes over the past three years in each of the tax jurisdictions in which we operate, our financial performance in recent quarters, statutory carry forward periods and tax planning alternatives. Finally, we considered both our near and long-term financial outlook. After considering all available evidence (both positive and negative), we concluded that recognition of valuation allowances for substantially all of our U.S. and Singapore based deferred tax assets was not required at December 31, 2018 or December 31, 2017. Our conclusions regarding the realizability of our deferred tax assets caused us to substantially reduce the valuation allowances recorded against our U.S. and Singapore-based deferred tax assets in the fourth quarter of 2016, resulting in recognition of a significant non-cash income tax benefit.

## ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Not applicable

Table of Contents

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

**CONSOLIDATED BALANCE SHEETS**

**CYBEROPTICS CORPORATION**

| (In thousands, except share information) | December 31, 2018 | December 31, 2017 |
|---|---|---|
| **ASSETS** | | |
| Cash and cash equivalents | $ 9,248 | $ 6,944 |
| Marketable securities | 5,771 | 6,670 |
| Accounts receivable, less allowance for doubtful accounts of $314 at December 31, 2018 and $473 at December 31, 2017 | 15,859 | 10,772 |
| Inventories | 16,163 | 14,393 |
| Other current assets | 2,096 | 1,593 |
| Total current assets | 49,137 | 40,372 |
| | | |
| Marketable securities, long-term | 10,322 | 9,073 |
| Equipment and leasehold improvements, net | 2,861 | 2,307 |
| Intangibles, net | 333 | 380 |
| Goodwill | 1,366 | 1,366 |
| Other assets | 259 | 261 |
| Deferred tax assets | 5,422 | 5,742 |
| Total assets | $ 69,700 | $ 59,501 |
| | | |
| **LIABILITIES AND STOCKHOLDERS' EQUITY** | | |
| Accounts payable | $ 8,513 | $ 4,294 |
| Advance customer payments | 636 | 393 |
| Accrued expenses | 3,568 | 2,285 |
| Total current liabilities | 12,717 | 6,972 |
| | | |
| Other liabilities | 629 | 88 |
| Reserve for income taxes | 143 | 159 |
| Total liabilities | 13,489 | 7,219 |
| | | |
| Commitments and contingencies | | |
| | | |
| **Stockholders' equity:** | | |
| Preferred stock, no par value, 5,000,000 shares authorized, none outstanding | — | — |
| Common stock, no par value, 25,000,000 shares authorized, 7,100,825 shares issued and outstanding at December 31, 2018 and 6,979,686 shares issued and outstanding at December 31, 2017 | 35,637 | 34,080 |
| Accumulated other comprehensive loss | (1,690) | (1,409) |
| Retained earnings | 22,264 | 19,611 |
| Total stockholders' equity | 56,211 | 52,282 |
| Total liabilities and stockholders' equity | $ 69,700 | $ 59,501 |

**THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE CONSOLIDATED FINANCIAL STATEMENTS.**

Table of Contents

**CONSOLIDATED STATEMENTS OF OPERATIONS**

**CYBEROPTICS CORPORATION**

| | Year Ended December 31, | |
|---|---|---|
| **(In thousands, except per share amounts)** | **2018** | **2017** |
| Revenues | $64,720 | $ 53,333 |
| Cost of revenues | 36,109 | 28,573 |
| Gross margin | 28,611 | 24,760 |
| Research and development expenses | 8,819 | 8,022 |
| Selling, general and administrative expenses | 16,389 | 15,657 |
| Amortization of intangibles | 44 | 66 |
| Income from operations | 3,359 | 1,015 |
| Interest income and other income (expense), net | 220 | (107) |
| Income before income taxes | 3,579 | 908 |
| Income tax provision (benefit) | 752 | (404) |
| Net income | $2,827 | $ 1,312 |
| Net income per share – Basic | $0.40 | $ 0.19 |
| Net income per share – Diluted | $0.39 | $ 0.19 |
| Weighted average shares outstanding – Basic | 7,028 | 6,946 |
| Weighted average shares outstanding – Diluted | 7,208 | 7,075 |

**THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE CONSOLIDATED FINANCIAL STATEMENTS.**

Table of Contents

**CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME**

**CYBEROPTICS CORPORATION**

| | Year Ended December 31, | |
|---|---|---|
| **(In thousands)** | **2018** | **2017** |
| Net income | $ 2,827 | $ 1,312 |
| **Other comprehensive income (loss), before tax:** | | |
| Foreign currency translation adjustments | (255) | 738 |
| **Unrealized gains (losses) on available-for-sale securities:** | | |
| Unrealized gains (losses) | 26 | (3) |
| Reclassification adjustment for gains included in net income | (3) | — |
| Total unrealized gains (losses) on available-for-sale securities | 23 | (3) |
| Other comprehensive income (loss), before tax | (232) | 735 |
| Income tax provision related to items of other comprehensive income (loss) | 5 | 204 |
| Other comprehensive income (loss), net of tax | (237) | 531 |
| Total comprehensive income | $ 2,590 | $ 1,843 |

**THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE CONSOLIDATED FINANCIAL STATEMENTS.**

Table of Contents

**CONSOLIDATED STATEMENTS OF CASH FLOWS**

**CYBEROPTICS CORPORATION**

| (In thousands) | Year Ended December 31, 2018 | 2017 |
|---|---|---|
| **CASH FLOWS FROM OPERATING ACTIVITIES:** | | |
| Net income | $ 2,827 | $ 1,312 |
| **Adjustments to reconcile net income to net cash provided by (used in) operating activities:** | | |
| Depreciation and amortization | 2,499 | 2,285 |
| Recovery of doubtful accounts | (159) | (48) |
| Deferred taxes | 371 | (297) |
| Foreign currency transaction losses (gains) | (155) | 115 |
| Share-based compensation | 936 | 895 |
| Unrealized loss on available for sale equity security | 37 | — |
| Realized gain on available for sale marketable securities | (3) | — |
| **Changes in operating assets and liabilities:** | | |
| Accounts receivable | (4,928) | 171 |
| Inventories | (2,845) | (3,163) |
| Other assets | (542) | (31) |
| Accounts payable | 4,266 | (2,100) |
| Advance customer payments | 10 | 62 |
| Accrued expenses | 1,782 | (1,627) |
| Net cash provided by (used in) operating activities | 4,096 | (2,426) |
| **CASH FLOWS FROM INVESTING ACTIVITIES:** | | |
| Proceeds from maturities of available-for-sale marketable securities | 8,053 | 6,931 |
| Proceeds from sales of available-for-sale marketable securities | 545 | — |
| Purchases of available-for-sale marketable securities | (8,944) | (7,475) |
| Additions to equipment and leasehold improvements | (1,964) | (1,226) |
| Additions to patents | (115) | (120) |
| Net cash used in investing activities | (2,425) | (1,890) |
| **CASH FLOWS FROM FINANCING ACTIVITIES:** | | |
| Proceeds from exercise of stock options | 525 | 378 |
| Tax payments related to shares withheld for share-based compensation plans | (123) | (35) |
| Common stock repurchases | — | (240) |
| Proceeds from issuance of common stock under employee stock purchase plan | 219 | 258 |
| Net cash provided by financing activities | 621 | 361 |
| Effects of exchange rate changes on cash and cash equivalents | 12 | 259 |
| Net increase (decrease) in cash and cash equivalents | 2,304 | (3,696) |
| Cash and cash equivalents – beginning of period | 6,944 | 10,640 |
| Cash and cash equivalents – end of period | $ 9,248 | $ 6,944 |

**THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE CONSOLIDATED FINANCIAL STATEMENTS.**

Table of Contents

**CONSOLIDATED STATEMENTS OF STOCKHOLDERS'EQUITY**

**CYBEROPTICS CORPORATION**

| (In thousands) | Common Stock Shares | Common Stock Amount | Accumulated Other Comprehensive Loss | Retained Earnings | Total Stockholders' Equity |
|---|---|---|---|---|---|
| BALANCE, December 31, 2016 | 6,902 | $ 32,801 | $ (1,940) | $ 18,037 | $ 48,898 |
| Increase related to adoption of ASU 2016-09 | — | 23 | — | 262 | 285 |
| Exercise of stock options and vesting of restricted stock units, net of shares exchanged as payment | 73 | 378 | — | — | 378 |
| Tax payments related to shares withheld for share-based compensation plans | (7) | (35) | — | — | (35) |
| Share issuances for director compensation | 8 | — | — | — | — |
| Share-based compensation | — | 895 | — | — | 895 |
| Issuance of common stock under Employee Stock Purchase Plan | 19 | 258 | — | — | 258 |
| Repurchase of common stock | (15) | (240) | — | — | (240) |
| Other comprehensive income, net of tax | — | — | 531 | — | 531 |
| Net income | — | — | — | 1,312 | 1,312 |
| BALANCE, December 31, 2017 | 6,980 | 34,080 | (1,409) | 19,611 | 52,282 |
| Adoption of ASU 2016-01 | — | — | (44) | 44 | — |
| Adoption of ASU 2014-09 | — | — | — | (218) | (218) |
| Exercise of stock options and vesting of restricted stock units, net of shares exchanged as payment | 111 | 525 | — | — | 525 |
| Tax payments related to shares withheld for share-based compensation plans | (14) | (123) | — | — | (123) |
| Share issuances for director compensation | 8 | — | — | — | — |
| Share-based compensation | — | 936 | — | — | 936 |
| Issuance of common stock under Employee Stock Purchase Plan | 16 | 219 | — | — | 219 |
| Other comprehensive loss, net of tax | — | — | (237) | — | (237) |
| Net income | — | — | — | 2,827 | 2,827 |
| BALANCE, December 31, 2018 | 7,101 | $ 35,637 | $ (1,690) | $ 22,264 | $ 56,211 |

**THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE CONSOLIDATED FINANCIAL STATEMENTS.**

Table of Contents

**NOTES TO THE CONSOLIDATED FINANCIAL STATEMENTS**

**CYBEROPTICS CORPORATION**

**NOTE 1 - BUSINESS DESCRIPTION AND SIGNIFICANT ACCOUNTING POLICIES**

**Description of Business**

We are a leading global developer and manufacturer of high precision sensing technology solutions. Our products are used in surface mount technology (SMT), semiconductor and metrology markets to significantly improve yields and productivity.

**Principles of Consolidation**

The consolidated financial statements include the accounts of CyberOptics Corporation and its wholly-owned subsidiaries. In these notes to the consolidated financial statements, these companies are collectively referred to as “CyberOptics,” “we,” “us,” or “our.” All significant inter-company accounts and transactions have been eliminated in consolidation.

**Segment Reporting**

We operate in a single reportable segment that includes the design, development and manufacture of high precision sensing technology solutions.

**Use of Estimates**

The preparation of consolidated financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ significantly from those estimates.

**Cash and Cash Equivalents**

We consider all highly liquid investments purchased with an original maturity of 90 days or less to be cash equivalents. Cash and cash equivalents consist of funds maintained in demand deposit accounts, money market accounts, corporate debt instruments and U.S. government backed obligations. Cash and cash equivalent balances, at times, may exceed federally insured limits.

**Marketable Securities**

All marketable securities are classified as available-for-sale and consist of U.S. government and agency backed obligations, certificates of deposit, corporate debt instruments, asset backed securities or equity securities. Marketable securities are classified as short-term or long-term in the consolidated balance sheet based on their maturity date and expectations regarding sales.

Available-for-sale securities are carried at fair value. Unrealized gains and losses for marketable debt securities are reported as a separate component of stockholders' equity until realized. Unrealized gains and losses for marketable equity securities are recognized in net income. Fair values are primarily determined using quoted market prices. The carrying amounts of securities, for purposes of computing unrealized gains and losses, are determined by specific identification. The cost of securities sold is also determined by specific identification.

We monitor the carrying value of our marketable debt securities compared to their fair value to determine whether an other-than-temporary impairment has occurred. Factors considered in determining whether a loss is other-than-temporary include the length of time and extent to which fair value has been less than the cost basis, credit quality and our ability and intent to hold the investment for a period of time sufficient to allow for any anticipated recovery in market value. If a decline in fair value of our marketable debt securities is determined to be other-than-temporary, an impairment charge related to that specific investment is recorded in net income.

See Recent Accounting Developments for additional information related to our adoption of Accounting Standards Update (ASU) 2016-01, *Recognition and Measurement of Financial Assets and Financial Liabilities* (ASU 2016-01).

Cash and marketable securities held by foreign subsidiaries totaled $362,000 at December 31, 2018 and $187,000 at December 31, 2017.

Table of Contents

**Inventories**

Inventories are stated at the lower of cost or net realizable value, with cost determined using the first-in, first-out (FIFO) method. Appropriate consideration is given to deterioration, obsolescence, and other factors in evaluating net realizable value. Demonstration inventories are stated at cost less accumulated amortization, generally based on a 36 month useful life.

Accumulated amortization for demonstration inventories totaled $1.9 million at December 31, 2018 and $1.5 million at December 31, 2017.

**Accounts Receivable and Allowance for Doubtful Accounts**

We extend unsecured credit to our customers in the normal course of business. Allowances for doubtful accounts are maintained for estimated losses resulting from the inability of our customers to make required payments. In making the determination of the appropriate allowance for doubtful accounts, we consider specific accounts, historical write-offs, changes in customer relationships and credit worthiness and concentrations of credit risk. Specific accounts receivable are written-off once a determination is made that the account is uncollectible.

**Equipment and Leasehold Improvements**

Equipment and leasehold improvements are stated at cost. Significant additions or improvements extending asset lives are capitalized, while repairs and maintenance are charged to expense as incurred. In-progress costs are capitalized with depreciation beginning when assets are placed in service. Depreciation is recorded using the straight-line method over the estimated useful lives of the equipment, ranging from one to seven years. Leasehold improvements are amortized using the straight-line method over the shorter of the asset useful life or the underlying lease term, ranging from one to eight years. Gains or losses on dispositions are included in current operations.

