
**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549**

**FORM 10-K
ANNUAL REPORT
PURSUANT TO SECTIONS 13 OR 15(d)
OF THE SECURITIES EXCHANGE ACT OF 1934**

(MARK ONE)

**ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE
SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2019

OR

**TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES
EXCHANGE ACT OF 1934**

Commission file number 001-06462

TERADYNE, INC.

(Exact Name of Registrant as Specified in Its Charter)

MASSACHUSETTS
(State or Other Jurisdiction of
Incorporation or Organization)

04-2272148
(I.R.S. Employer
Identification Number)

600 RIVERPARK DRIVE
NORTH READING, MASSACHUSETTS
(Address of Principal Executive Offices)

01864
(Zip Code)

Registrant's telephone number, including area code: (978) 370-2700

Securities registered pursuant to Section 12(b) of the Act:

<u>Title of each class</u>	<u>Trading Symbol(s)</u>	<u>Name of each exchange on which registered</u>
Common Stock, par value \$0.125 per share	TER	Nasdaq Stock Market LLC

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 Exchange 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 for 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 every Interactive Data File to be submitted 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 such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of "large accelerated filer," "accelerated filer" and "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act (check one):

Large accelerated filer Accelerated filer Non-accelerated filer Smaller reporting company
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 standards 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 Exchange Act). Yes No

The aggregate market value of the voting stock held by non-affiliates of the registrant as of June 28, 2019 was approximately \$7.3 billion based upon the closing price of the registrant's Common Stock on the Nasdaq Stock Market on that date.

The number of shares outstanding of the registrant's only class of Common Stock as of February 24, 2020 was 166,784,497 shares.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's proxy statement in connection with its 2020 annual meeting of shareholders are incorporated by reference into Part III of this Form 10-K.

TERADYNE, INC.

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TERADYNE, INC.

FORM 10-K

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains “forward-looking statements” within the meaning of the Private Securities Litigation Reform Act of 1995, Section 27A of the Securities Act and Section 21E of the Securities Exchange Act. When used herein, the words “will,” “would,” “believe,” “anticipate,” “plan,” “expect,” “estimate,” “project,” “intend,” “may,” “see,” “target” and other words and terms of similar meaning are intended to identify forward-looking statements although not all forward looking statements contain these identifying words. Forward looking statements involve risks and uncertainties, including, but not limited to, those discussed in the section entitled “Risk Factors” of this annual report on Form 10-K and elsewhere, and in other reports we file with the Securities and Exchange Commission. Readers are cautioned not to place undue reliance on these forward-looking statements which reflect management’s analysis only as of the date hereof and are subject to risks and uncertainties that could cause actual results to differ materially from those stated or implied. Teradyne assumes no obligation to update these forward-looking statements for any reason, except as may be required by law.

PART I

Item 1: *Business*

Teradyne, Inc. (“Teradyne”) was founded in 1960 and is a leading global supplier of automation equipment for test and industrial applications.

We design, develop, manufacture and sell automatic test systems used to test semiconductors, wireless products, data storage and complex electronics systems in the consumer electronics, wireless, automotive, industrial, computing, communications, and aerospace and defense industries. Our industrial automation products include collaborative robotic arms, autonomous mobile robots and advanced robotic control software used by global manufacturing and light industrial customers to improve quality, increase manufacturing and material handling efficiency and decrease manufacturing costs. Our automatic test equipment and industrial automation products and services include:

- semiconductor test (“Semiconductor Test”) systems;
- defense/aerospace (“Defense/Aerospace”) test instrumentation and systems, storage test (“Storage Test”) systems, and circuit-board test and inspection (“Production Board Test”) systems (collectively these products represent “System Test”);
- industrial automation (“Industrial Automation”) products; and
- wireless test (“Wireless Test”) systems.

We have a customer base which includes integrated device manufacturers (“IDMs”), outsourced semiconductor assembly and test providers (“OSATs”), original equipment manufacturers (“OEMs”), wafer foundries, fabless companies that design, but contract with others for the manufacture of integrated circuits (“ICs”), developers of wireless devices and consumer electronics, manufacturers of circuit boards, automotive suppliers, wireless product manufacturers, storage device manufacturers, aerospace and military contractors, and distributors that sell collaborative robots, autonomous mobile robots and wireless test systems. The sales of our products and services are dependent, to a large degree, on customers who are subject to cyclical trends in demand for their products. These cyclical periods have had, and will continue to have, a significant effect on our business because our customers often delay or accelerate purchases in reaction to changes in their businesses and to demand fluctuations in the semiconductor, electronics and industrial automation industries. Historically, these demand fluctuations have resulted in significant variations in our results of operations.

The market for our test products is concentrated with a limited number of significant customers accounting for a substantial portion of the purchases of test equipment. A few customers drive significant demand for our products both through direct sales and sales to the customer's supply partners. We expect that sales of our test products will continue to be concentrated with a limited number of significant customers for the foreseeable future.

In 2019, revenue in our test businesses exceeded our plan as a result of Semiconductor Test demand in China, early 5G test investments and strength in our System Test businesses. The revenue growth of our Industrial Automation business was below our plan. In 2020, we expect continued strong momentum in our test businesses and improvement in the growth of our Industrial Automation businesses.

On February 26, 2018, we acquired Energid Technologies Corporation ("Energid") for a total purchase price of approximately \$27.6 million. Energid's technology enables and simplifies the programming of complex robotic motions used in a wide variety of end markets, ranging from heavy industry to healthcare, utilizing both traditional robots and collaborative robots. Energid is included in our Industrial Automation segment.

On April 25, 2018, we acquired Mobile Industrial Robots ApS ("MiR"), a Danish limited liability company. MiR is a leading maker of collaborative autonomous mobile robots ("AMRs") for industrial applications. The total purchase price was approximately \$197.8 million, which included cash paid of approximately \$145.2 million and \$52.6 million in fair value of contingent consideration payable upon achievement of certain thresholds and targets for revenue and earnings before interest and taxes through 2020. Contingent consideration for 2018 was \$30.8 million and was paid in March 2019. Contingent consideration for 2019 was \$9.1 million and is expected to be paid in March 2020. The remaining maximum contingent consideration that could be paid is \$63.2 million. MiR is included in our Industrial Automation segment.

On January 30, 2019, we acquired all of the issued and outstanding shares of Lemsys SA ("Lemsys") for a total purchase price of approximately \$9.1 million. Lemsys strengthens our position in the electrification trends of vehicles, solar, wind, and industrial applications. Lemsys is included in our Semiconductor Test segment.

On June 3, 2019, we invested \$15.0 million in RealWear, Inc. ("RealWear"). RealWear, a private company, develops and sells advanced wearable technology including industrial, hands-free, head-mounted augmented reality devices that make the workplace safer and more productive. On February 28, 2020, RealWear's debt holder demanded repayment of its \$25.0 million loan to RealWear. As a result, in the fourth quarter of 2019, we recorded an impairment charge of \$15.0 million to reduce our investment in RealWear to zero as of December 31, 2019.

On November 13, 2019, we acquired 100% of the membership interests of AutoGuide, LLC ("AutoGuide"), a maker of high payload AMRs, an emerging and fast growing segment of the global forklift market. The total purchase price was approximately \$81.7 million, which included cash paid of approximately \$57.8 million and \$24.0 million in fair value of contingent consideration payable upon achievement of certain performance targets, extending potentially through 2022. The maximum contingent consideration that could be paid is \$106.9 million. AutoGuide's AMRs are used for material transport of payloads up to 4,500 kg in manufacturing, warehouse and logistics applications. These products complement MiR's lower payload products. AutoGuide is included in our Industrial Automation segment.

Investor Information

We are a Massachusetts corporation incorporated on September 23, 1960. We are subject to the informational requirements of the Securities Exchange Act of 1934 ("Exchange Act"). We file periodic reports, proxy statements and other information with the Securities and Exchange Commission ("SEC"). The SEC maintains an internet site (<http://www.sec.gov>) that contains reports, proxy and information statements and other information regarding issuers that file documents electronically.

You can access financial and other information, including the charters of our Audit Committee, Compensation Committee and Nominating and Corporate Governance Committee, our Corporate Governance Guidelines and Code of Conduct, by clicking the Investors link on our web site at www.teradyne.com. We make available, free of charge, copies of our filings with the SEC, including our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act through our web site as soon as reasonably practicable after filing such material electronically or otherwise furnishing it to the SEC.

Products

Semiconductor Test

We design, manufacture, sell and support Semiconductor Test products and services on a worldwide basis. The test systems we provide are used both for wafer level and device package testing. These chips are used in automotive, industrial, communications, consumer, smartphones, and computer and electronic game applications, among others. Semiconductor devices span a broad range of functionality, from very simple low-cost devices such as appliance microcontrollers, operational amplifiers or voltage regulators to complex digital signal processors and microprocessors as well as memory devices. Semiconductor Test products and services are sold to IDMs that integrate the fabrication of silicon wafers into their business, “Fabless” companies that outsource the manufacturing of silicon wafers, “Foundries” that cater to the processing and manufacturing of silicon wafers, and OSATs that provide test and assembly services for the final packaged devices to both Fabless companies and IDMs. Fabless companies perform the design of integrated circuits without manufacturing capabilities, and use Foundries for wafer manufacturing and OSATs for test and assembly. These customers obtain the overall benefit of comprehensively testing devices and reducing the total costs associated with testing by using our Semiconductor Test systems to:

- improve and control product quality;
- measure and improve product performance;
- reduce time to market; and
- increase production yields.

Our FLEX Test Platform architecture advances our core technologies to produce test equipment that is designed for high efficiency multi-site testing. Multi-site testing involves the simultaneous testing of many devices in parallel. Leading semiconductor manufacturers are using multi-site testing to significantly improve their “Cost of Test” economics. The FLEX Test Platform architecture addresses customer requirements through the following key capabilities:

- A high efficiency multi-site architecture that reduces tester overhead such as instrument setup, synchronization and data movement, and signal processing;
- The IG-XL™ software operating system which provides fast program development, including instant conversion from single to multi-site test; and
- Broad technology coverage by instruments designed to cover the range of test parameters, coupled with a universal slot test head design that allows easy test system reconfiguration to address changing test needs.

FLEX Test Platform purchases are made by IDMs, OSATs, Foundries and Fabless customers. The FLEX Test Platform has become a widely used test solution at OSATs by providing versatile testers that can handle the widest range of devices, allowing OSATs to leverage their capital investments. The broad consumer, automotive and broadband markets have historically driven most of the device volume growth in the semiconductor industry. These markets include smartphones, cell phones, tablets, set top boxes, HDTVs, game controllers, computer graphics, and automotive controllers to name a few. These end use markets continue to be drivers for the FLEX

Test Platform family of products because they require a wide range of technologies and instrument coverage. In 2019, we introduced our next generation UltraFlex^{Plus} tester, the newest member of the UltraFlex family, UltraFlex^{Plus} uses the new PACETTM architecture to deliver superior economics and fast time to market for complex digital devices. The FLEX Test Platform has an installed base of more than 7,000 systems.

Our J750TM test system shares the IG-XL software environment with the family of FLEX Test Platform systems. The J750 is designed to address the highest volume semiconductor devices, such as microcontrollers, that are central to the functionality of almost every consumer electronics product, from small appliances to automobiles. J750 test systems combine compact packaging, high throughput and ease of production test. We extended the J750 platform technology to create the IP750 Image SensorTM test system. The IP750 is focused on testing image sensor devices used in smartphones and other imaging products. We have continued to invest in the J750 platform with new instrument releases that bring new capabilities to existing market segments and expand the J750 platform to new devices that include high end microcontrollers and the latest generation of cameras. The J750 platform has an installed base of over 5,800 systems.

Our Magnum platform addresses the requirements of mass production test of memory devices such as flash memory and DRAM. Flash and DRAM memory are widely used core building blocks in modern electronic products finding wide application in consumer, industrial, and computing equipment. Magnum V, the newest member of the family, is a next generation memory test solution designed for parallel memory test in the flash, DRAM and multi-chip package markets. In 2019, we introduced a high-speed DRAM test version of our Magnum platform called Magnum Epic giving us full product coverage of the memory test market. The Magnum platform has an installed base of over 2,800 systems.

Our ETS platform is used by semiconductor manufacturers and assembly and test subcontractors, primarily in the analog/mixed signal markets that cover more cost sensitive applications. Our proprietary SmartPinTM technology enables high efficiency multi-site testing, on an individual test system, permitting greater test throughput. Semiconductors tested by ETS platform systems are incorporated into a wide range of products in historically high-growth markets, including mobile devices, video/multimedia products, automotive electronics, computer peripherals, and notebook and desktop computers. The newest products from the platform include the ETS-88, a high performance multi-site production test system designed to test a wide variety of high volume commodity and precision devices, and the ETS-800, a high performance multi-site production test system to test high complexity power devices in automotive, industrial and consumer applications. The ETS platform has an installed base of over 5,200 systems.

Lemsys SA, which we acquired in January 2019, has added a high power discrete device tester to our portfolio of semiconductor testers. Lemsys's testers address the emerging segment for high power discrete devices used in electric vehicles, wind and solar power generation and other high power industrial applications.

System Test

Our System Test segment is comprised of three business units: Defense/Aerospace, Storage Test and Production Board Test.

Defense/Aerospace

We are a leading provider of high performance test systems, subsystems, instruments and service for the defense and aerospace markets. Our test products are used to ensure the readiness of military and commercial aerospace electronics systems. New programs, such as tactical aircraft and missile systems, as well as upgrade programs, continue to fuel the demand for high performance test systems in this market. Our test products are well-suited to the demands of defense/aerospace electronics manufacturers and repair depots worldwide. Our leadership in this market is underscored by our success with major Department of Defense programs across all U.S. military service branches and many allied defense services worldwide.

Storage Test

The Storage Test business unit addresses the high throughput, automated manufacturing test requirements of hard disk drive (“HDD”) and solid state disk (“SSD”) manufacturers and semiconductor manufacturers. Our products address the client and enterprise storage markets. The client market is driven by the needs of desktop, laptop, and external HDD and SSD storage products. The enterprise market is driven by the needs of data centers and cloud storage. In 2017, we developed a system level test product for the semiconductor production market, called Titan. Titan is used to test devices following wafer and package test. The business unit’s products lead in addressing customer requirements related to factory density, throughput and thermal performance.

Production Board Test

Our test systems are used by electronics manufacturers worldwide to perform In-Circuit-Test (“ICT”) and device programming of printed circuit board assemblies. Fast, accurate and cost-effective test capabilities are hallmark features of our Test Station and Spectrum ICT product families. We offer the Test Station in off-line and automated in-line configurations. The automated in-line configurations address the growing requirements for automating production lines for high volume applications, such as automotive electronics.

Industrial Automation

Our Industrial Automation segment is comprised of four business units: Universal Robots, Mobile Industrial Robots, AutoGuide and Energid.

Universal Robots

Universal Robots, which was acquired in June 2015, is a leading supplier of collaborative robots, which are low-cost, easy-to-deploy and simple-to-program robots that work side by side with production workers to improve quality, increase manufacturing efficiency and decrease manufacturing costs. Collaborative robots are designed to mimic the motion of a human arm and can be fitted with task specific grippers or fixtures to support a wide range of applications. Universal Robots offers three collaborative robot models, the UR3, UR5, and UR10, each with different weight carrying capacity and arm reach. All models are easily integrated into existing production environments. Universal Robots’ products are differentiated by their:

- easy programming using a graphical interface which allows users to program the collaborative robot in a few hours;
- flexibility and ease of use in allowing customers to change the task the collaborative robot is performing as their production demands dictate;
- safe operations as collaborative robots can assist workers in side by side production environments requiring no special safety enclosures or shielding to protect workers; and
- short payback period, on average less than 12 months.

In 2018, Universal Robots introduced its e-Series collaborative robots which include technology advances that enable faster development of applications, greater precision and improved safety. Universal Robots offers four e-Series collaborative robot models UR3e, UR5e, UR10e and UR16e that was launched in September 2019.

Cumulatively, Universal Robots has sold over 42,000 collaborative robots in diverse production environments and applications.

Mobile Industrial Robots

MiR, which was acquired in April 2018, is a leading supplier of collaborative autonomous mobile robots (“AMRs”), which are low-cost, easy-to-deploy and simple-to-program mobile robots that increase manufacturing

and warehouse efficiency and decrease costs. Collaborative autonomous mobile robots are designed to move material from point to point via autonomous navigation rather than the need for traditional mobile robot guidance infrastructure such as painted or magnetic strips, and are designed to navigate safely around obstacles and people. MiR offers four collaborative autonomous mobile robot models, the MiR100, MiR200, MiR500 and MiR 1000 (launched in May 2019) each with different payload carrying capacity. All models are easily integrated into existing production environments. MiR's products are differentiated by their:

- easy programming using a graphical interface which allows users to program the collaborative robot in a few hours;
- ease of use, speed of deployment and flexibility in allowing customers to change the task as their demands dictate;
- reliable autonomous navigation over large manufacturing and warehouse areas; and
- short payback period, on average 12–18 months.

Cumulatively, MiR has sold over 3,000 collaborative autonomous mobile robots in diverse production and warehouse environments and applications.

Energid

Energid, which was acquired in February 2018, is a leading supplier of real-time advanced robot motion control software, which automation suppliers use to coordinate the control of multiple automation axes for performing tasks. Motion control software performs the complex mathematics and functions needed to enable robot motion for tasks such as grasping and moving an object. Energid offers developer and run time licenses of its Actin software. Actin is integrated by customers into the customers' robot and automation solutions. Actin products are differentiated by their:

- highly flexible, adaptive, robot motion control; and
- task optimized robotic path planning.

Cumulatively, Energid has sold over 500 Actin developer and run time licenses deployed in diverse automation applications.

AutoGuide

AutoGuide, which was acquired in November 2019, is a maker of high payload AMRs, an emerging and fast growing segment of the global forklift market. AutoGuide's AMRs are used for material transport of payloads up to 4,500 kg in manufacturing, warehouse and logistics applications. These products complement MiR's lower payload products.

Cumulatively, AutoGuide has sold over 150 autonomous mobile robots in diverse production and warehouse environments and applications.

Wireless Test

Our acquisition of LitePoint in 2011 and ZTEC Instruments Inc. ("ZTEC") in 2013 expanded our product offerings in the wireless test market. Under the LitePoint brand name, these products provide test solutions utilized in the development and manufacturing of wireless devices. The world's leading makers of smartphones, tablets, notebooks, laptops, peripherals, and Internet-of-Things (IoT) devices rely on LitePoint technology to ensure their products get into consumer hands with high quality and high efficiency.

LitePoint hardware and software wireless test solutions are used in test insertions that span design verification to high volume manufacturing and are deployed across the entire production eco-system from the

wireless chipset suppliers to the consumer brands. Wireless devices are often tested at multiple points along the manufacturing process that include insertions at component, system-in-package (“SiP”), module, PCB, SMT and finished product stages.

Design verification is an important step in the development process for evaluating product performance prior to starting production. As end market unit volumes have increased, the quantity of units and the amount of data that must be analyzed for a successful product launch continues to grow. LitePoint products provide easy to use, domain specific tools for rapid analysis of product performance. This helps to speed time to market.

In high volume manufacturing, before products are packaged and shipped, wireless test enables the calibration of each individual product’s wireless performance to improve range, data throughput and battery life. Testing also verifies product specifications for product quality control. As markets become increasingly competitive, product performance and quality provide brand differentiation.

Wireless standards can be thought of in two categories, connectivity and cellular. Connectivity covers many standards such as Wi-Fi, Bluetooth, and GPS. LitePoint’s IQxel products cover emerging Wi-Fi standards such as WiFi 6 (802.11ax) and includes a variety of other standards such as Bluetooth Classic, Bluetooth 5.0 and Bluetooth low energy, Zigbee, Z-Wave, NFC, LoRa, GPS, GLONASS and others.

The IQxel product family’s high-performance wireless and multi-device testing economics is aligned with the needs of networking equipment, Internet gateways, IoT products and embedded modules used in smartphones, tablets, and PCs. In 2019, we introduced a new product in the IQxel family for testing 7GHz WiFi devices. Another connectivity product, the IQnfc, addresses the growing use of NFC technology for payments with mobile devices.

Cellular standards include 2G, 3G, 4G and emerging 5G mobile phone technologies. LitePoint’s IQxstream is a multi-device production test optimized solution for high-speed testing of GSM, EDGE, CDMA2000, TD-SCDMA, WCDMA, HSPA+, LTE-FDD, TD_LTE, and LTE-A, and 5G technologies. It is used for calibration and verification of smartphones, tablets, small cell wireless gateways and embedded cellular modules. The IQcell, is a multi-device cellular signaling test solution which enables user experience testing of LTE cellular devices via over-the-air connections. The IQgig family provides test solution at the intermediary and millimeter wave frequencies for 5G and 802.11ad. In 2018, we introduced a new product in the IQgig family for testing mm-wave handsets.

To complement the test systems, LitePoint offers turnkey test software for over 350 of the most popular wireless chipsets. These optimized solutions provide rapid development of high volume manufacturing solutions with a minimum of engineering effort by customers.

Sales and Distribution

In 2019 and 2018, no single direct customer accounted for more than 10% of our consolidated revenues. In 2017, revenues from Taiwan Semiconductor Manufacturing Company Ltd. accounted for 13% of our consolidated revenues. Taiwan Semiconductor Manufacturing Company Ltd. is a customer of our Semiconductor Test segment. In each of the years, 2019, 2018 and 2017, our five largest direct customers in aggregate accounted for 27%, 27% and 32% of our consolidated revenues, respectively.

OSAT customers, such as Taiwan Semiconductor Manufacturing Company Ltd., often purchase our test systems based upon recommendations from OEMs, IDMs and Fabless companies. In all cases when an OSAT customer purchases a test system from us, we consider the OSAT as the customer since credit risk, title and risk of loss, among other things, are between Teradyne and the OSAT. We estimate consolidated revenues driven by Huawei Technologies Co. Ltd. (“Huawei”), combining direct sales to that customer with sales to the customer’s OSATs, accounted for approximately 11%, 4% and 1% of our consolidated revenues in 2019, 2018 and 2017,

respectively. We estimate consolidated revenues driven by another OEM customer, combining direct sales to that customer with sales to the customer's OSATs (which include Taiwan Semiconductor Manufacturing Company Ltd.), accounted for approximately 10%, 13% and 22% of our consolidated revenues in 2019, 2018 and 2017, respectively. The loss of, or significant decrease in demand from Huawei or this other OEM customer, or any of our five largest direct customers, could have a material adverse effect on our business, results of operations and financial condition.

We have sales and service offices located throughout North America, Central America, Asia and Europe. We sell in these areas predominantly through a direct sales force, except for Industrial Automation products, which are sold through distributors. Our manufacturing activities are primarily conducted through subcontractors and outsourced contract manufacturers with significant operations in China and Malaysia.

Sales to customers outside the United States were 85%, 87%, and 88%, respectively, of our consolidated revenues in 2019, 2018 and 2017. Sales are attributed to geographic areas based on the location of the customer site.

See also "Item 1A: Risk Factors" and Note T: "Operating Segment, Geographic and Significant Customer Information" in Notes to Consolidated Financial Statements.

Competition

We face significant competition throughout the world in each of our reportable segments. Competitors in the Semiconductor Test segment include, among others, Advantest Corporation and Cohu, Inc.

Competitors in the System Test segment include, among others, Keysight Technologies, Inc., Advantest Corporation, Test Research, Inc. and SPEA S.p.A.

Competitors in our Industrial Automation segment include manufacturers of traditional industrial robots such as KUKA Robotics Corporation, ABB, FANUC and Yaskawa Electric Corporation, companies with emerging collaborative robot offerings such as Techman, Doosan, and AUBO Robotics, and manufacturers of autonomous mobile robots such as Omron, Fetch, OTTO Motors, Vecna, Seegrid and Balyo.

Competitors in our Wireless Test segment include, among others, Rohde & Schwarz GmbH & Co. KG, Anritsu Company, Keysight Technologies, Inc. and National Instruments Corporation.

Some of our competitors have substantially greater financial and other resources to pursue engineering, manufacturing, marketing and distribution of their products. We also face competition from emerging Asian companies and from internal suppliers at several of our customers. Some of our competitors have introduced or announced new products with certain performance characteristics which may be considered equal or superior to those we currently offer. We expect our competitors to continue to improve the performance of their current products and to introduce new products or new technologies that provide improved cost of ownership and performance characteristics. See also "Item 1A: Risk Factors."

Backlog

At December 31, 2019 and 2018, our backlog of unfilled orders in our four reportable segments was as follows:

	<u>2019</u>	<u>2018</u>
	(in millions)	
Semiconductor Test	\$543.2	\$367.5
System Test	206.0	149.5
Wireless Test	42.9	32.0
Industrial Automation	17.9	19.7
	<u>\$810.0</u>	<u>\$568.7</u>

Customers may delay delivery of products or cancel orders suddenly and without advanced notice, subject to possible cancellation penalties. Due to possible customer changes in delivery schedules and cancellation of orders, our backlog at any particular date is not necessarily indicative of the actual sales for any succeeding period. Delays in delivery schedules or cancellations of backlog during any particular period could have a material adverse effect on our business, financial condition or results of operations.

Raw Materials

Our products contain electronic and mechanical components that are provided by a wide range of suppliers. Some of these components are standard products, while others are manufactured to our specifications. We can experience occasional delays in obtaining timely delivery of certain items. While the majority of our components are available from multiple suppliers, certain items are obtained from sole sources. We may experience a temporary adverse impact if any of our sole source suppliers delay or cease to deliver products.

Intellectual Property and Licenses

The development of our products, both hardware and software, is based in significant part on proprietary information, our brands and technology. We protect our rights in proprietary information, brands and technology through various methods, such as:

- patents;
- copyrights;
- trademarks;
- trade secrets;
- standards of business conduct and related business practices; and
- technology license agreements, software license agreements, non-disclosure agreements, employment agreements, and other agreements.

However, these protections might not be effective in all circumstances. Competitors might independently develop similar technology or exploit our proprietary information and our brands in countries where we lack enforceable intellectual property rights or where enforcement of such rights through the legal system provides an insufficient deterrent. Also, intellectual property protections can lapse or be invalidated through appropriate legal processes. We do not believe that any single piece of intellectual property or proprietary rights is essential to our business.

Employees

As of December 31, 2019, we employed approximately 5,400 people. Since the inception of our business, we have experienced no work stoppages or other labor disturbances.

Environmental Affairs

We are subject to various federal, state, and local government laws and regulations relating to the protection of employee health and safety and the environment. We accrue for all known environmental liabilities when it becomes probable that we will incur cleanup costs and those costs can reasonably be estimated. Estimated environmental costs are not expected to materially affect the financial position or results of our operations in future periods. However, estimates of future costs are subject to change due to protracted cleanup periods and changing environmental remediation laws and regulations.

INFORMATION ABOUT OUR EXECUTIVE OFFICERS

Pursuant to General Instruction G (3) of Form 10-K, the following table is included in Part I of this Annual Report on Form 10-K in lieu of being included in the Proxy Statement for the Annual Meeting of Shareholders. The table sets forth the names of all of our executive officers and certain other information relating to their positions held with Teradyne and other business experience. Our executive officers do not have a specific term of office but rather serve at the discretion of the Board of Directors.

<u>Executive Officer</u>	<u>Age</u>	<u>Position</u>	<u>Business Experience for The Past 5 Years</u>
Mark E. Jagiela	59	Chief Executive Officer and President	Chief Executive Officer since February 2014; President of Teradyne since January 2013; President of Semiconductor Test from 2003 to February 2016; Vice President of Teradyne from 2001 to 2013.
Sanjay Mehta	51	Vice President, Chief Financial Officer and Treasurer	Vice President, Chief Financial Officer and Treasurer of Teradyne since April 2019; Senior Vice President and General Manager of Compute and XR Products at Qualcomm Technologies, Inc. (“Qualcomm”) from June 2018 to March 2019; President of Qualcomm’s semiconductor segment (“QCT”) China from March 2016 to June 2018; Senior Vice President Business Operations of QCT at Qualcomm from November 2015 to March 2016; Chief Financial Officer and Senior Vice President, Sales Operations, of QCT at Qualcomm from October 2010 to November 2015.
Charles J. Gray	58	Vice President, General Counsel and Secretary	Vice President, General Counsel and Secretary of Teradyne since April 2009.
Bradford B. Robbins	61	President of Wireless Test	President of Wireless Test since August 2014; Chief Operating Officer of LitePoint Corporation from 2012 to 2014; Vice President of Teradyne since 2001.
Gregory S. Smith	56	President of Semiconductor Test	President of Semiconductor Test since February 2016; Vice President, SOC Business Group and Marketing Manager for Semiconductor Test Group from January 2014 to February 2016; Business Unit Manager, Complex SOC Business Unit from 2009 to January 2014.
Walter G. Vahey	55	Executive Vice President, Business Development	Executive Vice President, Business Development since December 2017; President of System Test from July 2012 to December 2017; Vice President of Teradyne since 2008; General Manager of Storage Test from 2008 to December 2017; General Manager of Production Board Test from April 2013 to December 2017.

Item 1A: Risk Factors

Risks Associated with Our Business

The risks described below are not the only risks that we face. Additional risks and uncertainties not currently known to us or that we currently deem to be immaterial also may materially adversely affect our business, financial condition and/or operating results.

Our business is impacted by global and industry-specific economic cycles, which are difficult to predict, and actions we have taken or may take to offset these cycles may not be sufficient.

Capital equipment providers in the electronics, semiconductor industries and industrial automation, such as Teradyne, have, in the past, been negatively impacted by both sudden slowdowns in the global economies and recurring cyclicality within those industries. These cycles have resulted in periods of over-supply; a trend we believe will continue to occur. Our business and results of operations depend, in significant part, upon capital expenditures of manufacturers of semiconductors electronics and other industrial products, which in turn depend upon the current and anticipated market demand for those products. Disruption or deterioration in economic conditions may reduce customer purchases of our products, thereby reducing our revenues and earnings. In addition, such adverse changes in economic conditions, and resulting slowdowns in the market for our products, may, among other things, result in increased price competition for our products, increased risk of excess and obsolete inventories, increased risk in the collectability of our accounts receivable from our customers, potential reserves for doubtful accounts and write-offs of accounts receivable, increased risk of restructuring charges, and higher operating costs as a percentage of revenues, which, in each case and together, adversely affect our operating results. We are unable to predict the likely duration, frequency and severity of disruptions in financial markets, credit availability, and adverse economic conditions throughout the world, and we cannot ensure that the level of revenues or new orders for a fiscal quarter will be sustained in subsequent quarters. We have taken actions to address the effects of general economic variability and recurring industry cyclicality, including implementing cost control and reduction measures. We cannot predict whether these measures will be sufficient to offset global or market-specific disruptions that might affect our test businesses and we may need to take additional or different measures in the future.

We are subject to intense competition.

We face significant competition throughout the world in each of our reportable segments. Some of our competitors have substantial financial and other resources to pursue engineering, manufacturing, marketing and distribution of their products. We also face competition from emerging Asian companies and internal development at several of our customers. Some of our competitors have introduced or announced new products with certain performance characteristics that may be considered equal or superior to those we currently offer. We expect our competitors to continue to improve the performance of their current products and to introduce new products or new technologies that provide improved cost of ownership and performance characteristics. New product introductions by competitors could cause a decline in revenues or loss of market acceptance of our products.

The market for our products is concentrated, and our business depends, in part, on obtaining orders from a few significant customers.

The market for our products is concentrated with a limited number of significant customers accounting for a substantial portion of the purchases of test equipment. In each of the years 2019, 2018 and 2017, our five largest direct customers in aggregate accounted for 27%, 27% and 32% of consolidated revenues, respectively.

We estimate consolidated revenues driven by Huawei, combining direct sales to that customer with sales to the customer's OSATs, accounted for approximately 11%, 4% and 1% of our consolidated revenues in 2019, 2018 and 2017, respectively. We estimate consolidated revenues driven by another OEM customer, combining direct sales to that customer with sales to the customer's OSATs (which include Taiwan Semiconductor Manufacturing Company Ltd.), accounted for approximately 10%, 13% and 22% of our consolidated revenues in 2019, 2018 and 2017, respectively. In any one reporting period, a single customer or several customers may contribute even a larger percentage of our consolidated revenues. In addition, our ability to increase sales will depend, in part, on our ability to obtain orders from current or new significant customers. The opportunities to obtain orders from these customers may be limited, which may impair our ability to grow revenues. We expect that sales of our products will continue to be concentrated with a limited number of significant customers for the

foreseeable future. The loss of a significant customer or any reduction in orders by these customers, including reductions due to market or competitive conditions, such as we experienced in our Wireless Test segment, would likely have a material adverse effect on our business, financial condition or results of operations.

Our operating results are likely to fluctuate significantly.

Our operating results are affected by a wide variety of factors that could materially adversely affect revenues or profitability. The following factors could impact future operations:

- a worldwide economic slowdown or disruption in the global financial or industrial markets;
- competitive pressures on selling prices;
- our ability to introduce, and the market acceptance of, new products;
- changes in product revenues mix resulting from changes in customer demand;
- the level of orders received which can be shipped in a quarter because of the tendency of customers to wait until late in a quarter to commit to purchase due to capital expenditure approvals and constraints occurring at the end of a quarter, or the hope of obtaining more favorable pricing from a competitor seeking the business;
- engineering and development investments relating to new product introductions, and the expansion of manufacturing, outsourcing and engineering operations in Asia;
- provisions for excess and obsolete inventory relating to the lack of demand for and the discontinuance of products;
- impairment charges for certain long-lived and intangible assets, and goodwill;
- an increase in the leasing of our products to customers;
- disruption caused by health epidemics, such as the coronavirus outbreak;
- our ability to expand our global distribution channel for our collaborative and mobile robots;
- parallel or multi-site testing which could lead to a decrease in the ultimate size of the market for our semiconductor and electronic test products; and
- the ability of our suppliers and subcontractors to meet product quality or delivery requirements needed to satisfy customer orders for our products, especially if consolidated revenues increase.

As a result of the foregoing and other factors, we have experienced and may continue to experience material fluctuations in future operating results on a quarterly or annual basis which could materially and adversely affect our business, financial condition, operating results or stock price.

We are subject to risks of operating internationally.

A significant portion of our total revenues is derived from customers outside the United States. Our international sales and operations are subject to significant risks and difficulties, including:

- unexpected changes in legal and regulatory requirements affecting international markets;
- changes in tariffs and exchange rates;
- social, political and economic instability, acts of terrorism and international conflicts;
- disruption caused by health epidemics, such as the coronavirus outbreak;
- difficulties in protecting intellectual property;
- difficulties in accounts receivable collection;

- cultural differences in the conduct of business;
- difficulties in staffing and managing international operations;
- compliance with anti-corruption laws;
- compliance with data privacy regulations;
- compliance with customs and trade regulations; and
- compliance with international tax laws and regulations.

In addition, an increasing portion of our products and the products we purchase from our suppliers are sourced or manufactured in foreign locations, including China and Malaysia, and a large portion of the devices our products test are fabricated and tested by foundries and subcontractors in Taiwan, China, Korea and other parts of Asia. As a result, we are subject to a number of economic and other risks, particularly during times of political, health or financial instability in these regions. Disruption of manufacturing or supply sources in these international locations could materially adversely impact our ability to fill customer orders and potentially result in lost business.

The implementation of tariffs and export controls on our products may have a material impact on our business.

Our business operations and supply chain are global and may be disrupted by the implementation of tariffs and export controls on our products.

In 2018, the United States Trade Representative imposed a 25% tariff on many products, including certain Teradyne products that are made in China and imported into the United States. We have implemented operational changes that mitigate the impact of the 25% tariff on the import of our impacted products into the United States. As a result, we do not expect that the tariff will have a material adverse effect on our business, financial condition or results of operations.

Also in 2018, the United States Department of Commerce announced that it has commenced a review of new export controls focusing on emerging and foundational technologies. While there is uncertainty as to the technologies that will be covered, the new export controls could cover technologies used in one or more Teradyne products and, therefore, could impact the sale of certain Teradyne products and have a material adverse effect on our business, financial condition or results of operations.

In addition to the actions taken by the United States, China has implemented retaliatory tariffs on products made in the United States and imported into China, including certain Teradyne products. We have implemented operational changes that mitigate the impact of the retaliatory tariffs. However, notwithstanding our efforts, the retaliatory tariffs or other trade restrictions implemented by China could disrupt our business operations, sales and supply chain and, therefore, have a material adverse effect on our business, financial condition or results of operations.

Trade regulations and restrictions could impact our ability to sell products to and support certain customers, which may materially adversely affect our sales and results of operations.

We are subject to U.S. laws and regulations that limit and restrict the export of some of our products and services and may restrict our transactions with certain customers, business partners and other persons. In certain circumstances, export control and economic sanctions regulations may prohibit the export of certain products, services and technologies, and in other circumstances we may be required to obtain an export license before exporting the controlled item. We must also comply with export restrictions and laws imposed by other countries affecting trade and investments. We maintain an export compliance program but there are risks that the compliance controls could be circumvented, exposing us to legal liabilities. Compliance with these laws has not

significantly limited our sales, but could significantly limit them in the future. Changes in, and responses to, U.S. trade policy could reduce the competitiveness of our products and cause our sales to drop, which could have a material adverse effect on our business, financial condition or results of operations.

The U.S. government from time to time has issued export restrictions that prohibit U.S. companies from exporting U.S. manufactured products, foreign manufactured products with more than 25% controlled U.S. content, as well as U.S. origin technology. For example, the U.S. Department of Commerce has restricted the access of U.S. origin technologies to certain Chinese companies by adding those companies to the Entity List under U.S. Export Administration Regulations (“EAR”).

