

## **An Investment Analysis Case Study: The Tesla Bot**



## Project Logistics

*This case is a group project that is due on March 29 before 10.30 am*

**Stating the obvious:** Each group will turn in one report (sounds obvious but I might as well make it explicit) **electronically (as a pdf file)**. While you should include your cash flows tables in your report, you don't have to attach any excel spreadsheets.

**Cover page:** Each report should have a cover page that contains the following – the names of the group members in alphabetical order and the following summary information on the analysis:

1. Decision on Investment: Invest or Do not invest
2. Cost of capital: % value
3. Return on capital: % value
4. NPV – 15-year life: \$ value
5. NPV- Longer life: \$ value

**Report format:** Please try to keep your report brief. In the report, be clear about:

- a. Any assumptions you made to get to your conclusion
- b. Your final recommendation

**Exhibits:** Please make sure that you include the following in your exhibits

- a. The table of earnings/cash flows by year, with line item details.
- b. Your computation of cost of equity/capital/discount rate

**Time:** To keep time straight, you can assume the following:

Next year: Year 1

Most recent year: Just ended

Right now: Time 0. Any “up front” expenditure is incurred immediately.

# Tesla Robotics

## Company Background

Tesla has revolutionized the automobile business, not only with its success with electric cars, but also by getting the automobile business to change its tune on electric cars. After crossing the trillion-dollar threshold, the market capitalization for the company has dropped more than 50% in recent months, but it is still worth more than any other automobile company in the world:



The core of the company is built around electric cars, but Tesla has also shown promise in other businesses, perhaps explaining the premiums that investors are willing to pay for it. While that promise may come to fruition, it is worth noting that Tesla's operating results in recent years reflect its dependence on two businesses: a fast-growing automobile business for the bulk of its revenues and profits and a smaller-growing solar panel business that it obtained when it bought Solar City a few years ago. The most recent financial statements are summarized at the end of the case, with Exhibit 1 summarizes Tesla's income statement for the most recent financial years, and Exhibit 2 summarizes its balance sheets for the last year.

## The Bot Business Opportunity

One of the businesses that Tesla is exploring is the robotics business, where its research work has already yielded benefits, with [a prototype \(the Optimus\)](#) that can replace human labor on mechanical and tedious tasks. Initially, Tesla's plans for the robot use it replace employees on factory floors in Tesla factories around the world, reducing the cost of production for electric vehicles, their core business. However, Tesla is now considering expanding its vision to sell these robots to other companies that have large numbers of workers toiling at repetitive jobs, with a focus on mining, logistics and retail companies, a market that it sees as both big and profitable.

### *The Project Details*

To make this leap into *the Bot Business*, Tesla will have to spend considerable amounts creating capacity to make the additional robots, and you have been asked to collect the data to make the assessment and have come back with the following information:

1. R&D Expenses: Tesla has already spent (and expensed) \$2 billion on research on robotics technology and development of the commercial design. None of that money can be recouped at this stage, even if Tesla pulls the plug on the outward-looking Bot business.
2. Introductory Costs; If Tesla decides to go ahead with the robotics investment, it will have to spend \$20 billion up front (right now) to lock in suppliers, distributors and retailers, and to invest in capacity. The cost is depreciable over the next 10 years, down to a salvage value of \$ 2 billion, and Tesla expects to use straight-line depreciation.
3. Market Potential: The robotics market in 2022 was \$25 billion (in market size), but it is expected to grow 15% a year, every year for the next 10 years, to reach \$101.1 billion in 2032, after which it is expected to grow at the inflation rate.

Year	Size of Robotics Market (\$ millions)
Last Year	\$ 25,000
Next Year	\$ 28,750
2	\$ 33,063
3	\$ 38,022
4	\$ 43,725
5	\$ 50,284
6	\$ 57,827