**Goodwill**

Goodwill represents the excess of purchase price over the fair value of net assets acquired in a business combination. We have determined that we have one reporting unit. We evaluate the carrying value of goodwill

annually on December 31st and more frequently if management believes indicators of impairment exist. Such indicators could include, but are not limited to (1) a significant adverse change in legal factors or in business climate, (2) unanticipated competition, or (3) an adverse action or assessment by a regulator. We first assess qualitative factors to determine whether it is more likely than not that our fair value is greater than carrying value (i.e. net book value). If we conclude that it is more likely than not that our fair value is greater than carrying value, no further testing is required. If we conclude that it is more likely than not that our fair value is less than carrying value, we conduct a two-step quantitative goodwill impairment test. The first step of the impairment test involves comparing our fair value to carrying value. We estimate our fair value using the income approach. The income approach is a valuation technique under which we estimate future cash flows using financial forecasts. Future estimated cash flows are discounted to their present value to calculate fair value. When considering fair value, we also give consideration to the control premium in excess of our current market capitalization that might be obtained from a third party acquirer. If we determine that our carrying value exceeds fair value, the amount of impairment loss must be measured. The second step of the goodwill impairment test involves comparing the implied fair value of our goodwill with the carrying value of that goodwill. The amount by which the carrying value of the goodwill exceeds its implied value, if any, is recognized as an impairment loss.

On December 31, 2018 and 2017, we performed a qualitative assessment to determine if there was any indication that our goodwill might be impaired. After considering all available evidence, including our financial performance, financial outlook and current market capitalization, we concluded that it is more likely than not that our fair value is greater than carrying value. As a result, no further testing was deemed necessary, and we determined that our goodwill was not impaired. No amounts were recorded for goodwill impairment in 2018 or 2017.

**Patents**

Patents consist of legal and patent registration costs for protection of our proprietary technology. We amortize patent costs on a straight-line basis, based upon their estimated life.

**Long Lived Assets**

Intangible assets subject to amortization and other long-lived assets are reviewed for impairment when events or changes in circumstances indicate that the carrying amount of the assets may not be recoverable. An impairment loss would be recognized when future undiscounted cash flows expected to result from use of the asset and eventual disposition are less than the carrying amount.

**Revenue Recognition**

Effective January 1, 2018, we adopted ASU 2014-9, *Revenue from Contracts with Customers* and the related amendments (also referred to as Topic 606) using the modified retrospective method. Topic 606 was applied to all uncompleted contracts by recognizing the cumulative effect of initially applying Topic 606 as an adjustment to the opening balance of equity at January 1, 2018. Therefore, the comparative financial information for 2017 has not been adjusted and continues to be reported under Topic 605, *Revenue Recognition* (Topic 605). See Recent Accounting Developments and Note 2 for additional information related to our adoption of Topic 606.

Table of Contents

***Revenue Accounting - Topic 606***

Under Topic 606, revenue is measured based on consideration specified in the contract with a customer. A performance obligation is a promise in a contract to transfer a distinct good or service to the customer and is the unit of account in Topic 606. Revenue from all customers, including distributors, is recognized when a performance obligation is satisfied by transferring control of a product or service to a customer. Amounts billed to customers for shipping and handling are included in revenue. Taxes collected from customers and remitted to governmental authorities are excluded from revenue on the net basis of accounting. Accounts receivable are due under normal trade terms, typically 90 days or less.

Sales involving multiple performance obligations typically include the sale of an inspection system or metrology product, installation and training, and in some cases, an extended warranty. When a sale involves multiple performance obligations, we account for individual products and services separately if the customer can benefit from the product or service on its own or with other resources that are readily available to the customer and the product or service are separately identifiable from other promises in the arrangement. The consideration is allocated between separate performance obligations in proportion to their estimated stand-alone selling price. If the stand-alone selling price is not directly observable, we use the cost plus margin approach to estimate stand-alone selling price. Costs related to products delivered are recognized in the period revenue is recognized; including product warranties for periods ranging from 1 to 3 years (see Note 7).

Our performance obligations are satisfied at a point in time or over time as work progresses. Revenue for products and services transferred to customers at a point in time is recognized when obligations under the terms of the contract with our customer are satisfied; generally with the transfer of control upon shipment. Sales of some products may require customer acceptance due to performance or other acceptance criteria that is considered more than a formality. For these product sales, revenue is recognized upon notification of customer acceptance.

Periodically, sensor product arrangements with our original equipment manufacturers (OEM's) will create an asset with no alternative use and include an enforceable right to payment. For these arrangements, control is transferred over the manufacturing process; therefore, revenue is recognized over time utilizing an input method based on actual costs incurred in the manufacturing process to date relative to total expected production costs. For certain longer duration 3D scanning service projects, we progress bill as the services are performed. These arrangements create an asset with no alternative use and include an enforceable right to payment. For these arrangements, control is transferred over the hours incurred to complete the scanning project; therefore, revenue is recognized over time utilizing an input method based on actual hours incurred relative to total projected project hours. For maintenance and extended warranty contracts, revenue is recognized over time on a straight-line basis over the term of the contract as the customer simultaneously receives and consumes the benefits of the coverage.

Accounting for contracts recognized over time under Topic 606 involves the use of various techniques to estimate total contract revenue and costs. Contract estimates are based on various assumptions to project the outcome of future events that may span multiple years. We review and update our contract-related estimates regularly, and record adjustments as needed.

***Practical Expedients - Topic 606***

We generally expense the incremental costs of obtaining a contract when incurred because the amortization period for these costs would be less than one year. These costs primarily relate to sales commissions and are recorded in selling, general and administrative expense in our consolidated statements of operations.

We do not disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less, primarily consisting of product installation and training. We do not adjust the promised amount of consideration for the effects of a significant financing component if we expect, at contract inception, that the period between when we transfer a promised good or service to a customer and when the customer pays for that good or service will be one year or less.

***Revenue Accounting - Topic 605***

Prior to January 1, 2018, revenue from all customers, including distributors, is recognized when all significant contractual obligations have been satisfied, pricing is fixed and determinable and collection of the resulting receivable is reasonably assured. Generally, product revenues are recognized upon shipment under Ex-works terms, and include shipping and handling costs. Revenue from services is recognized as work is performed. Taxes collected from customers and remitted to governmental authorities are excluded from revenue on the net basis of accounting. Estimated returns and warranty costs are recorded at the time of sale. Sales of some inspection system products may require customer acceptance due to performance or other acceptance criteria included in the terms of sale. For these inspection system product sales, revenue is recognized at the time of customer acceptance. Our multiple deliverable arrangements typically include the sale of an inspection system or metrology product, related installation and training and, in some cases, an extended warranty. Revenue from installation and training are recognized as the services are provided. Revenue from extended warranties is recognized ratably over the warranty period.

Table of Contents

When a sale involves multiple elements, revenue is allocated to each respective element at inception of an arrangement using the relative selling price method. Selling price is determined based on a selling price hierarchy, consisting of vendor specific objective evidence (VSOE), third party evidence or estimated selling price. Management's best estimate of the selling price of an inspection system and metrology products is based on the cost of the product and a reasonable margin based on geographic location and competitive market conditions. We use VSOE to establish fair value for extended warranty, installation and training services. If VSOE is not available to establish fair value for extended warranty, installation and training services, we estimate a selling price based on the cost-build-up for the particular service and a reasonable gross margin. Costs related to products delivered are recognized in the period revenue is recognized. Cost of revenues consists primarily of direct labor, manufacturing overhead, materials and components and excludes amortization of intangible assets.