On May 16, 2019, Huawei and 68 of its affiliates, including HiSilicon, were added to the U.S. Department of Commerce Entity List under the EAR. This action by the U.S. Department of Commerce imposes new export licensing requirements on exports, re-exports, and in-country transfers of all U.S. regulated products, software and technology to the designated Huawei entities. While most of our products are not subject to the EAR and therefore not affected by the Entity List restrictions, certain of our products are currently manufactured in the U.S. and thus subject to the Entity List restrictions. Compliance with the Entity List restrictions has not significantly impacted our sales. In addition, the prohibition on transfers of U.S. origin technology to Huawei could significantly limit our ability to service certain of our products sold to Huawei and our ability to engage in product development activities with Huawei and, therefore, could have a material adverse effect on our business, financial condition or results of operations. Furthermore, Huawei’s inability to obtain products from other companies in its supply chain may adversely impact Huawei’s demand for our products. Huawei or other foreign customers affected by future U.S. government sanctions or threats of sanctions may respond by developing their own solutions to replace our products or by adopting our foreign competitors’ solutions. Also, our controls related to Entity List compliance could be circumvented, exposing us to legal liabilities. Even if such restrictions are lifted, any financial or other penalties or continuing export restrictions imposed on Huawei could have a material adverse effect on our business, financial condition or results of operations.

The U.S. Department of Commerce is seeking to modify the U.S. EAR to expand the scope of the regulations to include more products that would become subject to the Entity List restrictions relating to Huawei and the designated Huawei entities including HiSilicon. These modified regulations, if implemented as currently reported, would impact our ability to continue to sell certain products directly to Huawei and HiSilicon, both of which are significant Teradyne customers. However, based on our understanding, these proposed modified regulations would not impact our sales to third party contract manufacturers used by Huawei and HiSilicon to manufacture and test semiconductor and other electronic devices. Because the business environment for Huawei is both fluid and uncertain, there are also risks that Huawei and HiSilicon may have less demand for our products and/or may purchase products from our competitors who are not impacted by the U.S. regulations. Until these or any new regulations become public and effective, we will not know the extent of the impact on our business with Huawei and HiSilicon. However, it is possible that these modified regulations and any other additional regulations that may be implemented by the U.S. Department of Commerce or other government agency would have a material impact on our business and financial results.

If we fail to develop new technologies to adapt to our customers’ needs and if our customers fail to accept our new products, our revenues will be adversely affected.

We believe that our technological position depends primarily on the technical competence and creative ability of our engineers. In a rapidly evolving market, such as ours, the development or acquisition of new technologies, commercialization of those technologies into products and market acceptance and customer demand for those products are critical to our success. Successful product development or acquisition, introduction and acceptance depend upon a number of factors, including:

- new product selection;
- ability to meet customer requirements including with respect to safety and cyber security;

- development of competitive products by competitors;
- timely and efficient completion of product design;
- timely and efficient implementation of manufacturing and manufacturing processes;
- timely remediation of product performance issues, if any, identified during testing;
- assembly processes and product performance at customer locations;
- differentiation of our products from our competitors' products;
- management of customer expectations concerning product capabilities and product life cycles;
- transition of customers to new product platforms;
- compliance with product safety regulations;
- ability to protect products from cyber attacks when used by our customers;
- ability to attract and retain technical talent; and
- innovation that does not infringe on the intellectual property rights of third parties.

We may be subject to product recalls and warranty and product liability claims.

We invest significant resources in the design, manufacture and testing of our products. However, we may discover design or manufacturing defects in our products after they have been shipped and, as a result, we may incur development and remediation costs and be required to settle warranty and product liability claims. In addition, if any of our products contain defects or have reliability, quality or safety issues, we may need to conduct a product recall which could result in significant repair or replacement costs and substantial delays in product shipments and may damage our reputation which could make it more difficult to sell our products. Any of these results could have a material adverse effect on our business, results of operations or financial condition.

If our suppliers do not meet product or delivery requirements, we could have reduced revenues and earnings.

Certain components, including semiconductor chips, may be in short supply from time to time because of high industry demand or the inability of some vendors to consistently meet our quality or delivery requirements. If any of our suppliers were to cancel contracts or commitments or fail to meet the quality or delivery requirements needed to satisfy customer orders for our products, we could lose time-sensitive customer orders, have significantly decreased revenues and earnings and be subject to contractual penalties, which would have a material adverse effect on our business, results of operations and financial condition. In addition, we rely on contract manufacturers for certain subsystems used in our products, and our ability to meet customer orders for those products depends upon the timeliness and quality of the work performed by these subcontractors, over whom we do not exercise any control.

To a certain extent, we are dependent upon the ability of our suppliers and contractors to help meet increased product or delivery requirements. It may be difficult for certain suppliers to meet delivery requirements in a period of rapid growth, therefore impacting our ability to meet our customers' demands.

Our suppliers are subject to trade regulations, including tariffs and export restrictions imposed by the United States government and by the governments of other countries. These regulations could impact our suppliers' ability to provide us with components for our products or could increase the price of those components.

We rely on the financial strength of our suppliers. There can be no assurance that the loss of suppliers either as a result of financial viability, bankruptcy or otherwise will not have a material adverse effect on our business, results of operations or financial condition.

Our operations may be adversely impacted if our outsourced contract manufacturers or service providers fail to perform.

We depend on Flex Ltd. ("Flex") to manufacture and test our FLEX and J750 family of products from its facility in China, Plexus Corp. ("Plexus") to manufacture and test our Magnum and ETS family of products from

its facility in Malaysia, and on other contract manufacturers to manufacture other products. If for any reason these contract manufacturers cannot provide us with these products in a timely fashion, or at all, we may not be able to sell these products to our customers until we enter a similar arrangement with an alternative contract manufacturer. The Flex facility in China may be impacted by the ongoing trade dispute between the United States and China, by regulations implemented by the United States or China, or disruption caused by health epidemics, such as the coronavirus outbreak.

If we experience a problem with our supply of products from Flex or our other contract manufacturers, it may take us significant time to either manufacture the product or find an alternate contract manufacturer, which could result in substantial expense and disruption to our business.

We have also outsourced certain general and administrative functions to reputable service providers, many of which are in foreign countries, sometimes impacting communication with them because of language and time differences. Their presence in foreign countries also increases the risk they could be exposed to political risk. Additionally, there may be difficulties encountered in coordinating the outsourced operations with existing functions and operations. If we fail in successfully coordinating and managing the outsourced service providers, it may cause an adverse effect on our operations which could have a material adverse effect on our business, results of operations or financial condition.

We may not fully realize the benefits of our acquisitions or strategic alliances.

In June 2015, we acquired Universal Robots, in 2018, we acquired Energid and MiR and, in 2019, we acquired Lemsys and AutoGuide. We may not be able to realize the benefit of acquiring or successfully growing these businesses. We may continue to acquire additional businesses, form strategic alliances or create joint ventures with third parties that we believe will complement or augment our existing businesses. We may not be able to realize the expected synergies and cost savings from the integration with our existing operations of other businesses or technologies that we may acquire. In addition, the integration process for our acquisitions may be complex, costly and time consuming and include unanticipated issues, expenses and liabilities. We may have difficulty in developing, manufacturing and marketing the products of a newly acquired company in a manner that enhances the performance of our combined businesses or product lines and allows us to realize value from expected synergies. Following an acquisition, we may not achieve the revenue or net income levels that justify the acquisition. Acquisitions may also result in one-time charges (such as acquisition-related expenses, write-offs or restructuring charges) or in the future, impairment of goodwill or acquired intangible assets that adversely affect our operating results. Additionally, we may fund acquisitions of new businesses, strategic alliances or joint ventures by utilizing our cash, incurring debt, issuing shares of our common stock, or by other means.

We may incur significant liabilities if we fail to comply with environmental regulations.

We are subject to both domestic and international environmental regulations and statutory strict liability relating to the use, storage, discharge, site cleanup and disposal of hazardous chemicals used in our manufacturing processes. If we fail to comply with present and future regulations, or are required to perform site remediation, we could be subject to future liabilities or cost, including penalties or the suspension of production. Present and future regulations may also:

- restrict our ability to expand facilities;
- restrict our ability to ship certain products;
- require us to modify our operations logistics;
- require us to acquire costly equipment; or
- require us to incur other significant costs and expenses.

Pursuant to present regulations and agreements, we are conducting groundwater and subsurface assessment and monitoring and are implementing remediation and corrective action plans for facilities located in

Massachusetts and New Hampshire which are no longer conducting manufacturing operations. As of December 31, 2019, we have not incurred material costs as a result of the monitoring and remediation steps taken at the Massachusetts and New Hampshire sites.

On January 27, 2003, the European Union adopted the following directives: (i) the directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (the “RoHS Directive”); and (ii) the directive on Waste Electrical and Electronic Equipment (the “WEEE Directive”). The WEEE Directive became effective August 13, 2005 and the RoHS Directive became effective on July 6, 2006. Both the RoHS Directive and the WEEE Directive alter the form and manner in which electronic equipment is imported, sold and handled in the European Union. Other jurisdictions, such as China, have followed the European Union’s lead in enacting legislation with respect to hazardous substances and waste removal. Ensuring compliance with the RoHS Directive, the WEEE Directive and similar legislation in other jurisdictions, and integrating compliance activities with our suppliers and customers could result in additional costs and disruption to operations and logistics and thus, could have a negative impact on our business, operations or financial condition.

We currently are, and in the future may be, subject to litigation or regulatory proceedings that could have an adverse effect on our business.

From time to time, we may be subject to litigation or other administrative, regulatory or governmental proceedings, including tax audits and resulting claims that could require significant management time and resources and cause us to incur expenses and, in the event of an adverse decision, pay damages or incur costs in an amount that could have a material adverse effect on our financial position or results of operations.

Third parties may claim we are infringing their intellectual property and we could suffer significant litigation costs, licensing expenses or be prevented from selling our products.

We have been sued for patent infringement in the past and receive notifications from time to time that we may be in violation of patents held by others. An assertion of patent infringement against us, if successful, could have a material adverse effect on our ability to sell our products or it could force us to seek a license to the intellectual property rights of others or alter such products so that they no longer infringe the intellectual property rights of others. A license could be very expensive to obtain or may not be available at all. Similarly, changing our products or processes to avoid infringing the rights of others may be costly or impractical. Additionally, patent litigation could require a significant use of management resources and involve a lengthy and expensive defense, even if we eventually prevail. If we do not prevail, we might be forced to pay significant damages, obtain licenses, modify our products, or stop making our products; each of which could have a material adverse effect on our financial condition, operating results or cash flows.

If we are unable to protect our intellectual property (“IP”), we may lose a valuable asset or may incur costly litigation to protect our rights.

We protect the technology that is incorporated in our products in several ways, including through patent, copyright, trademark and trade secret protection and by contractual agreement. However, even with these protections, our IP may still be challenged, invalidated or subject to other infringement actions. While we believe that our IP has value in the aggregate, no single element of our IP is in itself essential. If a significant portion of our IP is invalidated or ineffective, our business could be materially adversely affected.

We may incur higher tax rates than we expect and may have exposure to additional international tax liabilities and costs.

We are subject to paying income taxes in the United States and various other countries where we operate. Our effective tax rate is dependent on where our earnings are generated and the tax regulations and the

interpretation and judgment of administrative tax or revenue authorities in the United States and other countries. We have pursued a global tax strategy which could be adversely affected by the mix of earnings and tax rates in the countries where we operate, changes to tax laws, tax regulations or an adverse tax ruling by administrative authorities. We are also subject to tax audits in the countries where we operate. Any material change in our tax liability resulting from changes in tax laws, tax regulations, administrative ruling or from an audit from an administrative tax or revenue authority could negatively affect our financial results.

As a multinational corporation, we are subject to income taxes as well as non-income based taxes, in both the United States and various foreign jurisdictions. In certain foreign jurisdictions, we qualify for tax incentives and tax holidays based on our ability to meet, on a continuing basis, various tests relating to our employment levels, research and development expenditures and other qualification requirements in a particular foreign jurisdiction. While we intend to operate in such a manner to maintain and maximize our tax incentives, no assurance can be given that we have so qualified or that we will so qualify for any particular year or jurisdiction. If we fail to qualify and to remain qualified for certain foreign tax incentives and tax holidays, we may be subject to further taxation or an increase in our effective tax rate which would adversely impact our financial results. In December 2015, we entered into an agreement with the Singapore Economic Development Board which extended our Singapore tax holiday under substantially similar terms to the agreement which expired on December 31, 2015. The new tax holiday is scheduled to expire on December 31, 2020. The tax savings attributable to the Singapore tax holiday for the years ended December 31, 2019, 2018 and 2017 were \$15.1 million or \$0.08 per diluted share, \$11.9 million or \$0.06 per diluted share and \$24.8 million or \$0.12 per diluted share, respectively. These tax savings may not be achievable in subsequent years due to changes in Singapore's tax laws or the expiration of the tax holiday.

In addition, we may incur additional costs, including headcount expenses, in order to maintain or obtain a foreign tax incentive in a particular foreign jurisdiction.

We have significant guarantees, indemnification and customer confidentiality obligations.

From time to time, we make guarantees to customers regarding the delivery, price and performance of our products and guarantee certain indebtedness, performance obligations or lease commitments of our subsidiary and affiliate companies. We also have agreed to provide indemnification to our officers, directors, employees and agents, to the extent permitted by law, arising from certain events or occurrences while the officer, director, employee or agent, is or was serving at our request in such capacity. Additionally, we have confidentiality obligations to certain customers and if breached would require the payment of significant penalties. If we become liable under any of these obligations, it could materially and adversely affect our business, financial condition or operating results. For additional information see Note M: "Commitments and Contingencies—Guarantees and Indemnification Obligations" in Notes to Consolidated Financial Statements.

We may discontinue or reduce our quarterly cash dividend or share repurchase program.

In January 2014, our Board of Directors initiated a quarterly cash dividend of \$0.06 per share. Our Board of Directors increased our quarterly cash dividend to \$0.07 per share in January 2017, to \$0.09 per share in January 2018 and to \$0.10 per share in January 2020. In January 2018, our Board of Directors approved a \$1.5 billion share repurchase authorization. In 2019 and 2018, we repurchased \$500 million and \$823 million of common stock, respectively. In January 2020, our Board of Directors approved a new \$1.0 billion share repurchase authorization and cancelled the 2018 authorization. We intend to repurchase a minimum of \$250 million in 2020. Holders of our common stock are only entitled to receive dividends when and if they are declared by our Board of Directors. Future cash dividends and share repurchases are subject to the discretion of our Board of Directors and will depend, among other things, upon our earnings, capital requirements and financial condition. While we have declared a quarterly cash dividend on our common stock and authorized a share repurchase program, we are not required to do either and may reduce or eliminate our cash dividend or share repurchase program in the

future. The reduction or elimination of our cash dividend or our share repurchase program could adversely affect the market price of our common stock.

We have incurred indebtedness and may incur additional indebtedness.

On December 12, 2016, we completed a private offering of \$460.0 million aggregate principal amount of 1.25% convertible senior unsecured notes (the “Notes”) due December 15, 2023 and received net proceeds, after issuance costs, of approximately \$450.8 million, \$33.0 million of which was used to pay the net cost, after being partially offset by proceeds from the sale of the warrants, of the convertible note hedge transactions and \$50.1 million of which was used to repurchase 2 million shares of our common stock. Holders of the Notes may require us to repurchase the Notes upon the occurrence of certain fundamental changes involving us or the holders may elect to convert into shares of our common stock.

The issuance of the Notes and any additional indebtedness, among other things, could:

- make it difficult to make payments on this indebtedness and our other obligations;
- make it difficult to obtain any necessary future financing for working capital, capital expenditures, debt service requirements or other purposes;
- require the dedication of a substantial portion of any cash flow from operations to service for indebtedness, thereby reducing the amount of cash flow available for other purposes, including capital expenditures; and
- limit our flexibility in planning for, or reacting to, changes in our business and the industries in which we compete.

On April 27, 2015, we entered into a five-year, senior secured revolving credit facility of up to \$350.0 million, which was terminated on June 27, 2019.

Our convertible note hedge and warrant transactions could impact the value of our stock.

Concurrent with the offering of the Notes, we entered into convertible note hedge transactions (the “Note Hedge Transactions”) with the initial purchasers or their affiliates (the “Option Counterparties”). The Note Hedge Transactions cover, subject to customary anti-dilution adjustments, the number of shares of our common stock that underlie the Notes, with a strike price equal to the conversion price of the Notes of \$31.62. The Note Hedge Transactions cover, subject to customary anti-dilution adjustments, approximately 14.5 million shares of our common stock.

Separately and concurrent with the pricing of the Notes, we entered into warrant transactions with the Option Counterparties (the “Warrant Transactions”) in which we sold net-share-settled (or, at our election subject to certain conditions, cash-settled) warrants to the Option Counterparties. The Warrant Transactions cover, subject to customary anti-dilution adjustments, approximately 14.5 million shares of our common stock. The strike price of the warrants is \$39.68 per share. The Warrant Transactions could have a dilutive effect to our common stock to the extent that the market price per share of our common stock, as measured under the terms of the Warrant Transactions, exceeds the applicable strike price of the warrants.

The Note Hedge Transactions are expected to reduce the potential dilution to our common stock upon any conversion of the Notes. However, the Warrant Transactions could separately have a dilutive effect to the extent that the market value per share of our common stock exceeds the applicable strike price of the warrants. The net cost of the Note Hedge Transactions, after being partially offset by the proceeds from the sale of the warrants, was approximately \$33.0 million.

In connection with establishing their initial hedge of these convertible note hedge and warrant transactions, the Option Counterparties have entered into various derivative transactions with respect to our common stock

and/or purchase shares of our common stock or other securities, including the Notes, concurrent with, or shortly after, the pricing of the Notes. In addition, the Option Counterparties may modify their hedge positions by entering into or unwinding various derivative transactions with respect to our common stock or by selling our common stock or other securities, including the Notes, in secondary market transactions (and may do so during any observation period related to the conversion of the Notes). These activities could adversely impact the value of our common stock and the Notes.

We may not be able to pay our debt and other obligations.

If our cash flow is inadequate to meet our obligations, we could face substantial liquidity problems. If we are unable to generate sufficient cash flow or otherwise obtain funds necessary to make required payments on the Notes or certain of our other obligations, we would be in default under the terms thereof, which would permit the holders of those obligations to accelerate their maturity and also could cause defaults under future indebtedness we may incur. Any such default could have a material adverse effect on our business, prospects, financial position and operating results. In addition, we cannot be certain that we would be able to repay amounts due on the Notes if those obligations were to be accelerated following the occurrence of any other event of default as defined in the instruments creating those obligations, or if the holders of the Notes require us to repurchase the Notes upon the occurrence of a fundamental change involving us. Moreover, we cannot be certain that we will have sufficient funds or will be able to arrange for financing to pay the principal amount due on the Notes at maturity.

Our business may suffer if we are unable to attract and retain key employees.

Competition for employees with skills we require is intense in the high technology industry. Our success will depend on our ability to attract and retain key technical employees. The loss of one or more key or other employees, a decrease in our ability to attract additional qualified employees, or the delay in hiring key personnel could each have a material adverse effect on our business, results of operations or financial condition.

Our operations, and the operations of our customers and suppliers, are subject to risks of natural catastrophic events, widespread health epidemics, acts of war, terrorist attacks and the threat of domestic and international terrorist attacks, any one of which could result in cancellation of orders, delays in deliveries or other business activities, or loss of customers and could negatively affect our business and results of operations.

Our business is international in nature, with our sales, service and administrative personnel and our customers and suppliers located in numerous countries throughout the world. Our operations, and those of our customers and suppliers, are subject to disruption for a variety of reasons, including work stoppages, acts of war, terrorism, health epidemics, fires, earthquakes, hurricanes, volcanic eruptions, energy shortages, telecommunication failures, tsunamis, flooding or other natural disasters. Such disruption could materially increase our costs and expenses as well as cause delays in, among other things, shipments of products to our customers, our ability to perform services requested by our customers, or the installation and acceptance of our products at customer sites. Any of these conditions could have a material adverse effect on our business, financial condition or results of operations.

Commencing in early February 2020, the coronavirus outbreak has resulted in disruption to our business operations in China, including increased travel restrictions and the extended closing of certain of our offices. At this time, the disruption has not had a material adverse impact on our business. If the spread of the virus continues and disruption in China or elsewhere worsens, our business may be materially impacted.

A breach of our operational or security systems could negatively affect our business and results of operations.

We rely on various information technology networks and systems to process, transmit and store electronic information, including proprietary and confidential data, and to carry out and support a variety of business

activities, including manufacturing, research and development, supply chain management, sales and accounting. We have experienced several attempted cyber-attacks of our network. None of the attempted attacks has caused a disruption to our operations or had a material adverse effect on our business or financial results. As a result of the attempts, we have taken further preventive security measures to protect our systems. Despite these preventative security measures we have implemented, we may continue to be vulnerable to attempts by third parties to gain unauthorized access to our networks or sabotage our systems. These attempts, which might be related to criminal hackers, industrial espionage or state-sponsored intrusions, include trying to covertly introduce malware to our computers, networks and systems and impersonating authorized users. In addition, third party suppliers and service providers that we rely on to manage our networks and systems and process and store our proprietary and confidential data may also be subject to similar attacks. Such attempts could result in the misappropriation, theft, misuse, disclosure or loss or destruction of the intellectual property, or the proprietary, confidential or personal information, of Teradyne or our employees, customers, suppliers or other third parties, as well as damage to or disruptions in our information technology networks and systems. These threats are constantly evolving, thereby increasing the difficulty of defending against them or implementing adequate preventative measures. While we seek to detect and investigate all security incidents and to prevent their recurrence, attempts to gain unauthorized access to our information technology networks and systems may be successful, and in some cases, we might be unaware of an incident or its magnitude and effects. A failure in or a breach of our operational or security systems or infrastructure, or those of our suppliers and other service providers, including as a result of cyber-attacks, could have a material adverse effect on our business or financial results, disrupt our business, result in the disclosure or misuse of proprietary or confidential information, damage our reputation, cause losses and increase our costs. We expect to continue to devote significant resources to the security of our information technology networks and systems.

We may face risks associated with shareholder activism.

Publicly traded companies are subject to campaigns by shareholders advocating corporate actions such as financial restructuring, increased borrowing, special dividends, stock repurchases or divestitures. We may become subject in the future to such shareholder activity and demands. Such activities could interfere with our ability to execute our business plans, be costly and time-consuming, disrupt our operations, divert the attention of management or result in our initiating borrowing or increasing our share repurchase plan or dividend, any of which could have an adverse effect on our business or stock price.

Provisions of our charter and by-laws and Massachusetts law may make a takeover of Teradyne more difficult.

There are provisions in our basic corporate documents and under Massachusetts law that could discourage, delay or prevent a change in control, even if a change in control may be regarded as beneficial to some or all of our stockholders.

Item 1B: *Unresolved Staff Comments*

None.

Item 2: *Properties*

Our corporate headquarters is located in North Reading, Massachusetts in buildings that we own consisting of approximately 422,000 square feet. We conduct manufacturing, engineering, sales and marketing, service, corporate administration and other operations in many locations worldwide. We own approximately 600,000 square feet and lease over 1,400,000 square feet of office space for these operations. We believe our existing facilities and planned expansions noted below are adequate to meet our current and reasonably foreseeable requirements. We regularly evaluate our expected facility needs and periodically makes adjustments based on these evaluations. During the next two years, we plan to purchase property and build new buildings in Odense, Denmark for our robotics operations and in San Jose, Costa Rica for our service and manufacturing operations.

Item 3: *Legal Proceedings*

We are subject to legal proceedings, claims and investigations that arise in the ordinary course of business such as, but not limited to, patent, employment, commercial and environmental matters. We believe that we have meritorious defenses against all pending claims and intend to vigorously contest them. While it is not possible to predict or determine the outcomes of any pending claims or to provide possible ranges of losses that may arise, we believe the potential losses associated with all of these actions are unlikely to have a material adverse effect on our results of operations, financial condition or cash flows.

Item 4: *Mine Safety Disclosure*

Not Applicable.

PART II

Item 5: *Market for Registrant’s Common Equity, Related Shareholder Matters and Issuer Purchases of Equity Securities*

Our common stock is traded on the Nasdaq Global Select Market under the trading symbol “TER”.

See “Item 7: Management’s Discussion and Analysis of Financial Condition and Results of Operations,” for information on the frequency and amounts of our quarterly cash dividends, equity compensation plans and performance graph.

The following table includes information with respect to repurchases we made of our common stock during the three months ended December 31, 2019 (in thousands except per share price):

<u>Period</u>	<u>(a) Total Number of Shares (or Units) Purchased</u>	<u>(b) Average Price Paid per Share (or Unit)</u>	<u>(c) Total Number of Shares (or Units) Purchased as Part of Publicly Announced Plans or Programs</u>	<u>(d) Maximum Number (or Approximate Dollar Value) of Shares (or Units) that may Yet Be Purchased Under the Plans or Programs</u>
September 30, 2019 – October 27, 2019	757	\$59.49	756	\$262,786
October 28, 2019 – November 24, 2019	690	\$63.81	689	\$218,846
November 25, 2019 – December 31, 2019	658	\$64.38	657	\$176,522
	<u>2,105(1)</u>	<u>\$62.43(1)</u>	<u>2,102</u>	

(1) Includes approximately three thousand shares at an average price of \$60.44 withheld from employees for the payment of taxes.

We satisfy U.S. federal and state minimum withholding tax obligations due upon the vesting and the conversion of restricted stock units into shares of our common stock, by automatically withholding from the shares being issued, a number of shares with an aggregate fair market value on the date of such vesting and conversion that would satisfy the minimum withholding amount due.

Item 6: *Selected Financial Data*

	<u>Years Ended December 31,</u>				
	<u>2019</u>	<u>2018</u>	<u>2017</u>	<u>2016</u>	<u>2015</u>
	(dollars in thousands, except per share amounts)				
Consolidated Statement of Operations					
Data (1)(2)(3)(4)(5):					
Revenues	\$2,294,965	\$2,100,802	\$2,136,606	\$1,753,250	\$1,639,578
Net income (loss)	\$ 467,468	\$ 451,779	\$ 257,692	\$ (43,421)	\$ 206,477
Net income (loss) per common share-basic	\$ 2.74	\$ 2.41	\$ 1.30	\$ (0.21)	\$ 0.98
Net income (loss) per common share-diluted	\$ 2.60	\$ 2.35	\$ 1.28	\$ (0.21)	\$ 0.97
Cash dividend declared per common share	\$ 0.36	\$ 0.36	\$ 0.28	\$ 0.24	\$ 0.24
Consolidated Balance Sheet Data:					
Total assets	\$2,787,014	\$2,706,606	\$3,109,545	\$2,762,493	\$2,548,674
Long-term debt obligations	\$ 394,687	\$ 379,981	\$ 365,987	\$ 352,669	\$ —

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- (1) The year ended December 31, 2019 includes a \$26.0 million tax benefit from the release of uncertain tax position reserves due to the IRS completion of its audit of our 2015 Federal tax return, a \$15.0 million charge for the impairment of the investment in RealWear, \$8.2 million of pension actuarial losses, and the results of operations of Lemsys and AutoGuide from January 30, 2019 and November 13, 2019, respectively.
 - (2) The year ended December 31, 2018 includes \$49.5 million of tax benefit related to the finalization of the U.S. transition tax liability, \$3.3 million of pension actuarial gains, and the results of operations of Mobile Industrial Robots and Energid from April 25, 2018 and February 26, 2018, respectively.
 - (3) The year ended December 31, 2017 includes \$186.0 million of pension tax expense related to the Tax Reform Act and \$6.6 million of pension actuarial gains.
 - (4) The year ended December 31, 2016 includes a \$254.9 million goodwill impairment charge and an \$83.3 million acquired intangible assets impairment charge related to the Wireless Test segment, and \$3.2 million of pension actuarial gains.
 - (5) The year ended December 31, 2015 includes \$17.7 million of pension actuarial losses, a \$5.4 million gain from the sale of an equity investment and the results of operations of Universal Robots from June 12, 2015.

Item 7: *Management's Discussion and Analysis of Financial Condition and Results of Operations*

Overview

We are a leading global supplier of automation equipment for test and industrial applications. We design, develop, manufacture and sell automatic test systems used to test semiconductors, wireless products, data storage and complex electronics systems in the consumer electronics, wireless, automotive, industrial, computing, communications, and aerospace and defense industries. Our industrial automation products include collaborative robotic arms, autonomous mobile robots and advanced robotic control software used by global manufacturing and light industrial customers to improve quality, increase manufacturing and material handling efficiency and decrease manufacturing costs. Our automatic test equipment and industrial automation products and services include:

- semiconductor test (“Semiconductor Test”) systems;
- defense/aerospace (“Defense/Aerospace”) test instrumentation and systems, storage test (“Storage Test”) systems, and circuit-board test and inspection (“Production Board Test”) systems (collectively these products represent “System Test”);
- industrial automation (“Industrial Automation”) products; and
- wireless test (“Wireless Test”) systems.

We have a customer base which includes integrated device manufacturers (“IDMs”), outsourced semiconductor assembly and test providers (“OSATs”), original equipment manufacturers (“OEMs”), wafer foundries, fabless companies that design, but contract with others for the manufacture of integrated circuits (“ICs”), developers of wireless devices and consumer electronics, manufacturers of circuit boards, automotive suppliers, wireless product manufacturers, storage device manufacturers, aerospace and military contractors, and distributors that sell collaborative robots, autonomous mobile robots and wireless test systems. The sales of our products and services are dependent, to a large degree, on these customers who are subject to cyclical trends in the demand for their products. These cyclical periods have had, and will continue to have, a significant effect on our business because our customers often delay or accelerate purchases in reaction to changes in their businesses and to demand fluctuations in the semiconductor, electronics and industrial automation industries. Historically, these demand fluctuations have resulted in significant variations in our results of operations.

The market for our test products is concentrated with a limited number of significant customers accounting for a substantial portion of the purchases of test equipment. A few customers drive significant demand for our test products both through direct sales and sales to the customers’ supply partners. We expect that sales of our test products will continue to be concentrated with a limited number of significant customers for the foreseeable future.

In 2019, revenue in our test businesses exceeded our plan as a result of Semiconductor Test demand in China, early 5G test investments and strength in our System Test businesses. The revenue growth of our Industrial Automation businesses was below our plan. In 2020, we expect continued strong momentum in our test businesses and improvement in the growth of our Industrial Automation businesses.

On February 26, 2018, we acquired Energid Technologies Corporation (“Energid”) for a total purchase price of approximately \$27.6 million. Energid’s technology enables and simplifies the programming of complex robotic motions used in a wide variety of end markets, ranging from heavy industry to healthcare, utilizing both traditional robots and collaborative robots. Energid is included in our Industrial Automation segment.

On April 25, 2018, we acquired Mobile Industrial Robots ApS (“MiR”), a Danish limited liability company. MiR is a leading maker of collaborative autonomous mobile robots (“AMRs”) for industrial applications. The total purchase price was approximately \$197.8 million, which included cash paid of approximately \$145.2 million and \$52.6 million in fair value of contingent consideration payable upon achievement of certain thresholds and targets for revenue and earnings before interest and taxes through 2020. Contingent consideration for 2018 was \$30.8 million and was paid in March 2019. Contingent consideration for 2019 was \$9.1 million and is expected to be paid in March 2020. The remaining maximum contingent consideration that could be paid is \$63.2 million. MiR is included in our Industrial Automation segment.

Based on our December 31, 2019 goodwill impairment test, the MiR reporting unit’s estimated fair value exceeded its carrying value by 14%. The MiR goodwill amount is \$123.6 million as of December 31, 2019. Key assumptions in the goodwill valuation model are forecasted revenues, discount rate and earnings before interest and taxes. A change in any of these key assumptions could result in the reporting unit being impaired in a future period.

On January 30, 2019, we acquired all of the issued and outstanding shares of Lemsys SA (“Lemsys”) for a total purchase price of approximately \$9.1 million. Lemsys strengthens our position in the electrification trends of vehicles, solar, wind, and industrial applications. Lemsys is included in our Semiconductor Test segment.

On June 3, 2019, we invested \$15.0 million in RealWear, Inc. (“RealWear”). RealWear, a private company, develops and sells advanced wearable technology including industrial, hands-free, head-mounted augmented reality devices that make the workplace safer and more productive. On February 28, 2020, RealWear’s debt holder demanded repayment of its \$25.0 million loan to RealWear. As a result, in the fourth quarter of 2019, we recorded an impairment charge of \$15.0 million to reduce our investment in RealWear to zero as of December 31, 2019.

On November 13, 2019, we acquired 100% of the membership interests of AutoGuide, LLC (“AutoGuide”), a maker of high payload AMRs, an emerging and fast growing segment of the global forklift market. The total purchase price was approximately \$81.7 million, which included cash paid of approximately \$57.8 million and \$24.0 million in fair value of contingent consideration payable upon achievement of certain performance targets, extending potentially through 2022. The maximum contingent consideration that could be paid is \$106.9 million. AutoGuide’s AMRs are used for material transport of payloads up to 4,500 kg in manufacturing, warehouse and logistics applications. These products complement MiR’s lower payload products. AutoGuide is included in our Industrial Automation segment, which is a key component of our growth strategy.

We believe our recent acquisitions and investments have enhanced our opportunities for growth. We intend to continue to invest in our business, grow market share in our markets and further expand our addressable markets while tightly managing our costs.

Critical Accounting Policies and Estimates

We have identified the policies discussed below as critical to understanding our business and our results of operations and financial condition. The impact and any associated risks related to these policies on our business operations is discussed throughout Management’s Discussion and Analysis of Financial Condition and Results of Operations where such policies affect our reported and expected financial results.

Revenue from Contracts with Customers

In accordance with ASC 606, “*Revenue from Contracts with Customers*” (“ASC 606”), we recognize revenues, when or as control is transferred to a customer. Our determination of revenue is dependent upon a five step process outlined below.

- We account for a contract with a customer when there is written approval, the contract is committed, the rights of the parties, including payment terms, are identified, the contract has commercial substance and consideration is probable of collection.
- We periodically enter into contracts with customers in which a customer may purchase a combination of goods and services, such as products with extended warranty obligations. We determine performance obligations by assessing whether the products or services are distinct from the other elements of the contract. In order to be distinct, the product or service must perform either on its own or with readily available resources and must be separate within the context of the contract.
- We consider the amount stated on the face of the purchase order to be the transaction price. We do not have variable consideration which could impact the stated purchase price agreed to by us and the customer.
- Transaction price is allocated to each individual performance obligation based on the standalone selling price of that performance obligation. We use standalone transactions when available to value each performance obligation. If standalone transactions are not available, we will estimate the standalone selling price through market assessments or cost plus a reasonable margin analysis. Any discounts from standalone selling price are spread proportionally to each performance obligation.
- In order to determine the appropriate timing for revenue recognition, we first determine if the transaction meets any of three criteria for over time recognition. If the transaction meets the criteria for over time recognition, we recognize revenue as the good or service is delivered. We use input variables such as hours or months utilized or costs incurred to determine the amount of revenue to recognize in a given period. Input variables are used as they best align consumption with benefit to the customer. For transactions that do not meet the criteria for over time recognition, we will recognize revenue at a point in time based on an assessment of the five criteria for transfer of control. We have concluded that revenue should be recognized when shipped or delivered based on contractual terms. Typically, acceptance of our products and services is a formality as we deliver similar systems, instruments and robots to standard specifications. In cases where acceptance is not deemed a formality, we will defer revenue recognition until customer acceptance.

Translation of Non-U.S. Currencies

The functional currency for all non-U.S. subsidiaries is the U.S. dollar, except for Universal Robots, MiR and Lemsys for which the local currency is its functional currency. All foreign currency denominated monetary assets and liabilities are remeasured on a monthly basis into the functional currency using exchange rates in effect at the end of the period. All foreign currency denominated non-monetary assets and liabilities are remeasured into the functional currency using historical exchange rates. Net foreign exchange gains and losses resulting from remeasurement are included in other (income) expense, net. For Universal Robots, MiR and Lemsys, assets and liabilities are translated into U.S. dollars using exchange rates in effect at the end of the period. Revenues and expense amounts are translated using an average of exchange rates in effect during the period. Translation adjustments are recorded within accumulated other comprehensive income (loss) on the balance sheet.

Retirement and Postretirement Plans

We recognize net actuarial gains and losses and the change in the fair value of the plan assets in our operating results in the year in which they occur or upon any interim remeasurement of the plans. We calculate

the expected return on plan assets using the fair value of the plan assets. Actuarial gains and losses are generally measured annually as of December 31 and, accordingly, recorded during the fourth quarter of each year or upon any interim remeasurement of the plans.

In March 2017, the Financial Accounting Standards Board (“FASB”) issued ASU 2017-07, “*Compensation—Retirement Benefits (Topic 715): Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost.*” We retrospectively adopted the new accounting guidance on presentation of net periodic pension costs and net periodic postretirement benefit costs in the first quarter of 2018. This guidance requires the service cost component of net benefit costs to be reported in the same line item in the consolidated statement of operations as other employee compensation costs. The non-service components of net benefit costs such as interest cost, expected return on assets, amortization of prior service cost, and actuarial gains or losses, are required to be reported separately outside of income or loss from operations. Following the adoption of this guidance, we continue to record the service cost component in the same line item as other employee compensation costs and the non-service components of net benefit costs such as interest cost, expected return on assets, amortization of prior service cost, and actuarial gains or losses are reported within other (income) expense, net. In 2017, the retrospective adoption of this standard decreased income from operations by \$5.0 million, due to the reclass of net actuarial pension gains and increased non-operating (income) expense by the same amount with no impact to net income (loss).

Inventories

Inventories are stated at the lower of cost using a standard costing system which approximates cost based on a first-in, first-out basis or net realizable value. On a quarterly basis, we use consistent methodologies to evaluate all inventories for net realizable value. We record a provision for both excess and obsolete inventory when such write-downs or write-offs are identified through the quarterly review process. The inventory valuation is based upon assumptions about future demand, product mix, and possible alternative uses.