7	\$ 66,500
8	\$ 76,476
9	\$ 87,947
10	\$ 101,139

4. Market Share: Tesla expects to gain a 5% market share of the robotics market next year if the Optimus is introduced as a commercial product and increase that market share by 5% a year (10% in the second year, 15% in the third year, 20% in the fourth year and 25% in year 5) to reach a target market share of 25% of the overall market by the fifth year. It expects to maintain that market share beyond year 6.
5. Unit Economics: Tesla expects robots to be priced for mass use by businesses, which will compress margins. Tesla expects that the cost of manufacturing the robots, not including depreciation, to be only 60% of the price it plans to sell the robots at. (Just for clarification, the 40% profit margin is prior to depreciation and other operating expenses that are not directly tied to making the robots; it is therefore not quite an EBITFDA margin, since EBITDA is after those other operating expenses.)
6. Marketing Options and Costs: Since Tesla's existing marketing is built for its electric car business, and is focused on consumers, and the Tesla robots will be sold to other businesses. Tesla expects to spend \$500 million next year on direct marketing and sales commissions, to boost its robotics business, growing at the same rate as the total robotics market each year after that.
7. Geographical & Customer breakdown: Tesla expects to get its revenues from the robotics globally, with the following breakdown for revenues:

<i>Region</i>	<i>% of Revenues</i>
Africa	2.00%
Asia	15.00%
Australia & New Zealand	3.00%
Central and South America	10.00%
Eastern Europe & Russia	5.00%
Middle East	5.00%
North America	40.00%
Western Europe	20.00%

Tesla expects this revenue breakdown for the Tesla Bot to be stable over time. The regional country risk premiums (over and above the mature market premium) are provided in exhibit 3. You can assume that the premium for mature markets is 6.00%.

The robots will be marketed to other businesses, with three businesses representing the core market are retail, mining and logistics businesses. Note that Tesla does not intend to sell these robots to other automobile companies, to preserve its competitive advantages in the auto business.

8. Distribution Facilities and Costs: Tesla currently uses a large distribution facility in the United States that it owns and operates for its electric batteries and cars. Tesla used only 40% of the facility in the most recent year, but the demand for this space from its current products (not including the Tesla Bot) is expected to grow 10% a year (i.e., to 44% next year, 48.4% the year after etc.) for the next 10 years. If Tesla goes ahead with the Tesla Bot, it will use 30% of the total capacity to store Bot supplies and products, and this capacity usage will grow by 5% each year for the remaining nine years. (Tesla Bot will use 35% of capacity in year 2, 40% in year 3 and so on....) If the capacity limit is reached, Tesla will have to invest a substantial amount to create a new facility of equivalent capacity. The current estimate of the cost of building a new distribution facility is \$ 2 billion, but this cost will grow at the inflation rate.
9. G&A expenses: Tesla will allocate 10% of its existing general and administrative costs to the new division. These costs total \$ 1.5 billion for the entire firm in the most recent year and are expected to grow 5% a year for the next 10 years, with or without the Tesla Bot investment. In addition, it is expected that Tesla will have an increase of \$ 0.2 billion in general and administrative costs next year when the Bot is introduced, and this amount will grow with the total robot market after that. The latter cost is directly related to the new Bot division.
10. Advertising Expenses: Tesla spent \$ 2 billion on advertising in the most recent year. If Tesla does not invest in the Bot, it expects this cost to increase 5% a year for the next 10 years. If the Bot is introduced, the total advertising expenses each year, from years 1 to 10, are expected to be 15% higher than they would have been without the Bot division, with the incremental advertising directed at business customers for the Bot.
11. Working Capital: The Bot will create working capital needs, which you have estimated as follows:
  - The sale of Bots to retailers will create accounts receivable amounting to 5% of revenues each year.

- Inventory (of both the input material and finished Bots) will be approximately 10% of the variable production cost (not including depreciation, marketing costs, allocations or advertising expenses).
- Accounts payable will be 6% of the variable production cost (not including depreciation, marketing costs, allocations or advertising expenses).

All of these working capital investments will have to be made at the beginning of each year in which goods are sold. Thus, the working capital investment for the first year will have to be made at the beginning of the first year.

12. Side benefits for software sales: If Tesla goes ahead with the Bot, it will see revenues for its software increase by \$1 billion next year (as they are integrated into the Bot) and grow at the inflation rate after that. The after-tax operating margin (after tax operating income/ revenues) is 40% for software.
13. Risk Measures: As you can see in exhibit 4, the beta for Tesla is 1.97, calculated using weekly returns over the last 2 years and against the S&P 500 Index. Tesla currently gets about 92% of its revenues from automobiles, 7% from energy and 1% from software. The details of the beta calculation are included in Exhibit 4, as well as bottom-up beta estimates for each of Tesla's existing businesses. The current stock price for the firm is \$ 200/share and there are 3,164 million shares outstanding.
14. Debt Choices: Tesla expects to finance the Bot division using the same mix of debt and equity (in market value terms) as it is using currently in the rest of its business. (Use the balance sheet in exhibit 2 and make judgments on what should be counted as debt, when computing cost of capital. You can assume that book debt at Tesla is close the market value of that debt.) Tesla was rated **Baa** by Moody's and **the default spread for companies with that rating is 2.00%**.
15. Taxes: Tesla's effective tax rate in 2022 was 8.7%, largely because of deferred taxes, but its marginal tax rate is 25%.
16. Macro data: The current long-term US Treasury bond rate is 3.5%, and the expected inflation rate is 2.5%.
17. Other information: You have collected information on other business electronics companies in Exhibit 5. The data includes the regression betas of these companies and relevant information on both market values of debt, equity and cash. You can assume