**Foreign Currency Translation**

Financial position and results of operations of our international subsidiaries are measured using local currency as their functional currency. Assets and liabilities of these operations are translated at the exchange rates in effect at each fiscal year-end. Statements of operations accounts are translated at the average rates of exchange prevailing during the year. Translation adjustments arising from the use of differing exchange rates from period to period are included as a cumulative translation adjustment in stockholders' equity.

**Foreign Currency Transactions**

Foreign currency transaction gains and losses are included in interest income and other income (expense), net in the statement of operations. We recognized a foreign currency transaction gain of $72,000 in 2018 and a foreign currency transaction loss of $177,000 in 2017.

**Research and Development**

Research and development (R&D) costs, including software development, are expensed when incurred. Software development costs are required to be expensed until the point that technological feasibility and proven marketability of the product are established; costs otherwise capitalizable after such point also are expensed because they are insignificant. All other R&D costs are expensed as incurred. R&D expenses consist primarily of salaries, project materials, contract labor and other costs associated with ongoing product development and enhancement efforts.

**Advertising Costs**

We expense all advertising costs as incurred. Advertising expense incurred was $314,000 in 2018 and $400,000 in 2017.

**Warranty Costs**

We provide for the estimated cost of product warranties, which cover products for periods ranging from one to three years at the time revenue is recognized.

**Income Taxes**

We evaluate uncertain tax positions using the “more likely than not” threshold (i.e., a likelihood of occurrence greater than fifty percent). The recognition threshold is met when an entity concludes that a tax position, based solely on its technical merits, is more likely than not to be sustained upon examination by the relevant taxing authority. Those tax positions failing to qualify for initial recognition are classified as a gross unrecognized tax benefit until the first interim period in which they meet the more likely than not standard, or are resolved through negotiation or litigation with the taxing authority, or upon expiration of the statute of limitations. De-recognition of a tax position that was previously recognized occurs when an entity subsequently determines that a tax position no longer meets the more likely than not threshold of being sustained.

Only the portion of the unrecognized tax benefit that is expected to be paid within one year is classified as a current liability. As a result, liabilities expected to be resolved without the payment of cash (e.g., resolution due to the expiration of the statute of limitations) or are not expected to be paid within one year are not classified as current. It is our policy to record estimated interest and penalties as income tax expense and tax credits as a reduction in income tax expense.

Deferred income taxes are recorded to reflect the tax consequences in future years of differences between the financial reporting and tax bases of assets and liabilities. Income tax expense is the sum of the tax currently payable and the change in the deferred tax assets and liabilities during the period, excluding changes in deferred tax assets recorded to goodwill. Valuation allowances are established when, in the opinion of management, there is uncertainty that some portion or all of the deferred tax assets will not be realized. We assess the realizability of our deferred tax assets and the need for a valuation allowance based on all positive and negative evidence.

Table of Contents

**Net Income Per Share**

Basic net income per basic share is computed by dividing net income by the weighted average number of common shares outstanding during the period. Net income per diluted share is computed by dividing net income by the weighted average number of common and common equivalent shares outstanding during the period. Common equivalent shares consist of common shares to be issued upon exercise of stock options, vesting of restricted stock units, vesting of restricted shares and from purchases of shares under our employee stock purchase plan, as calculated using the treasury stock method. Common equivalent shares are excluded from the calculation of net income per diluted share if their effect is anti-dilutive.

**Fair Value of Financial Instruments**

The carrying amounts of financial instruments such as cash equivalents, accounts receivable, other assets, accounts payable, accrued expenses and other liabilities approximate their related fair values due to the short-term maturities of these instruments.

**Share-Based Compensation**

All share-based payments to employees, including grants of stock options, are required to be recognized as an expense in our consolidated statements of operations based on the grant date fair value of the award. We utilize the straight-line method of expense recognition over the award's service period for our graded vesting options. The fair value of stock options has been determined using the Black-Scholes model. We account for the impact of forfeitures related to employee share-based payment arrangements when the forfeitures occur. We have classified employee share based compensation within our consolidated statement of operations in the same manner as our cash based employee compensation costs.

See Note 6 to the consolidated financial statements for additional information related to employee share-based compensation. See Recent Accounting Developments for additional information related to our adoption of ASU 2016-09, *Improvements to Employee Share-Based Payment Accounting* (ASU 2016-09).

**Related Party Transactions**

One of our board members serves as the President and Chief Executive Officer of Key Tronic Corporation, and our President and Chief Executive Officer serves on the board of Key Tronic Corporation. Our sales to Key Tronic Corporation totaled $13,000 in 2018 and $133,000 in 2017. Amounts due from Key Tronic Corporation at December 31, 2018 and December 31, 2017 were inconsequential.

**Recent Accounting Developments**

In May 2014, the Financial Accounting Standards Board (the "FASB") issued Topic 606, which provided guidance on the recognition of revenue from contracts with customers. Revenue recognition depicts the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. Topic 606 also requires disclosures regarding the nature, amount, timing and uncertainty of revenue and cash flows arising from contracts with customers. We performed a review of the requirements of the new guidance and identified which of our revenue streams are within the scope of Topic 606. We applied the five-step model of the new standard to a selection of contracts within each of our revenue streams, and compared the results to our current accounting practices. We also performed detailed contract reviews to complete necessary adjustments to our existing accounting policies, and implemented changes to our processes and internal controls to capture new data and address changes in financial reporting. We expanded our consolidated financial statement disclosures to comply with the requirements of Topic 606. We adopted the new standard using the modified retrospective method, with the cumulative effect of initially applying the guidance recognized at the date of initial application. Our adoption of Topic 606 on January 1, 2018 resulted in a $218,000 decrease in retained earnings to record the cumulative effect adjustment. Adoption of Topic 606 increased our revenues in the year ended December 31, 2018 by $81,000, when compared to revenue recognition under Topic 605. Adoption of Topic 606 increased our net income in the year ended December 31, 2018 by $64,000, or approximately $0.01 per share.

On January 1, 2017, we adopted ASU 2016-09, which impacted the accounting for share-based payment transactions, including the income tax consequences, classification of awards as either equity or liabilities, and classification in the consolidated statement of cash flows. At January 1, 2017, we had excess tax benefits from employee share-based payments that were not recognized because current taxes payable had not been reduced. Under the new standard, we are required to recognize the excess tax benefits regardless of whether or not they reduce income taxes payable in the current period. The new standard also requires all excess tax benefits and tax deficiencies to be recognized as income tax expense or benefit in our statement of operations. Prior to our adoption of ASU 2016-09, share-based compensation expense was based on the number of awards that were expected to vest in the future. Under the new standard, we are allowed to account for the impact of forfeitures related to share-based payment arrangements when the forfeitures occur. Recognition of the deferred tax assets for previously unrecognized excess tax benefits and the impact of additional share-based compensation expense resulting from the change in the accounting for stock option forfeitures were required to be applied using a modified retrospective approach. At January 1, 2017, we recorded a $278,000 credit to retained earnings and a corresponding debit to deferred tax assets for previously unrecognized excess tax benefits. We also recorded a $23,000 credit to common stock, a $16,000 debit to retained earnings and a $7,000 debit to deferred tax assets for additional share-based compensation expense related to the change in accounting for stock option forfeitures.