Equity Incentive and Stock Purchase Plans

Stock-based compensation expense is based on the grant-date fair value estimated in accordance with the provisions of ASC 718, “*Compensation—Stock Compensation.*” Upon adoption of ASU 2016-09, “*Compensation-Stock Compensation (Topic 718): Improvements to Employee Share-Based Payment Accounting,*” in the first quarter of 2017, we made an accounting policy election to continue accounting for forfeitures by applying an estimated forfeiture rate and recognizing compensation costs only for those stock-based compensation awards expected to vest. In accordance with ASU 2016-09, starting in the first quarter of 2017, excess tax benefits or tax deficiencies are recognized as a discrete tax benefit or discrete tax expense to the current income tax provision in our consolidated statements of operations and are reported as cash flows from operating activities. On January 1, 2017, a cumulative effect adjustment of \$39.1 million for any prior year excess tax benefits or tax deficiencies not previously recorded was recorded as an increase to retained earnings and deferred tax assets. All cash payments made to taxing authorities on the employees’ behalf for withheld shares are presented as financing activities on the statement of cash flows. In 2019, 2018 and 2017, we recognized a discrete tax benefit of \$4.9 million, \$7.6 million and \$6.3 million, respectively, related to net excess tax benefit.

Income Taxes

Deferred tax assets and liabilities are determined based on differences between financial reporting and tax basis of assets and liabilities and are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse. The measurement of deferred tax assets is reduced by a valuation allowance if it is more likely than not that some or all of the deferred tax assets will not be realized. We performed the required assessment of positive and negative evidence regarding the realization of the net deferred tax assets in accordance with ASC 740, “*Accounting for Income Taxes.*” This assessment included the evaluation of scheduled

reversals of deferred tax liabilities, estimates of projected future taxable income and tax-planning strategies. Although realization is not assured, based on our assessment, we concluded that it is more likely than not that such assets, net of the existing valuation allowance, will be realized.

Investments

We account for our investments in debt and equity securities in accordance with the provisions of ASC 320-10, “*Investments—Debt and Equity Securities*.” On a quarterly basis, we review our investments to identify and evaluate those that have an indication of a potential other-than-temporary impairment. Factors considered in determining whether a loss is other-than-temporary include:

- The length of time and the extent to which the market value has been less than cost;
- The financial condition and near-term prospects of the issuer; and
- The intent and ability to retain the investment in the issuer for a period of time sufficient to allow for any anticipated recovery in market value.

Investment in Other Companies

We account for investments in other companies at cost and evaluate for impairment or an indication of changes in fair value resulting from observable price changes in orderly transactions for the identical or similar investment of the same issuer on a quarterly basis.

Financial Assets and Financial Liabilities

In January 2016, the FASB issued ASU 2016-01, “*Financial Instruments—Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities*.” We adopted the new accounting guidance in the first quarter of 2018 using the modified retrospective approach. This guidance requires that changes in fair value of equity marketable securities be accounted for directly in earnings. Previously, the changes in fair value of equity marketable securities were recorded in accumulated other comprehensive income on the balance sheet. We continue to record realized gains in interest income and realized losses in interest expense. The adoption of this new accounting guidance increased the January 1, 2018 retained earnings balance by \$3.1 million and decreased the accumulated other comprehensive income balance by the same amount.

Goodwill, Intangible and Long-Lived Assets

We assess goodwill for impairment at least annually in the fourth quarter, as of December 31, on a reporting unit basis, or more frequently, when events and circumstances occur indicating that the recorded goodwill may be impaired. If the book value of a reporting unit exceeds its fair value, the implied fair value of goodwill is compared with the carrying amount of goodwill. If the carrying amount of goodwill exceeds the implied fair value of goodwill, an impairment charge is recorded in an amount equal to that excess.

No goodwill impairment was identified in 2019, 2018 and 2017.

Based on our December 31, 2019 goodwill impairment test, the MiR reporting unit’s estimated fair value exceeded its carrying value by 14%. The MiR goodwill amount is \$123.6 million as of December 31, 2019. Key assumptions in the goodwill valuation model are forecasted revenues, discount rate and earnings before interest and taxes. A change in any of these key assumptions could result in the reporting unit being impaired in a future period.

We assess the impairment of intangible and long-lived assets whenever events or changes in circumstances indicate that the carrying value may not be recoverable. Factors we consider important in the determination of an impairment include significant underperformance relative to historical or projected future operating results, significant changes in the manner that we use the acquired asset and significant negative industry or economic trends.

Business Combination

We recognize the tangible and intangible assets acquired and liabilities assumed based on their estimated fair values at the date of acquisition. The fair value of identifiable intangible assets is based on detailed cash flow valuations that use information and assumptions provided by management. We estimate the fair value of contingent consideration at the time of the acquisition using all pertinent information known to us at the time to assess the probability of payment of contingent amounts or through the use of a Monte Carlo simulation model. We allocate any excess purchase price over the fair value of the net tangible and intangible assets acquired and liabilities assumed to goodwill. The assumptions used in the valuations for our acquisitions may differ materially from actual results depending on performance of the acquired businesses and other factors. While we believe the assumptions used were appropriate, different assumptions in the valuation of assets acquired and liabilities assumed could have a material impact on the timing and extent of impact on our statements of operations. Goodwill is assigned to reporting units as of the date of the related acquisition.

Results of Operations

Information pertaining to fiscal year 2017 results of operations, including a year-to-year comparison against fiscal year 2018, was included in our Annual Report on Form 10-K for the year ended December 31, 2018 under Part II, Item 7, “Management’s Discussion and Analysis of Financial Position and Results of Operations,” which was filed with the SEC on March 1, 2019. This information is incorporated by reference herein.

The following table sets forth the percentage of total net revenues included in our consolidated statements of operations:

	Years Ended December 31,	
	2019	2018
Percentage of revenues:		
Revenues:		
Products	82.3%	82.3%
Services	<u>17.7</u>	<u>17.7</u>
Total revenues	100.0	100.0
Cost of revenues:		
Cost of products	34.1	34.6
Cost of services	<u>7.5</u>	<u>7.3</u>
Total cost of revenues (exclusive of acquired intangible assets amortization shown separately below)	<u>41.6</u>	<u>41.9</u>
Gross profit	58.4	58.1
Operating expenses:		
Selling and administrative	19.0	18.6
Engineering and development	14.1	14.4
Acquired intangible assets amortization	1.7	1.9
Restructuring and other	<u>(0.6)</u>	<u>0.7</u>
Total operating expenses	<u>34.3</u>	<u>35.5</u>
Income from operations	24.1	22.6
Non-operating (income) expenses:		
Interest income	(1.1)	(1.3)
Interest expense	1.0	1.5
Other (income) expense, net	<u>1.3</u>	<u>0.1</u>
Income before income taxes	22.9	22.3
Income tax provision	<u>2.5</u>	<u>0.8</u>
Net income	<u>20.4%</u>	<u>21.5%</u>

Revenues

Revenues for our reportable segments were as follows:

	<u>2019</u>	<u>2018</u>	<u>2018-2019</u> <u>Dollar</u> <u>Change</u>
		(in millions)	
Semiconductor Test	\$1,552.6	\$1,492.4	\$ 60.2
Industrial Automation	298.1	261.5	36.6
System Test	287.5	216.1	71.4
Wireless Test	157.3	132.0	25.3
Corporate and Other	(0.5)	(1.2)	0.7
	<u>\$2,295.0</u>	<u>\$2,100.8</u>	<u>\$194.2</u>

The increase in Semiconductor Test revenues of \$60.2 million, or 4%, from 2018 to 2019 was driven primarily by an increase in semiconductor tester sales for 5G infrastructure and image sensors and higher service revenue, partially offset by a decrease in sales in the automotive and analog test segments.

The increase in Industrial Automation revenues of \$36.6 million, or 14%, from 2018 to 2019 was primarily due to higher demand for collaborative robots. The MiR acquisition was completed in April 2018.

The increase in System Test revenues of \$71.4 million, or 33%, from 2018 to 2019 was primarily due to higher sales in Storage Test of 3.5" hard disk drive testers, higher sales in Defense/Aerospace test instrumentation and systems, and higher sales in Production Board Test from higher 5G demand.

The increase in Wireless Test revenues of \$25.3 million, or 19%, from 2018 to 2019 was primarily due to higher demand for millimeter wave and cellular test products driven by new wireless standards and 5G, partially offset by lower sales in connectivity test products and services.

Our reportable segments accounted for the following percentages of consolidated revenues:

	<u>2019</u>	<u>2018</u>
Semiconductor Test	68%	71%
Industrial Automation	13	12
System Test	13	10
Wireless Test	7	6
	<u>100%</u>	<u>100%</u>

Revenues by country as a percentage of total revenues were as follows (1):

	<u>2019</u>	<u>2018</u>
China	22%	17%
Taiwan	21	25
United States	15	13
Korea	10	8
Europe	10	11
Japan	8	8
Thailand	4	3
Singapore	4	5
Malaysia	3	6
Philippines	2	4
Rest of the World	2	2
	<u>100%</u>	<u>100%</u>

(1) Revenues attributable to a country are based on the location of the customer site.

The breakout of product and service revenues was as follows:

	<u>2019</u>	<u>2018</u>	<u>2018-2019 Dollar Change</u>
	(in millions)		
Products revenues	\$1,887.7	\$1,729.6	\$158.1
Services revenues	407.3	371.2	36.1
	<u>\$2,295.0</u>	<u>\$2,100.8</u>	<u>\$194.2</u>

Our product revenues increased \$158.1 million, or 9%, in 2019 from 2018 primarily due to higher sales in Semiconductor Test of testers for 5G infrastructure and image sensors, higher sales in Storage Test of 3.5” hard disk drive testers, and higher demand in Industrial Automation, partially offset by a decrease in sales in Semiconductor Test automotive and analog test segments. Service revenues increased \$36.1 million or 10%.

In 2019 and 2018, no single direct customer accounted for more than 10% of our consolidated revenues. In 2019 and 2018, our five largest direct customers in aggregate accounted for 27% and 27% of our consolidated revenues, respectively.

We estimate consolidated revenues driven by Huawei Technologies Co. Ltd. (“Huawei”), combining direct sales to that customer with sales to the customer’s OSATs, accounted for approximately 11% and 4% of our consolidated revenues in 2019 and 2018, respectively. We estimate consolidated revenues driven by another OEM customer, combining direct sales to that customer with sales to the customer’s OSATs, accounted for approximately 10% and 13% of our consolidated revenues in 2019 and 2018, respectively.

Gross Profit

	<u>2019</u>	<u>2018</u>	<u>2018-2019 Dollar / Point Change</u>
	(dollars in millions)		
Gross profit	\$1,339.8	\$1,220.4	\$119.4
Percent of total revenues	58.4%	58.1%	0.3

Gross profit as a percent of total revenues increased from 2018 to 2019 by 0.3 points, primarily due to favorable product mix in Semiconductor Test and Storage Test.

The breakout of product and service gross profit was as follows:

	<u>2019</u>	<u>2018</u>	<u>2018-2019 Dollar / Point Change</u>
	(dollars in millions)		
Product gross profit	\$1,105.6	\$1,002.5	\$103.1
Percent of product revenues	58.6%	58.0%	0.6
Service gross profit	\$ 234.2	\$ 217.9	\$ 16.3
Percent of service revenues	57.5%	58.7%	(1.2)

We assess the carrying value of our inventory on a quarterly basis by estimating future demand and comparing that demand against on-hand and on-order inventory positions. Forecasted revenues information is

obtained from the sales and marketing groups and incorporates factors such as backlog and future consolidated revenues. This quarterly process identifies obsolete and excess inventory. Obsolete inventory, which represents items for which there is no demand, is fully reserved. Excess inventory, which represents inventory items that are not expected to be consumed during the next twelve quarters for our Semiconductor Test, Industrial Automation and System Test segments and next four quarters for our Wireless Test segment, is written-down to estimated net realizable value.

During the year ended December 31, 2019, we recorded an inventory provision of \$15.2 million included in cost of revenues, primarily due to downward revisions to previously forecasted demand levels for certain products. Of the \$15.2 million of total excess and obsolete provisions, \$8.7 million was related to Semiconductor Test, \$4.0 million was related to Wireless Test, \$2.0 million was related to System Test, and \$0.5 million was related to Industrial Automation.

During the year ended December 31, 2018, we recorded an inventory provision of \$11.2 million included in cost of revenues, primarily due to downward revisions to previously forecasted demand levels for certain products. Of the \$11.2 million of total excess and obsolete provisions, \$6.8 million was related to Semiconductor Test, \$2.5 million was related to Wireless Test, \$1.2 million was related to System Test, and \$0.7 million was related to Industrial Automation.

During the years ended December 31, 2019 and 2018, we scrapped \$9.2 million and \$7.0 million of inventory, respectively, and sold \$3.2 million and \$6.7 million of previously written-down or written-off inventory, respectively. As of December 31, 2019, we had inventory related reserves for amounts which had been written-down or written-off totaling \$103.6 million. We have no pre-determined timeline to scrap the remaining inventory.

Selling and Administrative

Selling and administrative expenses were as follows:

	<u>2019</u>	<u>2018</u>	<u>2018-2019</u> <u>Change</u>
	(dollars in millions)		
Selling and administrative	\$437.1	\$390.7	\$46.4
Percent of total revenues	19.0%	18.6%	

The increase of \$46.4 million in selling and administrative expenses from 2018 to 2019 was due primarily to higher spending in Industrial Automation from higher sales and marketing spending in Universal Robots and MiR, which was acquired on April 25, 2018, higher sales and marketing spending in Semiconductor Test and higher variable compensation.

Engineering and Development

Engineering and development expenses were as follows:

	<u>2019</u>	<u>2018</u>	<u>2018-2019</u> <u>Change</u>
	(dollars in millions)		
Engineering and development	\$322.8	\$301.5	\$21.3
Percent of total revenues	14.1%	14.4%	

The increase of \$21.3 million in engineering and development expenses from 2018 to 2019 was due primarily to higher spending in Industrial Automation and Wireless Test and higher variable compensation.

Restructuring and Other

During the year ended December 31, 2019, we recorded a gain of \$22.2 million from the decrease in the fair value of the MiR contingent consideration liability, partially offset by a \$3.0 million increase in the fair value of the AutoGuide contingent consideration, \$2.9 million of severance charges related to headcount reductions primarily in Semiconductor Test and Industrial Automation, and \$2.5 million for acquisition related expenses and compensation.

During the year ended December 31, 2018, we recorded an expense of \$17.7 million for the increase in the fair value of the MiR contingent consideration liability, \$8.7 million of severance charges related to headcount reductions primarily in Semiconductor Test, and \$4.5 million for acquisition related expenses and compensation, partially offset by a gain of \$16.7 million from the decrease in the fair value of the Universal Robots contingent consideration liability.

The remaining accrual for severance of \$0.5 million is reflected in the accrued employees' compensation and withholdings on the balance sheet and is expected to be paid by October 2020.

Interest and Other

	<u>2019</u>	<u>2018</u>	<u>2018-2019</u>
		(in millions)	Change
Interest income	\$(24.8)	\$(26.7)	\$ 1.9
Interest expense	23.1	31.3	(8.2)
Other (income) expense, net	29.5	1.4	28.1

Interest income decreased by \$1.9 million from 2018 to 2019 due primarily to lower cash and marketable securities balances in 2019. Interest expense decreased by \$8.2 million from 2018 to 2019 due primarily to unrealized losses on equity marketable securities recognized in 2018. Other (income) expense, net increased by \$28.1 million from 2018 to 2019 due primarily to a \$15.0 million charge for the impairment of the investment in RealWear and an \$11.5 million change in pension actuarial (gains) losses from a \$3.3 million gain in 2018 to an \$8.2 million loss in 2019.

Income (Loss) Before Income Taxes

	<u>2019</u>	<u>2018</u>	<u>2018-2019</u>
		(in millions)	Change
Semiconductor Test	\$417.0	\$397.6	\$ 19.4
System Test	93.5	48.9	44.6
Wireless Test	35.6	29.1	6.5
Industrial Automation	(5.9)	7.7	(13.6)
Corporate and Other (1)	(14.4)	(15.4)	1.0
	<u>\$525.8</u>	<u>\$467.8</u>	<u>\$ 58.0</u>

(1) Included in Corporate and Other are the following: contingent consideration adjustments, investment impairment, pension and postretirement plans actuarial (gains) and losses, interest (income) and expense, net foreign exchange (gains) and losses, intercompany eliminations and acquisition related charges.

The increase in income before income taxes in Semiconductor Test from 2018 to 2019 was driven primarily by an increase in semiconductor tester sales for 5G infrastructure and image sensors, partially offset by a decrease in sales in the automotive and analog test segments. The increase in income before income taxes in System Test from 2018 to 2019 was primarily due to higher sales in Storage Test of 3.5" hard disk drive testers, higher sales in Defense/Aerospace test instrumentation and systems, and higher sales in Production Board Test

from higher 5G demand. The increase in income before income taxes in Wireless Test from 2018 to 2019 was primarily due to higher demand for millimeter wave and cellular test products driven by new wireless standards and 5G partially offset by lower sales in connectivity test products and services. The decrease in income before income taxes in Industrial Automation from 2018 to 2019 was due primarily to higher sales and marketing, and engineering spending.

Income Taxes

Income tax expense for 2019, 2018 and 2017 totaled \$58.3 million, \$16.0 million and \$266.7 million, respectively. The effective tax rate for 2019, 2018 and 2017 was 11.1%, 3.4% and 50.9%, respectively.

The increase in the effective tax rate from 2018 to 2019 is primarily attributable to increases in expense associated with U.S. global intangible low-taxed income and U.S. transition tax on the mandatory deemed repatriation of foreign earnings. These increases in expense were partially offset by increased benefit from the U.S. foreign derived intangible income deduction, foreign tax credits and a net reduction in reserves for uncertain tax positions.

We recorded \$186.0 million of additional income tax expense in the fourth quarter of 2017 which represented our best estimate of the impact of the Tax Reform Act in accordance with our understanding of the Tax Reform Act and available guidance as of that date. The \$186.0 million was primarily composed of expense of \$161.0 million related to the one-time transition tax on the mandatory deemed repatriation of foreign earnings, \$33.6 million of expense related to the remeasurement of certain deferred tax assets and liabilities based on the rates at which they are expected to reverse in the future, and benefit of \$10.3 million associated with the impact of correlative adjustments on uncertain tax positions. In accordance with the requirements of SEC Staff Accounting Bulletin (“SAB”) No. 118, “Income Tax Accounting Implications of the Tax Cuts and Jobs Act”, in the fourth quarter of 2018, we completed our analysis of the effect of the Tax Reform Act based on the application of the guidance available as of December 31, 2018 and recorded \$49.5 million of net income tax benefit. The net benefit consisted of \$51.7 million of benefit resulting from a reduction in the estimate of the one-time transition tax on the mandatory deemed repatriation of foreign earnings and an expense of \$2.2 million associated with the impact of correlative adjustments on uncertain tax positions.

The change in the effective tax rate from 2017 to 2018 was also impacted by a shift in the geographic distribution of income which increased income subject to taxation in the U.S. relative to lower tax rate jurisdictions, the benefit of the U.S. foreign derived intangible income deduction and increases in discrete benefit from non-taxable foreign exchange gains and losses.

We qualify for a tax holiday in Singapore by fulfilling the requirements of an agreement with the Singapore Economic Development Board under which certain headcount and spending requirements must be met. The tax savings attributable to the Singapore tax holiday for the years ended December 31, 2019, 2018 and 2017 were \$15.1 million or \$0.08 per diluted share, \$11.9 million or \$0.06 per diluted share and \$24.8 million or \$0.12 per diluted share, respectively. The tax holiday is scheduled to expire on December 31, 2020.

Contractual Obligations

The following table reflects our contractual obligations as of December 31, 2019:

	Payments Due by Period					Other
	Total	Less than 1 year	1-3 years	3-5 years	More than 5 years	
	(in thousands)					
Convertible debt	\$ 460,000	\$ —	\$ —	\$460,000	\$ —	\$ —
Purchase obligations	415,582	\$412,948	2,634	—	—	—
Retirement plans contributions	139,451	5,069	10,464	10,336	113,582	—
Transition tax payable (1)	88,157	5,515	15,741	22,628	44,273	—
Operating lease obligations	72,505	21,933	30,582	11,602	8,388	—
Interest on long term debt	23,000	5,750	11,500	5,750	—	—
Fair value of contingent consideration . . .	39,705	9,106	30,599	—	—	—
Other long-term liabilities reflected on the balance sheet under GAAP (2)	79,579	—	39,156	6,348	470	33,605
Total	\$1,317,979	\$460,321	\$140,676	\$516,664	\$166,713	\$33,605

- (1) Represents the transition tax liability associated with our accumulated foreign earnings as a result of enactment of the Tax Reform Act on December 22, 2017.
- (2) Included in other long-term liabilities are liabilities for customer advances, extended warranty, uncertain tax positions, deferred tax liabilities and other obligations. For certain long-term obligations, we are unable to provide a reasonably reliable estimate of the timing of future payments relating to these obligations and therefore we included these amounts in the column marked “Other.”

Liquidity and Capital Resources

Our cash, cash equivalents and marketable securities balance decreased by \$189 million from 2018 to 2019 to \$1,016 million.

Operating activities during 2019 provided cash of \$578.8 million. Changes in operating assets and liabilities used cash of \$51.7 million due to a \$121.6 million increase in operating assets and a \$69.9 million increase in operating liabilities.

The increase in operating assets was due to a \$70.4 million increase in accounts receivable due to increased sales, a \$27.4 million increase in inventories, and a \$23.8 million increase in prepayments and other assets.

The increase in operating liabilities was due to a \$39.3 million increase in deferred revenue and customer advance payments, a \$24.8 million increase in accounts payable, a \$15.3 million increase in accrued employee compensation and a \$9.2 million increase in other accrued liabilities, partially offset by a \$13.6 million decrease in income taxes, and \$5.1 million of retirement plan contributions.

Investing activities during 2019 used cash of \$156.7 million, due to \$662.7 million used for purchases of marketable securities, \$134.6 million used for purchases of property, plant and equipment, \$57.8 million, net of cash acquired, used for the acquisition of AutoGuide, \$15.0 million used for an investment in RealWear, and \$7.0 million, net of cash acquired, used for the acquisition of Lemsys, partially offset by \$611.9 million and \$105.6 million in proceeds from maturities and sales of marketable securities, respectively, and proceeds from life insurance of \$2.9 million related to the cash surrender value from the cancellation of Teradyne owned life insurance policies.

Financing activities during 2019 used cash of \$574.3 million, due to \$500.0 million used for the repurchase of 10.9 million shares of common stock at an average price of \$45.89 per share, \$61.3 million used for dividend

payments, \$27.6 million used for payments related to MiR and Universal Robots acquisition contingent consideration and \$14.7 million used for payments related to net settlement of employee stock compensation awards, partially offset by \$29.3 million from the issuance of common stock under employee stock purchase and stock option plans.

Operating activities during 2018 provided cash of \$476.9 million. Changes in operating assets and liabilities used cash of \$163.5 million. This was due to a \$105.8 million increase in operating assets and a \$57.7 million decrease in operating liabilities.

The increase in operating assets was due to a \$58.4 million increase in prepayments and other assets due primarily to payments to our contract manufacturers, a \$29.5 million increase in inventories, and a \$17.9 million increase in accounts receivable due to higher sales in the fourth quarter of 2018.

The decrease in operating liabilities was due to a \$80.4 million decrease in income taxes, primarily related to a decrease in our transitional tax liability associated with our accumulated foreign earnings under the U.S. Tax Reform Act, a \$5.5 million decrease in other accrued liabilities and \$4.3 million of retirement plans contributions, partially offset by a \$13.4 million increase in customer advance payments and deferred revenue, a \$12.9 million increase in accounts payable, and a \$6.3 million increase in accrued employee compensation due primarily to variable compensation.

Investing activities during 2018 provided cash of \$923.0 million, due to \$1,270.4 million and \$846.1 million in proceeds from maturities and sales of marketable securities, respectively, proceeds from a government subsidy of \$7.9 million for property, plant and equipment, and proceeds from life insurance of \$1.1 million related to the cash surrender value from the cancellation of a Teradyne owned life insurance policy, partially offset by \$918.7 million used for purchase of marketable securities, \$169.5 million used for the acquisitions of MiR and Energid, and \$114.4 million used for purchases of property, plant and equipment.

Financing activities during 2018 used cash of \$903.4 million, due to \$823.5 million used for the repurchase of 21.6 million shares of common stock at an average price of \$38.06 per share, \$67.3 million used for dividend payments, \$20.0 million used for payments related to net settlement of employee stock compensation awards, and \$13.6 million used for a payment related to Universal Robots acquisition contingent consideration, partially offset by \$21.0 million from the issuance of common stock under employee stock purchase and stock option plans.

In January 2019, May 2019, August 2019 and November 2019, our Board of Directors declared a quarterly cash dividend of \$0.09 per share. Total dividend payments in 2019 were \$61.3 million.

In January 2018, May 2018, August 2018 and November 2018, our Board of Directors declared a quarterly cash dividend of \$0.09 per share. Total dividend payments in 2018 were \$67.3 million.

In January 2020, our Board of Directors declared a quarterly cash dividend of \$0.10 per share to be paid on March 20, 2020 to shareholders of record as of February 21, 2020. Payment of future cash dividends are subject to the discretion of our Board of Directors and will depend, among other things, upon our earnings, capital requirements and financial condition.

In January 2018, our Board of Directors cancelled the December 2016 stock repurchase program and authorized a new stock repurchase program for up to \$1.5 billion of common stock. In 2019, we repurchased 10.9 million shares of common stock for \$500.0 million at an average price per share of \$45.89. In 2018, we repurchased 21.6 million shares of common stock for \$823.5 million at an average price per share of \$38.06. The cumulative repurchases as of December 31, 2019 totaled 32.5 million shares of common stock for \$1,323.0 million at an average price per share of \$40.68.

In January 2020, our Board of Directors cancelled the January 2018 stock repurchase program and approved a new stock repurchase program for up to \$1.0 billion of common stock. We intend to repurchase a minimum of \$250.0 million in 2020.

While we declared a quarterly cash dividend and authorized a share repurchase program, we may reduce or eliminate the cash dividend or share repurchase program in the future. Future cash dividends and stock repurchases are subject to the discretion of our Board of Directors, which will consider, among other things, our earnings, capital requirements and financial condition.

We believe our cash, cash equivalents and marketable securities balance will be sufficient to pay our quarterly dividend, execute our authorized share repurchase program and meet our working capital and expenditure needs for at least the next twelve months. Inflation has not had a significant long-term impact on earnings.

Retirement Plans

ASC 715-20, “*Compensation—Retirement Benefits—Defined Benefit Plans*,” requires an employer with defined benefit plans or other postretirement benefit plans to recognize an asset or a liability on its balance sheet for the overfunded or underfunded status of the plans as defined by ASC 715-20. The pension asset or liability represents the difference between the fair value of the pension plan’s assets and the projected benefit obligation as of December 31. For other postretirement benefit plans, the liability is the difference between the fair value of the plan’s assets and the accumulated postretirement benefit obligation as of December 31.

For the year ended December 31, 2019, our pension expense, which includes the U.S. Qualified Pension Plan (“U.S. Plan”), certain qualified plans for non-U.S. subsidiaries, and a U.S. Supplemental Executive Defined Benefit Plan, was approximately \$11.6 million. Pension expense is calculated based upon a number of actuarial assumptions. Discount rate and expected return on assets are two assumptions which are important elements of pension plan expense and asset/liability measurement. We evaluate our discount rate and expected rate of return on assets assumptions annually on a plan and country specific basis. We evaluate other assumptions related to demographic factors, such as retirement age, mortality and turnover periodically, and update them to reflect our experience and expectations for the future.

In developing the expected return on U.S. Plan assets assumption, we evaluated input from our investment manager and pension consultants, including their forecast of asset class return expectations. We believe that 4.25% was an appropriate rate of return on assets to use for 2019. The December 31, 2019 asset allocation for our U.S. Plan was 94% invested in fixed income securities, 5% invested in equity securities, and 1% invested in other securities. Our investment manager regularly reviews the actual asset allocation and periodically rebalances the portfolio to ensure alignment with our target allocations.

We recognize net actuarial gains and losses and the change in the fair value of plans assets in our operating results in the year in which they occur or upon any interim remeasurement of the plans. We calculate the expected return on plan assets using the fair value of the plan assets. Actuarial gains and losses are generally measured annually as of December 31 and, accordingly, recorded during the fourth quarter of each year or upon any interim remeasurement of the plans.

The discount rate that we utilized for determining future pension obligations for the U.S. Plan is based on the FTSE Pension Index adjusted for the U.S. Plan’s expected cash flows and was 3.10% at December 31, 2019, down from 4.15% at December 31, 2018. We estimate that in 2020 we will recognize approximately \$0.9 million of pension expense for the U.S. Plan. The U.S. Plan pension expense estimate for 2020 is based on a 3.1% discount rate and a 3.0% return on assets. Future pension expense or income will depend on future investment performance, changes in future discount rates and various other factors related to the employee population participating in our pension plans.

As of December 31, 2019, our pension plans had no unrecognized pension prior service cost.

The assets of the U.S. Plan consist substantially of fixed income securities. U.S. Plan assets have increased from \$144.3 million at December 31, 2018 to \$166.9 million at December 31, 2019 while the U.S. Plan's liability increased from \$127.4 million at December 31, 2018 to \$148.5 million at December 31, 2019. In 2019, the increase in plan assets and plan liability was due to a decrease in interest rates. In 2018, the accrued pension obligations for approximately 1,700 retiree participants were transferred to an insurance company and resulted in a \$151.3 million reduction in the pension benefit obligation and pension assets. We recorded a settlement loss of \$0.3 million related to the retiree group annuity transaction.

Our funding policy is to make contributions to our pension plans in accordance with local laws and to the extent that such contributions are tax deductible. During 2019, we made contributions of \$2.8 million to the U.S. supplemental executive defined benefit pension plan, and \$0.9 million to certain qualified plans for non-U.S. subsidiaries. In 2020, we expect to contribute approximately \$2.8 million to the U.S. supplemental executive defined benefit pension plan. Contributions to be made in 2020 to certain qualified plans for non-U.S. subsidiaries are based on local statutory requirements and are estimated at approximately \$1.0 million.

Equity Compensation Plans

In addition to our 1996 Employee Stock Purchase Plan discussed in Note Q: “*Stock-Based Compensation*” in Notes to Consolidated Financial Statements, we have a 2006 Equity and Cash Compensation Incentive Plan (the “2006 Equity Plan”) under which equity securities are authorized for issuance. The 2006 Equity Plan was initially approved by stockholders on May 25, 2006.

At our annual meeting of stockholders held May 21, 2013, our stockholders approved an amendment to the 2006 Equity Plan to increase the number of shares issuable thereunder by 10.0 million, for an aggregate of 32.0 million shares issuable thereunder, and our stockholders also approved an amendment to our 1996 Employee Stock Purchase Plan to increase the number of shares issuable thereunder by 5.0 million, for an aggregate of 30.4 million shares issuable thereunder. At our annual meeting of stockholders held May 12, 2015, our stockholders approved an amendment to the 2006 Equity Plan to extend its term until May 12, 2025.

The following table presents information about these plans as of December 31, 2019 (share numbers in thousands):

<u>Plan category</u>	<u>Number of securities to be issued upon exercise of outstanding options, warrants and rights</u>	<u>Weighted-average exercise price of outstanding options, warrants and rights</u>	<u>Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column one)</u>
Equity plans approved by shareholders	2,542(1)	\$34.52	8,543(2)
Equity plans not approved by shareholders (3)	47	2.89	—
Total	<u>2,589</u>	<u>29.91</u>	<u>8,543</u>

- (1) Includes 2,269,426 shares of restricted stock units that are not included in the calculation of the weighted average exercise price.
- (2) Consists of 6,719,918 securities available for issuance under the 2006 Equity Plan and 1,822,724 of securities available for issuance under the Employee Stock Purchase Plan.
- (3) In connection with the 2011 acquisition of LitePoint Corporation (the “LitePoint Acquisition”), we assumed the options granted under the LitePoint Corporation 2002 Stock Plan (the “LitePoint Plan”). Upon the consummation of the LitePoint Acquisition, these options were converted automatically into options to purchase an aggregate of 2,828,344 shares of our common stock. No additional awards were granted under the LitePoint Plan. As of December 31, 2019, there were outstanding options exercisable for an aggregate of

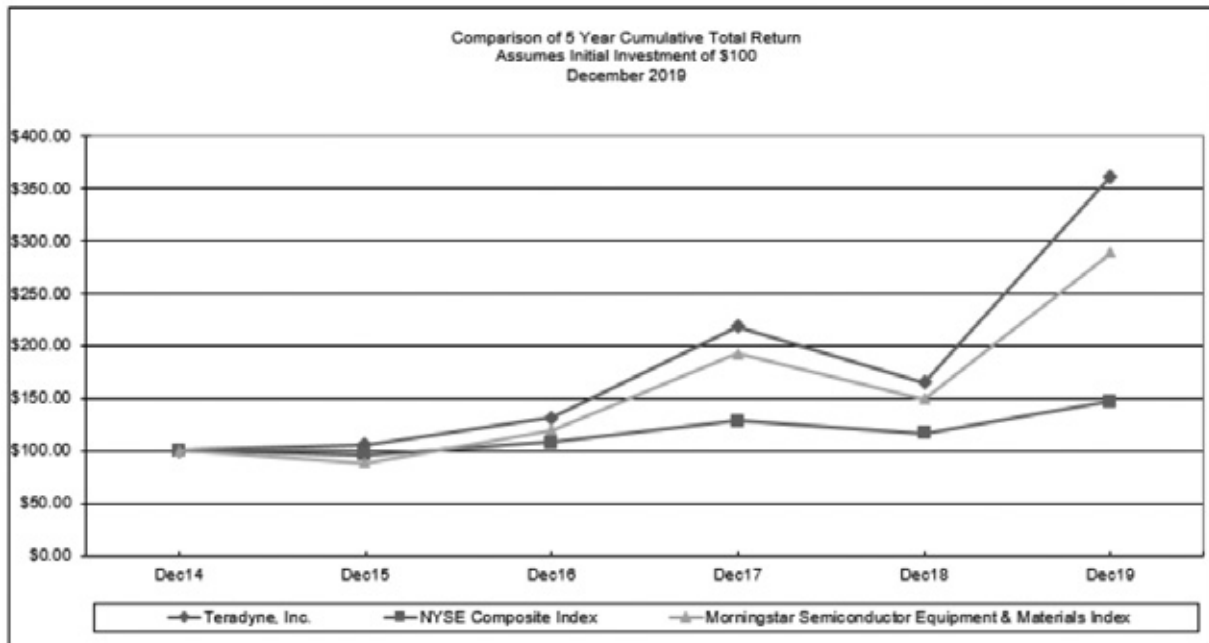
46,518 shares of our common stock pursuant to the LitePoint Plan, with a weighted average exercise price of \$2.89 per share.

The purpose of the 2006 Equity Plan is to motivate employees, officers and directors by providing equity ownership and compensation opportunities in Teradyne. The aggregate number of shares available under the 2006 Equity Plan as of December 31, 2019 was 6,719,918 shares of our common stock. The 2006 Equity Plan authorizes the grant of stock-based awards in the form of (1) non-qualified and incentive stock options, (2) stock appreciation rights, (3) restricted stock awards and restricted stock unit awards, (4) phantom stock, and (5) other stock-based awards. Awards may be tied to time-based vesting schedules and/or performance-based vesting measured by reference to performance criteria chosen by the Compensation Committee of the Board of Directors, which administers the 2006 Equity Plan. Awards may be made to any employee, officer, consultant and advisor of Teradyne and our subsidiaries, as well as, to our directors. The maximum number of shares of stock-based awards that may be granted to one participant during any one fiscal year is 2,000,000 shares of common stock.

As of December 31, 2019, total unrecognized compensation expense related to non-vested restricted stock units and options was \$45 million, and is expected to be recognized over a weighted average period of 1.8 years.

Performance Graph

The following graph compares the change in our cumulative total shareholder return in our common stock with (i) the NYSE Composite Index and (ii) the Morningstar Semiconductor Equipment & Materials Industry Group (compiled by Morningstar, Inc.). The comparison assumes \$100.00 was invested on December 31, 2014 in our common stock and in each of the foregoing indices and assumes reinvestment of dividends, if any. Historic stock price performance is not necessarily indicative of future price performance.



Recently Issued Accounting Pronouncements

On January 26, 2017, the FASB issued ASU 2017-04, “Intangibles—Goodwill and Other (Topic 350): Simplifying the Accounting for Goodwill Impairment.” The new guidance removes Step 2 of the goodwill impairment test, which requires a hypothetical purchase price allocation. Goodwill impairment will be the

amount by which a reporting unit’s carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. All other goodwill impairment guidance will remain largely unchanged. Entities will continue to have the option to perform a qualitative assessment to determine if a quantitative impairment test is necessary. The same one-step impairment test will be applied to goodwill at all reporting units, even those with zero or negative carrying amounts. Entities will be required to disclose the amount of goodwill at reporting units with zero or negative carrying amounts. The revised guidance will be applied prospectively, and is effective in 2020. Early adoption is permitted for any impairment tests performed after January 1, 2017. This pronouncement is not expected to have a material impact on our financial position, results of operations and statements of cash flows.

Item 7A: Quantitative and Qualitative Disclosures about Market Risks

Concentration of Credit Risk

Financial instruments which potentially subject us to concentrations of credit risk consist principally of cash equivalents, marketable securities, forward currency contracts and accounts receivable. Our cash equivalents consist primarily of money market funds invested in U.S. Treasuries and government agencies. Our fixed income available-for-sale marketable securities have a minimum rating of AA by one or more of the major credit rating agencies. We place forward currency contracts with high credit-quality financial institutions in order to minimize credit risk exposure. Concentrations of credit risk with respect to accounts receivable are limited due to the large number of geographically dispersed customers. We perform ongoing credit evaluations of our customers’ financial condition and from time to time may require customers to provide a letter of credit from a bank to secure accounts receivable. There were no customers who accounted for 10% or more of our accounts receivable balance as of December 31, 2019 or December 31, 2018.