a 25% marginal tax rate for these firms, as well. (You can also assume that the debt includes the present value of operating leases).



## Questions on the Project

### 1. Accounting Return Analysis

- Estimate the operating income from the proposed Bot investment to Tesla over the next 10 years.
- Estimate the after-tax return on capital for the investment over the 10-year period.
- Based upon the after-tax return on capital, would you accept or reject this project?

This will require you to make some assumptions about allocation and expensing. Make your assumptions as consistent as you can and estimate the return on capital.

### 2. Cash Flow Analysis

- Estimate the after-tax incremental cash flows from the proposed Tesla Bot investment to Tesla over the next 10 years.
- If the project is terminated at the end of the 10th year, and both working capital and investment in other assets can be sold for book value at the end of that year, estimate the net present value of this project to Tesla. Develop a net present value profile and estimate the internal rate of return for this project.
- If the Tesla Bot is expected to have a life much longer than 10 years, estimate the net present value of this project, making reasonable assumptions about investments needed and cash flows. Develop a net present value profile and estimate the internal rate of return for this project.

### 3. Sensitivity Analysis

- Estimate the sensitivity of your numbers to changes in two of the key assumptions underlying the analysis (You get to pick what you think are the two key assumptions).

Based upon your analysis, and any other considerations you might have, tell me whether Tesla should invest in this project or reject it. Explain, briefly, your decision.
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**Exhibit 1: Tesla's Income Statements (in \$ millions)**

	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
<b>Total Revenue</b>	<b>\$11,759</b>	<b>\$21,461</b>	<b>\$24,578</b>	<b>\$31,536</b>	<b>\$53,823</b>	<b>\$81,462</b>
Cost Of Goods Sold	\$9,536	\$17,419	\$20,509	\$24,906	\$40,217	\$60,609
<b>Gross Profit</b>	<b>\$2,223</b>	<b>\$4,042</b>	<b>\$4,069</b>	<b>\$6,630</b>	<b>\$13,606</b>	<b>\$20,853</b>
Selling General & Admin Exp.	\$2,477	\$2,835	\$2,646	\$3,188	\$4,517	\$3,946
R & D Exp.	\$1,378	\$1,460	\$1,343	\$1,491	\$2,593	\$3,075
Other Operating Expense/(Income)	-	-	-	-	-\$27	\$140
<b>Operating Income</b>	<b>-\$1,632</b>	<b>-\$253</b>	<b>\$80</b>	<b>\$1,951</b>	<b>\$6,523</b>	<b>\$13,692</b>
Interest Expense	-\$477	-\$653	-\$725	-\$748	-\$371	-\$191
Interest and Invest. Income	\$19	\$24	\$44	\$30	\$56	\$297
<b>Net Interest Exp.</b>	<b>-\$458</b>	<b>-\$629</b>	<b>-\$681</b>	<b>-\$718</b>	<b>-\$315</b>	<b>\$106</b>
Currency Exchange Gains (Loss)	-\$52	\$2	\$48	-\$114	\$97	-\$89
Other Non-Operating Inc. (Exp.)	-\$9	\$10	\$37	-\$8	\$38	\$46
<b>EBT Excl. Unusual Items</b>	<b>-\$2,151</b>	<b>-\$870</b>	<b>-\$516</b>	<b>\$1,111</b>	<b>\$6,343</b>	<b>\$13,755</b>
Restructuring Charges	-	-\$92	-\$87	-	-	-\$36
Impairment of Goodwill	-	-	-	-	-	-
Asset Writedown	-	-\$13	-\$15	-	-	-
In Process R & D Exp.	-	-	-\$47	-	-	-
Legal Settlements	-	-\$30	-	\$43	-	-
Other Unusual Items	-\$58	-	-	-	-	-
<b>EBT Incl. Unusual Items</b>	<b>-\$2,209</b>	<b>-\$1,005</b>	<b>-\$665</b>	<b>\$1,154</b>	<b>\$6,343</b>	<b>\$13,719</b>
Income Tax Expense	32.0	58.0	110.0	292.0	699.0	1,132.0
<b>Net Income to Company</b>	<b>(2,241.0)</b>	<b>(1,063.0)</b>	<b>(775.0)</b>	<b>862.0</b>	<b>5,644.0</b>	<b>12,587.0</b>
Minority Int. in Earnings	279.0	87.0	(87.0)	(141.0)	(125.0)	(31.0)
<b>Net Income</b>	<b>(1,962.0)</b>	<b>(976.0)</b>	<b>(862.0)</b>	<b>721.0</b>	<b>5,519.0</b>	<b>12,556.0</b>