Table of Contents

On January 1, 2018, we adopted ASU 2016-01, which revises the accounting related to (1) the classification and measurement of investments in equity securities and (2) the presentation of certain fair value changes for financial liabilities measured at fair value. The new standard also amends certain disclosure requirements associated with the fair value of financial instruments. ASU 2016-01 requires the fair value measurement of investments in equity securities and other ownership interests in an entity that do not result in consolidation and are not accounted for under the equity method. Entities will need to measure these investments and recognize changes in fair value in net income. Entities will no longer be able to recognize unrealized holding gains and losses on equity securities they classify under current guidance as available-for-sale in other comprehensive income. ASU 2016-01 was effective beginning January 1, 2018 and resulted in a cumulative-effect adjustment to beginning retained earnings, except for guidance relative to equity securities without readily determinable fair values, which is applied prospectively. Our adoption of ASU 2016-01 on January 1, 2018 resulted in a $44,000 increase in retained earnings and accumulated other comprehensive loss.

In February 2016, the FASB issued new lease accounting guidance, ASU 2016-02, *Leases* (also referred to as Topic 842). Under the new standard, at the commencement date, lessees will be required (a) to recognize a lease liability, which is a lessee's obligation to make lease payments arising from a lease, measured on a discounted basis, and (b) to record a right-of-use asset, which is an asset that represents the lessee’s right to use, or control the use of, a specified asset for the lease term. We are required to adopt ASU 2016-02 for our year beginning January 1, 2019, including interim periods within that year. In July 2018, the FASB issued ASU 2018-11, *Leases (Topic 842), Targeted Improvements* (ASU 2018-11), which gives companies the option of applying the new standard at the adoption date, rather than retrospectively to the earliest period presented in the financial statements, with recognition of a cumulative-effect adjustment to the opening balance of retained earnings in the period of adoption. We have chosen the option to apply the new standard at the adoption date and therefore we are not required to restate the financial statements of prior periods, nor will we be required to provide the disclosures required by Topic 842 for those prior periods. Upon adoption, we recognized an approximate $2.6 million right-of-use asset, and an approximate $3.2 million lease liability. Our previously recognized liability for lease incentives recorded under prior accounting standards was eliminated. The cumulative-effect adjustment to the opening balance of retained earnings related to our adoption of ASU 2016-02 was inconsequential. We do not believe that ASU 2016-02 will have a material impact on our results of operations. The impact of ASU 2016-02 is non-cash in nature and will not affect our cash flows. We will expand our financial statement disclosures in future periods.

In January 2017, the FASB issued guidance on simplifying the test for goodwill impairment, ASU 2017-04, *Simplifying the Test for Goodwill Impairment* (ASU 2017-04). Under the new standard, goodwill impairment would be measured as the amount by which a reporting unit’s carrying value exceeds its fair value, but not in an amount in excess of the carrying value of goodwill. The new standard eliminates the requirement to determine goodwill impairment by calculating the implied fair value of goodwill by hypothetically assigning the fair value of a reporting unit to all of its assets and liabilities as if that reporting unit had been acquired in a business combination. ASU 2017-04 is to be applied prospectively to impairment tests beginning January 1, 2020, with early adoption permitted. We are currently evaluating when we will adopt ASU 2017-04 and do not expect the adoption to have a material impact on our consolidated financial statements.

In February 2018, the FASB issued ASU 2018-02, *Reclassification of Tax Effects from Accumulated Other Comprehensive Income* (ASU 2018-02), which allows an entity to elect an option to reclassify the stranded tax effects related to the application of the Tax Cuts and Jobs Act from accumulated other comprehensive loss to retained earnings. The guidance also requires new disclosures regardless of an entity's election. The new standard is effective January 1, 2019 with early adoption permitted, and can be applied either in the period of adoption or retrospectively to all applicable periods. We do not expect the adoption of ASU 2018-02 to have a material impact on our consolidated financial statements.

**NOTE 2 – REVENUE RECOGNITION - TOPIC 606**

***Change in Revenue Accounting***

Effective January 1, 2018, we adopted ASU 2014-9, *Revenue from Contracts with Customers* and the related amendments (Topic 606) using the modified retrospective method. Topic 606 was applied to all uncompleted contracts by recognizing the cumulative effect of initially applying Topic 606 as an adjustment to the opening balance of retained earnings at January 1, 2018. Therefore, the comparative financial information for the year ended December 31, 2018 has not been adjusted and continues to be reported under Topic 605, *Revenue Recognition*.

The adoption of Topic 606 caused changes for (1) the impact of volume discounts that represent a material right which will now be estimated and recognized over the contract life rather than on a prospective basis, and (2) revenue will be recognized over time as the products are manufactured under certain contracts where our product is customized rather than at shipment. These changes increased our revenues in 2018 by $81,000, when compared to revenue recognition under Topic 605. Adoption of Topic 606 increased our net income in 2018 by $64,000, or approximately $0.01 per share.

Table of Contents

***Performance Obligations***

Our revenue performance obligations under Topic 606 are satisfied at a point or over time as work progresses. The following is a summary of our revenue performance obligations for 2018:

| (In thousands) | Revenues | Percent of Revenues |
|---|---|---|
| Revenue recognized over time | $ 4,118 | 6 % |
| Revenue recognized at a point in time | 60,602 | 94 % |
| | $ 64,720 | 100 % |

See Note 12 for additional information regarding disaggregation of revenue.

***Contract Balances***

Contract assets under Topic 606 consist of unbilled amounts from sales where we recognize the revenue over time and the revenue recognized exceeds the amount billed to the customer at a point in time. Accounts receivable are recorded when the right to payment becomes unconditional. Contract liabilities are recognized as revenue when we perform under the contract.

The following summarizes our contract assets and contract liabilities:

| (In thousands) | December 31, 2018 | January 1, 2018 |
|---|---|---|
| Contract assets, included in other current assets | $ — | $ — |
| Contract liabilities, included in advance customer payments/other liabilities | $ 366 | $ 443 |

Changes in contract assets in the year ended December 31, 2018 resulted from unbilled amounts under sensor product arrangements in which revenue is recognized over time. Changes in contract liabilities primarily resulted from reclassification of beginning contract liabilities to revenue as performance obligations were satisfied or for cash received in advance and not recognized as revenue. See Note 8 for changes in contractual obligations related to deferred warranty revenue. Amounts reclassified from beginning contract liabilities to revenue in the year ended December 31, 2018 totaled $354,000. Unsatisfied performance obligations are generally expected to be recognized as revenue over the next

one to three years. There were no impairment losses for contract assets in the twelve months ended December 31, 2018.