In addition to market risks, we have an equity price risk related to the fair value of our convertible senior unsecured notes issued in December 2016. In December 2016, Teradyne issued \$460 million aggregate principal amount of 1.25% convertible senior unsecured notes (the “Notes”) due December 15, 2023. As of December 31, 2019, the Notes had a fair value of \$1,010 million. The table below provides a sensitivity analysis of hypothetical 10% changes of Teradyne’s stock price as of the end of 2019 and the estimated impact on the fair value of the Notes. The selected scenarios are not predictions of future events, but rather are intended to illustrate the effect such event may have on the fair value of the Notes. The fair value of the Notes is subject to equity price risk due to the convertible feature. The fair value of the Notes will generally increase as Teradyne’s common stock price increases and will generally decrease as the common stock price declines in value. The change in stock price affects the fair value of the convertible senior notes, but does not impact Teradyne’s financial position, cash flows or results of operations due to the fixed nature of the debt obligation. Additionally, we carry the Notes at face value less unamortized discount on our balance sheet, and we present the fair value for required disclosure purposes only. In connection with the offering of the Notes we also sold warrants to the option counterparties. These transactions have been accounted for as an adjustment to our shareholders’ equity. The convertible note hedge transactions are expected to reduce the potential equity dilution upon conversion of the Notes. The warrants along with any shares issuable upon conversion of the Notes will have a dilutive effect on our earnings per share to the extent that the average market price of our common stock for a given reporting period exceeds the applicable strike price or conversion price of the warrants or Notes, respectively.

<u>Hypothetical Change in Teradyne Stock Price</u>	<u>Fair Value</u>	<u>Estimated change in fair value</u>	<u>Hypothetical percentage increase (decrease) in fair value</u>
10% Increase	\$1,103,496	\$ 93,221	9.2%
No Change	1,010,275	—	—
10% Decrease	918,822	(91,453)	(9.1)

See Note J: “Debt” for further information.

Exchange Rate Risk Management

We regularly enter into foreign currency forward contracts to hedge the value of our monetary assets and liabilities in Japanese Yen, British Pound, Korean Won, Taiwan Dollar, Singapore Dollar, Euro, Philippine Peso and Chinese Yuan. These foreign currency forward contracts have maturities of approximately one month. These contracts are used to minimize the effect of exchange rate fluctuations associated with the remeasurement of monetary assets and liabilities. We do not engage in currency speculation.

We performed a sensitivity analysis assuming a hypothetical 10% fluctuation in foreign exchange rates to the hedging contracts and the underlying exposures described above. As of December 31, 2019, 2018, and 2017, the analysis indicated that these hypothetical market movements would not have a material effect on our consolidated financial position, results of operations or cash flows.

Interest Rate Risk Management

We are exposed to potential losses due to changes in interest rates. Our interest rate exposure is primarily related to short-term and long-term marketable securities.

In order to estimate the potential loss due to interest rate risk, a fluctuation in interest rates of 25 basis points was assumed. Market risk for the short and long-term marketable securities was estimated as the potential change in the fair value resulting from a hypothetical change in interest rates for securities contained in the investment portfolio. The potential change in the fair value from changes in interest rates is immaterial as of December 31, 2019 and 2018.

Item 8: Financial Statements and Supplementary Data

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Teradyne, Inc.

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Teradyne, Inc. and its subsidiaries (the “Company”) as of December 31, 2019 and 2018, and the related consolidated statements of operations, comprehensive income, shareholders’ equity and cash flows for each of the three years in the period ended December 31, 2019, including the related notes and schedule of valuation and qualifying accounts for each of the three years in the period ended December 31, 2019 appearing under Item 15(c) (collectively referred to as the “consolidated financial statements”). We also have audited the Company’s internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2019, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Changes in Accounting Principles

As discussed in Note B to the consolidated financial statements, the Company changed the manner in which it accounts for leases in 2019 and the manner in which it accounts for revenue from contracts with customers in 2018.

Basis for Opinions

The Company’s management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in Management’s Annual Report on Internal Control over Financial Reporting appearing under Item 9A. Our responsibility is to express opinions on the Company’s consolidated financial statements and on the Company’s internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on

the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matters communicated below are matters arising from the current period audit of the consolidated financial statements that were communicated or required to be communicated to the audit committee and that (i) relate to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matters below, providing separate opinions on the critical audit matters or on the accounts or disclosures to which they relate.

Acquisition of AutoGuide, LLC - Valuation of Contingent Consideration and Developed Technology Intangible Asset

As described in Notes B, D and H to the consolidated financial statements, the Company completed its acquisition of AutoGuide, LLC on November 13, 2019. The total purchase price of approximately \$81.7 million included \$57.8 million of cash paid and \$24.0 million in fair value of contingent consideration, which was determined by management using the Monte Carlo simulation model. The valuation of the contingent consideration is dependent on the following assumptions: forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate. As part of the preliminary purchase price allocation, management recorded \$24.6 million for the acquired developed technology intangible asset at fair value using the income approach. Management's significant assumption utilized in the approach was the forecasted revenues.

The principal considerations for our determination that performing procedures relating to the valuation of contingent consideration and the acquired developed technology intangible asset in the AutoGuide, LLC acquisition is a critical audit matter are (i) there was a high degree of auditor judgment and subjectivity in applying procedures relating to the fair value measurement of the contingent consideration and the acquired developed technology intangible asset due to the significant amount of judgment by management when developing the fair value estimates, (ii) significant audit effort was required in evaluating the significant assumptions relating to the estimates, including forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate for the contingent consideration, and the forecasted revenues for the acquired developed technology intangible asset, and (iii) the audit effort involved the use of professionals with specialized skill and knowledge to assist in performing procedures and evaluating the audit evidence obtained.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to the acquisition accounting, including controls over management's valuation of contingent consideration and the acquired developed technology intangible asset. These procedures also included, among others, (i) reading the purchase agreement, (ii) evaluating the appropriateness of the approaches and reasonableness of the significant assumptions used by management in developing the fair value for the contingent consideration and acquired developed technology intangible asset, including the forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate for the contingent consideration and the forecasted revenues for the acquired developed technology intangible asset, and (iii) testing the completeness, accuracy and relevance of the underlying data used in the approaches. Evaluating whether the significant assumptions used were reasonable involved evaluating historical results and consistency with external industry and market data. Professionals with specialized skill and knowledge were used to assist in the evaluation of the appropriateness of management's Monte Carlo simulation model for the contingent consideration and the income approach for the acquired developed technology intangible asset, as well as the reasonableness of certain significant assumptions, including the discount rate.

Goodwill Impairment Assessment – Mobile Industrial Robots Reporting Unit

As described in Notes B and L to the consolidated financial statements, the Company's consolidated goodwill balance was \$416.4 million as of December 31, 2019, and the goodwill associated with the Mobile Industrial Robots reporting unit was \$123.6 million. Management assesses goodwill for impairment at least annually in the fourth quarter, as of December 31, on a reporting unit basis, or more frequently when events and circumstances occur indicating that the recorded goodwill may be impaired. As disclosed by management, if the book value of a reporting unit exceeds its fair value, the implied fair value of goodwill is compared with the carrying amount of goodwill. If the carrying amount of goodwill exceeds the implied fair value of goodwill, an impairment charge is recorded in an amount equal to that excess. Management determines the fair value of a reporting unit using the results derived from an income approach and a market approach, and weighting the fair value determined under each approach to determine an estimated fair value for a reporting unit. Management's estimate of fair value for the Mobile Industrial Robots reporting unit, using the income approach, utilized the following significant assumptions: forecasted revenues, discount rate and earnings before interest and taxes. The determination of fair value of the Mobile Industrial Robots reporting unit using the market approach utilized the following significant assumptions: revenue multiples from comparable companies.

The principal considerations for our determination that performing procedures relating to the goodwill impairment assessment of the Mobile Industrial Robots reporting unit is a critical audit matter are (i) there was a high degree of auditor judgment and subjectivity in applying procedures relating to the fair value measurement of the reporting unit due to the significant judgment by management when developing the fair value measurement of the reporting unit, (ii) significant audit effort was required in performing procedures and evaluating the audit evidence obtained relating to management's fair value estimate and significant assumptions, including forecasted revenues, discount rate, and earnings before interest and taxes for the income approach and revenue multiples from comparable companies for the market approach, and (iii) the audit effort involved the use of professionals with specialized skill and knowledge to assist in performing these procedures and evaluating the audit evidence obtained.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management's goodwill impairment assessment, including controls over the valuation of the Mobile Industrial Robots reporting unit. These procedures also included, among others, testing management's process for developing the fair value estimate, evaluating the appropriateness of the income approach and market approach, including the weighting of estimated fair value between the two approaches, testing the completeness, accuracy and relevance of underlying data used in the valuation approaches and evaluating the significant assumptions used by management, including forecasted revenues, discount rate,

earnings before interest and taxes, and revenue multiples from comparable companies. Evaluating management's assumptions related to the forecasted revenues and earnings before interest and taxes involved assessing whether the assumptions used by management were reasonable considering the past performance of the reporting unit and the consistency of the assumptions with evidence obtained in other areas of the audit. Evaluating the market approach involved assessing whether the revenue multiples used by management were reasonable by comparing to revenue multiples for comparable companies. Professionals with specialized skill and knowledge were used to assist in the evaluation of the Company's income approach and market approach, including the weighting of estimated fair value between the two approaches and certain significant assumptions, including the discount rate.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
March 2, 2020

We have served as the Company's auditor since 1968.

TERADYNE, INC.
CONSOLIDATED BALANCE SHEETS

	2019	2018
	(in thousands, except per share information)	
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 773,924	\$ 926,752
Marketable securities	137,303	190,096
Accounts receivable, less allowance for doubtful accounts of \$1,736 and \$1,673 in 2019 and 2018, respectively	362,368	291,267
Inventories, net	196,691	153,541
Prepayments and other current assets	188,598	170,826
Total current assets	1,658,884	1,732,482
Property, plant and equipment, net	320,216	279,821
Operating lease right-of-use assets, net	57,539	—
Marketable securities	104,490	87,731
Deferred tax assets	75,185	70,848
Retirement plans assets	18,457	16,883
Other assets	10,332	11,509
Acquired intangible assets, net	125,480	125,482
Goodwill	416,431	381,850
Total assets	\$2,787,014	\$2,706,606
LIABILITIES		
Current liabilities:		
Accounts payable	\$ 126,617	\$ 100,688
Accrued employees' compensation and withholdings	163,883	148,566
Deferred revenue and customer advances	104,876	77,711
Other accrued liabilities	70,871	78,272
Operating lease liabilities	19,476	—
Contingent consideration	9,106	34,865
Income taxes payable	44,200	36,185
Total current liabilities	539,029	476,287
Retirement plans liabilities	134,471	117,456
Long-term deferred revenue and customer advances	45,974	32,750
Long-term contingent consideration	30,599	35,678
Deferred tax liabilities	14,070	20,662
Long-term other accrued liabilities	19,535	37,547
Long-term operating lease liabilities	45,849	—
Long-term income taxes payable	82,642	83,891
Debt	394,687	379,981
Total liabilities	1,306,856	1,184,252
Commitments and contingencies (Note M)		
SHAREHOLDERS' EQUITY		
Common stock, \$0.125 par value, 1,000,000 shares authorized, 166,410 and 175,522 shares issued and outstanding at December 31, 2019 and 2018, respectively	20,801	21,940
Additional paid-in capital	1,720,129	1,671,645
Accumulated other comprehensive loss	(18,854)	(13,040)
Accumulated deficit	(241,918)	(158,191)
Total shareholders' equity	1,480,158	1,522,354
Total liabilities and shareholders' equity	\$2,787,014	\$2,706,606

The accompanying notes are an integral part of the consolidated financial statements.

TERADYNE, INC.

CONSOLIDATED STATEMENTS OF OPERATIONS

	Years Ended December 31,		
	2019	2018	2017
	(in thousands, except per share amounts)		
Revenues:			
Products	\$1,887,674	\$1,729,621	\$1,784,695
Services	407,291	371,181	351,911
Total revenues	2,294,965	2,100,802	2,136,606
Cost of revenues:			
Cost of products	782,047	727,138	760,967
Cost of services	173,089	153,270	154,186
Total cost of revenues (exclusive of acquired intangible assets amortization shown separately below)	955,136	880,408	915,153
Gross profit	1,339,829	1,220,394	1,221,453
Operating expenses:			
Selling and administrative	437,084	390,669	348,913
Engineering and development	322,824	301,505	307,305
Acquired intangible assets amortization	40,147	39,191	30,530
Restructuring and other	(13,880)	15,232	9,362
Total operating expenses	786,175	746,597	696,110
Income from operations	553,654	473,797	525,343
Non-operating (income) expenses:			
Interest income	(24,785)	(26,704)	(17,805)
Interest expense	23,145	31,269	21,663
Other (income) expense, net	29,522	1,431	(2,927)
Income before income taxes	525,772	467,801	524,412
Income tax provision	58,304	16,022	266,720
Net income	\$ 467,468	\$ 451,779	\$ 257,692
Net income per common share:			
Basic	\$ 2.74	\$ 2.41	\$ 1.30
Diluted	\$ 2.60	\$ 2.35	\$ 1.28
Weighted average common shares—basic	170,425	187,672	198,069
Weighted average common shares—diluted	179,459	192,605	201,641
Cash dividend declared per common share	\$ 0.36	\$ 0.36	\$ 0.28

The accompanying notes are an integral part of the consolidated financial statements.

TERADYNE, INC.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Years Ended December 31,		
	2019	2018	2017
	(in thousands)		
Net income	\$467,468	\$451,779	\$257,692
Other comprehensive income, net of tax:			
Foreign currency translation adjustment, net of tax of \$0, \$0, \$0	(10,991)	(28,442)	37,840
Available-for-sale marketable securities:			
Unrealized gains (losses) on debt securities arising during period, net of tax of \$1,659, \$(722), \$1,903, respectively	6,015	(2,110)	1,863
Less: Reclassification adjustment for (gains) losses included in net income, net of tax of \$(192), \$(21), \$(297), respectively	(690)	1,337	(441)
	5,325	(773)	1,422
Defined benefit pension and post-retirement plans:			
Amortization of prior service benefit included in net periodic pension and post-retirement benefit, net of tax \$(43), \$(71), \$(154), respectively	(148)	(245)	(272)
Other comprehensive (loss) income	(5,814)	(29,460)	38,990
Comprehensive income	\$461,654	\$422,319	\$296,682

The accompanying notes are an integral part of the consolidated financial statements.

TERADYNE, INC.

CONSOLIDATED STATEMENTS OF SHAREHOLDERS' EQUITY

	<u>Common Stock Shares</u>	<u>Common Stock Par Value</u>	<u>Additional Paid-in Capital</u>	<u>Accumulated Other Comprehensive (Loss) Income</u>	<u>Retained Earnings (Accumulated Deficit)</u>	<u>Total Shareholders' Equity</u>
	(in thousands)					
Year Ended December 31, 2016	199,177	\$24,897	\$1,593,684	\$(20,214)	\$ 230,292	\$1,828,659
Net issuance of common stock under stock-based plans	2,211	277	10,747			11,024
Stock-based compensation expense			33,982			33,982
Repurchase of common stock	(5,840)	(730)			(199,574)	(200,304)
Tax benefit related to stock options and restricted stock units					39,081	39,081
Cash dividends (\$0.07 per share)					(55,478)	(55,478)
Net income					257,692	257,692
Other comprehensive income				38,990		38,990
Year Ended December 31, 2017	<u>195,548</u>	<u>24,444</u>	<u>1,638,413</u>	<u>18,776</u>	<u>272,013</u>	<u>1,953,646</u>
Net issuance of common stock under stock-based plans	1,613	201	(72)			129
Stock-based compensation expense			33,304			33,304
Repurchase of common stock	(21,639)	(2,705)			(829,651)	(832,356)
Cash dividends (\$0.09 per share)					(67,367)	(67,367)
Net income					451,779	451,779
Other comprehensive loss				(29,460)		(29,460)
Reclassification of unrealized gains on equity securities				(3,125)	3,125	—
Reclassification of tax effects resulting from the Tax Reform Act				769	(769)	—
Cumulative effect of changes in accounting principle related to revenue recognition					12,679	12,679
Year Ended December 31, 2018	<u>175,522</u>	<u>21,940</u>	<u>1,671,645</u>	<u>(13,040)</u>	<u>(158,191)</u>	<u>1,522,354</u>
Net issuance of common stock under stock-based plans	1,784	223	10,399			10,622
Stock-based compensation expense			38,085			38,085
Repurchase of common stock	(10,896)	(1,362)			(489,840)	(491,202)
Cash dividends (\$0.09 per share)					(61,355)	(61,355)
Net income					467,468	467,468
Other comprehensive loss				(5,814)		(5,814)
Year Ended December 31, 2019	<u>166,410</u>	<u>\$20,801</u>	<u>\$1,720,129</u>	<u>\$(18,854)</u>	<u>\$(241,918)</u>	<u>\$1,480,158</u>

The accompanying notes are an integral part of the consolidated financial statements.

TERADYNE, INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS

	Years Ended December 31,		
	2019	2018	2017
	(in thousands)		
Cash flows from operating activities:			
Net income	\$ 467,468	\$ 451,779	\$ 257,692
Adjustments to reconcile net income from operations to net cash provided by operating activities:			
Depreciation	70,834	67,415	66,122
Amortization	49,821	45,809	41,953
Stock-based compensation	37,897	33,577	34,097
Deferred taxes	(9,456)	28,340	37,105
Provision for excess and obsolete inventory	15,244	11,242	8,844
Investment impairment	15,000	—	—
Contingent consideration fair value adjustment	(19,257)	987	7,820
(Gains) losses on investments	(6,033)	3,494	(878)
Retirement plans actuarial losses (gains)	8,176	(3,316)	(6,624)
Property insurance recovery, net	—	—	(4,309)
Other	766	1,083	1,585
Changes in operating assets and liabilities, net of businesses acquired:			
Accounts receivable	(70,440)	(17,938)	(80,584)
Inventories	(27,408)	(29,498)	44,960
Prepayments and other assets	(23,784)	(58,402)	2,254
Accounts payable and other liabilities	49,279	13,693	43,574
Deferred revenue and customer advances	39,313	13,379	4,984
Retirement plan contributions	(5,086)	(4,334)	(5,902)
Income taxes	(13,584)	(80,429)	173,802
Net cash provided by operating activities	578,750	476,881	626,495
Cash flows from investing activities:			
Purchases of property, plant and equipment	(134,642)	(114,379)	(105,375)
Proceeds from government subsidy for property, plant and equipment	—	7,920	—
Purchases of marketable securities	(662,701)	(918,744)	(1,391,917)
Proceeds from maturities of marketable securities	611,927	1,270,439	701,681
Proceeds from sales of marketable securities	105,586	846,122	527,746
Proceeds from insurance	2,912	1,126	5,064
Purchase of investment and acquisition of businesses, net of cash acquired	(79,742)	(169,474)	—
Net cash (used for) provided by investing activities	(156,660)	923,010	(262,801)
Cash flows from financing activities:			
Issuance of common stock under stock purchase and stock option plans	29,312	20,973	24,493
Repurchase of common stock	(500,000)	(823,478)	(200,304)
Dividend payments	(61,305)	(67,322)	(55,447)
Payments related to net settlement of employee stock compensation awards	(14,741)	(20,023)	(12,881)
Payments of contingent consideration	(27,615)	(13,571)	(1,050)
Net cash used for financing activities	(574,349)	(903,421)	(245,189)
Effects of exchange rate changes on cash and cash equivalents	(569)	439	3,454
(Decrease) Increase in cash and cash equivalents	(152,828)	496,909	121,959
Cash and cash equivalents at beginning of year	926,752	429,843	307,884
Cash and cash equivalents at end of year	\$ 773,924	\$ 926,752	\$ 429,843
Supplementary disclosure of cash flow information:			
Cash paid for:			
Interest	\$ 5,996	\$ 6,205	\$ 6,446
Income taxes	\$ 81,410	\$ 72,811	\$ 53,775

The accompanying notes are an integral part of the consolidated financial statements.

TERADYNE, INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

A. THE COMPANY

Teradyne, Inc. (“Teradyne”) is a leading global supplier of automation equipment for test and industrial applications. Teradyne designs, develops, manufactures and sells automatic test systems used to test semiconductors, wireless products, data storage and complex electronics systems in the consumer electronics, wireless, automotive, industrial, computing, communications, and aerospace and defense industries. Teradyne’s industrial automation products include collaborative robotic arms, autonomous mobile robots, and advanced robotic control software used by global manufacturing and light industrial customers to improve quality, increase manufacturing and material handling efficiency and decrease manufacturing costs. Teradyne’s automatic test equipment and industrial automation products and services include:

- semiconductor test (“Semiconductor Test”) systems;
- industrial automation (“Industrial Automation”) products;
- defense/aerospace (“Defense/Aerospace”) test instrumentation and systems, storage test (“Storage Test”) systems, and circuit-board test and inspection (“Production Board Test”) systems (collectively these products represent “System Test”); and
- wireless test (“Wireless Test”) systems.

On February 26, 2018, Teradyne acquired Energid Technologies Corporation (“Energid”) for a total purchase price of approximately \$27.6 million. Energid’s technology enables and simplifies the programming of complex robotic motions used in a wide variety of end markets, ranging from heavy industry to healthcare, utilizing both traditional robots and collaborative robots. Energid is included in Teradyne’s Industrial Automation segment.

On April 25, 2018, Teradyne acquired Mobile Industrial Robots ApS (“MiR”), a Danish limited liability company. MiR is a leading maker of collaborative autonomous mobile robots (“AMRs”) for industrial applications. The total purchase price was approximately \$197.68 million, which included cash paid of approximately \$145.2 million and \$52.6 million in fair value of contingent consideration payable upon achievement of certain thresholds and targets for revenue and earnings before interest and taxes through 2020. Contingent consideration for 2018 was \$30.8 million and was paid in March 2019. Contingent consideration for 2019 was \$9.1 million and is expected to be paid in March 2020. The maximum payment for the remaining MiR contingent consideration that could be paid is \$63.2 million. MiR is included in Teradyne’s Industrial Automation segment.

On January 30, 2019, Teradyne acquired all of the issued and outstanding shares of Lemsys SA (“Lemsys”) for a total purchase price of approximately \$9.1 million. Lemsys strengthens Teradyne’s position in the electrification of vehicles, solar and wind power, and industrial applications. Lemsys is included in Teradyne’s Semiconductor Test segment.

On June 3, 2019, Teradyne invested \$15.0 million in RealWear, Inc. (“RealWear”). RealWear, a private company, develops and sells advanced wearable technology including industrial, hands-free, head-mounted augmented reality devices that make the workplace safer and more productive. On February 28, 2020, RealWear’s debt holder demanded repayment of its \$25.0 million loan to RealWear. As a result, in the fourth quarter of 2019, Teradyne recorded an impairment charge of \$15.0 million to reduce its investment in RealWear to zero as of December 31, 2019.

On November 13, 2019, Teradyne acquired 100% of the membership interests of AutoGuide, LLC (“AutoGuide”), a maker of high payload AMRs, an emerging and fast growing segment of the global forklift market. The total purchase price was approximately \$81.7 million, which included cash paid of approximately

\$57.8 million and \$24.0 million in fair value of contingent consideration payable upon achievement of certain performance targets, extending potentially through 2022. The maximum contingent consideration that could be paid is \$106.9 million. AutoGuide's AMRs are used for material transport of payloads up to 4,500 kg in manufacturing, warehouse and logistics applications. These products complement MiR's lower payload products. AutoGuide is included in our Industrial Automation segment.

B. ACCOUNTING POLICIES

The consolidated financial statements include the accounts of Teradyne and its wholly-owned subsidiaries. All significant intercompany balances and transactions are eliminated. Certain prior years' amounts were reclassified to conform to the current year presentation.

Preparation of Financial Statements and Use of Estimates

The preparation of consolidated financial statements requires management to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent liabilities. On an on-going basis, management evaluates its estimates, including those related to inventories, investments, goodwill, intangible and other long-lived assets, accounts receivable, income taxes, deferred tax assets and liabilities, pensions, warranties, contingent consideration liabilities, and loss contingencies. Management bases its estimates on historical experience and on appropriate and customary assumptions that are believed to be 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. Actual results may differ significantly from these estimates.

Revenue Recognition

Revenue from Contracts with Customers

Teradyne adopted Accounting Standard Codification ("ASC") 606 "Revenue from Contracts with Customers" on January 1, 2018 using the modified retrospective method for all contracts not completed as of the date of adoption.

In accordance with ASC 606, Teradyne recognizes revenues, when or as control is transferred to a customer. Teradyne's determination of revenue is dependent upon a five step process outlined below.

- Teradyne accounts for a contract with a customer when there is written approval, the contract is committed, the rights of the parties, including payment terms, are identified, the contract has commercial substance and consideration is probable of collection.
- Teradyne periodically enters into contracts with customers in which a customer may purchase a combination of goods and services, such as products with extended warranty obligations. Teradyne determines performance obligations by assessing whether the products or services are distinct from the other elements of the contract. In order to be distinct, the product or service must perform either on its own or with readily available resources and must be separate within the context of the contract.
- Teradyne considers the amount stated on the face of the purchase order to be the transaction price. Teradyne does not have material variable consideration which could impact the stated purchase price agreed to by Teradyne and the customer.
- Transaction price is allocated to each individual performance obligation based on the standalone selling price of that performance obligation. Teradyne uses standalone transactions when available to value each performance obligation. If standalone transactions are not available, Teradyne will estimate the standalone selling price through market assessments or cost plus a reasonable margin analysis. Any discounts from standalone selling price are spread proportionally to each performance obligation.

- In order to determine the appropriate timing for revenue recognition, Teradyne first determines if the transaction meets any of three criteria for over time recognition. If the transaction meets the criteria for over time recognition, Teradyne recognizes revenue as the good or service is delivered. Teradyne uses input variables such as hours or months utilized or costs incurred to determine the amount of revenue to recognize in a given period. Input variables are used as they best align consumption with benefit to the customer. For transactions that do not meet the criteria for over time recognition, Teradyne will recognize revenue at a point in time based on an assessment of the five criteria for transfer of control. Teradyne has concluded that revenue should be recognized when shipped or delivered based on contractual terms. Typically, acceptance of Teradyne’s products and services is a formality as Teradyne delivers similar systems, instruments and robots to standard specifications. In cases where acceptance is not deemed a formality, Teradyne will defer revenue recognition until customer acceptance.

Performance Obligations

Products

Teradyne products consist primarily of semiconductor test systems and instruments, defense/aerospace test instrumentation and systems, storage test systems and instruments, circuit-board test and inspection systems and instruments, industrial automation products and wireless test systems. Teradyne’s hardware is recognized at a point in time upon transfer of control to the customer.

Services

Teradyne services consist of extended warranties, training and application support, service agreement, post contract customer support (“PCS”) and replacement parts. Each service is recognized based on relative standalone selling price. Extended warranty, training and support, service agreements and PCS are recognized over time based on the period of service. Replacement parts are recognized at a point in time upon transfer of control to the customer.

Teradyne does not allow customer returns or provide refunds to customers for any products or services. Teradyne products include a standard 12-month warranty. This warranty is not considered a distinct performance obligation because it does not obligate Teradyne to provide a separate service to the customer and it cannot be purchased separately. Cost related to warranty are included in cost of revenues when product revenues are recognized.

As of December 31, 2019 and 2018, deferred revenue and customer advances consisted of the following and are included in the short and long-term deferred revenue and customer advances:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Maintenance, service and training	\$ 63,815	\$ 58,362
Extended warranty	30,677	27,422
Customer advances, undelivered elements and other	56,358	24,677
Total deferred revenue and customer advances	<u>\$150,850</u>	<u>\$110,461</u>

Product Warranty

Teradyne generally provides a one-year warranty on its products, commencing upon installation, acceptance or shipment. A provision is recorded upon revenue recognition to cost of revenues for estimated warranty expense based on historical experience. Related costs are charged to the warranty accrual as incurred. The balance below is included in other accrued liabilities:

	<u>Amount</u> (in thousands)
Balance at December 31, 2016	\$ 7,203
Accruals for warranties issued during the period	14,223
Accruals related to pre-existing warranties	(379)
Settlements made during the period	<u>(12,847)</u>
Balance at December 31, 2017	8,200
Acquisition	41
Accruals for warranties issued during the period	13,045
Accruals related to pre-existing warranties	921
Settlements made during the period	<u>(14,298)</u>
Balance at December 31, 2018	7,909
Acquisition	14
Accruals for warranties issued during the period	14,106
Accruals related to pre-existing warranties	4,026
Settlements made during the period	<u>(17,059)</u>
Balance at December 31, 2019	<u>\$ 8,996</u>

When Teradyne receives revenue for extended warranties, beyond one year, it is deferred and recognized on a straight-line basis over the contract period. Related costs are expensed as incurred. The balance below is included in short and long-term deferred revenue and customer advances:

	<u>Amount</u> (in thousands)
Balance at December 31, 2016	\$ 28,200
Deferral of new extended warranty revenue	20,513
Recognition of extended warranty deferred revenue	<u>(24,275)</u>
Balance at December 31, 2017	24,438
Deferral of new extended warranty revenue	23,753
Recognition of extended warranty deferred revenue	<u>(20,769)</u>
Balance at December 31, 2018	27,422
Deferral of new extended warranty revenue	23,271
Recognition of extended warranty deferred revenue	<u>(20,016)</u>
Balance at December 31, 2019	<u>\$ 30,677</u>

Accounts Receivable and Allowance for Doubtful Accounts

Trade accounts receivable are recorded at the invoiced amount and do not bear interest. The volatility of the industries that Teradyne serves can cause certain of its customers to experience shortages of cash flows, which can impact their ability to make required payments. Teradyne maintains allowances for doubtful accounts for estimated losses resulting from the inability of its customers to make required payments. Estimated allowances for doubtful accounts are reviewed periodically taking into account the customer's recent payment history, the customer's current financial statements and other information regarding the customer's credit worthiness. Account balances are written off against the allowance when it is determined the receivable will not be recovered.

Teradyne sells certain trade accounts receivables on a non-recourse basis to third-party financial institutions pursuant to factoring agreements. Teradyne accounts for these transactions as sales of receivables and presents cash proceeds as a cash provided by operating activities in the consolidated statements of cash flows. Total trade accounts receivable sold under the factoring agreements were \$143.6 million and \$52.2 million during 2019 and 2018, respectively. Factoring fees for the sales of receivables are recorded in interest expense and are not material.

Inventories

Inventories are stated at the lower of cost (first-in, first-out basis) or net realizable value. On a quarterly basis, Teradyne uses consistent methodologies to evaluate all inventories for net realizable value. Teradyne records a provision for both excess and obsolete inventory when such write-downs or write-offs are identified through the quarterly review process. The inventory valuation is based upon assumptions about future demand, product mix and possible alternative uses.

Investments

Teradyne accounts for its investments in debt and equity securities in accordance with the provisions of ASC 320-10, “*Investments—Debt and Equity Securities*.” ASC 320-10 requires that certain debt and equity securities be classified into one of three categories; trading, available-for-sale or held-to-maturity securities. On a quarterly basis, Teradyne reviews its investments to identify and evaluate those that have an indication of a potential other-than-temporary impairment. Factors considered in determining whether a loss is other-than-temporary include:

- The length of time and the extent to which the market value has been less than cost;
- The financial condition and near-term prospects of the issuer; and
- The intent and ability to retain the investment in the issuer for a period of time sufficient to allow for any anticipated recovery in market value.

Teradyne uses the market and income approach techniques to value its financial instruments and there were no changes in valuation techniques during the twelve months ended December 31, 2019 and 2018. As defined in ASC 820-10, “*Fair Value Measurements and Disclosures*,” fair value is the price that would be received from the sale of an asset or paid to transfer a liability in an orderly transaction between market participants. ASC 820-10 requires that assets and liabilities carried at fair value be classified and disclosed in one of the following three categories:

Level 1: Quoted prices in active markets for identical assets as of the reporting date;

Level 2: Inputs other than Level 1, that are observable either directly or indirectly as of the reporting date. For example, a common approach for valuing fixed income securities is the use of matrix pricing. Matrix pricing is a mathematical technique used to value securities by relying on the securities’ relationship to other benchmark quoted prices, and is considered a Level 2 input; or

Level 3: Unobservable inputs that are not supported by market data. Unobservable inputs are developed based on the best information available, which might include Teradyne’s own data.

In accordance with ASC 820-10, Teradyne measures its debt and equity investments at fair value. Teradyne’s debt investments are classified as Level 2, and equity investments are classified as Level 1. Acquisition-related contingent consideration is classified as Level 3. Teradyne determines the fair value of acquisition-related contingent consideration using a Monte Carlo simulation model. Assumptions utilized in the model include forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate.

Financial Assets and Financial Liabilities

In January 2016, the Financial Accounting Standards Board (“FASB”) issued ASU 2016-01, “*Financial Instruments—Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities.*” Teradyne adopted the new accounting guidance in the first quarter of 2018 using the modified retrospective approach. This guidance requires that changes in fair value of equity securities be accounted for directly in earnings. Previously, the changes in fair value were recorded in accumulated other comprehensive income on the balance sheet. Teradyne continues to record realized gains in interest income and realized losses in interest expense. The adoption of this new accounting guidance increased the January 1, 2018 retained earnings balance by \$3.1 million and decreased the accumulated other comprehensive income balance by the same amount.

Investment in Other Company

Teradyne holds an investment in a private company that develops and sells advanced wearable technology. Teradyne does not have the ability to exert significant influence over the company. The investment was recorded at cost and is evaluated for impairment or an indication of changes in fair value resulting from observable price changes in orderly transactions for the identical or a similar investment of the same issuer on a quarterly basis. See Note D: “Acquisitions and Investment in Other Company.”

Prepayments

Prepayments consist of the following and are included in prepayments and other current assets on the balance sheet:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Contract manufacturer and supplier prepayments	\$143,392	\$131,642
Prepaid taxes	8,046	9,646
Prepaid maintenance and other services	8,503	8,487
Other prepayments	<u>16,753</u>	<u>12,744</u>
Total prepayments	<u>\$176,694</u>	<u>\$162,519</u>

Retirement and Postretirement Plans

Teradyne recognizes net actuarial gains and losses and the change in the fair value of the plan assets in its operating results in the year in which they occur or upon any interim remeasurement of the plans. Teradyne calculates the expected return on plan assets using the fair value of the plan assets. Actuarial gains and losses are generally measured annually as of December 31 and, accordingly, recorded during the fourth quarter of each year or upon any interim remeasurement of the plans.

Retirement Benefits

In March 2017, the FASB issued ASU 2017-07, “*Compensation—Retirement Benefits (Topic 715): Improving the Presentation of Net Periodic Pension Cost and Net Periodic Postretirement Benefit Cost.*” Teradyne retrospectively adopted the new accounting guidance on presentation of net periodic pension costs and net periodic postretirement benefit costs in the first quarter of 2018. This guidance requires the service cost component of net benefit costs to be reported in the same line item in the consolidated statement of operations as other employee compensation costs. The non-service components of net benefit costs such as interest cost, expected return on assets, amortization of prior service cost, and actuarial gains or losses, are required to be reported separately outside of income or loss from operations. Following the adoption of this guidance, Teradyne continues to record the service cost component in the same line item as other employee

compensation costs and the non-service components of net benefit costs such as interest cost, expected return on assets, amortization of prior service cost, and actuarial gains or losses are reported within other (income) expense, net. In the twelve months ended December 31, 2017, the retrospective adoption of this standard decreased income from operations by \$5.0 million, due to the removal of net actuarial pension gains and increased non-operating (income) expense by the same amount with no impact to net income.

Goodwill, Intangible and Long-Lived Assets

Teradyne accounts for goodwill and intangible assets in accordance with ASC 350-10, “*Intangibles-Goodwill and Other*.” Intangible assets are amortized over their estimated useful economic life and are carried at cost less accumulated amortization. Goodwill is assessed for impairment at least annually in the fourth quarter, as of December 31, on a reporting unit basis, or more frequently when events and circumstances occur indicating that the recorded goodwill may be impaired. In accordance with ASC 350-10, Teradyne has the option to perform a qualitative assessment to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying amount. If Teradyne determines this is the case, Teradyne is required to perform the two-step goodwill impairment test to identify potential goodwill impairment and measure the amount of goodwill impairment loss to be recognized. If Teradyne determines that it is more likely than not that the fair value of the reporting unit is greater than its carrying amounts, the two-step goodwill impairment test is not required.

In accordance with ASC 360-10, “*Impairment or Disposal of Long-Lived Assets*,” Teradyne reviews long-lived assets for impairment whenever events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable or that the useful lives of these assets are no longer appropriate. Each impairment test is based on a comparison of the estimated undiscounted cash flows to the recorded value of the asset. If impairment is indicated, the asset is written down to its estimated fair value based on a discounted cash flow analysis. The cash flow estimates used to determine the impairment, if any, contain management’s best estimates using appropriate assumptions and projections at that time.

Business Combination

Teradyne recognizes the tangible and intangible assets acquired and liabilities assumed based on their estimated fair values at the date of acquisition. The fair value of identifiable intangible assets is based on detailed cash flow valuations that use information and assumptions provided by management. Teradyne estimates the fair value of contingent consideration at the time of the acquisition using all pertinent information known to us at the time to assess the probability of payment of contingent amounts or through the use of a Monte Carlo simulation model. Teradyne allocates any excess purchase price over the fair value of the net tangible and intangible assets acquired and liabilities assumed to goodwill. The assumptions used in the valuations for our acquisitions may differ materially from actual results depending on performance of the acquired businesses and other factors. While Teradyne believes the assumptions used were appropriate, different assumptions in the valuation of assets acquired and liabilities assumed could have a material impact on the timing and extent of impact on our statements of operations. Goodwill is assigned to reporting units as of the date of the related acquisition.

Property, Plant and Equipment

Property, plant and equipment are stated at cost and depreciated over the estimated useful lives of the assets. Leasehold improvements and major renewals are capitalized and included in property, plant and equipment accounts while expenditures for maintenance and repairs and minor renewals are charged to expense. When assets are retired, the assets and related accumulated depreciation are removed from the accounts and any resulting gain or loss is reflected in the consolidated statements of operations.

Teradyne provides for depreciation of its assets principally on the straight-line method with the cost of the assets being charged to expense over their useful lives as follows:

Buildings	40 years
Building improvements	5 to 10 years
Leasehold improvements	Lesser of lease term or 10 years
Furniture and fixtures	10 years
Test systems manufactured internally	6 years
Machinery, equipment and software	3 to 5 years

Test systems manufactured internally are used by Teradyne for customer evaluations and manufacturing and support of its customers. Teradyne depreciates the test systems manufactured internally over a six-year life to cost of revenues, engineering and development, and selling and administrative expenses. Teradyne often sells internally manufactured test equipment to customers. Upon the sale of an internally manufactured test system, the net book value of the system is transferred to inventory and expensed as cost of revenues. The net book value of internally manufactured test systems sold in the years ended December 31, 2019, 2018, and 2017 was \$5.0 million, \$3.8 million, and \$3.6 million, respectively.

Leases

In February 2016, the Financial Accounting Standards Board (“FASB”) issued Accounting Standards Update (“ASU”) 2016-02, “*Leases (Topic 842)*” (“Topic 842”), which requires a lessee to record a right-of-use (“ROU”) asset and a lease liability on the balance sheet for operating leases with terms longer than twelve months. Teradyne adopted this standard and the related amendments (collectively “ASC 842”) on January 1, 2019 and utilized the modified retrospective approach provided by ASU 2018-11, “*Leases (Topic 842): Targeted Improvements,*” that allowed for a cumulative effect adjustment in the period of adoption. Under this method of adoption, the comparative information in the consolidated financial statements has not been revised and continues to be reported under the previously applicable lease accounting guidance (ASC 840). Teradyne also utilized the package of practical expedients permitted under the transition guidance which included the carry-forward of historical lease classification. Adoption of ASC 842 resulted in recording ROU assets and lease liabilities of approximately \$50.1 million and \$54.3 million, respectively. Operating lease liabilities were calculated using the discount rate on January 1, 2019. The adoption of ASC 842 did not have a material impact on beginning retained earnings, the consolidated statement of operations, cash flows, or earnings per share.

Under ASC 842, a contract is or contains a lease when Teradyne has the right to control the use of an identified asset. Teradyne determines if an arrangement is a lease at inception of the contract, which is the date on which the terms of the contract are agreed to and the agreement creates enforceable rights and obligations. The commencement date of the lease is the date that the lessor makes an underlying asset available for use by Teradyne. As of December 31, 2019, Teradyne does not have material leases that have not yet commenced.

Teradyne determines if the lease is an operating or finance lease at the lease commencement date based upon the terms of the lease and the nature of the asset. The lease term used to calculate the lease liability includes options to extend or terminate the lease when it is reasonably certain that the option will be exercised.

For leases commencing after January 1, 2019, the lease liability is measured at the present value of future lease payments, discounted using the discount rate for the lease at the commencement date. As Teradyne is typically unable to determine the implicit rate, Teradyne uses an incremental borrowing rate based on the lease term and economic environment at commencement date. Teradyne initially measures payments based on an index by using the applicable rate at lease commencement. Variable payments that do not depend on an index are not included in the lease liability and are recognized as they are incurred. The ROU asset is initially measured as the amount of lease liability, adjusted for any initial lease costs, prepaid lease payments, and reduced by any lease incentives.

Teradyne's contracts often include non-lease components such as common area maintenance. Teradyne elected the practical expedient to account for the lease and non-lease components as a single lease component. For leases with a term of one year or less Teradyne has elected not to record the lease asset or liability. The lease payments are recognized in the consolidated statement of earnings on a straight-line basis over the lease term. Teradyne includes lease costs within cost of revenues and operating expenses. See Note I: "Leases."

Engineering and Development Costs

Teradyne's products are highly technical in nature and require a large and continuing engineering and development effort. Software development costs incurred prior to the establishment of technological feasibility are charged to expense. Software development costs incurred subsequent to the establishment of technological feasibility are capitalized until the product is available for release to customers. To date, the period between achieving technological feasibility and general availability of the product has been short and software development costs eligible for capitalization have not been material. Engineering and development costs are expensed as incurred and consist primarily of salaries, contractor fees including non-recurring engineering charges related to product design, allocated facility costs, depreciation, and tooling costs.

Stock Compensation Plans and Employee Stock Purchase Plan

Stock-based compensation expense is based on the grant-date fair value estimated in accordance with the provisions of ASC 718-10, "*Compensation-Stock Compensation*."

In March 2016, the FASB issued ASU 2016-09, "*Compensation-Stock Compensation (Topic 718): Improvements to Employee Share-Based Payment Accounting*." Teradyne adopted this ASU in the first quarter of 2017. This ASU changes how Teradyne accounts for certain aspects of share-based payment awards to employees, including the accounting for income taxes, forfeitures, and statutory tax withholding requirements, as well as classification in the statements of cash flows.

Adoption of this ASU required recognition of a cumulative effect adjustment to retained earnings for any prior year excess tax benefits or tax deficiencies not previously recorded. The cumulative effect adjustment of \$39 million was recorded in the first quarter of 2017 as an increase to retained earnings and deferred tax assets.

This ASU also required a change in how Teradyne recognizes the excess tax benefits or tax deficiencies related to stock-based compensation. Prior to adopting ASU 2016-09, these excess tax benefits or tax deficiencies were credited or charged to additional paid-in capital in Teradyne's consolidated balance sheets. In accordance with ASU 2016-09, starting in the first quarter of 2017, these excess tax benefits or tax deficiencies are recognized as a discrete tax benefit or discrete tax expense to the current income tax provision in Teradyne's consolidated statements of operations.

ASU 2016-09 requires companies to adopt the amendment related to accounting for excess tax benefits or tax deficiencies on a prospective basis. In 2019, 2018 and 2017, Teradyne recognized a discrete tax benefit of \$4.9 million, \$7.6 million and \$6.3 million, respectively, related to net excess tax benefit.

In addition, under ASU 2016-09, all excess tax benefits related to share-based payments are reported as cash flows from operating activities. Previously, excess tax benefits from share-based payment arrangements were reported as cash flows from financing activities. The classification amendment was applied prospectively. This ASU also clarifies that all cash payments made to taxing authorities on the employees' behalf for withheld shares should be presented as financing activities on the statement of cash flows. Previously, Teradyne reported cash payments made to taxing authorities as operating activities on the statement of cash flows. This change was applied retrospectively.

Upon adoption of ASU 2016-09, Teradyne made an accounting policy election to continue accounting for forfeitures by applying an estimated forfeiture rate and to continue to recognize compensation costs only for those stock-based compensation awards expected to vest.

Under its stock compensation plans, Teradyne has granted stock options, restricted stock units and performance-based restricted stock units, and employees are eligible to purchase Teradyne's common stock through its Employee Stock Purchase Plan ("ESPP").

Income Taxes

Deferred tax assets and liabilities are determined based on differences between financial reporting and tax basis of assets and liabilities and are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse. The measurement of deferred tax assets is reduced by a valuation allowance if it is more likely than not that some or all of the deferred tax assets will not be realized. Teradyne performed the required assessment of positive and negative evidence regarding the realization of the net deferred tax assets in accordance with ASC 740, "Accounting for Income Taxes." This assessment included the evaluation of scheduled reversals of deferred tax liabilities, estimates of projected future taxable income and tax-planning strategies. Although realization is not assured, based on its assessment, Teradyne concluded that it is more likely than not that such assets, net of the existing valuation allowance, will be realized.

Advertising Costs

Teradyne expenses all advertising costs as incurred. Advertising costs were \$16.6 million, \$15.4 million and \$9.1 million in 2019, 2018 and 2017, respectively.

Translation of Non-U.S. Currencies

The functional currency for all non-U.S. subsidiaries is the U.S. dollar, except for Universal Robots, MiR and Lemsys for which the local currency is its functional currency. All foreign currency denominated monetary assets and liabilities are remeasured on a monthly basis into the functional currency using exchange rates in effect at the end of the period. All foreign currency denominated non-monetary assets and liabilities are remeasured into the functional currency using historical exchange rates. Net foreign exchange gains and losses resulting from remeasurement are included in other (income) expense, net. For Universal Robots, MiR and Lemsys, assets and liabilities are translated into U.S. dollars using exchange rates in effect at the end of the period. Revenues and expense amounts are translated using an average of exchange rates in effect during the period. Translation adjustments are recorded within accumulated other comprehensive income (loss) on the balance sheet.

Net foreign exchange gains and losses resulting from remeasurement are included in other (income) expense, net. For the years ended December 31, 2019, 2018, and 2017, (gains) losses from the remeasurement of the monetary assets and liabilities denominated in foreign currencies were \$(1.6) million, \$(2.5) million, and \$2.9 million, respectively.

These amounts do not reflect the corresponding (gains) losses from foreign exchange contracts. See Note H: "Financial Instruments" regarding foreign exchange contracts.

Net Income (Loss) per Common Share

Basic net income (loss) per common share is calculated by dividing net income (loss) by the weighted average number of common shares outstanding during the period. Except where the result would be anti-dilutive, diluted net income (loss) per common share is calculated by dividing net income (loss) by the sum of the weighted average number of common shares plus common stock equivalents, if applicable.

With respect to its convertible debt issued in 2016, Teradyne has determined that it has the ability and intent to settle the principal of the convertible debt in cash; accordingly, the principal amount is excluded from the determination of diluted earnings per share. As a result, Teradyne is accounting for the conversion spread using the treasury stock method.

Comprehensive Income (Loss)

Comprehensive income (loss) includes net income, unrealized pension and postretirement prior service costs and benefits, unrealized gains and losses on investments in debt marketable securities and foreign currency translation adjustment. Prior to 2018, comprehensive income (loss) included unrealized gains and losses on investments in equity marketable securities.

C. RECENTLY ISSUED ACCOUNTING PRONOUNCEMENTS

On January 26, 2017, the FASB issued ASU 2017-04, “*Intangibles—Goodwill and Other (Topic 350): Simplifying the Accounting for Goodwill Impairment.*” The new guidance removes Step 2 of the goodwill impairment test, which requires a hypothetical purchase price allocation. Goodwill impairment will now be the amount by which a reporting unit’s carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. All other goodwill impairment guidance will remain largely unchanged. Entities will continue to have the option to perform a qualitative assessment to determine if a quantitative impairment test is necessary. The same one-step impairment test will be applied to goodwill at all reporting units, even those with zero or negative carrying amounts. Entities will be required to disclose the amount of goodwill at reporting units with zero or negative carrying amounts. The revised guidance will be applied prospectively, and is effective in 2020. Early adoption is permitted for any impairment tests performed after January 1, 2017. This pronouncement is not expected to have a material impact on Teradyne’s financial position, results of operations and statements of cash flows.

D. ACQUISITIONS AND INVESTMENT IN OTHER COMPANY

Acquisitions

AutoGuide LLC

On November 13, 2019, Teradyne acquired 100% of the membership interests of AutoGuide, LLC (“AutoGuide”), a maker of high-payload AMRs, based in Chelmsford, MA, an emerging and fast growing segment of the global forklift market. The total purchase price was approximately \$81.7 million, which included cash paid of approximately \$57.8 million and \$24.0 million in fair value of contingent consideration payable upon achievement of certain performance targets, extending potentially through 2022. At December 31, 2019, the maximum contingent consideration that could be paid is \$106.9 million.

The contingent consideration is payable upon achievement of certain thresholds and targets for revenue and earnings before interest and taxes for periods from January 1, 2019 to December 31, 2020, January 1, 2019 to December 31, 2021, and January 1, 2019 to December 31, 2022.

The valuation of the contingent consideration is dependent on the following assumptions: forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate. These assumptions were estimated based on a review of the historical and projected results.

The AutoGuide acquisition was accounted for as a business combination and, accordingly, the results have been included in Teradyne’s consolidated results of operations from the date of acquisition. AutoGuide’s AMRs are used for material transport of payloads up to 4,500 kg in manufacturing, warehouse and logistics applications. These products complement MiR’s lower payload products and expand the Industrial Automation segment, which is a key component of Teradyne’s growth strategy.

The preliminary allocation of the total purchase price to AutoGuide’s net tangible assets and identifiable intangible assets was based on their estimated preliminary fair values as of the acquisition date. The excess of the purchase price over the identifiable intangible assets and net tangible assets in the amount of \$41.4 million was allocated to goodwill, which is deductible for tax purposes. AutoGuide’s results have been included in Teradyne’s Industrial Automation segment from the date of acquisition.

The following table represents the preliminary allocation of the purchase price:

	Purchase Price Allocation
	(in thousands)
Goodwill	\$41,372
Intangible assets	37,660
Tangible assets acquired and liabilities assumed:	
Other current assets	3,661
Non-current assets	1,227
Accounts payable and current liabilities	(1,223)
Long-term other liabilities	(949)
Total purchase price	<u>\$81,748</u>

Teradyne estimated the fair value of intangible assets using the income approach. Forecasted revenues is the key assumption for estimating the fair value. Acquired intangible assets are amortized on a straight-line basis over their estimated useful lives. Components of these intangible assets and their estimated useful lives at the acquisition date are as follows:

	Fair Value	Estimated Useful Life
	(in thousands)	(in years)
Developed technology	\$24,590	6.0
Customer relationships	7,360	6.0
Trademarks and tradenames	5,450	7.0
Backlog	260	0.3
Total intangible assets	<u>\$37,660</u>	6.1

For the period from November 13, 2019 to December 31, 2019, AutoGuide contributed \$1.4 million of revenues and had a \$(0.9) million loss before income taxes.

Lemsys SA

On January 30, 2019, Teradyne acquired all of the issued and outstanding shares of Lemsys SA (“Lemsys”) for a total purchase price of approximately \$9.1 million. Lemsys strengthens Teradyne’s position in the electrification of vehicles, solar and wind power, and industrial applications. The Lemsys acquisition was accounted for as a business combination and, accordingly, the results have been included in Teradyne’s Semiconductor Test segment from the date of acquisition. Teradyne’s final allocation of the purchase price was goodwill of \$1.4 million, which is not deductible for tax purposes, acquired intangible assets of \$4.6 million with an average estimated useful life of 5.2 years, and \$3.1 million of net tangible assets. The acquisition was not material to Teradyne’s consolidated financial statements.

Mobile Industrial Robots

On April 25, 2018, Teradyne acquired all of the issued and outstanding shares of MiR, a Danish limited liability company located in Odense, Denmark. MiR is a leading maker of collaborative autonomous mobile robots for industrial applications.

The total purchase price of \$197.8 million included \$145.2 million of cash paid and \$52.6 million of contingent consideration measured at fair value. The contingent consideration is payable in Euros upon the achievement of certain thresholds and targets for revenue and earnings before interest and taxes for periods from January 1, 2018 to December 31, 2018; January 1, 2018 to December 31, 2019; and January 1, 2018 to

December 31, 2020. Contingent consideration for the period from January 1, 2018 to December 31, 2018 was \$31.0 million and was paid in March 2019. Contingent consideration for the period from January 1, 2018 to December 31, 2019 was \$9.1 million, based on the results during the period and modification of the earn-out structure, and is expected to be paid in March 2020. At December 31, 2019, the remaining maximum amount of contingent consideration that could be paid is \$63.2 million.

The valuation of the contingent consideration is dependent on the following assumptions: forecasted revenues, revenue volatility, earnings before interest and taxes, and discount rate. These assumptions were estimated based on a review of the historical and projected results.

The MiR acquisition was accounted for as a business combination and, accordingly, the results have been included in Teradyne's consolidated results of operations from the date of acquisition. MiR's products will help expand the Industrial Automation segment, which is a key component of our growth strategy. The allocation of the total purchase price to MiR's net tangible liabilities and identifiable intangible assets was based on their estimated fair values as of the acquisition date. The excess of the purchase price over the identifiable intangible assets and net tangible liabilities in the amount of \$136.0 million was allocated to goodwill, which is not deductible for tax purposes. MiR's results have been included in Teradyne's Industrial Automation segment from the date of acquisition.

The following table represents the final allocation of the purchase price:

	<u>Purchase Price Allocation</u> (in thousands)
Goodwill	\$135,976
Intangible assets	80,670
Tangible assets acquired and liabilities assumed:	
Current assets	6,039
Non-current assets	1,336
Accounts payable and current liabilities	(7,336)
Long-term deferred tax liabilities	(18,007)
Other long-term liabilities	(900)
Total purchase price	<u>\$197,778</u>

Teradyne estimated the fair value of intangible assets using the income and cost approaches. Acquired intangible assets are amortized on a straight-line basis over their estimated useful lives.

Components of these intangible assets and their estimated useful lives at the acquisition date are as follows:

	<u>Fair Value</u> (in thousands)	<u>Estimated Useful Life</u> (in years)
Developed technology	\$58,900	7.0
Trademarks and tradenames	13,240	11.0
Customer relationships	8,500	2.5
Backlog	30	0.2
Total intangible assets	<u>\$80,670</u>	7.2

For the period from April 25, 2018 to December 31, 2018, MiR contributed \$24.1 million of revenues and had a \$(7.6) million loss before income taxes.

Energid Technologies Corporation

On February 26, 2018, Teradyne acquired all of the issued and outstanding shares of Energid for a total purchase price of approximately \$27.6 million. Energid’s technology enables and simplifies the programming of complex robotic motions used in a wide variety of end markets, ranging from heavy industry to healthcare, utilizing both traditional robots and collaborative robots. The Energid acquisition was accounted for as a business combination and, accordingly, Energid’s results have been included in Teradyne’s Industrial Automation segment from the date of acquisition. As of the acquisition date, Teradyne’s purchase price allocation was goodwill of \$14.4 million which is deductible for tax purposes, acquired intangible assets of \$12.3 million with an average estimated useful life of 7.7 years, and \$1.0 million of net tangible assets. The acquisition was not material to Teradyne’s consolidated financial statements.

Pro Forma Information

The following unaudited pro forma information gives effect to the acquisition of AutoGuide as if the acquisition occurred on January 1, 2018 and the acquisition of MiR as if the acquisition occurred on January 1, 2017. The unaudited pro forma results are not necessarily indicative of what actually would have occurred had the acquisition been in effect for the periods presented:

	For the Year Ended	
	December 31, 2019	December 31, 2018
	(in thousands, except per share amounts)	
Revenues	\$2,303,737	\$2,111,373
Net income	\$ 464,602	\$ 442,082
Net income per common share:		
Basic	<u>\$ 2.73</u>	<u>\$ 2.36</u>
Diluted	<u>\$ 2.59</u>	<u>\$ 2.30</u>

Pro forma results for the year ended December 31, 2019 were adjusted to exclude \$1.2 million of AutoGuide acquisition related costs and \$0.1 million of AutoGuide non-recurring expense related to fair value adjustment to acquisition-date inventory.

Pro forma results for the year ended December 31, 2018 were adjusted to include \$1.2 million of AutoGuide acquisition related costs and \$0.4 million of AutoGuide non-recurring expense related to fair value adjustment to acquisition-date inventory.

Pro forma results for the year ended December 31, 2018 were adjusted to exclude \$2.9 million of MiR acquisition related costs and \$0.4 million of MiR non-recurring expense related to fair value adjustment to acquisition-date inventory.

Investment in Other Company

On June 3, 2019, Teradyne invested \$15.0 million in RealWear, Inc. (“RealWear”). RealWear, a private company, develops and sells advanced wearable technology including industrial, hands-free, head-mounted augmented reality devices that make the workplace safer and more productive. The investment was recorded at cost and is evaluated for impairment or an indication of changes in fair value resulting from observable price changes in orderly transactions for the identical or similar investment of the same issuer on a quarterly basis. On February 28, 2020, RealWear’s debt holder demanded repayment of its \$25.0 million loan to RealWear. As a result, in the fourth quarter of 2019, Teradyne recorded an impairment charge of \$15.0 million to reduce its investment in RealWear to zero as of December 31, 2019.

E. REVENUE

Disaggregation of Revenue

The following table provides information about disaggregated revenue by timing of revenue recognition, primary geographical market, and major product lines.

	Semiconductor Test		Industrial Automation				System Test	Wireless Test	Corporate and Other	Total
	System on-a-chip	Memory	Universal Robots	Mobile Industrial Robots	AutoGuide	Energid				
(in thousands)										
For the Year Ended December 31, 2019 (1)										
<i>Timing of Revenue Recognition</i>										
Point in Time	\$1,070,375	\$247,221	\$244,515	\$44,329	\$1,144	\$ —	\$237,686	\$148,322	\$ (515)	\$1,993,077
Over Time	216,065	18,910	3,952	74	234	3,891	49,769	8,993	—	301,888
Total	\$1,286,440	\$266,131	\$248,467	\$44,403	\$1,378	\$3,891	\$287,455	\$157,315	\$ (515)	\$2,294,965
<i>Geographical Market</i>										
Asia Pacific	\$1,152,881	\$238,714	\$ 67,806	\$ 9,513	\$ —	\$ 221	\$132,826	\$126,549	\$ —	\$1,728,510
Americas	73,257	23,826	70,165	14,438	1,378	1,761	129,840	24,234	(515)	338,384
Europe, Middle East and Africa	60,302	3,591	110,496	20,452	—	1,909	24,789	6,532	—	228,071
Total	\$1,286,440	\$266,131	\$248,467	\$44,403	\$1,378	\$3,891	\$287,455	\$157,315	\$ (515)	\$2,294,965
For the Year Ended December 31, 2018 (1)										
<i>Timing of Revenue Recognition</i>										
Point in Time	\$1,010,493	\$259,366	\$231,895	\$24,115	\$ —	\$ 553	\$167,418	\$122,536	\$(1,205)	\$1,815,171
Over Time	208,456	14,102	2,200	—	—	2,689	48,714	9,470	—	285,631
Total	\$1,218,949	\$273,468	\$234,095	\$24,115	\$ —	\$3,242	\$216,132	\$132,006	\$(1,205)	\$2,100,802
<i>Geographical Market</i>										
Asia Pacific	\$1,067,879	\$245,264	\$ 58,381	\$ 5,950	\$ —	\$ 111	\$ 90,989	\$107,872	\$ —	\$1,576,446
Americas	78,498	17,353	68,938	7,326	—	1,540	96,763	19,166	(1,205)	288,379
Europe, Middle East and Africa	72,572	10,851	106,776	10,839	—	1,591	28,380	4,968	—	235,977
Total	\$1,218,949	\$273,468	\$234,095	\$24,115	\$ —	\$3,242	\$216,132	\$132,006	\$(1,205)	\$2,100,802

(1) Includes \$8.4 million and \$12.0 million in 2019 and 2018, respectively, for leases of Teradyne's systems recognized outside of ASC 606: "Revenue from Contracts with Customers."

Contract Balances

For the years ended December 31, 2019 and 2018, Teradyne recognized \$65.6 million and \$69.9 million, respectively, that was previously included within the deferred revenue and customer advances balances. This revenue primarily relates to undelivered hardware, extended warranties, training, application support, and post contract support. Each of these represents a distinct performance obligation. Teradyne expects to recognize 70% of the remaining performance obligation in the next 12 months, 26% in 1-3 years, and the remainder thereafter.

F. INVENTORIES

Inventories, net consisted of the following at December 31, 2019 and 2018:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Raw material	\$118,595	\$ 89,365
Work-in-process	32,695	31,014
Finished goods	45,401	33,162
	<u>\$196,691</u>	<u>\$153,541</u>

Inventory reserves for the years ended December 31, 2019 and 2018 were \$103.6 million and \$100.8 million, respectively.

G. PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment, net consisted of the following at December 31, 2019 and 2018:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Land	\$ 16,561	\$ 16,561
Buildings	107,282	105,935
Machinery, equipment and software	834,970	752,722
Furniture and fixtures	29,157	27,432
Leasehold improvements	59,378	52,536
Construction in progress	2,537	6,276
	1,049,885	961,462
Less: accumulated depreciation	729,669	681,641
	<u>\$ 320,216</u>	<u>\$279,821</u>

Depreciation of property, plant and equipment for the years ended December 31, 2019, 2018, and 2017 was \$70.8 million, \$67.4 million, and \$66.1 million, respectively. As of December 31, 2019 and 2018, the gross book value included in machinery and equipment for internally manufactured test systems being leased by customers was \$5.4 million and \$5.5 million, respectively. As of December 31, 2019 and 2018, the accumulated depreciation on these test systems was \$5.1 million and \$5.2 million, respectively.

H. FINANCIAL INSTRUMENTS

Cash Equivalents

Teradyne considers all highly liquid investments with maturities of three months or less at the date of acquisition to be cash equivalents.

Marketable Securities

Effective January 1, 2018, Teradyne adopted ASU 2016-01, “*Financial Instruments—Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities*,” using the modified retrospective approach. This guidance requires that changes in fair value of equity securities be accounted for directly in earnings. Prior to 2018, the changes in fair value of equity securities were recorded in accumulated other comprehensive income (loss) on the balance sheet.

Teradyne’s available-for-sale debt securities are classified as Level 2, and equity and debt mutual funds are classified as Level 1. Contingent consideration is classified as Level 3. The vast majority of Level 2 securities are

fixed income securities priced by third party pricing vendors. These pricing vendors utilize the most recent observable market information in pricing these securities or, if specific prices are not available, use other observable inputs like market transactions involving identical or comparable securities.

During the years ended December 31, 2019 and 2018, there were no transfers in or out of Level 1, Level 2, or Level 3 financial instruments.

Realized gains recorded in 2019, 2018, and 2017 were \$1.3 million, \$4.0 million, and \$1.1 million, respectively. Realized losses recorded in 2019, 2018, and 2017 were \$0.2 million, \$1.6 million, and \$0.3 million, respectively. Realized gains are included in interest income and realized losses are included in interest expense.

Unrealized gains on equity securities recorded during the years ended December 31, 2019 and 2018 were \$5.3 million and \$1.4 million, respectively. Unrealized losses on equity securities recorded during the years ended December 31, 2019 and 2018 were \$0.4 million and \$7.4 million, respectively. Unrealized gains on equity securities are included in interest income and unrealized losses are included in interest expense. Unrealized gains and losses on available-for-sale debt securities are included in accumulated other comprehensive income (loss) on the balance sheet.

The cost of securities sold is based on the specific identification method.

The following table sets forth by fair value hierarchy Teradyne's financial assets and liabilities that were measured at fair value on a recurring basis as of December 31, 2019 and 2018:

	December 31, 2019			Total
	Quoted Prices in Active Markets for Identical Instruments (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	
	(in thousands)			
Assets				
Cash	\$311,975	\$ —	\$ —	\$ 311,975
Cash equivalents	410,285	51,664	—	461,949
Available for sale securities:				
Corporate debt securities	—	97,307	—	97,307
Commercial paper	—	54,149	—	54,149
U.S. Treasury securities	—	42,382	—	42,382
U.S. government agency securities	—	9,952	—	9,952
Debt mutual funds	6,888	—	—	6,888
Certificates of deposit and time deposits	—	4,751	—	4,751
Non-U.S. government securities	—	592	—	592
Equity securities:				
Equity mutual funds	25,772	—	—	25,772
Total	\$754,920	\$260,797	\$ —	\$1,015,717
Derivative assets	—	528	—	528
Total	\$754,920	\$261,325	\$ —	\$1,016,245
Liabilities				
Contingent consideration	\$ —	\$ —	\$39,705	\$ 39,705
Derivative liabilities	—	203	—	203
Total	\$ —	\$ 203	\$39,705	\$ 39,908

Reported as follows:

	<u>(Level 1)</u>	<u>(Level 2)</u>	<u>(Level 3)</u>	<u>Total</u>
	(in thousands)			
Assets				
Cash and cash equivalents	\$722,260	\$ 51,664	\$ —	\$ 773,924
Marketable securities	—	137,303	—	137,303
Long-term marketable securities	32,660	71,830	—	104,490
Prepayments	—	528	—	528
Total	<u>\$754,920</u>	<u>\$261,325</u>	<u>\$ —</u>	<u>\$1,016,245</u>
Liabilities				
Other current liabilities	\$ —	\$ 203	\$ —	\$ 203
Contingent consideration	—	—	9,106	9,106
Long-term contingent consideration	—	—	30,599	30,599
Total	<u>\$ —</u>	<u>\$ 203</u>	<u>\$39,705</u>	<u>\$ 39,908</u>

	December 31, 2018			
	Quoted Prices in Active Markets for Identical Instruments (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	Total
	(in thousands)			
Assets				
Cash	\$312,512	\$ —	\$ —	\$ 312,512
Cash equivalents	253,525	360,715	—	614,240
Available for sale securities:				
U.S. Treasury securities	—	109,721	—	109,721
Commercial paper	—	86,117	—	86,117
Corporate debt securities	—	40,020	—	40,020
U.S. government agency securities	—	9,611	—	9,611
Certificates of deposit and time deposits	—	7,604	—	7,604
Debt mutual funds	3,187	—	—	3,187
Non-U.S. government securities	—	376	—	376
Equity securities:				
Equity mutual funds	21,191	—	—	21,191
	<u>\$590,415</u>	<u>\$614,164</u>	<u>\$ —</u>	<u>\$1,204,579</u>
Derivative assets	—	79	—	79
Total	<u>\$590,415</u>	<u>\$614,243</u>	<u>\$ —</u>	<u>\$1,204,658</u>
Liabilities				
Contingent consideration	\$ —	\$ —	\$70,543	\$ 70,543
Derivative liabilities	—	514	—	514
Total	<u>\$ —</u>	<u>\$ 514</u>	<u>\$70,543</u>	<u>\$ 71,057</u>

Reported as follows:

	<u>(Level 1)</u>	<u>(Level 2)</u>	<u>(Level 3)</u>	<u>Total</u>
	(in thousands)			
Assets				
Cash and cash equivalents	\$566,037	\$360,715	\$ —	\$ 926,752
Marketable securities	—	190,096	—	190,096
Long-term marketable securities	24,378	63,353	—	87,731
Prepayments	—	79	—	79
	<u>\$590,415</u>	<u>\$614,243</u>	<u>\$ —</u>	<u>\$1,204,658</u>
Liabilities				
Other current liabilities	\$ —	\$ 514	\$ —	\$ 514
Contingent consideration	—	—	34,865	34,865
Long-term contingent consideration	—	—	35,678	35,678
	<u>\$ —</u>	<u>\$ 514</u>	<u>\$70,543</u>	<u>\$ 71,057</u>

Changes in the fair value of Level 3 contingent consideration for the years ended December 31, 2019 and 2018 were as follows:

	<u>Contingent Consideration</u>
	(in thousands)
Balance at December 31, 2017	\$ 45,102
Acquisition of MiR	52,547
Foreign currency impact	(3,540)
Payments (1)	(24,553)
Fair value adjustment (2)	987
Balance at December 31, 2018	70,543
Acquisition of AutoGuide	23,976
Foreign currency impact	(967)
Payments (3)	(34,590)
Fair value adjustment (4)	(19,257)
Balance at December 31, 2019	<u>\$ 39,705</u>

- (1) During the year ended December 31, 2018, Teradyne paid \$24.6 million of contingent consideration for the earn-out in connection with the acquisition of Universal Robots.
- (2) During the year ended December 31, 2018, the fair value of contingent consideration for the earn-out in connection with the acquisition of MiR was increased by \$17.7 million primarily due to an increase in forecasted revenues. During the year ended December 31, 2018, the fair value of contingent consideration for the earn-out in connection with the acquisition of Universal Robots was decreased by \$16.7 million primarily due to a decrease in forecasted revenues.
- (3) During the year ended December 31, 2019, Teradyne paid \$30.8 million and \$3.8 million of contingent consideration for the earn-outs in connection with the acquisitions of MiR and Universal Robots, respectively.
- (4) During the year ended December 31, 2019, the fair value of contingent consideration for the earn-out in connection with the acquisition of MiR was decreased by \$22.2 million primarily due to a decrease in forecasted revenues partially offset by the impact from modification of the earn-out structure. During the year ended December 31, 2019, the fair value of contingent consideration for the earn-out in connection with the acquisition of AutoGuide was increased by \$3.0 million primarily due to an increase in forecasted revenues.

The following table provides quantitative information associated with the fair value measurement of Teradyne's Level 3 financial instrument:

<u>Liability</u>	<u>December 31, 2019 Fair Value</u>	<u>Valuation Technique</u>	<u>Unobservable Inputs</u>	<u>Weighted Average</u>
	(in thousands)			
Contingent consideration (AutoGuide)	\$ 26,952	Monte Carlo simulation	Revenue Volatility	11.5%
			Discount Rate	2.6%
Contingent consideration (MiR)	\$12,753(1)	Monte Carlo simulation	Revenue Volatility	14.0%
			Discount Rate	0.2%

(1) Contingent consideration related to MiR of \$9.1 million is expected to be paid in March 2020.

As of December 31, 2019, the significant unobservable inputs used in the Monte Carlo simulation to fair value the AutoGuide and MiR contingent consideration include forecasted revenues, revenue volatility, earnings before interest and taxes and discount rate. Increases or decreases in the inputs would result in a higher or lower fair value measurement. As of December 31, 2019, the maximum amount of contingent consideration that could be paid in connection with the acquisition of AutoGuide is \$106.9 million. The earn-out periods end on December 31, 2020, December 31, 2021 and December 31, 2022. As of December 31, 2019, the remaining maximum amount of contingent consideration that could be paid in connection with the acquisition of MiR is \$63.2 million. The remaining earn-out period ends on December 31, 2020.

The carrying amounts and fair values of Teradyne's financial instruments at December 31, 2019 and 2018 were as follows:

	<u>December 31, 2019</u>		<u>December 31, 2018</u>	
	<u>Carrying Value</u>	<u>Fair Value</u>	<u>Carrying Value</u>	<u>Fair Value</u>
	(in thousands)			
Assets				
Cash and cash equivalents	\$773,924	\$ 773,924	\$926,752	\$926,752
Marketable securities	241,793	241,793	277,827	277,827
Derivative assets	528	528	79	79
Liabilities				
Contingent consideration	39,705	39,705	70,543	70,543
Derivative liabilities	203	203	514	514
Convertible debt (1)	394,687	1,010,275	379,981	547,113

(1) The carrying value represents the bifurcated debt component only, while the fair value is based on quoted market prices for the convertible note which includes the equity conversion features.

The fair values of accounts receivable, net and accounts payable approximate the carrying amount due to the short term nature of these instruments.

The following tables summarize the composition of available-for-sale marketable securities at December 31, 2019 and 2018:

	December 31, 2019				
	Available-for-Sale				Fair Market Value of Investments with Unrealized Losses
	Cost	Unrealized Gain	Unrealized (Loss)	Fair Market Value	
	(in thousands)				
Corporate debt securities	\$ 93,267	\$4,081	\$ (41)	\$ 97,307	\$ 2,009
Commercial paper	54,124	26	(1)	54,149	1,391
U.S. Treasury securities	42,167	431	(216)	42,382	17,556
U.S. government agency securities	9,942	14	(4)	9,952	3,043
Debt mutual funds	6,753	135	—	6,888	—
Certificates of deposit and time deposits	4,751	—	—	4,751	—
Non-U.S. government securities	592	—	—	592	—
	<u>\$211,596</u>	<u>\$4,687</u>	<u>\$(262)</u>	<u>\$216,021</u>	<u>\$23,999</u>

Reported as follows:

	Cost	Unrealized Gain	Unrealized (Loss)	Fair Market Value	Fair Market Value of Investments with Unrealized Losses	
		(in thousands)				
	Marketable securities	\$137,144	\$ 160	\$ (1)	\$137,303	\$ 2,922
Long-term marketable securities	74,452	4,527	(261)	78,718	21,077	
	<u>\$211,596</u>	<u>\$4,687</u>	<u>\$(262)</u>	<u>\$216,021</u>	<u>\$23,999</u>	

	December 31, 2018				
	Available-for-Sale				Fair Market Value of Investments with Unrealized Losses
	Cost	Unrealized Gain	Unrealized (Loss)	Fair Market Value	
	(in thousands)				
U.S. Treasury securities	\$110,969	\$112	\$(1,360)	\$109,721	\$ 75,040
Commercial paper	86,130	13	(26)	86,117	85,094
Corporate debt securities	41,133	432	(1,545)	40,020	24,767
U.S. government agency securities	9,646	1	(36)	9,611	7,077
Certificates of deposit and time deposits	7,604	—	—	7,604	—
Debt mutual funds	3,153	34	—	3,187	—
Non-U.S. government securities	376	—	—	376	—
	<u>\$259,011</u>	<u>\$592</u>	<u>\$(2,967)</u>	<u>\$256,636</u>	<u>\$191,978</u>

Reported as follows:

	Cost	Unrealized Gain	Unrealized (Loss)	Fair Market Value	Fair Market Value of Investments with Unrealized Losses	
		(in thousands)				
	Marketable securities	\$190,100	\$ 88	\$ (92)	\$190,096	\$140,262
Long-term marketable securities	68,911	504	(2,875)	66,540	51,716	
	<u>\$259,011</u>	<u>\$592</u>	<u>\$(2,967)</u>	<u>\$256,636</u>	<u>\$191,978</u>	

As of December 31, 2019, the fair market value of investments with unrealized losses less than one year totaled \$23.6 million.

As of December 31, 2018, the fair market value of investments with unrealized losses totaled \$192.0 million. Of this value, \$28.5 million had unrealized losses of \$1.6 million greater than one year and \$163.5 million had unrealized losses of \$1.4 million for less than one year.

Teradyne reviews its investments to identify and evaluate investments that have an indication of possible impairment. Based on this review, Teradyne determined that the unrealized losses related to these investments at December 31, 2019 and 2018, were not other than temporary.

The contractual maturities of investments in available-for-sale marketable securities held at December 31, 2019 were as follows:

	<u>Cost</u>	<u>Fair Value</u>
	(in thousands)	
Due within one year	\$137,144	\$137,303
Due after 1 year through 5 years	15,264	15,351
Due after 5 years through 10 years	14,436	14,576
Due after 10 years	37,999	41,903
Total	<u>\$204,843</u>	<u>\$209,133</u>

Contractual maturities of investments in available-for-sale marketable securities held at December 31, 2019 exclude \$6.9 million of debt mutual funds as they do not have a contractual maturity date.