**NOTE 3 – MARKETABLE SECURITIES**

Our investments in marketable securities are classified as available-for-sale and consist of the following:

| | December 31, 2018 | | | |
|---|---|---|---|---|
| **(In thousands)** | **Cost** | **Unrealized Gains** | **Unrealized Losses** | **Fair Value** |
| **Short-Term** | | | | |
| U.S. government and agency obligations | $ 3,377 | $ — | $ (20) | $ 3,357 |
| Corporate debt securities and certificates of deposit | 1,787 | 3 | (5) | 1,785 |
| Asset backed securities | 633 | — | (4) | 629 |
| Marketable securities – short-term | $ 5,797 | $ 3 | $ (29) | $ 5,771 |
| **Long-Term** | | | | |
| U.S. government and agency obligations | $ 6,114 | $ 10 | $ (23) | $ 6,101 |
| Corporate debt securities and certificates of deposit | 754 | 1 | (3) | 752 |
| Asset backed securities | 3,422 | 2 | (15) | 3,409 |
| Equity security | 42 | 18 | — | 60 |
| Marketable securities – long-term | $ 10,332 | $ 31 | $ (41) | $ 10,322 |

Table of Contents

| | December 31, 2017 | | | |
|---|---|---|---|---|
| **(In thousands)** | **Cost** | **Unrealized Gains** | **Unrealized Losses** | **Fair Value** |
| **Short-Term** | | | | |
| U.S. government and agency obligations | $ 4,381 | $ — | $ (13) | $ 4,368 |
| Corporate debt securities and certificates of deposit | 1,792 | — | (4) | 1,788 |
| Asset backed securities | 515 | — | (1) | 514 |
| Marketable securities – short-term | $ 6,688 | $ — | $ (18) | $ 6,670 |
| **Long-Term** | | | | |
| U.S. government and agency obligations | $ 4,801 | $ — | $ (33) | $ 4,768 |
| Corporate debt securities and certificates of deposit | 1,189 | — | (10) | 1,179 |
| Asset backed securities | 3,045 | — | (16) | 3,029 |
| Equity security | 42 | 55 | — | 97 |
| Marketable securities – long-term | $ 9,077 | $ 55 | $ (59) | $ 9,073 |

| | **In Unrealized Loss Position For Less Than 12 Months** | | **In Unrealized Loss Position For Greater Than 12 Months** | |
|---|---|---|---|---|
| (In thousands) | **Fair Value** | **Gross Unrealized Losses** | **Fair Value** | **Gross Unrealized Losses** |
| **December 31, 2018** | | | | |
| U.S. government and agency obligations | $ 1,548 | $ (4) | $ 4,608 | $ (39) |
| Corporate debt securities and certificates of deposit | 250 | — | 1,178 | (8) |
| Asset backed securities | 1,023 | (3) | 2,137 | (16) |
| Marketable securities | $ 2,821 | $ (7) | $ 7,923 | $ (63) |
| **December 31, 2017** | | | | |
| U.S. government and agency obligations | $ 5,593 | $ (29) | $ 3,543 | $ (17) |
| Corporate debt securities and certificates of deposit | 478 | (2) | 1,991 | (12) |
| Asset backed securities | 2,312 | (9) | 1,232 | (8) |
| Marketable securities | $ 8,383 | $ (40) | $ 6,766 | $ (37) |

On January 1, 2018, we adopted ASU 2016-01, which requires us to recognize the change in fair value of our equity security in net income rather than in comprehensive income. See Note 1 for additional information regarding our adoption of ASU 2016-01. Our investments in marketable debt securities all have maturities of less than 5 years. Net pre-tax unrealized losses for marketable securities of $54,000 at December 31, 2018 and $22,000 at December 31, 2017 have been recorded as a component of accumulated other comprehensive loss in stockholders' equity. We have determined that the net pre-tax unrealized losses for marketable debt securities at December 31, 2018 and December 31, 2017 were caused by fluctuations in interest rates and are temporary in nature. We review our marketable debt securities to identify and evaluate investments that have indications of possible impairment. Factors considered in determining whether a loss is other-than-temporary include the length of time and extent to which fair value has been less than the cost basis, credit quality and our ability and intent to hold the investment for a period of time sufficient to allow for any anticipated recovery in market value. We received proceeds from the sales of marketable securities of $545,000 in 2018. No marketable securities were sold in 2017. We realized a gain of $3,000 from the sales of marketable securities in 2018. See Note 5 for additional information regarding the fair value of our investments in marketable securities.

Investments in marketable securities classified as cash equivalents of $2.5 million at December 31, 2018 and $1.6 million at December 31, 2017, consist of corporate debt securities and certificates of deposit. There were no unrealized gains or losses associated with any of these securities at December 31, 2018 or December 31, 2017.

Table of Contents

**NOTE 4 - COMPREHENSIVE INCOME (LOSS)**

Reclassification adjustments are made to avoid double counting for items included in comprehensive income (loss) that are also recorded as part of net income.

Reclassifications and taxes related to items of other comprehensive income (loss) are as follows:

| (In thousands) | Year Ended December 31, 2018 | | | Year Ended December 31, 2017 | | |
|---|---|---|---|---|---|---|
| | Before Tax | Tax Effect | Net of Tax Amount | Before Tax | Tax Effect | Net of Tax Amount |
| Foreign currency translation adjustments | $(255) | $— | $(255) | $ 738 | $ (204) | $ 534 |
| Net changes related to available-for-sale securities: | | | | | | |
| Unrealized gains (losses) | 26 | (5) | 21 | (3) | — | (3) |
| Reclassification adjustments for gains included in interest income and other | (3) | — | (3) | — | — | — |
| Total net changes related to available-for-sale securities | 23 | (5) | 18 | (3) | — | (3) |
| Other comprehensive income (loss) | $(232) | $(5) | $(237) | $ 735 | $ (204) | $ 531 |

At December 31, 2018 and December 31, 2017 components of accumulated other comprehensive loss is as follows:

| (In thousands) | Foreign Currency Translation Adjustments | Available-for-Sale Securities | Accumulated Other Comprehensive Loss |
|---|---|---|---|
| Balances at December 31, 2016 | $ (1,928) | $ (12) | $ (1,940) |
| Other comprehensive income (loss) before reclassifications | 534 | (3) | 531 |
| Reclassifications from accumulated other comprehensive loss | — | — | — |
| Net current period other comprehensive income (loss) | 534 | (3) | 531 |
| Balances at December 31, 2017 | $ (1,394) | $ (15) | $ (1,409) |
| Decrease related to adoption of ASU 2016-01 | — | (44) | (44) |
| Other comprehensive income (loss) before reclassifications | (255) | 21 | (234) |
| Reclassifications from accumulated other comprehensive loss | — | (3) | (3) |
| Net current period other comprehensive income (loss) | (255) | 18 | (237) |
| Balances at December 31, 2018 | $ (1,649) | $ (41) | $ (1,690) |

**NOTE 5 - FAIR VALUE MEASUREMENTS**

We determine the fair value of our assets and liabilities based on the exchange price that would be received for an asset or paid to transfer a liability (exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. Valuation techniques used to measure

fair value maximize the use of observable inputs and minimize the use of unobservable inputs. We use a fair value hierarchy with three levels of inputs, of which the first two are considered observable and the last is considered unobservable, to measure fair value. The fair value hierarchy gives the highest priority to quoted prices in active markets for identical assets or liabilities (Level 1). The next highest priority is based on quoted prices for similar assets or liabilities in active markets or quoted prices for identical or similar assets or liabilities in non-active markets or other observable inputs (Level 2). The lowest priority is given to unobservable inputs (Level 3). The following provides information regarding fair value measurements for our marketable securities as of December 31, 2018 and December 31, 2017 according to the three-level fair value hierarchy.