Derivatives

Teradyne conducts business in a number of foreign countries, with certain transactions denominated in local currencies. The purpose of Teradyne's foreign currency management is to minimize the effect of exchange rate fluctuations on certain foreign currency denominated monetary assets and liabilities. Teradyne does not use derivative financial instruments for trading or speculative purposes.

To minimize the effect of exchange rate fluctuations associated with the remeasurement of monetary assets and liabilities denominated in foreign currencies, Teradyne enters into foreign currency forward contracts. The change in fair value of these derivatives is recorded directly in earnings, and is used to offset the change in value of the monetary assets and liabilities denominated in foreign currencies.

At December 31, 2019 and 2018, Teradyne had the following contracts to buy and sell non-U.S. currencies for U.S. dollars and other non-U.S. currencies with the following notional amounts:

	<u>December 31, 2019</u>			<u>December 31, 2018</u>		
	<u>Buy Position</u>	<u>Sell Position</u>	<u>Net Total</u>	<u>Buy Position</u>	<u>Sell Position</u>	<u>Net Total</u>
	(in millions)					
Japanese Yen	\$(29.3)	\$ —	\$(29.3)	\$(35.0)	\$ —	\$(35.0)
Taiwan Dollar	(18.4)	—	(18.4)	(11.2)	—	(11.2)
Korean Won	(10.7)	—	(10.7)	(9.6)	—	(9.6)
British Pound Sterling	(3.8)	—	(3.8)	(1.4)	—	(1.4)
Euro	—	47.8	47.8	—	82.2	82.2
Singapore Dollar	—	25.3	25.3	—	15.7	15.7
Philippine Peso	—	5.2	5.2	—	5.2	5.2
Chinese Yuan	—	4.4	4.4	—	2.8	2.8
Total	<u>\$(62.2)</u>	<u>\$82.7</u>	<u>\$ 20.5</u>	<u>\$(57.2)</u>	<u>\$105.9</u>	<u>\$ 48.7</u>

The fair value of the outstanding contracts was a gain of \$0.3 million and a loss of \$0.4 million, respectively, at December 31, 2019 and 2018.

Gains and losses on foreign currency forward contracts and foreign currency remeasurement gains and losses on monetary assets and liabilities are included in other (income) expense, net.

The following table summarizes the fair value of derivative instruments as of December 31, 2019 and 2018:

	<u>Balance Sheet Location</u>	<u>December 31,</u>	<u>December 31,</u>
		<u>2019</u>	<u>2018</u>
		<u>(in thousands)</u>	
Derivatives not designated as hedging instruments:			
Foreign exchange contracts	Prepayments	\$ 528	\$ 79
Foreign exchange contracts	Other current liabilities	(203)	(514)
Total		<u>\$ 325</u>	<u>\$(435)</u>

The following table summarizes the effect of derivative instruments in the statements of operations recognized for the years ended December 31, 2019, 2018, and 2017.

	<u>Location of (Gains) Losses Recognized in Statement of Operations</u>	<u>December 31,</u>	<u>December 31,</u>	<u>December 31,</u>
		<u>2019</u>	<u>2018</u>	<u>2017</u>
		<u>(in thousands)</u>		
Derivatives not designated as hedging instruments:				
Foreign exchange contracts	Other (income) expense, net	\$5,960	\$7,386	\$(1,133)

- (1) The table does not reflect the corresponding gains and losses from the remeasurement of the monetary assets and liabilities denominated in foreign currencies.
- (2) For the years ended December 31, 2019 and 2018, net gains from the remeasurement of monetary assets and liabilities denominated in foreign currencies were \$1.6 million and \$2.5 million, respectively.
- (3) For the year ended December 31, 2017, net losses from the remeasurement of monetary assets and liabilities denominated in foreign currencies were \$2.9 million.

See Note J: "Debt" regarding derivatives related to the convertible senior notes.

Concentration of Credit Risk

Financial instruments which potentially subject Teradyne to concentrations of credit risk consist principally of cash equivalents, marketable securities, forward currency contracts and accounts receivable. Teradyne's cash equivalents consist primarily of money market funds invested in U.S. Treasuries and government agencies. Teradyne's fixed income available-for-sale marketable securities have a minimum rating of AA by one or more of the major credit rating agencies. Teradyne places foreign currency forward contracts with high credit-quality financial institutions in order to minimize credit risk exposure. Concentrations of credit risk with respect to accounts receivable are limited due to the large number of geographically dispersed customers. Teradyne performs ongoing credit evaluations of its customers' financial condition and from time to time may require customers to provide a letter of credit from a bank to secure accounts receivable. There were no customers who accounted for 10% or more of Teradyne's accounts receivable balance as of December 31, 2019 and 2018.

I. LEASES

On January 1, 2019, Teradyne adopted ASC 842 using the modified retrospective approach. Under this method of adoption, the comparative information in the consolidated financial statements has not been revised

and continues to be reported under the previously applicable lease accounting guidance (ASC 840). Adoption of ASC 842 resulted in recording ROU assets and lease liabilities of approximately \$50.1 million and \$54.3 million, respectively. The adoption of ASC 842 did not have a material impact on beginning retained earnings, the consolidated statement of operations, cash flows, or earnings per share.

Teradyne has facility and auto leases, which are accounted for as operating leases. Teradyne's facility leases are primarily used for administrative functions, research and development, manufacturing, and storage and distribution. Remaining lease terms range from less than one year to twelve years.

Total lease expense for the year ended December 31, 2019 was \$35.6 million and included \$11.1 million of variable lease costs and \$2.6 million of costs related to short-term leases, which are not recorded on the consolidated balance sheets.

At December 31, 2019, the weighted average remaining lease term and weighted average discount rate for operating leases was 4.5 years and 5.0%, respectively.

Supplemental cash flow information related to leases was as follows:

	<u>For the Year Ended December 31, 2019</u>
	(in thousands)
Cash paid for amounts included in the measurement of lease liabilities included in operating cash flows	\$19,400
Right-of-use assets obtained in exchange for new lease obligations	26,739

Maturities of lease liabilities as of December 31, 2019 were as follows:

	<u>Operating Lease</u>
	(in thousands)
2020	\$21,874
2021	17,638
2022	12,944
2023	6,496
2024	5,106
Thereafter	<u>8,388</u>
Total lease payments	72,446
Less imputed interest	<u>(7,121)</u>
Total lease liabilities	<u>\$65,325</u>

As of December 31, 2018, future non-cancelable rent obligations as determined under ASC 840 were as follows:

	<u>Operating Lease</u>
	(in thousands)
2019	\$19,570
2020	18,293
2021	13,578
2022	9,693
2023	5,449
Thereafter	<u>9,472</u>
Total lease payments	<u>\$76,055</u>

J. DEBT

Convertible Senior Notes

On December 12, 2016, Teradyne completed a private offering of \$460.0 million aggregate principal amount of 1.25% convertible senior unsecured notes (the “Notes”) due December 15, 2023 and received net proceeds, after issuance costs, of approximately \$450.8 million, \$33.0 million of which was used to pay the net cost of the convertible note hedge transactions and \$50.1 million of which was used to repurchase 2.0 million shares of Teradyne’s common stock under its existing stock repurchase program from purchasers of the Notes in privately negotiated transactions effected through one of the initial purchasers or its affiliates conducted concurrently with the pricing of the Note offering. The Notes will mature on December 15, 2023, unless earlier repurchased or converted. The Notes bear interest at a rate of 1.25% per year payable semiannually in arrears on June 15 and December 15 of each year. The Notes will be convertible at the option of the noteholders at any time prior to the close of business on the business day immediately preceding September 15, 2023, only under the following circumstances: (1) during any calendar quarter beginning after March 31, 2017 (and only during such calendar quarter), if the closing sale price of Teradyne’s common stock, for at least 20 trading days (whether or not consecutive) during a period of 30 consecutive trading days ending on the last trading day of the immediately preceding calendar quarter is greater than 130% of the conversion price on each applicable trading day; (2) during the five business day period after any five consecutive trading day period (the “measurement period”) in which the trading price (as defined in the Indenture) per \$1,000 principal amount of Notes for each trading day of the measurement period was less than 98% of the product of the closing sale price of the Teradyne’s common stock and the conversion rate on each such trading day; and (3) upon the occurrence of specified corporate events. On or after September 15, 2023 until the close of business on the second scheduled trading day immediately preceding the maturity date, holders may convert their Notes at any time, regardless of the foregoing circumstances. Teradyne may satisfy its conversion obligation by paying or delivering cash, shares of its common stock or a combination of cash and shares of its common stock, at Teradyne’s election. As of December 31, 2019, the conversion price was approximately \$31.62 per share of Teradyne’s common stock. The conversion rate is subject to adjustment under certain circumstances.

Concurrent with the offering of the Notes, Teradyne entered into convertible note hedge transactions (the “Note Hedge Transactions”) with the initial purchasers or their affiliates (the “Option Counterparties”). The Note Hedge Transactions cover, subject to customary anti-dilution adjustments, the number of shares of the common stock that underlie the Notes, with a strike price equal to the conversion price of the Notes of \$31.62. The Note Hedge Transactions cover, subject to customary anti-dilution adjustments, approximately 14.5 million shares of Teradyne’s common stock.

Separately and concurrent with the pricing of the Notes, Teradyne entered into warrant transactions with the Option Counterparties (the “Warrant Transactions”) in which it sold net-share-settled (or, at its election subject to certain conditions, cash-settled) warrants to the Option Counterparties. The Warrant Transactions cover, subject to customary anti-dilution adjustments, approximately 14.5 million shares of common stock. As of December 31, 2019, the strike price of the warrants was approximately \$39.68 per share. The strike price is subject to adjustment under certain circumstances. The Warrant Transactions could have a dilutive effect to Teradyne’s common stock to the extent that the market price per share of Teradyne’s common stock, as measured under the terms of the Warrant Transactions, exceeds the applicable strike price of the warrants.

The Note Hedge Transactions are expected to reduce the potential dilution to Teradyne’s common stock upon any conversion of the Notes. However, the Warrant Transactions could separately have a dilutive effect to the extent that the market value per share of Teradyne’s common stock exceeds the applicable strike price of the warrant. The net cost of the Note Hedge Transactions, after being partially offset by the proceeds from the sale of the warrants, was approximately \$33.0 million.

In connection with establishing their initial hedge of these convertible note hedge and warrant transactions, the Option Counterparties have entered into various derivative transactions with respect to Teradyne’s common

stock and/or purchased shares of Teradyne's common stock or other securities, including the Notes, concurrent with, or shortly after, the pricing of the Notes. In addition, the Option Counterparties may modify their hedge positions by entering into or unwinding various derivative transactions with respect to Teradyne's common stock or by selling Teradyne's common stock or other securities, including the Notes, in secondary market transactions (and may do so during any observation period related to the conversion of the Notes). These activities could adversely affect the value of Teradyne's common stock and the Notes.

Teradyne considered the guidance of ASC 815-40, "*Derivatives and Hedging—Contracts in Entity's Own Equity*," and concluded that the convertible note hedge is both indexed to Teradyne's stock and should be classified in stockholders' equity in its statements of financial position. The convertible note hedge is considered indexed to Teradyne's stock as the terms of the Note Hedge Transactions do not contain an exercise contingency and the settlement amount equals the difference between the fair value of a fixed number of Teradyne's shares and a fixed strike price. Because the only variable that can affect the settlement amount is Teradyne's stock price, which is an input to the fair value of a fixed-for-fixed option contract, the convertible note hedge is considered indexed to Teradyne's stock.

Teradyne assessed whether the convertible note hedge should be classified as equity under ASC 815-40. In the Note Hedge Transactions contract the settlement terms permit net cash settlement or net share settlement, at the option of Teradyne. Therefore, the criteria as set forth in ASC 815-40 were evaluated by Teradyne. In reviewing the criteria, Teradyne noted the following: (1) the convertible note hedge does not require Teradyne to issue shares; (2) there is no requirement to net cash settle the convertible note hedge for failure to make timely filings with the SEC; (3) in the case of termination, the convertible note hedge is settled in the same consideration as the holders of the underlying stock; (4) the counterparty does not have rights that rank higher than those of a shareholder of the stock underlying the convertible note hedge; and (5) there is no requirement to post collateral. Based on its analysis of those criteria, Teradyne concluded that the convertible note hedge should be recorded in equity and no further adjustment should be made in future periods to adjust the value of the convertible note hedge.

Teradyne analyzed the Warrant Transactions under ASC 815-40, "*Derivatives and Hedging—Contracts in Entity's Own Equity*," and other relevant literature, and determined that it met the criteria for classification as an equity transaction and is considered indexed to Teradyne's stock. As a result, Teradyne recorded the proceeds from the warrants as an increase to additional paid-in capital. Teradyne does not recognize subsequent changes in fair value of the warrants in its financial statements.

The provisions of ASC 470-20, "*Debt with Conversion and Other Options*," are applicable to the Notes. ASC 470-20 requires Teradyne to separately account for the liability (debt) and equity (conversion feature) components of the Notes in a manner that reflects Teradyne's nonconvertible debt borrowing rate at the date of issuance when interest cost is recognized in subsequent periods. Teradyne allocated \$100.8 million of the \$460.0 million principal amount of the Notes to the equity component, which represents a discount to the debt and will be amortized to interest expense using the effective interest method through December 2023. Accordingly, Teradyne's effective annual interest rate on the Notes will be approximately 5.0%. The Notes are classified as long-term debt in the balance sheet based on their December 15, 2023 maturity date. Debt issuance costs of approximately \$7.2 million are being amortized to interest expense using the effective interest method over the seven-year term of the Notes. As of December 31, 2019, debt issuance costs were approximately \$4.3 million.

The below tables represents the key components of Teradyne's convertible senior notes:

	<u>December 31, 2019</u>	<u>December 31, 2018</u>
	(in thousands)	
Debt principal	\$460,000	\$460,000
Unamortized discount	<u>65,313</u>	<u>80,019</u>
Net carrying amount of convertible debt	<u>\$394,687</u>	<u>\$379,981</u>
	For the year ended	
	<u>December 31, 2019</u>	<u>December 31, 2018</u>
	(in thousands)	
Contractual interest expense on the coupon	\$ 5,750	\$ 5,750
Amortization of the discount component and debt issue fees recognized as interest expense	<u>14,706</u>	<u>13,995</u>
Total interest expense on the convertible debt	<u>\$20,456</u>	<u>\$19,745</u>

As of December 31, 2019, the unamortized discount was \$65.3 million, which will be amortized over four years using the effective interest rate method. The carrying amount of the equity component was \$100.8 million. As of December 31, 2019, the conversion price was approximately \$31.62 per share and if converted the value of the notes was \$992.0 million.

Revolving Credit Facility

On June 27, 2019, Teradyne terminated its credit agreement, which Teradyne entered into with Barclays Bank PLC on April 27, 2015. The terminated credit agreement, which was undrawn at termination, provided for a five-year, senior secured revolving credit facility of up to \$350 million.

K. ACCUMULATED OTHER COMPREHENSIVE (LOSS) INCOME

Changes in accumulated other comprehensive (loss) income, which is presented net of tax, consist of the following:

	Foreign Currency Translation Adjustment	Unrealized Gains (Losses) on Marketable Securities	Retirement Plans Prior Service Credit	Total
	(in thousands)			
Balance at December 31, 2017, net of tax of \$0, \$1,815, \$(932)	\$ 15,919	\$ 1,362	\$1,495	\$ 18,776
Other comprehensive loss before reclassifications, net of tax of \$0, \$(722), \$0	(28,442)	(2,110)	—	(30,552)
Amounts reclassified from accumulated other comprehensive income, net of tax of \$0, \$(21), \$(71) ...	—	1,337	(245)	1,092
Net current period other comprehensive loss, net of tax of \$0, \$(743), \$(71)	(28,442)	(773)	(245)	(29,460)
Reclassification of tax effects resulting from the Tax Reform Act, net of tax of \$0, \$(691), \$(78), respectively (a)	—	691	78	769
Reclassification of unrealized gains on equity securities, net of tax of \$0, \$(902), \$0, respectively, (b)	—	(3,125)	—	(3,125)
Balance at December 31, 2018, net of tax of \$0, \$(521), \$(1,081)	(12,523)	(1,845)	1,328	(13,040)
Other comprehensive (loss) income before reclassifications, net of tax of \$0, \$1,659, \$0	(10,991)	6,015	—	(4,976)
Amounts reclassified from accumulated other comprehensive income, net of tax of \$0, \$(192), \$(43) ..	—	(690)	(148)	(838)
Net current period other comprehensive (loss) income, net of tax of \$0, \$1,467, \$(43)	(10,991)	5,325	(148)	(5,814)
Balance at December 31, 2019, net of tax of \$0, \$946, \$(1,124)	\$(23,514)	\$ 3,480	\$1,180	\$(18,854)

- (a) In the year ended December 31, 2018, Teradyne early adopted ASU 2018-02, “Income Statement—Reporting Comprehensive Income (Topic 220): Reclassification of Certain Tax Effects from Accumulated Other Comprehensive Income.” As a result, the stranded tax effects resulting from the Tax Reform Act enacted in December 2017 were reclassified from accumulated other comprehensive income to retained earnings.
- (b) In the year ended December 31, 2018, Teradyne adopted ASU 2016-01, “Financial Instruments—Overall (Subtopic 825-10): Recognition and Measurement of Financial Assets and Financial Liabilities.” See Note B: “Accounting Policies.”

Reclassifications out of accumulated other comprehensive income to the statements of operations for the years ended December 31, 2019, 2018, and 2017, were as follows:

<u>Details about Accumulated Other Comprehensive Income Components</u>	<u>For the year ended</u>			<u>Affected Line Item in the Statements of Operations</u>
	<u>December 31, 2019</u>	<u>December 31, 2018</u>	<u>December 31, 2017</u>	
	(in thousands)			
Available-for-sale marketable securities				
Unrealized gains (losses), net of tax of \$192, \$21, \$297	\$690	\$(1,337)	\$441	Interest income (expense)
Defined benefit pension and postretirement plans:				
Amortization of prior service benefit, net of tax of \$43, \$71, \$154	<u>148</u>	<u>245</u>	<u>272</u>	(a)
Total reclassifications, net of tax of \$235, \$92, \$451	<u>\$838</u>	<u>\$(1,092)</u>	<u>\$713</u>	Net income

(a) The amortization of prior service credit is included in the computation of net periodic pension cost and postretirement benefit; see Note P: "Retirement Plans."

L. GOODWILL AND INTANGIBLE ASSETS

Goodwill

Teradyne performs its annual goodwill impairment test as required under the provisions of ASC 350-10, "Intangibles—Goodwill and Other," on December 31 of each fiscal year unless interim indicators of impairment exist. Goodwill is considered to be impaired when the net book value of a reporting unit exceeds its estimated fair value.

Teradyne has the option to perform a qualitative assessment ("Step zero") to determine whether it is more likely than not that the fair value of a reporting unit is less than its carrying amount. If Teradyne determines this is the case, Teradyne is required to perform the two-step goodwill impairment test to identify potential goodwill impairment and measure the amount of goodwill impairment loss to be recognized. If Teradyne determines that it is more likely than not that the fair value of the reporting unit is greater than its carrying amounts, the two-step goodwill impairment test is not required. When performing the two-step process, the first step involves a comparison of the estimated fair value of a reporting unit to its carrying amount, including goodwill. In performing the first step, Teradyne determines the fair value of a reporting unit using the results derived from an income approach and a market approach, weighting the fair value determined under each approach to determine an estimated fair value for a reporting unit. The income approach is estimated through the discounted cash flow ("DCF") analysis. Determining fair value requires the exercise of significant judgment, including judgments about appropriate discount rates, perpetual growth rates, and the amount and timing of expected future cash flows. Discount rates are based on a weighted average cost of capital ("WACC"), which represents the average rate a business must pay its providers of debt and equity, plus a risk premium. The WACC used to test goodwill is derived from a group of comparable companies. The cash flows employed in the DCF analysis are derived from internal forecasts and external market forecasts. The market approach estimates the fair value of the reporting unit by utilizing the market comparable method which is based on revenue and earnings multiples from comparable companies. If the estimated fair value of a reporting unit exceeds its carrying amount, goodwill of the reporting unit is not impaired and the second step of the impairment test is not necessary. If the carrying amount of a reporting unit exceeds its estimated fair value, then the second step of the goodwill impairment test must be performed. The second step of the goodwill impairment test compares the implied fair value of the reporting unit's goodwill with its carrying amount of goodwill to measure the amount of impairment loss, if any. The implied fair value of goodwill is determined in the same manner as the amount of goodwill recognized in a

business combination, whereby the estimated fair value of the reporting unit is allocated to all of the assets and liabilities of that unit (including any unrecognized intangible assets) as if the reporting unit had been acquired in a business combination and the fair value of the reporting unit was the purchase price paid. If the carrying amount of the reporting unit's goodwill exceeds the implied fair value of that goodwill, an impairment loss is recognized in an amount equal to that excess.

In the fourth quarter of 2019, Teradyne performed the annual goodwill impairment test. Teradyne completed step one of the two-step impairment test for the Universal Robots, MiR and Energid reporting units. Teradyne completed step zero for the Wireless Test, Defense/Aerospace and AutoGuide reporting units. There was no impairment as a result of the annual test performed in the fourth quarter of 2019.

Based on Teradyne's December 31, 2019 goodwill impairment test, the MiR reporting unit's estimated fair value exceeded its carrying value by 14%. The MiR goodwill amount is \$123.6 million as of December 31, 2019. Key assumptions in the goodwill valuation model are forecasted revenues, discount rate, earnings before interest and taxes, and revenue multiples from comparable companies. A change in any of these key assumptions could result in the reporting unit being impaired in a future period.

In the fourth quarter of 2018, Teradyne performed the annual goodwill impairment test. Teradyne completed step one of the two-step impairment test for the Universal Robots reporting unit. Teradyne completed step zero for the Wireless Test and Defense/Aerospace, MiR, and Energid reporting units. There was no impairment as a result of the annual test performed in the fourth quarter of 2018.

In the fourth quarter of 2017, Teradyne performed the annual goodwill impairment test. Teradyne completed step one of the two-step impairment test for the Universal Robots reporting unit. Teradyne completed step zero for the Wireless Test and Defense/Aerospace reporting units. There was no impairment as a result of the annual test performed in the fourth quarter of 2017.

The changes in the carrying amount of goodwill by reportable segments for the years ended December 31, 2019 and 2018 are as follows:

	<u>Industrial Automation</u>	<u>Wireless Test</u>	<u>Semiconductor Test</u>	<u>System Test</u>	<u>Total</u>
	(in thousands)				
Balance at December 31, 2017:					
Goodwill	\$233,519	\$ 361,819	\$ 260,540	\$ 158,699	\$1,014,577
Accumulated impairment losses	—	(353,843)	(260,540)	(148,183)	(762,566)
	233,519	7,976	—	10,516	252,011
MiR acquisition	135,976	—	—	—	135,976
Energid acquisition	14,394	—	—	—	14,394
Foreign currency translation adjustment	(20,531)	—	—	—	(20,531)
Balance at December 31, 2018:					
Goodwill	363,358	361,819	260,540	158,699	1,144,416
Accumulated impairment losses	—	(353,843)	(260,540)	(148,183)	(762,566)
	363,358	7,976	—	10,516	381,850
Lemsys acquisition	—	—	1,428	—	1,428
AutoGuide acquisition	41,372	—	—	—	41,372
Foreign currency translation adjustment	(8,247)	—	28	—	(8,219)
Balance at December 31, 2019:					
Goodwill	396,483	361,819	261,996	158,699	1,178,997
Accumulated impairment losses	—	(353,843)	(260,540)	(148,183)	(762,566)
	<u>\$396,483</u>	<u>\$ 7,976</u>	<u>\$ 1,456</u>	<u>\$ 10,516</u>	<u>\$ 416,431</u>

Intangible Assets

Teradyne reviews long-lived assets for impairment whenever events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable or that the useful lives of these assets are no longer appropriate.

There were no events or circumstances indicating that the carrying value of intangible and long-lived assets may not be recoverable in 2019, 2018 and 2017.

Amortizable intangible assets consist of the following and are included in intangible assets, net on the balance sheets:

	December 31, 2019			
	Gross Carrying Amount (1)(2)	Accumulated Amortization (2)	Foreign Currency Translation Adjustment	Net Carrying Amount
	(in thousands)			
Developed technology	\$361,787	\$(279,000)	\$(5,709)	\$ 77,078
Customer relationships	75,669	(59,077)	(455)	16,137
Tradenames and trademarks	70,120	(36,671)	(1,184)	32,265
Backlog	260	(260)	—	—
Total intangible assets	<u>\$507,836</u>	<u>\$(375,008)</u>	<u>\$(7,348)</u>	<u>\$125,480</u>

	December 31, 2018			
	Gross Carrying Amount	Accumulated Amortization	Foreign Currency Translation Adjustment	Net Carrying Amount
	(in thousands)			
Developed technology	\$336,308	\$(252,080)	\$(4,079)	\$ 80,149
Customer relationships	97,153	(83,448)	(340)	13,365
Tradenames and trademarks	64,420	(31,653)	(799)	31,968
Non-compete agreement	320	(320)	—	—
Backlog	30	(30)	—	—
Total intangible assets	<u>\$498,231</u>	<u>\$(367,531)</u>	<u>\$(5,218)</u>	<u>\$125,482</u>

- (1) Includes intangible assets acquired in 2019, \$37.7 million from the AutoGuide acquisition and \$4.6 million from the Lemsys acquisition.
- (2) In 2019, \$32.7 million of amortizable intangible assets became fully amortized and have been eliminated from the gross carrying amount and accumulated amortization.

Aggregate intangible assets amortization expense for the years ended December 31, 2019, 2018, and 2017, was \$40.1 million, \$39.2 million, and \$30.5 million, respectively. Estimated intangible assets amortization expense for each of the five succeeding fiscal years is as follows:

<u>Year</u>	<u>Amortization Expense</u> (in thousands)
2020	\$30,606
2021	20,593
2022	19,700
2023	19,226
2024	18,921
Thereafter	16,434

M. COMMITMENTS AND CONTINGENCIES

Purchase Commitments

As of December 31, 2019, Teradyne had entered into non-cancelable purchase commitments for certain components and materials. The purchase commitments covered by the agreements aggregate to approximately \$415.6 million, of which \$412.9 million is for less than one year.

Legal Claims

Teradyne is subject to legal proceedings, claims and investigations that arise in the ordinary course of business such as, but not limited to, patent, employment, commercial and environmental matters. Teradyne believes that it has meritorious defenses against all pending claims and intends to vigorously contest them. While it is not possible to predict or determine the outcomes of any pending claims or to provide possible ranges of losses that may arise, Teradyne believes the potential losses associated with all of these actions are unlikely to have a material adverse effect on its business, financial position or results of operations.

Guarantees and Indemnification Obligations

Teradyne provides indemnification, to the extent permitted by law, to its officers, directors, employees and agents for liabilities arising from certain events or occurrences while the officer, director, employee, or agent, is or was serving, at Teradyne's request in such capacity. Teradyne has entered into indemnification agreements with certain of its officers and directors. With respect to acquisitions, Teradyne provides indemnifications to or assumes indemnification obligations for the current and former directors, officers and employees of the acquired companies in accordance with the acquired companies' by-laws and charter. As a matter of practice, Teradyne has maintained directors' and officers' liability insurance coverage including coverage for directors and officers of acquired companies.

Teradyne enters into agreements in the ordinary course of business with customers, resellers, distributors, integrators and suppliers. Most of these agreements require Teradyne to defend and/or indemnify the other party against intellectual property infringement claims brought by a third party with respect to Teradyne's products. From time to time, Teradyne also indemnifies customers and business partners for damages, losses and liabilities they may suffer or incur relating to personal injury, personal property damage, product liability, breach of confidentiality obligations and environmental claims relating to the use of Teradyne's products and services or resulting from the acts or omissions of Teradyne, its employees, authorized agents or subcontractors. On occasion, Teradyne has also provided guarantees to customers regarding the delivery and performance of its products in addition to the warranty described below.

As a matter of ordinary course of business, Teradyne warrants that its products will substantially perform in accordance with its standard published specifications in effect at the time of delivery. Most warranties have a one-year duration commencing from installation. A provision is recorded upon revenue recognition to cost of revenue for estimated warranty expense based upon historical experience. When Teradyne receives revenue for extended warranties beyond the standard duration, the revenue is deferred and recognized on a straight-line basis over the contract period. Related costs are expensed as incurred. As of December 31, 2019 and 2018, Teradyne had a product warranty accrual of \$9.0 million and \$7.9 million, respectively, included in other accrued liabilities, and revenue deferrals related to extended warranties of \$30.7 million and \$27.4 million, respectively, included in short and long-term deferred revenue and customer advances.

In addition, in the ordinary course of business, Teradyne provides minimum purchase guarantees to certain vendors to ensure continuity of supply against the market demand. Although some of these guarantees provide penalties for cancellations and/or modifications to the purchase commitments as the market demand decreases, most of the guarantees do not. Therefore, as the market demand decreases, Teradyne re-evaluates these guarantees and determines what charges, if any, should be recorded.

With respect to its agreements covering product, business or entity divestitures and acquisitions, Teradyne provides certain representations, warranties and covenants to purchasers and agrees to indemnify and hold such purchasers harmless against breaches of such representations, warranties and covenants. Many of the indemnification claims have a definite expiration date while some remain in force indefinitely. With respect to its acquisitions, Teradyne may, from time to time, assume the liability for certain events or occurrences that took place prior to the date of acquisition.

As a matter of ordinary course of business, Teradyne occasionally guarantees certain indebtedness obligations of its subsidiary companies, limited to the borrowings from financial institutions, purchase commitments to certain vendors, and lease commitments to landlords.

Based on historical experience and information known as of December 31, 2019, and 2018, except for product warranty, Teradyne has not recorded any liabilities for these guarantees and obligations because the amount would be immaterial.

N. NET INCOME PER COMMON SHARE

The following table sets forth the computation of basic and diluted net income per common share:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	<u>(in thousands, except per share amounts)</u>		
Net income for basic and diluted net income per share	\$467,468	\$451,779	\$257,692
Weighted average common shares-basic	170,425	187,672	198,069
Effect of dilutive potential common shares:			
Incremental shares from assumed conversion of convertible notes (1)	4,909	2,749	1,298
Convertible note hedge warrant shares (2)	2,698	485	112
Restricted stock units	1,236	1,385	1,800
Stock options	178	278	335
Employee stock purchase rights	13	36	27
Dilutive potential common shares	<u>9,034</u>	<u>4,933</u>	<u>3,572</u>
Weighted average common shares-diluted	<u>179,459</u>	<u>192,605</u>	<u>201,641</u>
Net income per common share-basic	<u>\$ 2.74</u>	<u>\$ 2.41</u>	<u>\$ 1.30</u>
Net income per common share-diluted	<u>\$ 2.60</u>	<u>\$ 2.35</u>	<u>\$ 1.28</u>

- (1) Incremental shares from the assumed conversion of the convertible notes was calculated using the difference between the average Teradyne stock price for the period and the conversion price of \$31.62, multiplied by 14.5 million shares. The result of this calculation, representing the total intrinsic value of the convertible debt, was divided by the average Teradyne stock price for the period.
- (2) Convertible notes hedge warrant shares were calculated using the difference between the average Teradyne stock price for the period and the warrant price of \$39.68, multiplied by 14.5 million shares. The result of this calculation, representing the total intrinsic value of the warrant, was divided by the average Teradyne stock price for the period.

The computation of diluted net income per common share for 2018 excludes the effect of the potential exercise of stock options to purchase approximately 0.1 million shares and restricted stock units to purchase approximately 0.5 million shares because the effect would have been anti-dilutive.

The computation of diluted net income per common share for 2017 excludes the effect of the potential exercise of stock options to purchase approximately 0.1 million shares because the effect would have been anti-dilutive.

O. RESTRUCTURING AND OTHER

During the year ended December 31, 2019, Teradyne recorded a gain of \$22.2 million for the decrease in the fair value of the MiR contingent consideration liability, partially offset by a \$3.0 million increase in the fair value of the AutoGuide contingent consideration liability, \$2.9 million of severance charges related to headcount reductions primarily in Semiconductor Test and Industrial Automation, and \$2.5 million for acquisition related expenses and compensation.

During the year ended December 31, 2018, Teradyne recorded an expense of \$17.7 million for the increase in the fair value of the MiR contingent consideration liability, \$8.7 million of severance charges related to headcount reductions primarily in Semiconductor Test, and \$4.5 million for acquisition related expenses and compensation, partially offset by a gain of \$16.7 million for the decrease in the fair value of the Universal Robots contingent consideration liability.

During the year ended December 31, 2017, Teradyne recorded an expense of \$7.8 million for the increase in the fair value of the Universal Robots contingent consideration liability, \$3.8 million of severance charges related to headcount reductions primarily in Semiconductor Test, \$1.1 million for an impairment of fixed assets in Semiconductor Test, \$1.0 million for a lease impairment of a Wireless Test facility in Sunnyvale, CA, which was terminated in September 2017, and \$0.8 million of expenses related to an earthquake in Kumamoto, Japan, partially offset by \$5.1 million of property insurance recovery related to the Japan earthquake.

P. RETIREMENT PLANS

ASC 715, “*Compensation—Retirement Benefits*,” requires an employer with defined benefit plans or other postretirement benefit plans to recognize an asset or a liability on its balance sheet for the overfunded or underfunded status of the plans as defined by ASC 715. The pension asset or liability represents a difference between the fair value of the pension plan’s assets and the projected benefit obligation at December 31. Teradyne uses a December 31 measurement date for all of its plans.

Defined Benefit Pension Plans

Teradyne has defined benefit pension plans covering a portion of domestic employees and employees of certain non-U.S. subsidiaries. Benefits under these plans are based on employees’ years of service and compensation. Teradyne’s funding policy is to make contributions to the plans in accordance with local laws and to the extent that such contributions are tax deductible. The assets of these plans consist primarily of fixed income and equity securities. In addition, Teradyne has an unfunded supplemental executive defined benefit plan in the United States to provide retirement benefits in excess of levels allowed by the Employment Retirement Income Security Act (“ERISA”) and the Internal Revenue Code (the “IRC”), as well as unfunded qualified foreign plans.

During 2018, Teradyne purchased a group annuity contract for its retiree participants in the U.S. qualified pension plan. Under the group annuity, the accrued pension obligations for approximately 1,700 retiree participants were transferred to an insurance company. The reduction in the pension benefit obligation and pension assets was \$151.3 million. During 2018, Teradyne recorded a settlement loss of \$0.3 million related to the retiree group annuity transaction.

The December 31 balances of these defined benefit pension plans assets and obligations are shown below:

	2019		2018	
	United States	Foreign	United States	Foreign
	(in thousands)			
Assets and Obligations				
Change in benefit obligation:				
Projected benefit obligation:				
Beginning of year	\$178,237	\$ 39,146	\$ 363,026	\$ 39,353
Service cost	1,608	751	2,196	786
Interest cost	7,189	691	8,940	687
Actuarial loss (gain)	24,447	4,520	(30,136)	773
Benefits paid	(7,690)	(836)	(14,793)	(741)
Retiree annuity purchase	—	—	(151,341)	—
Liability loss due to settlement	—	—	345	—
Non-U.S. currency movement	—	(320)	—	(1,712)
End of year	<u>203,791</u>	<u>43,952</u>	<u>178,237</u>	<u>39,146</u>
Change in plan assets:				
Fair value of plan assets:				
Beginning of year	144,301	1,400	324,506	1,307
Company contributions	2,805	923	2,587	822
Actual return on plan assets	27,516	64	(16,658)	50
Benefits paid	(7,690)	(836)	(14,793)	(741)
Retiree annuity purchase	—	—	(151,341)	—
Non-U.S. currency movement	—	35	—	(38)
End of year	<u>166,932</u>	<u>1,586</u>	<u>144,301</u>	<u>1,400</u>
Funded status	<u>\$ (36,859)</u>	<u>\$ (42,366)</u>	<u>\$ (33,936)</u>	<u>\$ (37,746)</u>

The following table provides amounts recorded within the account line items of the statements of financial position as of December 31:

	2019		2018	
	United States	Foreign	United States	Foreign
	(in thousands)			
Retirement plans assets	\$ 18,457	\$ —	\$ 16,883	\$ —
Accrued employees' compensation and withholdings	(2,826)	(922)	(2,676)	(852)
Retirement plans liabilities	<u>(52,490)</u>	<u>(41,444)</u>	<u>(48,143)</u>	<u>(36,894)</u>
Funded status	<u>\$ (36,859)</u>	<u>\$ (42,366)</u>	<u>\$ (33,936)</u>	<u>\$ (37,746)</u>

The following table provides amounts recognized in accumulated other comprehensive income as of December 31:

	2019		2018	
	United States	Foreign	United States	Foreign
	(in thousands)			
Deferred taxes related to prior service cost recognized in other comprehensive income	<u>\$560</u>	<u>\$—</u>	<u>\$560</u>	<u>\$—</u>

The accumulated benefit obligation for the United States defined benefit pension plans was \$198.2 million and \$172.8 million at December 31, 2019 and 2018, respectively. The accumulated benefit obligation for foreign defined benefit pension plans was \$39.9 million and \$35.6 million at December 31, 2019 and 2018, respectively.