Table of Contents

| (In thousands) | Balance December 31, 2018 | Fair Value Measurements at December 31, 2018 Using Quoted Prices in Active Markets for Identical Assets (Level 1) | Significant Other Observable Inputs (Level 2) | Significant Unobservable Inputs (Level 3) |
|---|---|---|---|---|
| **Marketable securities:** | | | | |
| U.S. government and agency obligations | $ 9,458 | $ — | $ 9,458 | $ — |
| Corporate debt securities and certificates of deposit | 2,537 | — | 2,537 | — |
| Asset backed securities | 4,038 | — | 4,038 | — |
| Equity security | 60 | 60 | — | — |
| Total marketable securities | $ 16,093 | $ 60 | $ 16,033 | $ — |

| (In thousands) | Balance December 31, 2017 | Fair Value Measurements at December 31, 2017 Using Quoted Prices in Active Markets for Identical Assets (Level 1) | Significant Other Observable Inputs (Level 2) | Significant Unobservable Inputs (Level 3) |
|---|---|---|---|---|
| **Marketable securities:** | | | | |
| U.S. government and agency obligations | $ 9,136 | $ — | $ 9,136 | $ — |
| Corporate debt securities and certificates of deposit | 2,967 | — | 2,967 | — |
| Asset backed securities | 3,543 | — | 3,543 | — |
| Equity security | 97 | 97 | — | — |
| Total marketable securities | $ 15,743 | $ 97 | $ 15,646 | $ — |

During the years ended December 31, 2018 and 2017, we owned no Level 3 securities and there were no transfers within the three level hierarchy. A significant transfer is recognized when the inputs used to value a security have been changed which merit a transfer between the disclosed levels of the valuation hierarchy.

The fair value for our U.S. government and agency obligations, corporate debt securities and certificates of deposit and asset backed securities are determined based on valuations provided by external investment managers who obtain them from a variety of industry standard data providers. The fair value for our equity security is based on a quoted market price obtained from an active market.

The carrying amounts of financial instruments such as cash equivalents, accounts receivable, other assets, accounts payable, accrued expenses and other liabilities approximate their related fair values due to the short-term maturities of these instruments. Non-financial assets such as equipment and leasehold improvements, goodwill and intangible assets are subject to non-recurring fair value measurements if they are deemed impaired. We had no re-measurements of non-financial assets to fair value in 2018 or 2017.

## NOTE 6 – SHARE-BASED COMPENSATION

We have three share-based compensation plans that are administered by the Compensation Committee of the Board of Directors. We have an Employee Stock Incentive Plan for officers, other employees, consultants and independent contractors under which we have granted options and restricted stock units to officers and other employees, an Employee Stock Purchase Plan under which shares of our common stock may be acquired by employees at discounted prices, and a Non-Employee Director Stock Plan that provides for automatic grants of shares of our common stock to non-employee directors. New shares of our common stock are issued upon stock option exercises, vesting of restricted stock units, issuances of shares to board members and issuances of shares under our Employee Stock Purchase Plan.

Table of Contents

**Employee Stock Incentive Plan**

As of December 31, 2018, there are 259,789 shares of common stock reserved in the aggregate for issuance pursuant to future awards under our Employee Stock Incentive Plan and 559,453 shares of common stock reserved in the aggregate for issuance pursuant to outstanding awards under our Employee Stock Incentive Plan. Although our Compensation Committee has authority to issue options, restricted stock, restricted stock units, share grants and other share-based benefits under our Employee Stock Incentive Plan, to date only restricted stock units and stock options have been granted under the plan. Options have been granted at an option price per share equal to the market value of our common stock on the date of grant, vest over a four year period and expire seven years after the date of grant. Restricted stock units vest over a four year period and entitle the holders to one share of our common stock for each restricted stock unit. Reserved shares underlying outstanding awards, including options and restricted shares, that are forfeited are available under the Employee Stock Incentive Plan for future grant.

**Non-Employee Director Stock Plan**

As of December 31, 2018, there were 60,000 shares of common stock reserved in the aggregate for issuance pursuant to future restricted share awards under our Non-Employee Director Stock Plan and 16,000 shares of common stock reserved in the aggregate for issuance pursuant to outstanding stock option awards under our Non-Employee Director Stock Plan. Under the terms of the plan, each non-employee director will automatically be granted 2,000 shares of our common stock on the date of each annual meeting at which such director is elected to serve on the board. At our May 11, 2017 annual meeting, our shareholders, upon recommendation of the Board of Directors, approved amendments to the Non-Employee Director Stock Plan that eliminated annual stock option grants for non-employee directors and provided for annual restricted share grants of 2,000 shares of common stock which vest in four equal quarterly installments during the year after the grant date, provided the non-employee director is still serving as a director on the applicable vesting date.

On the date of our 2018 annual meeting, we issued a total of 8,000 shares of our common stock to our non-employee directors. The shares had an aggregate fair market value on the date of grant equal to $130,000 (grant date fair value of $16.25 per share). As of December 31, 2018, 4,000 of these shares were vested. The aggregate fair value of the outstanding unvested shares based on the closing price of our common stock on December 31, 2018 was $71,000.

On the date of our 2017 annual meeting, we issued a total of 8,000 shares of our common stock to our non-employee directors. The shares had an aggregate fair market value on the date of grant equal to $167,000 (grant date fair value of $20.90 per share).

**Stock Option Activity**

The following is a summary of activity in stock options for 2018:

| | Options Outstanding | Weighted Average Exercise Price Per Share |
|---|---|---|
| Outstanding, December 31, 2017 | 568,525 | $ 10.24 |
| Granted | 52,850 | 19.46 |
| Exercised | (89,183) | 7.94 |
| Expired | (500) | 26.40 |
| Forfeited | (8,650) | 14.10 |
| Outstanding, December 31, 2018 | 523,042 | $ 11.48 |
| Exercisable, December 31, 2018 | 360,318 | $ 9.40 |

The intrinsic value of an option is the amount by which the market price of the underlying common stock exceeds the option's exercise price. For options outstanding at December 31, 2018, the weighted average remaining contractual term of all outstanding options was 4.0 years and their aggregate intrinsic value was $3.6 million. At December 31, 2018, the weighted average remaining contractual term of options that were exercisable was 3.22 years and their aggregate intrinsic value was $3.1 million. The aggregate intrinsic value of stock options exercised was $1.0 million in 2018 and $782,000 in 2017. We received proceeds from stock option exercises of $525,000 in 2018 and $378,000 in 2017. The aggregate fair value of options that vested was $616,000 in 2018 and $443,000 in 2017.

The fair value of stock options granted to our employees and non-employee directors was estimated on the date of grant using the Black-Scholes model. The Black-Scholes valuation model incorporates ranges of assumptions that are disclosed in the table below. The risk-free interest rate is based on the United States Treasury yield curve at the time of grant with a remaining term equal to the expected life of the awards. We used historical experience to estimate the expected term, representing the length of time in years, that the options are expected to be outstanding. Expected volatility was computed based on historical fluctuations in the daily price of our common stock.

Table of Contents

For stock options granted in the two year period ended December 31, 2018, we utilized the fair value of our common stock on the date of grant and employed the following key assumptions in computing fair value using the Black-Scholes option-pricing model:

| | 2018 | 2017 |
|---|---|---|
| Risk-free interest rates | 2.70% - 2.71% | 2.14% - 2.15% |
| Expected life in years | 5.00 - 5.35 | 5.00 - 5.29 |
| Expected volatility | 52.79% - 53.68% | 52.30% - 52.86% |
| Dividend yield | 0.00% | 0.00% |
| Weighted average fair value on grant date | $9.59 | $7.36 |

**Restricted Shares and Restricted Stock Units**

Restricted shares are granted under our Non-Employee Director Stock Plan. Restricted stock units are granted under our Employee Stock Incentive Plan. There were 32,350 restricted shares and restricted stock units granted in 2018 (weighted average grant date fair value of $18.67 each). There were 32,200 restricted shares and restricted stock units granted in 2017 (weighted average grant date fair value of $16.77 each). The aggregate fair value of outstanding restricted shares and restricted stock units based on the closing share price of our common stock as of December 31, 2018 was $995,000. The aggregate fair value of restricted shares and stock units that vested, based on the closing share price of our common stock on the vesting date, was $553,000 in 2018 and $453,000 in 2017.

The following is a summary of activity in restricted shares and restricted stock units for 2018:

| Non-vested restricted stock units | Shares | Weighted Average Grant Date Fair Value |
|---|---|---|
| Non-vested at December 31, 2017 | 54,212 | $ 14.86 |
| Granted | 32,350 | 18.67 |
| Vested | (30,151) | 13.84 |
| Forfeited | — | — |
| Non-vested at December 31, 2018 | 56,411 | $ 17.59 |

**Employee Stock Purchase Plan**

We have an Employee Stock Purchase Plan available to eligible U.S. employees. Under terms of the plan, eligible employees may designate from 1% to 10% of their compensation to be withheld through payroll deductions, up to a maximum of $6,500 in each plan year, for the purchase of common stock at 85% of the lower of the market price on the first or last day of the offering period. Purchases under this plan were 16,403 shares in 2018 and 18,404 shares in 2017. At our 2018 annual meeting, our shareholders adopted amendments to the plan increasing the number of shares

authorized for issuance under the plan by 150,000 and extending the expiration date of the plan to August 1, 2028. As of December 31, 2018, 174,469 shares remain available for future issuance under this plan.

**Share-Based Compensation Information**

Pre-tax share-based compensation expense for 2018 includes $675,000 for stock options and restricted stock units, $117,000 for our employee stock purchase plan, and $144,000 for 8,000 restricted shares issued to board members for compensation purposes. Pre-tax stock-based compensation expense for 2017 includes $667,000 for stock options and restricted stock units, $121,000 for our employee stock purchase plan, and $107,000 for 8,000 restricted shares issued to board members for compensation purposes.

| (In thousands) | 2018 | 2017 |
|---|---|---|
| Pre-tax share-based compensation expense | $ 936 | $ 895 |
| Income tax benefits related to share-based compensation | $ 329 | $ 310 |

At December 31, 2018, the total unrecognized compensation cost related to non-vested share-based compensation arrangements was $2.2 million and the related weighted average period over which such cost is expected to be recognized is 2.96 years.

In 2018, we recognized a $303,000 income tax benefit from the exercise of stock options and vesting of share-based payments, including $155,000 of excess tax benefits. In 2017, we recognized a $421,000 income tax benefit from the exercise of stock options and vesting of share-based payments, including $227,000 of excess tax benefits.

Table of Contents

**NOTE 7 - NET INCOME PER SHARE**

Net income per basic share is computed by dividing net income by the weighted average number of common shares outstanding during the period. Net income per diluted share is computed by dividing net income by the weighted average number of common and common equivalent shares outstanding during the period. Common equivalent shares consist of common shares to be issued upon exercise of stock options, vesting of restricted stock units, vesting of restricted shares and from purchases of shares under our Employee Stock Purchase Plan, as calculated using the treasury stock method. Common equivalent shares are excluded from the calculation of net income per diluted share if their effect is anti-dilutive. The components of net income per basic and diluted share were as follows:

| (In thousands except per share amounts) | Net Income | Weighted Average Shares Outstanding | Per Share Amount |
|---|---|---|---|
| **Year Ended 12/31/2018:** | | | |
| Basic | $ 2,827 | 7,028 | $ 0.40 |
| Dilutive effect of common equivalent shares | — | 180 | (0.01) |
| Dilutive | $ 2,827 | 7,208 | $ 0.39 |

| (In thousands except per share amounts) | Net Income | Weighted Average Shares Outstanding | Per Share Amount |
|---|---|---|---|
| **Year Ended 12/31/2017:** | | | |
| Basic | $ 1,312 | 6,946 | $ 0.19 |
| Dilutive effect of common equivalent shares | — | 129 | — |
| Dilutive | $ 1,312 | 7,075 | $ 0.19 |

Potentially dilutive shares excluded from the calculations of net income per diluted share due to their anti-dilutive effect were as follows: 258,000 shares in 2018 and 356,000 shares in 2017.

**NOTE 8 - OTHER FINANCIAL STATEMENT DATA**

Inventories consist of the following:

| | December 31, | |
|---|---|---|
| (In thousands) | 2018 | 2017 |
| Raw materials and purchased parts | $ 8,821 | $ 7,383 |
| Work in process | 2,446 | 1,666 |
| Finished goods | 4,896 | 5,344 |
| Total inventories | $ 16,163 | $ 14,393 |

Equipment and leasehold improvements consist of the following:

| (In thousands) | December 31, 2018 | 2017 |
|---|---|---|
| Equipment | $ 14,983 | $ 14,088 |
| Leasehold improvements | 2,052 | 1,688 |
| | 17,035 | 15,776 |
| Accumulated depreciation and amortization | (14,174) | (13,469) |
| | $ 2,861 | $ 2,307 |

Depreciation and amortization expense related to equipment and leasehold improvements was $1.3 million in 2018 and $1.3 million in 2017.

Table of Contents

Intangible assets consist of the following:

| (In thousands) | December 31, 2018 | | | December 31, 2017 | | |
|---|---|---|---|---|---|---|
| | Gross Carrying Amount | Accumulated Amortization | Net | Gross Carrying Amount | Accumulated Amortization | Net |
| Patents | $ 2,754 | $ (2,533) | $ 221 | $ 2,687 | $ (2,463) | $ 224 |
| Software | 206 | (141) | 65 | 206 | (111) | 95 |
| Marketing assets and customer relationships | 101 | (54) | 47 | 101 | (45) | 56 |
| Non-compete agreements | 101 | (101) | — | 101 | (96) | 5 |
| | $ 3,162 | | | | | |