Information for pension plans with an accumulated benefit obligation in excess of plan assets as of December 31:

	2019		2018	
	United States	Foreign	United States	Foreign
	(in millions)			
Projected benefit obligation	\$55.3	\$44.0	\$50.8	\$39.1
Accumulated benefit obligation	53.2	39.9	48.6	35.6
Fair value of plan assets	—	1.6	—	1.4

Expense

For the years ended December 31, 2019, 2018, and 2017, Teradyne’s net periodic pension cost (income) was comprised of the following:

	2019		2018		2017	
	United States	Foreign	United States	Foreign	United States	Foreign
	(in thousands)					
Components of Net Periodic Pension Cost (Income):						
Service cost	\$ 1,608	\$ 751	\$ 2,196	\$ 786	\$ 2,239	\$ 818
Interest cost	7,189	691	8,940	687	13,151	852
Expected return on plan assets	(6,042)	(29)	(9,049)	(19)	(12,008)	(165)
Amortization of prior service cost	—	—	58	—	70	—
Net actuarial loss (gain)	2,973	4,485	(4,429)	743	(6,712)	(310)
Settlement loss	—	—	345	—	—	—
Total net periodic pension cost (income)	\$ 5,728	\$5,898	\$(1,939)	\$2,197	\$ (3,260)	\$1,195
Changes in Plan Assets and Benefit Obligations						
Recognized in Other Comprehensive Income:						
Reversal of amortization items:						
Prior service cost	—	—	(58)	—	(70)	—
Total recognized in other comprehensive income	—	—	(58)	—	(70)	—
Total recognized in net periodic pension cost (income)						
and other comprehensive income	\$ 5,728	\$5,898	\$(1,997)	\$2,197	\$ (3,330)	\$1,195

Weighted Average Assumptions to Determine Net Periodic Pension Cost at January 1:

	2019		2018		2017	
	United States	Foreign	United States	Foreign	United States	Foreign
Discount rate	4.1%	1.8%	3.4%	1.8%	3.9%	1.8%
Expected return on plan assets	4.3	2.0	4.3	1.5	4.0	2.0
Salary progression rate	2.5	2.5	2.3	2.7	2.6	2.7

Weighted Average Assumptions to Determine Pension Obligations at December 31:

	2019		2018	
	United States	Foreign	United States	Foreign
Discount rate	3.0%	1.1%	4.1%	1.8%
Salary progression rate	2.6	2.5	2.5	2.6

In developing the expected return on plan assets assumption, Teradyne evaluates input from its investment manager and pension consultants, including their forecast of asset class return expectations. Teradyne believes that 4.25% was an appropriate rate to use for fiscal 2019 for the U.S. Qualified Pension Plan (“U.S. Plan”).

Teradyne recognizes net actuarial gains and losses and the change in the fair value of the plan assets in its operating results in the year in which they occur or upon any interim remeasurement of the plans. Teradyne calculates the expected return on plan assets using the fair value of the plan assets. Actuarial gains and losses are generally measured annually as of December 31 and, accordingly, recorded during the fourth quarter of each year or upon any interim remeasurement of the plans.

The discount rate utilized to determine future pension obligations for the U.S. Plan is based on FTSE Pension Index adjusted for the plan’s expected cash flows and was 3.10% at December 31, 2019, down from 4.15% at December 31, 2018.

Plan Assets

As of December 31, 2019, the fair value of Teradyne’s pension plans’ assets totaled \$168.5 million of which \$166.9 million was related to the U.S. Plan and \$1.6 million was related to the Taiwan defined benefit pension plan. Substantially all of Teradyne’s pension plans’ assets are held in individual trusts, which were established for the investment of assets of Teradyne’s sponsored retirement plans.

The following table provides weighted average pension asset allocation by asset category at December 31, 2019 and 2018:

	2019		2018	
	United States	Foreign	United States	Foreign
Fixed income securities	94.0%	— %	94.0%	— %
Equity securities	5.0	—	5.0	—
Other	1.0	100.0	1.0	100.0
	<u>100.0%</u>	<u>100.0%</u>	<u>100.0%</u>	<u>100.0%</u>

The assets of the U.S. Plan are overseen by the Teradyne Fiduciary Committee which is comprised of members of senior management drawn from appropriate diversified levels of the management team. The Fiduciary Committee is responsible for setting the policy that provides the framework for management of the U.S. Plan assets. In accordance with its responsibilities, the Fiduciary Committee meets on a regular basis to review the performance of the U.S. Plan assets and compliance with the investment policy. The policy sets forth an investment structure for managing U.S. Plan assets, including setting the asset allocation ranges, which are expected to provide an appropriate level of overall diversification required to maximize the long-term return on plan assets for a prudent and reasonable level of risk given prevailing market conditions, total investment return over the long term, and preservation of capital, while maintaining sufficient liquidity to pay the benefits of the U.S. Plan. The investment portfolio will not, at any time, have a direct investment in Teradyne stock. It may have indirect investment in Teradyne stock, if one of the funds selected by the investment manager invests in Teradyne stock. In developing the asset allocation ranges, third party asset allocation studies are periodically performed that consider the current and expected positions of the plan assets and funded status. Based on this study and other appropriate information, the Fiduciary Committee establishes asset allocation ranges taking into account acceptable risk targets and associated returns. The investment return objectives are to avoid excessive volatility and produce a rate of return that at least matches the Policy Index identified below. The manager’s investment performance is reviewed at least annually. Results for the total portfolio and for each major category of assets are evaluated in comparison with appropriate market indices and the Policy Index.

The target asset allocation and the index for each asset category for the U.S. Plan, per the investment policy, are as follows:

<u>Asset Category:</u>	<u>Policy Index:</u>	<u>Target Allocation</u>
U.S. corporate fixed income	Barclays U.S. Corporate A or Better Index	75%
Global equity	MSCI World Minimum Volatility Index	5
U.S. government fixed income	Barclays U.S. Long Government Bond Index	14
High yield fixed income	Barclays U.S. High Yield Index	5
Cash	Citigroup Three Month U.S. Treasury Bill Index	1

Teradyne's U.S. Plan invests primarily in common trust funds. Units held in the common trust funds are valued at the unit price as reported by the investment manager based on the asset value of the underlying investments; underlying investments in equity securities are valued at the last reported sales price, and underlying investments in fixed-income securities are generally valued using methods based upon market transactions for comparable securities.

In 2017, the U.K. defined benefit pension was terminated and the obligations and assets of the plan were transferred to an insurance company.

During the year ended December 31, 2019, there were no transfers of pension assets in or out of Level 1, Level 2, and Level 3. During the year ended December 31, 2018, \$2.7 million of pension assets were transferred out of Level 3 to Level 2.

The fair value of pension plan assets by asset category and by level at December 31, 2019 and December 31, 2018 were as follows:

	December 31, 2019							
	United States				Foreign			
	Level 1	Level 2	Level 3	Total	Level 1	Level 2	Level 3	Total
	(in thousands)							
Fixed income securities:								
Corporate debt securities	\$ —	\$133,792	\$—	\$133,792	\$—	\$ —	\$—	\$ —
U.S. government securities	—	23,186	—	23,186	—	—	—	—
Global equity	—	8,344	—	8,344	—	—	—	—
Other	—	—	—	—	—	1,586	—	1,586
Cash and cash equivalents	1,610	—	—	1,610	—	—	—	—
Total	\$1,610	\$165,322	\$—	\$166,932	\$—	\$1,586	\$—	\$1,586

	December 31, 2018							
	United States				Foreign			
	Level 1	Level 2	Level 3	Total	Level 1	Level 2	Level 3	Total
	(in thousands)							
Fixed income securities:								
Corporate debt securities	\$ —	\$115,424	\$—	\$115,424	\$—	\$ —	\$—	\$ —
U.S. government securities	—	20,176	—	20,176	—	—	—	—
Global equity	—	7,252	—	7,252	—	—	—	—
Other	—	—	—	—	—	1,400	—	1,400
Cash and cash equivalents	1,449	—	—	1,449	—	—	—	—
Total	\$1,449	\$142,852	\$—	\$144,301	\$—	\$1,400	\$—	\$1,400

Changes in the fair value of Level 3 group annuity insurance contracts for the year ended December 31, 2018 were as follows:

	<u>Group Annuity Insurance Contracts</u>
	(in thousands)
Balance at December 31, 2017	\$ 3,166
Transfer out of level 3	(2,658)
Purchases of retiree annuity insurance contracts	(512)
Interest and market value adjustments	59
Benefits paid	(40)
Other	(15)
Balance at December 31, 2018	<u>\$ —</u>

Contributions

Teradyne's funding policy is to make contributions to the plans in accordance with local laws and to the extent that such contributions are tax deductible. During 2019, Teradyne contributed \$2.8 million to the U.S. supplemental executive defined benefit pension plan and \$0.9 million to certain qualified plans for non-U.S. subsidiaries. During 2018, Teradyne contributed \$2.6 million to the U.S supplemental executive defined benefit pension plan and \$0.8 million to certain qualified plans for non-U.S. subsidiaries. In 2020, contributions to the U.S. supplemental executive defined benefit pension plan and certain qualified plans from non-U.S. subsidiaries will be approximately \$2.8 million and \$1.0 million, respectively.

Expected Future Pension Benefit Payments

Future benefit payments are expected to be paid as follows:

	<u>United States</u>	<u>Foreign</u>
	(in thousands)	
2020	\$ 8,027	\$1,237
2021	8,416	985
2022	9,163	982
2023	9,785	1,258
2024	10,558	1,098
2025-2029	59,665	6,129

Postretirement Benefit Plans

In addition to receiving pension benefits, U.S. Teradyne employees who meet early retirement eligibility requirements as of their termination dates may participate in Teradyne's Welfare Plan, which includes medical and dental benefits up to age 65. Death benefits provide a fixed sum to retirees' survivors and are available to all retirees. Substantially all of Teradyne's current U.S. employees could become eligible for these benefits, and the existing benefit obligation relates primarily to those employees.

The December 31 balances of the postretirement assets and obligations are shown below:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Assets and Obligations		
Change in benefit obligation:		
Projected benefit obligation:		
Beginning of year	\$ 9,256	\$ 6,177
Service cost	41	39
Interest cost	347	196
Actuarial loss	717	25
Benefits paid	(1,358)	(889)
Special termination benefits	—	3,708
End of year	<u>9,003</u>	<u>9,256</u>
Change in plan assets:		
Fair value of plan assets:		
Beginning of year	—	—
Company contributions	1,358	889
Benefits paid	(1,358)	(889)
End of year	<u>—</u>	<u>—</u>
Funded status	<u>\$(9,003)</u>	<u>\$(9,256)</u>

The following table provides amounts recorded within the account line items of financial position as of December 31:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Accrued employees' compensation and withholdings	\$(1,231)	\$(1,310)
Retirement plans liability	(7,772)	(7,946)
Funded status	<u>\$(9,003)</u>	<u>\$(9,256)</u>

The following table provides amounts recognized in accumulated other comprehensive income as of December 31:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Prior service credit, before tax	\$ (58)	\$ (249)
Deferred taxes	(1,684)	(1,641)
Total recognized in other comprehensive income, net of tax	<u>\$(1,742)</u>	<u>\$(1,890)</u>

Expense

For the years ended December 31, 2019, 2018, and 2017, Teradyne's net periodic postretirement benefit cost (income) was comprised of the following:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Components of Net Periodic Postretirement Benefit			
Cost (income):			
Service cost	\$ 41	\$ 39	\$ 34
Interest cost	347	196	201
Amortization of prior service credit	(191)	(373)	(496)
Net actuarial loss	717	25	398
Special termination benefits	—	3,708	591
Total net periodic postretirement benefit cost	<u>914</u>	<u>3,595</u>	<u>728</u>
Changes in Plan Assets and Benefit Obligations Recognized in Other			
Comprehensive Income:			
Prior service cost	—	—	—
Reversal of amortization items:			
Prior service credit	191	373	496
Total recognized in other comprehensive income	<u>191</u>	<u>373</u>	<u>496</u>
Total recognized in net periodic postretirement cost and other comprehensive income	<u>\$1,105</u>	<u>\$3,968</u>	<u>\$1,224</u>

Weighted Average Assumptions to Determine Net Periodic Postretirement Benefit Income as of January 1:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Discount rate	4.0%	3.4%	3.9%
Initial health care cost trend rate	7.5	7.9	7.3
Ultimate health care cost trend rate	4.5	4.5	5.0
Year in which ultimate health care cost trend rate is reached	2026	2026	2023

Weighted Average Assumptions to Determine Postretirement Benefit Obligation as of December 31:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Discount rate	3.0%	4.0%	3.4%
Initial medical trend	7.1	7.5	7.9
Ultimate health care trend	4.5	4.5	4.5
Medical cost trend rate decrease to ultimate rate in year	2026	2026	2026

Assumed health care trend rates could have a significant effect on the amounts reported for health care plans. A one percentage point change in the assumed health care cost trend rates for the year ended December 31, 2019 would have the following effects:

	<u>1 Percentage Point Increase</u>	<u>1 Percentage Point Decrease</u>
	(in thousands)	
Effect on total service and interest cost components	\$ 6	\$ (6)
Effect on postretirement benefit obligations	139	(133)

Expected Future Benefit Payments

Future benefit payments are expected to be paid as follows:

	<u>Benefit Payments</u> (in thousands)
2020	\$1,231
2021	1,171
2022	958
2023	789
2024	662
2025-2029	1,965

Q. STOCK-BASED COMPENSATION

Stock Compensation Plans

On July 17, 2019 (the “Retirement Date”), former Chief Financial Officer Gregory Beecher retired as Vice President and Senior Advisor of Teradyne, and Teradyne entered into an agreement (the “Retirement Agreement”) with Mr. Beecher. Under the Retirement Agreement, Mr. Beecher’s unvested time-based restricted stock units and stock options granted prior to 2019 were modified to allow continued vesting; unvested time-based restricted stock units and stock options granted in 2019 were modified to allow continued vesting through January 31, 2023 (the “Non-Competition Period”) in a pro-rated amount based on the number of days that Mr. Beecher was employed during 2019; unvested, performance-based restricted stock units awarded in 2019 will vest on the date the amount of shares underlying the performance-based restricted stock units are determined in a pro-rated amount of shares based on the number of days that Mr. Beecher was employed during 2019; vested options or options that vest during the Non-Competition Period may be exercised for the remainder of the applicable option term. During 2019, Teradyne recorded a stock based compensation expense of \$2.1 million related to the Retirement Agreement.

Under Teradyne’s stock compensation plans, Teradyne grants time-based restricted stock units, performance-based restricted stock units, stock options and employees are eligible to purchase Teradyne’s common stock through its Employee Stock Purchase Plan (“ESPP”).

Time-based restricted stock unit awards granted to employees vest in equal annual installments over four years. Restricted stock unit awards granted to non-employee directors vest after a one-year period, with 100% of the award vesting on the earlier of (a) the first anniversary of the grant date or (b) the date of the following year’s Annual Meeting of Shareholders. Teradyne expenses the cost of the restricted stock unit awards subject to time-based vesting, which is determined to be the fair market value of the shares at the date of grant, ratably over the period during which the restrictions lapse.

Performance-based restricted stock units (“PRsUs”) granted to Teradyne’s executive officers may have a performance metric based on relative total shareholder return (“TSR”). Teradyne’s three-year TSR performance is measured against the New York Stock Exchange (“NYSE”) Composite Index. The final number of TSR PRsUs that vest will vary based upon the level of performance achieved from 200% to 0% of the target shares capped at four times the grant date value for grants prior to 2019. The TSR PRsUs will vest upon the three-year anniversary of the grant date. The TSR PRsUs are valued using a Monte Carlo simulation model. The number of units expected to be earned, based upon the achievement of the TSR market condition, is factored into the grant date Monte Carlo valuation. Compensation expense is recognized on a straight-line basis over the shorter of the three-year service period or the period from the grant to the date described in the retirement provisions below. Compensation expense for employees meeting the retirement provisions prior to the grant date will be recognized in full on the date of the grant. Compensation expense is recognized regardless of the eventual number of units that are earned based upon the market condition, provided the executive officer remains an employee at the end

of the three-year period. Compensation expense is reversed if at any time during the three-year service period the executive officer is no longer an employee, subject to the retirement and termination eligibility provisions noted below.

PRsUs granted to Teradyne’s executive officers may also have a performance metric based on three-year cumulative non-GAAP profit before interest and tax (“PBIT”) as a percent of Teradyne’s revenue. Non-GAAP PBIT is a financial measure equal to GAAP income from operations less restructuring and other, net; amortization of acquired intangible assets; acquisition and divestiture related charges or credits; pension actuarial gains and losses; non-cash convertible debt interest expense; and other non-recurring gains and charges. The final number of PBIT PRsUs that vest will vary based upon the level of performance achieved from 200% to 0% of the target shares. The PBIT PRsUs will vest upon the three-year anniversary of the grant date. Compensation expense is recognized on a straight-line basis over the shorter of the three-year service period or the period from the grant date to the date described in the retirement provisions below. Compensation expense for employees meeting the retirement provisions prior to the grant date will be recognized in full on the date of grant. Compensation expense is recognized based on the number of units that are earned based upon the three-year Teradyne PBIT as a percent of Teradyne’s revenue, provided the executive officer remains an employee at the end of the three-year period subject to the retirement and termination eligibility provisions noted below.

If a PRsU recipient’s employment ends prior to the determination of the performance percentage due to (1) permanent disability or death or (2) retirement or termination other than for cause, after attaining both at least age sixty and at least ten years of service, then all or a portion of the recipient’s PRsUs (based on the actual performance percentage achieved on the determination date) will vest on the date the performance percentage is determined. Except as set forth in the preceding sentence, no PRsUs will vest if the executive officer is no longer an employee at the end of the three-year period.

Stock options to purchase Teradyne’s common stock at 100% of the fair market value on the grant date vest in equal annual installments over four years from the grant date and have a maximum term of seven years.

During 2019, 2018 and 2017, Teradyne granted 0.8 million, 0.6 million and 0.8 million of service-based restricted stock unit awards to employees at a weighted average grant date fair value of \$37.65, \$45.92 and \$28.19, respectively.

During 2019, 2018 and 2017, Teradyne granted 0.1 million of service-based restricted stock unit awards to non-employee directors at a weighted average grant date fair value of \$48.03, \$35.81 and \$34.48, respectively.

During 2019, 2018 and 2017, Teradyne granted 0.1 million TSR PRsUs, with a grant date fair value of \$51.51, \$54.85 and \$35.66 respectively. The fair value was estimated using the Monte Carlo simulation model with the following assumptions:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Risk-free interest rate	2.6%	2.2%	1.5%
Teradyne volatility-historical	31.9%	26.8%	26.6%
NYSE Composite Index volatility-historical	11.9%	12.4%	13.4%
Dividend yield	1.0%	0.8%	1.0%

Expected volatility was based on the historical volatility of Teradyne’s stock and the NYSE Composite Index for each of the 2019, 2018 and 2017 grants over the most recent three-year period. The risk-free interest rate was determined using the U.S. Treasury yield curve in effect at the time of each of the grants. Dividend yield was based upon an estimated annual dividend amount of \$0.36 per share for 2019 and 2018 and \$0.28 per share for 2017, divided by Teradyne’s stock price on the grant date of \$37.95 for the 2019 grants, \$47.70 for the 2018 grants and \$28.56 for 2017 grants.

During 2019, 2018 and 2017, Teradyne granted 0.1 million of PBIT PRSUs with a grant date fair value of \$36.88, \$46.62 and \$27.72, respectively.

During 2019, 2018 and 2017, Teradyne granted 0.1 million of service-based stock options to executive officers at a weighted average grant date fair value of \$10.64, \$12.17 and \$7.13, respectively.

The fair value of stock options was estimated using the Black-Scholes option-pricing model with the following assumptions:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Expected life (years)	5.0	5.0	5.0
Risk-free interest rate	2.5%	2.4%	2.0%
Volatility-historical	30.1%	26.4%	27.8%
Dividend yield	1.00%	0.80%	1.00%

Teradyne determined the stock options' expected life based upon historical exercise data for executive officers, the age of the executive officers and the terms of the stock option grant. Volatility was determined using historical volatility for a period equal to the expected life. The risk-free interest rate was determined using the U.S. Treasury yield curve in effect at the time of grant. Dividend yield was based upon an estimated annual dividend amount of \$0.36 per share divided by Teradyne's stock price on the grant date of \$37.95 for the 2019 grants, \$47.70 for the 2018 grants and \$28.56 for the 2017 grants.

Stock compensation plan activity for the years 2019, 2018, and 2017, is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Restricted Stock Units:			
Non-vested at January 1	2,454	3,174	3,778
Awarded	1,139	790	939
Vested	(1,237)	(1,382)	(1,434)
Forfeited	(87)	(128)	(109)
Non-vested at December 31	<u>2,269</u>	<u>2,454</u>	<u>3,174</u>
Stock Options:			
Outstanding at January 1	506	531	926
Granted	102	69	111
Exercised	(280)	(94)	(501)
Forfeited	(7)	—	—
Expired	(2)	—	(5)
Outstanding at December 31	<u>319</u>	<u>506</u>	<u>531</u>
Vested and expected to vest at December 31	<u>319</u>	<u>506</u>	<u>531</u>
Exercisable at December 31	<u>85</u>	<u>256</u>	<u>233</u>

Total shares available for the years 2019, 2018, and 2017:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Shares available:			
Available for grant at January 1	7,874	8,605	9,546
Options granted	(102)	(69)	(111)
Options forfeited	7	—	—
Restricted stock units awarded	(1,139)	(790)	(939)
Restricted stock units forfeited	87	128	109
Available for grant at December 31	<u>6,727</u>	<u>7,874</u>	<u>8,605</u>

Weighted average restricted stock unit award date fair value information for the years 2019, 2018, and 2017, is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Non-vested at January 1	\$29.22	\$21.71	\$18.27
Awarded	39.08	45.99	28.91
Vested	23.59	20.20	17.90
Forfeited	35.60	24.67	20.35
Non-vested at December 31	\$35.58	\$29.22	\$21.71

Restricted stock unit awards aggregate intrinsic value information at December 31 for the years 2019, 2018, and 2017 is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Vested	\$ 46,110	\$63,688	\$ 40,649
Outstanding	154,752	77,015	132,875
Expected to vest	152,374	77,187	130,594

Restricted stock units weighted average remaining contractual terms (in years) information at December 31 for the years 2019, 2018, and 2017 is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Outstanding	1.02	0.92	1.00
Expected to vest	1.02	0.91	0.99

Weighted average stock options exercise price information for the year ended December 31, 2019 is as follows:

	<u>2019</u>
Outstanding at January 1	\$19.06
Options granted	37.95
Options exercised	13.20
Options forfeited	36.75
Options cancelled	1.48
Outstanding at December 31	29.91
Exercisable at December 31	14.97

The total cash received from employees as a result of employee stock options exercises during the years ended December 31, 2019, 2018, and 2017, was \$3.7 million, \$1.0 million and \$6.8 million, respectively. In connection with these exercises, the tax benefit realized by Teradyne for the years ended December 31, 2019, 2018, and 2017, was \$2.0 million, \$0.4 million, and \$2.5 million, respectively.

Stock option aggregate intrinsic value information for the years ended December 31, 2019, 2018, and 2017 is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Exercised	\$ 9,232	\$2,960	\$ 8,035
Outstanding	12,218	7,359	14,831
Vested and expected to vest	7,701	7,359	14,831
Exercisable	4,517	5,905	9,076

Stock options weighted average remaining contractual terms (in years) information at December 31, for the years 2019, 2018, and 2017 is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
Outstanding	4.2	3.6	4.1
Vested and expected to vest	5.0	3.6	4.1
Exercisable	2.1	2.4	2.8

As of December 31, 2019, total unrecognized expense related to non-vested restricted stock unit awards and stock options was \$45 million, and is expected to be recognized over a weighted average period of 1.8 years.

Employee Stock Purchase Plan

Under the ESPP, eligible employees may purchase shares of common stock through regular payroll deductions of up to 10% of their compensation, to a maximum of shares with a fair market value of \$25,000 per calendar year, not to exceed 6,000 shares. Under the plan, the price paid for the common stock is equal to 85% of the stock price on the last business day of the six-month purchase period.

In July 2019, 0.3 million shares of common stock were issued to employees who participated in the plan during the first half of 2019 at the price of \$40.72 per share. In January 2020, Teradyne issued 0.2 million shares of common stock to employees who participated in the plan during the second half of 2019 at the price of \$57.96 per share.

In July 2018, 0.3 million shares of common stock were issued to employees who participated in the plan during the first half of 2018 at the price of \$32.36 per share. In January 2019, Teradyne issued 0.4 million shares of common stock to employees who participated in the plan during the second half of 2018 at the price of \$26.67 per share.

In July 2017, 0.3 million shares of common stock were issued to employees who participated in the plan during the first half of 2017 at the price of \$25.53 per share. In January 2018, Teradyne issued 0.3 million shares of common stock to employees who participated in the plan during the second half of 2017 at the price of \$35.99 per share.

As of December 31, 2019, there were 1.8 million shares available for grant under the ESPP.

The following table provides the effect to income from operations for recording stock-based compensation for the years ended December 31, 2019, 2018, and 2017:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
		(in thousands)	
Cost of revenues	\$ 3,480	\$ 3,129	\$ 3,212
Engineering and development	9,913	9,181	9,370
Selling and administrative	<u>24,504</u>	<u>21,267</u>	<u>21,515</u>
Stock-based compensation	37,897	33,577	34,097
Income tax benefit	(8,360)	(12,036)	(10,462)
Total stock-based compensation expense after income taxes	<u>\$29,537</u>	<u>\$ 21,541</u>	<u>\$ 23,635</u>

R. SAVINGS PLAN

Teradyne sponsors a defined contribution employee retirement savings plan (“Savings Plan”) covering substantially all U.S. employees. Under the Savings Plan, employees may contribute up to 20% of their compensation (subject to Internal Revenue Service limitations). The Savings Plan provides for a discretionary employer match that is determined each year. In 2019, 2018 and 2017, Teradyne matched 100% of eligible employee contributions up to 4% of their compensation for employees not accruing benefits in the U.S. Qualified Pension Plan. There was no match for employees still actively accruing benefits in the U.S. Qualified Pension Plan. Teradyne’s contributions vest 25% per year for the first four years of employment, and contributions for those employees with four years of service vest immediately.

In addition, Teradyne sponsors an unfunded U.S. Supplemental Savings Plan to provide savings benefits in excess of those allowed by the Employee Retirement Income Security Act of 1974 and the Internal Revenue Code. The provisions of this plan are the same as the Savings Plan. The liability for the U.S. Supplemental Savings Plan at December 31, 2019 and 2018, was \$32.7 million and \$24.4 million, respectively, and is included in retirement plan liabilities. Teradyne contributes to defined contributions savings plans for its foreign employees. Under Teradyne’s savings plans, amounts charged to the statements of operations for the years ended December 31, 2019, 2018, and 2017 were \$20.9 million, \$19.4 million, and \$16.8 million, respectively.

S. INCOME TAXES

The components of income (loss) before income taxes and the provision (benefit) for income taxes as shown in the consolidated statements of operations were as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Income before income taxes			
U.S.	\$192,442	\$189,691	\$ 76,699
Non-U.S.	333,330	278,110	447,713
	<u>\$525,772</u>	<u>\$467,801</u>	<u>\$524,412</u>
Provision (benefit) for income taxes			
Current:			
U.S. Federal	\$ 19,297	\$ (59,122)	\$162,679
Non-U.S.	52,810	45,083	64,313
State	(4,347)	1,721	2,623
	<u>67,760</u>	<u>(12,318)</u>	<u>229,615</u>
Deferred:			
U.S. Federal	(4,522)	29,252	43,687
Non-U.S.	(8,007)	(1,243)	(6,476)
State	3,073	331	(106)
	<u>(9,456)</u>	<u>28,340</u>	<u>37,105</u>
Total provision for income taxes	<u>\$ 58,304</u>	<u>\$ 16,022</u>	<u>\$266,720</u>

Income tax expense for 2019, 2018 and 2017 totaled \$58.3 million, \$16.0 million and \$266.7 million, respectively. The effective tax rate for 2019, 2018 and 2017 was 11.1%, 3.4% and 50.9%, respectively.

On December 22, 2017, the U.S. enacted the Tax Cuts and Jobs Act of 2017 (the "Tax Reform Act"), making significant changes to the Internal Revenue Code. The Tax Reform Act has significant direct and indirect implications for accounting for income taxes under ASC 740, "Accounting for Income Taxes" some of which could not be calculated with precision until further clarification and guidance was made available from tax authorities, regulatory bodies or the FASB. In light of this uncertainty, on December 22, 2017 the SEC issued Staff Accounting Bulletin ("SAB") No. 118, "Income Tax Accounting Implications of the Tax Cuts and Jobs Act," to address uncertainty in the application of U.S. GAAP when the registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Tax Reform Act. In accordance with SAB 118, Teradyne recorded \$186.0 million of additional income tax expense in the fourth quarter of 2017 which represented Teradyne's best estimate of the impact of the Tax Reform Act in accordance with Teradyne's understanding of the Tax Reform Act and available guidance as of that date. The \$186.0 million was primarily composed of expense of \$161.0 million related to the one-time transition tax on the mandatory deemed repatriation of foreign earnings, \$33.6 million of expense related to the remeasurement of certain deferred tax assets and liabilities based on the rates at which they are expected to reverse in the future, and a benefit of \$10.3 million associated with the impact of correlative adjustments on uncertain tax positions. In accordance with the requirements of SAB 118, in the fourth quarter of 2018, Teradyne completed its analysis of the effect of the Tax Reform Act based on the application of the most recently available guidance as of December 31, 2018 and recorded \$49.5 million of net income tax benefit. The net benefit consisted of \$51.7 million of benefit resulting from a reduction in the estimate of the one-time transition tax on the mandatory deemed repatriation of foreign earnings and an expense of \$2.2 million associated with the impact of correlative adjustments on uncertain tax positions.

Teradyne has made an accounting policy election to account for GILTI as a component of tax expense in the period in which Teradyne is subject to the rules and therefore did not provide any deferred tax impacts of GILTI in its consolidated financial statements.

The increase in the effective tax rate from 2018 to 2019 is primarily attributable to increases in expense associated with GILTI and the transition tax on the mandatory deemed repatriation of foreign earnings. These increases in expense were partially offset by increased benefit from the U.S. foreign derived intangible income deduction, foreign tax credits and a net reduction of reserves for uncertain tax positions.

On July 27, 2015, in *Altera Corp. (“Altera”) v. Commissioner*, the U.S. Tax Court issued an opinion invalidating the regulations relating to the treatment of stock-based compensation expense in an intercompany cost-sharing arrangement. A final decision was issued by the Tax Court in December 2015. The IRS appealed the decision in June 2016. On July 24, 2018, the U.S. Court of Appeals for the Ninth Circuit (“Ninth Circuit”) issued a decision that was subsequently withdrawn and a reconstituted panel conferred on the appeal. On June 7, 2019, the Ninth Circuit upheld the cost-sharing regulations. On November 12, 2019 the Ninth Circuit denied Altera’s petition for rehearing of its case. As a result, during the fourth quarter of 2019, Teradyne recognized a tax expense of approximately \$6.3 million related to the inclusion of stock-based compensation in its intercompany cost-sharing arrangement.

The decrease in the effective tax rate from 2017 to 2018 was primarily attributable to the \$186.0 million of income tax expense recorded in the fourth quarter of 2017 for the impact of the Tax Reform Act and the \$51.7 million of income tax benefit recorded in the fourth quarter of 2018 resulting from a reduction in the estimate of the one-time transition tax on the mandatory deemed repatriation of foreign earnings and an expense of \$2.2 million associated with the impact of correlative adjustments on uncertain tax positions. The change in the effective tax rate from 2017 to 2018 was also impacted by a shift in the geographic distribution of income which increased income subject to taxation in the U.S. relative to lower tax rate jurisdictions, the benefit of the U.S. foreign derived intangible income deduction and increases in discrete benefit from non-taxable foreign exchange gains and losses.

A reconciliation of the effective tax rate for the years 2019, 2018 and 2017 is as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
U.S. statutory federal tax rate	21.0%	21.0%	35.0%
U.S. global intangible low-taxed income	6.2	0.3	—
U.S. transition tax	1.9	(10.5)	28.7
State income taxes, net of federal tax benefit	0.5	0.1	(0.4)
Foreign tax credits	(5.9)	(2.2)	(2.2)
Uncertain tax positions	(4.3)	1.0	1.7
Foreign taxes	(4.0)	(2.0)	(16.3)
U.S. foreign derived intangible income	(2.6)	(1.8)	—
U.S. research and development credit	(1.8)	(2.2)	(1.6)
Equity compensation	(0.7)	(1.2)	(0.8)
Impact of rate change on deferred taxes	—	0.3	6.9
Domestic production activities deduction	—	—	(0.3)
Other, net	0.8	0.6	0.2
	<u>11.1%</u>	<u>3.4%</u>	<u>50.9%</u>

Teradyne qualifies for a tax holiday in Singapore by fulfilling the requirements of an agreement with the Singapore Economic Development Board under which certain headcount and spending requirements must be met. The tax savings attributable to the Singapore tax holiday for the years ended December 31, 2019, 2018 and 2017 were \$15.1 million or \$0.08 per diluted share, \$11.9 million or \$0.06 per diluted share and \$24.8 million or \$0.12 per diluted share, respectively. The tax holiday is scheduled to expire on December 31, 2020.

Significant components of Teradyne's deferred tax assets (liabilities) as of December 31, 2019 and 2018 were as follows:

	<u>2019</u>	<u>2018</u>
	(in thousands)	
Deferred tax assets		
Tax credits	\$ 79,480	\$ 69,091
Accruals	25,424	23,449
Pension liabilities	24,459	20,826
Inventory valuations	18,572	18,514
Deferred revenue	7,622	9,130
Equity compensation	7,042	7,190
Vacation accrual	4,768	4,772
Investment impairment	3,292	—
Net operating loss carryforwards	2,705	3,658
Marketable securities	—	962
Other	1,472	685
Gross deferred tax assets	174,836	158,277
Less: valuation allowance	(77,177)	(69,852)
Total deferred tax assets	<u>\$ 97,659</u>	<u>\$ 88,425</u>
Deferred tax liabilities:		
Depreciation	\$(18,238)	\$(14,028)
Intangible assets	(16,705)	(24,211)
Marketable securities	(1,601)	—
Total deferred tax liabilities	<u>\$(36,544)</u>	<u>\$(38,239)</u>
Net deferred assets	<u>\$ 61,115</u>	<u>\$ 50,186</u>

As of December 31, 2019 and 2018, Teradyne evaluated the likelihood that it would realize deferred income taxes to offset future taxable income and concluded that it is more likely than not that a substantial majority of its deferred tax assets will be realized through consideration of both the positive and negative evidence. At December 31, 2019 and 2018, Teradyne maintained a valuation allowance for certain deferred tax assets of \$77.2 million and \$69.9 million, respectively, primarily related to state net operating losses and state tax credit carryforwards, due to the uncertainty regarding their realization. Adjustments could be required in the future if Teradyne estimates that the amount of deferred tax assets to be realized is more or less than the net amount recorded.

At December 31, 2019, Teradyne had operating loss carryforwards that expire in the following years:

	<u>State</u> <u>Operating Loss</u> <u>Carryforwards</u>	<u>Federal</u> <u>Operating Loss</u> <u>Carryforwards</u>	<u>Foreign</u> <u>Operating Loss</u> <u>Carryforwards</u>
	(in thousands)		
2020	\$ 269	\$ —	\$ —
2021	2,141	—	—
2022	4,934	—	—
2023	4,342	—	—
2024	1,498	—	—
2025-2029	7,673	—	—
2030-2034	4,329	—	15
Beyond 2034	2,185	554	74
Non-expiring	1,357	—	4,207
Total	<u>\$28,728</u>	<u>\$ 554</u>	<u>\$4,296</u>

Teradyne has approximately \$108.4 million of tax credit carryforwards including federal business tax credits of approximately \$2.1 million which expire in 2028 and 2029, and state tax credits of \$106.3 million, of which \$59.7 million do not expire and the remainder expires in the years 2020 through 2039.

Teradyne's gross unrecognized tax benefits for the years ended December 31, 2019, 2018 and 2017 were as follows:

	<u>2019</u>	<u>2018</u>	<u>2017</u>
	(in thousands)		
Beginning balance, as of January 1	\$ 43,395	\$ 36,263	\$ 38,958
Additions:			
Tax positions for current year	1,322	4,716	8,208
Tax positions for prior years	8,043	2,626	199
Reductions:			
Tax positions for prior years	(31,397)	(153)	(10,573)
Expiration of statutes	(183)	(57)	(325)
Settlements with tax authorities	—	—	(204)
Ending balance as of December 31	<u>\$ 21,180</u>	<u>\$ 43,395</u>	<u>\$ 36,263</u>

Current year additions relate to federal and state research credits. Prior year additions primarily relate to stock-based compensation. Prior year reductions are primarily composed of federal and state reserves related to transfer pricing and research credits and resulted from the completion of the 2015 U.S. federal audit in the first quarter of 2019.

Of the \$21.2 million of unrecognized tax benefits as of December 31, 2019, \$12.7 million would impact the consolidated income tax rate if ultimately recognized. The remaining \$8.5 million would impact deferred taxes if recognized.

Teradyne does not anticipate a material change in the balance of unrecognized tax benefits as of December 31, 2019 in the next twelve months.

Teradyne records all interest and penalties related to income taxes as a component of income tax expense. Accrued interest and penalties related to income tax items at December 31, 2019 and 2018 amounted to \$1.4 million and \$0.3 million, respectively. For the years ended December 31, 2019, 2018 and 2017, expense of \$1.1 million, expense of \$0.1 million and benefit of \$0.1 million, respectively, was recorded for interest and penalties related to income tax items.

Teradyne is subject to U.S. federal income tax, as well as income tax in multiple state, local and foreign jurisdictions. As of December 31, 2019, all material state and local income tax matters have been concluded through 2013, all material federal income tax matters have been concluded through 2015 and all material foreign income tax matters have been concluded through 2011. However, in some jurisdictions, including the United States, operating losses and tax credits may be subject to adjustment until such time as they are utilized and the year of utilization is closed to adjustment.

As of December 31, 2019, Teradyne is not permanently reinvested with respect to the unremitted earnings of non-U.S. subsidiaries to the extent that those earnings exceed local statutory and operational requirements. Remittance of those earnings is not expected to result in material income tax.

T. OPERATING SEGMENT, GEOGRAPHIC AND SIGNIFICANT CUSTOMER INFORMATION

Teradyne has four reportable segments (Semiconductor Test, Industrial Automation, System Test and Wireless Test). Each of the Semiconductor Test, System Test, and Wireless Test segments is also an individual

operating segment. The Industrial Automation reportable segment consists of operating segments with discrete financial information, which have been combined into one reportable segment as they share similar economic characteristics, types of products, production processes, distribution channels, and currency risks. The Semiconductor Test segment includes operations related to the design, manufacturing and marketing of semiconductor test products and services. The System Test segment includes operations related to the design, manufacturing and marketing of products and services for defense/aerospace instrumentation test, storage test and circuit-board test. The Industrial Automation segment includes operations related to the design, manufacturing and marketing of collaborative robotic arms, autonomous mobile robots and advanced robotic control software. The Wireless Test segment includes operations related to the design, manufacturing and marketing of wireless test products and services.

Teradyne evaluates performance based on several factors, of which the primary financial measure is business segment income (loss) before income taxes. The accounting policies of the business segments are the same as those described in Note B: "Accounting Policies."

Segment information for the years ended December 31, 2019, 2018, and 2017 is as follows:

	<u>Semiconductor Test</u>	<u>Industrial Automation</u>	<u>System Test</u>	<u>Wireless Test</u>	<u>Corporate And Other</u>	<u>Consolidated</u>
	(in thousands)					
2019						
Revenues	\$1,552,571	\$298,139	\$287,455	\$157,315	\$ (515)	\$2,294,965
Income (loss) before taxes (1)(2)	416,973	(5,916)	93,543	35,585	(14,413)	525,772
Total assets (3)	784,808	671,559	131,428	97,299	1,101,920	2,787,014
Property additions	112,145	9,076	3,059	10,362	—	134,642
Depreciation and amortization expense	59,197	40,904	5,518	5,365	9,671	120,655
2018						
Revenues	\$1,492,417	\$261,452	\$216,132	\$132,006	\$ (1,205)	\$2,100,802
Income (loss) before taxes (1)(2)	397,645	7,670	48,857	29,052	(15,423)	467,801
Total assets (3)	669,452	607,502	88,098	77,570	1,263,984	2,706,606
Property additions	94,496	11,188	3,469	5,226	—	114,379
Depreciation and amortization expense	58,095	36,755	6,430	5,328	6,616	113,224
2017						
Revenues	\$1,662,549	\$170,056	\$192,135	\$111,866	\$ —	\$2,136,606
Income (loss) before taxes (1)(2)	491,361	8,763	10,305	17,350	(3,368)	524,411
Total assets (3)	597,480	368,037	97,018	59,912	1,987,098	3,109,545
Property additions	87,920	7,044	5,976	4,435	—	105,375
Depreciation and amortization expense	58,901	25,711	6,646	5,392	11,425	108,075

- (1) Included in Corporate and Other are: contingent consideration adjustments, investment impairment, pension and postretirement plans actuarial gains (losses), severance charges, property insurance recovery related to the Japan earthquake, interest income, interest expense, net foreign exchange gains (losses), intercompany eliminations and acquisition related charges.
- (2) Included in income (loss) before taxes are charges and credits related to restructuring and other, and inventory charges.
- (3) Total assets are attributable to each segment. Corporate assets consist of cash and cash equivalents, marketable securities and certain other assets.

Included in each segment are charges and credits in the following line items in the statements of operations:

	For the Year Ended December 31,		
	2019	2018	2017
	(in thousands)		
Semiconductor Test:			
Cost of revenues—inventory charge	\$ 8,731	\$ 6,822	\$ 4,606
Restructuring and other—employee severance	1,277	8,429	1,779
Restructuring and other—impairment of fixed assets	—	—	1,124
Industrial Automation:			
Restructuring and other—employee severance	\$ 796	\$ —	\$ 1,414
Restructuring and other—acquisition related expenses and compensation	741	1,163	—
Cost of revenues—inventory charge	508	680	—
System Test:			
Cost of revenues—inventory charge	\$ 2,000	\$ 1,175	\$ 1,918
Wireless:			
Cost of revenues—inventory charge	\$ 4,005	\$ 2,565	\$ 2,190
Restructuring and other—lease impairment	—	—	972
Corporate and Other:			
Restructuring and other—MiR contingent consideration adjustment	\$(22,199)	\$ 17,666	\$ —
Other (income) expense, net—investment impairment charge	15,000	—	—
Restructuring and other—AutoGuide contingent consideration adjustment	2,976	—	—
Selling and administrative—equity modification charge	2,108	—	—
Restructuring and other—acquisition related expenses and compensation	1,765	3,422	—
Restructuring and other—Universal Robots contingent consideration adjustment	—	(16,679)	7,820
Restructuring and other—property insurance recovery related to Japan earthquake	—	—	(5,064)

Information as to Teradyne's revenues by country is as follows:

	2019	2018	2017
	(in thousands)		
Revenues from customers (1):			
China	\$ 514,327	\$ 348,942	\$ 260,451
Taiwan	485,681	516,322	687,031
United States	333,059	282,869	252,516
Korea	239,504	163,224	206,819
Europe	219,015	223,207	163,715
Japan	175,322	158,281	169,093
Thailand	87,503	59,184	29,566
Singapore	84,111	108,618	101,085
Malaysia	58,200	122,797	124,048
Philippines	54,560	77,996	105,850
Rest of the World	43,683	39,362	36,432
	<u>\$2,294,965</u>	<u>\$2,100,802</u>	<u>\$2,136,606</u>

(1) Revenues attributable to a country are based on location of customer site.

In 2019 and 2018, no single direct customer accounted for more than 10% of Teradyne's consolidated revenues. In 2017, revenues from Taiwan Semiconductor Manufacturing Company Ltd. accounted for 13% of its consolidated revenues. Taiwan Semiconductor Manufacturing Company Ltd. is a customer of Teradyne's Semiconductor Test segment. Teradyne estimates consolidated revenues driven by Huawei Technologies Co.

Ltd. (“Huawei”), combining direct sales to that customer with sales to the customer’s OSATs, accounted for approximately 11% and 4% of its consolidated revenues in 2019 and 2018, respectively. Teradyne estimates consolidated revenues driven by another OEM customer, combining direct sales to that customer with sales to the customer’s OSATs (which include Taiwan Semiconductor Manufacturing Company Ltd.), accounted for approximately 10%, 13% and 22% of its consolidated revenues in 2019, 2018 and 2017, respectively.

Long-lived assets by geographic area:

	<u>United States</u>	<u>Foreign(1)</u>	<u>Total</u>
	(in thousands)		
December 31, 2019	\$252,812	\$124,943	\$377,755
December 31, 2018	\$209,368	\$ 70,453	\$279,821

(1) As of December 31, 2019 and 2018, long-lived assets attributable to Singapore were \$35.2 million and \$19.4 million, respectively.

U. STOCK REPURCHASE PROGRAM

In December 2016, Teradyne’s Board of Directors approved a \$500.0 million share repurchase authorization which commenced on January 1, 2017. The cumulative repurchases as of December 31, 2017 totaled 5.8 million shares of common stock for \$200.0 million at an average price per share of \$34.30.

In January 2018, Teradyne’s Board of Directors cancelled the December 2016 stock repurchase program and authorized a new stock repurchase program for up to \$1.5 billion of common stock. In 2019, Teradyne repurchased 10.9 million shares of common stock for \$500.0 million at an average price per share of \$45.89. In 2018, Teradyne repurchased 21.6 million shares of common stock for \$823.5 million at an average price per share of \$38.06. The cumulative repurchases as of December 31, 2019 totaled 32.5 million shares of common stock for \$1,323.0 million at an average price per share of \$40.68.

In January 2020, Teradyne’s Board of Directors cancelled the January 2018 repurchase program and approved a new stock repurchase program for up to \$1.0 billion of common stock. Teradyne intends to repurchase a minimum of \$250.0 million in 2020.

V. SUBSEQUENT EVENTS

In January 2020, Teradyne’s Board of Directors declared a quarterly cash dividend of \$0.10 per share to be paid on March 20, 2020 to shareholders of record as of February 21, 2020.

While Teradyne declared a quarterly cash dividend and authorized a share repurchase program, it may reduce or eliminate the cash dividend or share repurchase program in the future. Future cash dividends and stock repurchases are subject to the discretion of Teradyne’s Board of Directors which will consider, among other things, Teradyne’s earnings, capital requirements and financial condition.

On February 28, 2020, RealWear’s debt holder demanded repayment of its \$25.0 million loan to RealWear. As a result, in the fourth quarter of 2019, Teradyne recorded an impairment charge of \$15.0 million to reduce its investment in RealWear to zero as of December 31, 2019.

SUPPLEMENTARY INFORMATION
(Unaudited)

The following sets forth certain unaudited consolidated quarterly statements of operations data for each of Teradyne's last eight quarters. In management's opinion, this quarterly information reflects all adjustments, consisting only of normal recurring adjustments, necessary for a fair statement for the periods presented. Such quarterly results are not necessarily indicative of future results of operations and should be read in conjunction with the audited consolidated financial statements of Teradyne and the notes thereto included elsewhere herein.

	2019			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	(1)	(2)	(3)	(4)(5)(6)
	(in thousands, except per share amounts)			
Revenues:				
Products	\$393,442	\$457,511	\$488,170	\$548,552
Services	100,657	106,667	93,868	106,098
Total revenues	494,099	564,178	582,038	654,650
Cost of revenues:				
Cost of products	165,368	193,299	197,196	226,184
Cost of services	41,096	46,961	39,804	45,228
Total cost of revenues (exclusive of acquired intangible assets amortization shown separately below)	206,464	240,260	237,000	271,412
Gross profit	287,635	323,918	345,038	383,238
Operating expenses:				
Selling and administrative	102,013	108,811	109,166	117,092
Engineering and development	76,791	81,434	77,804	86,794
Acquired intangible assets amortization	10,634	10,083	9,647	9,784
Restructuring and other	5,112	(10,404)	(6,500)	(2,088)
Total operating expenses	194,550	189,924	190,117	211,582
Income from operations	93,085	133,994	154,921	171,656
Non-operating (income) expense:				
Interest income	(8,052)	(5,430)	(5,159)	(6,145)
Interest expense	5,713	5,800	5,682	5,950
Other (income) expense, net	1,445	2,447	2,665	22,965
Income before income taxes	93,979	131,177	151,733	148,886
Income tax (benefit) provision	(15,159)	33,780	15,873	23,811
Net income	\$109,138	\$ 97,397	\$135,860	\$125,075
Net income per common share—basic	\$ 0.63	\$ 0.57	\$ 0.80	\$ 0.75
Net income per common share—diluted	\$ 0.62	\$ 0.55	\$ 0.75	\$ 0.69
Cash dividend declared per common share	\$ 0.09	\$ 0.09	\$ 0.09	\$ 0.09

(1) Restructuring and other includes a \$3.0 million fair value adjustment to increase the MiR acquisition contingent consideration, \$1.3 million of acquisition related expenses and compensation and \$0.8 million of employee severance charges.

(2) Restructuring and other includes a \$11.7 million gain for the decrease in the fair value of the MiR contingent consideration liability, partially offset by \$0.8 million of employee severance charges and \$0.5 million of acquisition related expenses and compensation.

- (3) Restructuring and other includes a \$7.8 million gain for the decrease in the fair value of MiR contingent consideration liability, partially offset by \$0.8 million of employee severance charges and \$0.5 million of acquisition related expenses and compensation.
- (4) Restructuring and other includes a \$5.8 million gain for the decrease in the fair value adjustment to the MiR acquisition contingent consideration, partially offset by a \$3.0 million fair value adjustment to increase the AutoGuide acquisition contingent consideration, \$0.5 million of employee severance charges and \$0.2 million of acquisition related expenses and compensation.
- (5) Teradyne recorded pension and post retirement net actuarial losses of \$7.7 million for the fourth quarter in 2019. See Note B: “Accounting Policies” for a discussion of Teradyne’s accounting policy.
- (6) Other (income) expense, net includes a \$15.0 million charge for the impairment of the investment in RealWear.

	2018			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	(1)	(2)	(3)	(4)(5)
	(in thousands, except per share amounts)			
Revenues:				
Products	\$403,925	\$434,051	\$470,994	\$420,652
Services	83,542	92,878	95,854	98,906
Total revenues	487,467	526,929	566,848	519,558
Cost of revenues:				
Cost of products	180,958	180,777	195,339	170,064
Cost of services	36,677	38,818	37,816	39,959
Total cost of revenues (exclusive of acquired intangible assets amortization shown separately below)	217,635	219,595	233,155	210,023
Gross profit	269,832	307,334	333,693	309,535
Operating expenses:				
Selling and administrative	90,505	99,410	100,202	100,552
Engineering and development	74,408	75,342	77,049	74,706
Acquired intangible assets amortization	7,698	9,793	11,142	10,558
Restructuring and other	(313)	2,389	1,710	11,446
Total operating expenses	172,298	186,934	190,103	197,262
Income from operations	97,534	120,400	143,590	112,273
Non-operating (income) expense:				
Interest income	(5,981)	(5,427)	(6,213)	(9,083)
Interest expense	6,890	5,639	5,557	13,182
Other (income) expense, net	805	176	3,405	(2,954)
Income before income taxes	95,820	120,012	140,841	111,128
Income tax provision (benefit)	8,846	18,975	20,863	(32,662)
Net income	\$ 86,974	\$101,037	\$119,978	\$143,790
Net income per common share—basic	\$ 0.45	\$ 0.53	\$ 0.65	\$ 0.80
Net income per common share—diluted	\$ 0.43	\$ 0.52	\$ 0.63	\$ 0.79
Cash dividend declared per common share	\$ 0.09	\$ 0.09	\$ 0.09	\$ 0.09

- (1) Restructuring and other includes a \$3.5 million gain for the decrease in the fair value of the Universal Robots contingent consideration liability, partially offset by \$2.5 million of acquisition related expenses and compensation and \$2.4 million of employee severance charges.

- (2) Restructuring and other includes a \$5.0 million gain for the decrease in the fair value of the Universal Robots contingent consideration liability, partially offset by \$3.9 million of employee severance charges and \$0.8 million of acquisition related expenses and compensation.
- (3) Restructuring and other includes \$1.7 million of employee severance charges, \$0.8 million of acquisition related expenses and compensation, partially offset by a \$0.8 million gain for the decrease in the fair value of the Universal Robots contingent consideration liability.
- (4) Restructuring and other includes a \$17.7 million fair value adjustment to increase the MiR acquisition contingent consideration, \$0.8 million of employee severance charges, and \$0.5 million acquisition related expenses and compensation, partially offset by a \$7.4 million gain for the decrease in the fair value of the Universal Robots contingent consideration liability.
- (5) Teradyne recorded pension and post retirement net actuarial gains of \$3.5 million for the fourth quarter in 2018. See Note B: “Accounting Policies” for a discussion of Teradyne’s accounting policy.

Item 9: *Changes in and disagreements with accountants on accounting and financial disclosure*

None.

Item 9A: *Controls and procedures*

Disclosure Controls and Procedures

As of the end of the period covered by this report, our management, with the participation of our CEO and CFO, evaluated the effectiveness of our disclosure controls and procedures pursuant to Rule 13a-15(b) promulgated under the Exchange Act. Based upon that evaluation, our CEO and CFO concluded that, as of the end of the period covered by this report, our disclosure controls and procedures were effective in ensuring that material information required to be disclosed by us in the reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms, including ensuring that such material information is accumulated and communicated to our management, including our CEO and CFO, as appropriate to allow timely decisions regarding required disclosure.

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting during the fourth fiscal quarter ended December 31, 2019 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Management’s Annual Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rule 13a-15(f). Under the supervision and with the participation of our management, including our CEO and CFO, we conducted an evaluation of the effectiveness of our internal control over financial reporting based on the framework in *Internal Control—Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission. Based on our evaluation under the framework in *Internal Control—Integrated Framework* (2013), our management concluded that our internal control over financial reporting was effective as of December 31, 2019.

The effectiveness of our internal control over financial reporting as of December 31, 2019 has been audited by PricewaterhouseCoopers LLP, our independent registered public accounting firm, as stated in their report which is included under Item 8 of this Annual Report.

Inherent Limitations on Effectiveness of Controls

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that

controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Item 9B: *Other Information*

None.

PART III

Item 10: *Directors, Executive Officers and Corporate Governance*

Certain information relating to our directors and executive officers, committee information, reports and charters, executive compensation, security ownership of certain beneficial owners and management and related stockholder matters, and certain relationships and related transactions is incorporated by reference herein from our definitive proxy statement in connection with our Annual Meeting of Shareholders to be held on May 8, 2020. The proxy statement will be filed with the SEC not later than 120 days after the close of the fiscal year. For this purpose, the Compensation Committee Report included in such proxy statement is specifically not incorporated herein. Also see “Item 1: Business—Our Executive Officers.”

Item 11: *Executive Compensation*

Certain information relating to our directors and executive officers, executive compensation, security ownership of certain beneficial owners and management and related stockholder matters, and certain relationships and related transactions is incorporated by reference herein from our definitive proxy statement in connection with our Annual Meeting of Shareholders to be held on May 8, 2020. The proxy statement will be filed with the SEC not later than 120 days after the close of the fiscal year. For this purpose, the Compensation Committee Report included in such proxy statement is specifically not incorporated herein.

Item 12: *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters*

Certain information relating to our directors and executive officers, executive compensation, security ownership of certain beneficial owners and management and related stockholder matters, and certain relationships and related transactions is incorporated by reference herein from our definitive proxy statement in connection with our Annual Meeting of Shareholders to be held May 8, 2020. The proxy statement will be filed with the SEC not later than 120 days after the close of the fiscal year. For this purpose, the Compensation Committee Report included in such proxy statement is specifically not incorporated herein. Also see “Item 7: Management’s Discussion and Analysis of Financial Condition and Results of Operations—Equity Compensation Plans.”

Item 13: *Certain Relationships and Related Transactions, and Director Independence*

Certain information relating to our directors and executive officers, executive compensation, security ownership of certain beneficial owners and management and related stockholder matters, and certain relationships and related transactions is incorporated by reference herein from our definitive proxy statement in connection with our Annual Meeting of Shareholders to be held on May 8, 2020. The proxy statement will be filed with the SEC not later than 120 days after the close of the fiscal year. For this purpose, the Compensation Committee Report included in such proxy statement is specifically not incorporated herein.

Item 14: *Principal Accountant Fees and Services*

Certain information relating to audit fees and other of Teradyne’s independent registered public accounting firm is incorporated by reference herein from our definitive proxy statement in connection with our Annual Meeting of Shareholders to be held on May 8, 2020. The proxy statement will be filed with the SEC not later than 120 days after the close of the fiscal year. For this purpose, the Audit Committee Report included in such proxy statement is specifically not incorporated herein.

PART IV

Item 15: *Exhibits and Financial Statement Schedule.*

15(a)(1) Financial Statements

The following consolidated financial statements are included in Item 8:

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Report of Independent Registered Public Accounting Firm	42
Consolidated Balance Sheets as of December 31, 2019 and 2018	46
Consolidated Statements of Operations for the years ended December 31, 2019, 2018 and 2017	47
Consolidated Statements of Comprehensive Income for the years ended December 31, 2019, 2018 and 2017	48
Consolidated Statements of Shareholders' Equity for the years ended December 31, 2019, 2018 and 2017	49
Consolidated Statements of Cash Flows for the years ended December 31, 2019, 2018 and 2017	50

15(a)(2) Financial Statement Schedule

The following consolidated financial statement schedule is included in Item 15(c):

Schedule II—Valuation and Qualifying Accounts

Schedules other than those listed above have been omitted since they are either not required or information is otherwise included.

15(a)(3) Listing of Exhibits

The Exhibits which are filed with this report or which are incorporated by reference herein are set forth in the Exhibit Index.

15(c) Financial Statement Schedules

TERADYNE, INC.

SCHEDULE II—VALUATION AND QUALIFYING ACCOUNTS

<u>Column A</u>	<u>Column B</u>	<u>Column C</u>	<u>Column D</u>	<u>Column E</u>	<u>Column F</u>
<u>Description</u>	<u>Balance at Beginning of Period</u>	<u>Additions Charged to Cost and Expenses</u>	<u>Other</u>	<u>Deductions</u>	<u>Balance at End of Period</u>
	(in thousands)				
Valuation reserve deducted in the balance sheet from the asset to which it applies:					
Accounts receivable:					
2019 Allowance for doubtful account	\$1,673	\$87	\$28	\$ 52	\$1,736
2018 Allowance for doubtful account	\$2,219	\$—	\$20	\$566	\$1,673
2017 Allowance for doubtful accounts	\$2,356	\$ 4	\$—	\$141	\$2,219

<u>Column A</u>	<u>Column B</u>	<u>Column C</u>	<u>Column D</u>	<u>Column E</u>	<u>Column F</u>
<u>Description</u>	<u>Balance at Beginning of Period</u>	<u>Additions Charged to Cost and Expenses</u>	<u>Other</u>	<u>Deductions</u>	<u>Balance at End of Period</u>
	(in thousands)				
Valuation reserve deducted in the balance sheet from the asset to which it applies:					
Inventory:					
2019 Inventory reserve	\$100,779	\$15,244	\$ (85)	\$12,382	\$103,556
2018 Inventory reserve	\$102,896	\$11,242	\$ 368	\$13,727	\$100,779
2017 Inventory reserve	\$116,016	\$ 8,844	\$(126)	\$21,838	\$102,896

<u>Column A</u>	<u>Column B</u>	<u>Column C</u>	<u>Column D</u>	<u>Column E</u>	<u>Column F</u>
<u>Description</u>	<u>Balance at Beginning of Period</u>	<u>Additions Charged to Cost and Expenses</u>	<u>Other</u>	<u>Deductions</u>	<u>Balance at End of Period</u>
	(in thousands)				
Valuation reserve deducted in the balance sheet from the asset to which it applies:					
Deferred taxes:					
2019 Valuation allowance	\$69,852	\$ 7,325	\$—	\$—	\$77,177
2018 Valuation allowance	\$63,919	\$ 6,333	\$—	\$400	\$69,852
2017 Valuation allowance	\$48,369	\$15,571	\$—	\$ 21	\$63,919

Item 16: Form 10-K Summary

Not applicable.

EXHIBIT INDEX

The following designated exhibits are, as indicated below, either filed herewith or have heretofore been filed with the Securities and Exchange Commission and are referred to and incorporated by reference to such filings.

Exhibit No.	Description	SEC Document Reference
2.1	Share Sale and Purchase Agreement to and among Teradyne Robotics Holdings Denmark ApS, Teradyne, Inc. and the shareholders of Mobile Industrial Robots ApS dated April 25, 2018.	Exhibit 2.1 to Teradyne’s Quarterly Report on Form 10-Q for the quarter ended April 1, 2018.
2.2	Amendment No. 1 dated as of October 10, 2019 to Share Sale and Purchase Agreement by and among Teradyne Robotics Holdings Denmark ApS, Teradyne, Inc. and the former shareholders of Mobile Industrial Robots ApS.	Filed herewith.
3.1	Restated Articles of Organization.	Exhibit 3.1 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2018.
3.2	Amended and Restated By-laws, as amended.	Exhibit 3.1 to Teradyne’s Quarterly Report on Form 10-Q for the quarter ended September 30, 2007.
4.1	Indenture dated as of December 12, 2016, between Teradyne Inc. and Wilmington Trust, National Association, as trustee.	Exhibit 4.1 to Teradyne’s Current Report on Form 8-K filed on December 12, 2016.
4.2	Description of Teradyne, Inc. Securities Registered under Section 12 of the Exchange Act.	Filed herewith.
10.1†	Standard Manufacturing Agreement entered into as of November 24, 2003 by and between Teradyne and Solectron.	Exhibit 10.1 to Teradyne’s Quarterly Report on Form 10-Q for the quarter ended September 30, 2007.
10.2†	Second Amendment to Standard Manufacturing Agreement, dated as of August 27, 2007, by and between Teradyne and Solectron.	Exhibit 10.3 to Teradyne’s Quarterly Report on Form 10-Q for the quarter ended September 30, 2007.
10.3†	Sixth Amendment to Standard Manufacturing Agreement, dated as of July 27, 2009, by and between Teradyne and Flextronics Corporation.	Exhibit 10.5 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2009.
10.4	Addendum to Standard Manufacturing Agreement (Authorized Purchase Agreement)—Revised July 1, 2010.	Exhibit 10.6 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2010.
10.5	Eighth Amendment to Standard Manufacturing Agreement, dated as of April 13, 2012, by and between Teradyne and Flextronics Sales & Marketing North Asia (L) LTD.	Exhibit 10.7 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2012.

Exhibit No.	Description	SEC Document Reference
10.6†	Ninth Amendment to Standard Manufacturing Agreement, dated as of September 17, 2012, by and between Teradyne and Flextronics Sales & Marketing North Asia (L) LTD.	Exhibit 10.8 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2012.
10.7	2006 Equity and Cash Compensation Incentive Plan, as amended.*	Exhibit 10.9 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2018.
10.8	Danish Sub-Plan to the 2006 Equity and Cash Compensation Incentive Plan.	Exhibit 10.10 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2018.
10.9	Form of Performance-Based Restricted Stock Unit Agreement for Executive Officers under 2006 Equity and Cash Compensation Incentive Plan.*	Exhibit 10.10 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2017.
10.10	Form of Time-Based Restricted Stock Unit Agreement for Executive Officers under 2006 Equity and Cash Compensation Incentive Plan.*	Exhibit 10.11 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2017.
10.11	Form of Executive Officer Stock Option Agreement under 2006 Equity and Cash Compensation Incentive Plan, as amended.*	Exhibit 10.15 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2017.
10.12	Form of Restricted Stock Unit Agreement for Directors under 2006 Equity and Cash Compensation Incentive Plan.*	Exhibit 10.12 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2016.
10.13	1996 Employee Stock Purchase Plan, as amended.*	Exhibit 10.15 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2018.
10.14	Sub-Plan to the 1996 Employee Stock Purchase Plan for participants located in the European Union /European Economic Area.	Filed herewith.
10.15	Danish Sub-Plan to the 1996 Employee Stock Purchase Plan.	Filed herewith.
10.16	Deferral Plan for Non-Employee Directors, as amended.*	Exhibit 10.2 to Teradyne’s Quarterly Report on form 10-Q for the quarter ended September 28, 2008.
10.17	Supplemental Savings Plan, as amended and restated.*	Exhibit 10.18 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2008.
10.18	Supplemental Executive Retirement Plan, as restated.*	Exhibit 10.19 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2008.
10.19	Agreement Regarding Termination Benefits dated January 22, 2014 between Teradyne and Mark Jagiela.*	Exhibit 10.24 to Teradyne’s Annual Report on Form 10-K for the fiscal year ended December 31, 2013.

Exhibit No.	Description	SEC Document Reference
10.20	Employment Agreement dated May 7, 2004 between Teradyne and Mark Jagiela.*	Exhibit 10.37 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended July 4, 2004.
10.21	Executive Officer Retirement Agreement dated July 17, 2019 between Teradyne and Gregory R. Beecher.*	Exhibit 10.1 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended June 30, 2019.
10.22	Executive Officer Change in Control Agreement dated January 22, 2014 between Teradyne and Mark Jagiela, as amended.*	Exhibit 10.29 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2013.
10.23	Amended and Restated Executive Officer Change in Control Agreement dated May 26, 2009 between Teradyne and Charles J. Gray, as amended.*	Exhibit 10.30 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2012.
10.24	Employment Agreement dated July 24, 2009 between Teradyne and Charles J. Gray.*	Exhibit 10.1 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended April 4, 2010.
10.25	Amended and Restated Executive Officer Change in Control Agreement dated June 30, 2012 between Teradyne and Walter G. Vahey, as amended.*	Exhibit 10.32 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2012.
10.26	Employment Agreement dated February 6, 2013 between Teradyne and Walter G. Vahey.*	Exhibit 10.33 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2012.
10.27	Executive Officer Change in Control Agreement dated September 1, 2014 between Teradyne, Inc. and Bradford Robbins.*	Exhibit 10.1 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended September 28, 2014.
10.28	Employment Agreement dated September 1, 2014 between Teradyne, Inc. and Bradford Robbins.*	Exhibit 10.2 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended September 28, 2014.
10.29	Executive Change in Control Agreement dated February 8, 2016 between Teradyne, Inc. and Greg Smith.	Exhibit 10.1 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended April 3, 2016.
10.30	Employment Agreement dated February 8, 2016 between Teradyne, Inc. and Greg Smith.	Exhibit 10.2 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended April 3, 2016.
10.31	Teradyne Offer of Employment dated February 8, 2019 for Sanjay Mehta.*	Exhibit 10.1 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019.
10.32	Executive Officer Change in Control Agreement dated April 25, 2019 between Teradyne, Inc. and Sanjay Mehta.*	Exhibit 10.2 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019.
10.33	Employment Agreement dated April 25, 2019 between Teradyne, Inc. and Sanjay Mehta.*	Exhibit 10.3 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019.
10.34	Agreement Regarding Termination Benefits dated April 25, 2019 between Teradyne, Inc. and Sanjay Mehta.*	Exhibit 10.4 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019.

Exhibit No.	Description	SEC Document Reference
10.35	Time-Based Restricted Stock Unit Agreement dated May 1, 2019 for Sanjay Mehta under 2006 Equity and Cash Compensation Plan.*	Exhibit 10.5 to Teradyne's Quarterly Report on Form 10-Q for the quarter ended March 31, 2019.
10.36	Form of Indemnification Agreement.*	Exhibit 10.24 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2006.
10.37	LitePoint Corporation 2002 Stock Plan.	Exhibit 10.43 to Teradyne's Annual Report on Form 10-K for the fiscal year ended December 31, 2011.
10.38	Letter Agreement, dated December 6, 2016, between Barclays Bank PLC and Teradyne, Inc., regarding the Base Warrants.	Exhibit 10.1 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.39	Letter Agreement, dated December 6, 2016, between Bank of America, N.A., and Teradyne, Inc. regarding the Base Warrants.	Exhibit 10.2 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.40	Letter Agreement, dated December 6, 2016, between Wells Fargo Bank, National Association and Teradyne, Inc. regarding the Base Warrants.	Exhibit 10.3 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.41	Letter Agreement, dated December 6, 2016, between Barclays Bank PLC and Teradyne, Inc. regarding the Base Call Option Transaction.	Exhibit 10.4 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.42	Letter Agreement, dated December 6, 2016, between Bank of America, N.A. and Teradyne, Inc. regarding the Base Call Option Transaction.	Exhibit 10.5 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.43	Letter Agreement, dated December 6, 2016, between Wells Fargo Bank, National Association and Teradyne, Inc. regarding the Base Call Option Transaction.	Exhibit 10.6 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.44	Letter Agreement, dated December 9, 2016, between Barclays Bank PLC and Teradyne, Inc., regarding the Additional Warrants	Exhibit 10.7 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.45	Letter Agreement, dated December 9, 2016, between Bank of America, N.A., and Teradyne, Inc. regarding the Additional Warrants.	Exhibit 10.8 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.46	Letter Agreement, dated December 9, 2016, between Wells Fargo Bank, National Association and Teradyne, Inc. regarding the Additional Warrants.	Exhibit 10.9 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.47	Letter Agreement, dated December 9, 2016, between Barclays Bank PLC and Teradyne, Inc. regarding the Additional Call Option Transaction.	Exhibit 10.10 to Teradyne's Current Report on Form 8-K filed December 12, 2016.

Exhibit No.	Description	SEC Document Reference
10.48	Letter Agreement, dated December 9, 2016, between Bank of America, N.A. and Teradyne, Inc. regarding the Additional Call Option Transaction	Exhibit 10.11 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
10.49	Letter Agreement, dated December 9, 2016, between Wells Fargo Bank, National Association and Teradyne, Inc. regarding the Additional Call Option Transaction.	Exhibit 10.12 to Teradyne's Current Report on Form 8-K filed December 12, 2016.
21.1	Subsidiaries of Teradyne.	Filed herewith.
23.1	Consent of PricewaterhouseCoopers LLP.	Filed herewith.
31.1	Rule 13a-14(a) Certification of Principal Executive Officer.	Filed herewith.
31.2	Rule 13a-14(a) Certification of Principal Financial Officer.	Filed herewith.
32.1	Section 1350 Certification of Principal Executive Officer.	Furnished herewith.
32.2	Section 1350 Certification of Principal Financial Officer.	Furnished herewith.
101	The following financial information from Teradyne, Inc.'s Annual Report on Form 10-K for the fiscal year ended December 31, 2019, formatted in Inline XBRL (eXtensible Business Reporting Language): (i) Consolidated Balance Sheets as of December 31, 2019 and December 31, 2018, (ii) Consolidated Statements of Operations for the years ended December 31, 2019, 2018 and 2017, (iii) Consolidated Statements of Comprehensive Income (Loss) for the years ended December 31, 2019, 2018 and 2017 (iv) Consolidated Statements of Shareholders' Equity for the years ended December 31, 2019, 2018 and 2017, (v) Consolidated Statements of Cash Flows for the years ended December 31, 2019, 2018 and 2017, and (vi) the Notes to Consolidated Financial Statements.	
104	The cover page of the Annual Report on Form 10-K formatted in Inline XBRL (included in Exhibit 101).	

† -Confidential treatment granted.

* -Management contract or compensatory plan.

Exhibit 21.1

Present Subsidiaries

Entity Name:	State or Jurisdiction Of Incorporation	Percentage of Voting Securities Owned
Teradyne (Asia) Pte., Ltd.	Singapore	100%*
Teradyne Canada Limited.	Canada	100%
Teradyne de Costa Rica S.R.L.	Costa Rica	100%
Teradyne GmbH	Germany	100%*
Teradyne Holdings Denmark ApS	Denmark	100%*
Teradyne (India) Engineering Private Ltd.	India	100%*
Teradyne International Holdings B.V.	The Netherlands	100%
Teradyne International UK Holdings Ltd.	United Kingdom	100%*
Teradyne Italia Srl	Italy	100%*
Teradyne K.K.	Japan	100%
Teradyne Korea Ltd.	Korea	100%*
Teradyne Limited.	United Kingdom	100%*
Teradyne Malaysia Sdn. Bhd.	Malaysia	99%*
Teradyne Philippines Limited.	Delaware	100%
Teradyne Robotics Holdings Denmark ApS	Denmark	100%*
Teradyne SAS	France	100%
Teradyne (Shanghai) Co., Ltd	Peoples Republic of China	100%*
Teradyne Taiwan LLC.	Delaware	100%*
Teradyne Thailand Ltd.	Delaware	100%
Energid Technologies Corporation	Florida	100%
GenRad, LLC	Delaware	100%
Herco Technology Corp.	California	100%
P.L.S.T., Inc. (f/k/a Perception Laminates, Inc.)	California	100%
Eagle Test Systems, Inc.	Delaware	100%
Nextest Systems Corporation	Delaware	100%
Lemsys SA	Switzerland	100%*
LitePoint Corporation	Delaware	100%
LitePoint Europe A/S.	Denmark	100%*
LitePoint Technology Limited.	Hong Kong	100%*
LitePoint Technology (Shanghai) Company Ltd.	Peoples Republic of China	100%*
LitePoint Japan K.K.	Japan	100%*
LitePoint Design Test, LLC.	New Mexico	100%*
LitePoint Vietnam Limited	Socialist Republic of Vietnam	100%*
Mobile Industrial Robots A/S	Denmark	100%*
Mobile Industrial Robots, Inc.	Delaware	100%*
Mobile Industrial Robots GmbH	Germany	100%*
Mobile Industrial Robots Pte. Ltd.	Singapore	100%*
MiR Robots S.L.	Spain	100%*
MiR Robots (Shanghai) Co. Ltd.	Peoples Republic of China	100%*
Universal Robots A/S	Denmark	100%*
Universal Robots (Spain) S.L.	Spain	100%*
Universal Robots (Singapore) Pte. Ltd.	Singapore	100%*
Universal Robots (India) Pte. Ltd.	India	100%*
Universal Robots (Shanghai) Co. Ltd.	Peoples Republic of China	100%*
Universal Robots (USA), Inc.	Delaware	100%*
Universal Robots GmbH	Germany	100%*
Universal Robots Mexico S.A. de C.V.	Mexico	100%*
Universal Robots (UK) Ltd.	United Kingdom	100%*
UR Technology (Shanghai) Co. Ltd.	People Republic of China	100%*
AutoGuide, LLC.	Delaware	100%

* Indirect subsidiaries whose voting securities are 100% controlled by Teradyne, Inc.

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Form S-8 (Nos. 333-188824; 333-177246; 333-159723; 333-155564; 333-149017; 333-143231; 333-134519; 333-116632; 333-101983; 333-68074; 333-56373; 333-32547; and 333-07177) of Teradyne, Inc. of our report dated March 2, 2020 relating to the consolidated financial statements and financial statement schedule and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP

Boston, Massachusetts

March 2, 2020

CERTIFICATIONS

I, Mark E. Jagiela, certify that:

1. I have reviewed this annual report on Form 10-K of Teradyne, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officers and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officers and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal controls over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 2, 2020

By: /s/ MARK E. JAGIELA

Mark E. Jagiela
Chief Executive Officer

I, Sanjay Mehta, certify that:

1. I have reviewed this annual report on Form 10-K of Teradyne, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officers and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officers and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal controls over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 2, 2020

By: /s/ SANJAY MEHTA

Sanjay Mehta
Chief Financial Officer

**CERTIFICATION PURSUANT TO
18 U.S.C SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report of Teradyne, Inc. (the “Company”) on Form 10-K for the period ending December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Mark E. Jagiela, Chief Executive Officer of the Company, certify pursuant to 18 U.S.C Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to the best of my knowledge:

- (1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and
- (2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ MARK E. JAGIELA

Mark E. Jagiela
Chief Executive Officer

March 2, 2020

**CERTIFICATION PURSUANT TO
18 U.S.C SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report of Teradyne, Inc. (the “Company”) on Form 10-K for the period ending December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Sanjay Mehta, Chief Financial Officer of the Company, certify pursuant to 18 U.S.C Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that to the best of my knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ SANJAY MEHTA

Sanjay Mehta
Chief Financial Officer

March 2, 2020