**Exhibit 2: Tesla's Balance Sheet (in \$ millions)**

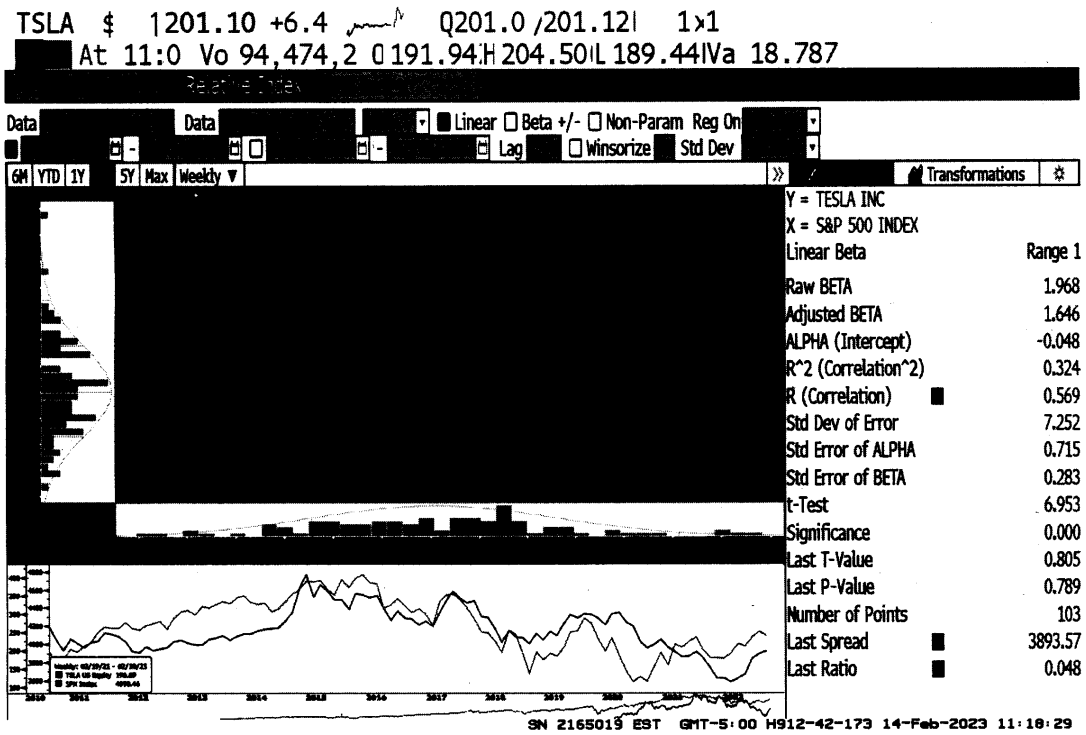
	2017	2018	2019	2020	2021	2022
<b>ASSETS</b>						
Cash And Equivalents	\$3,368	\$3,686	\$6,268	\$19,384	\$17,576	\$16,253
Short Term Investments	-	-	-	-	\$131	\$5,932
<b>Total Cash &amp; ST Investments</b>	<b>\$3,368</b>	<b>\$3,686</b>	<b>\$6,268</b>	<b>\$19,384</b>	<b>\$17,707</b>	<b>\$22,185</b>
Accounts Receivable	\$515	\$949	\$1,324	\$1,903	\$1,986	\$3,116
<b>Total Receivables</b>	<b>\$515</b>	<b>\$949</b>	<b>\$1,324</b>	<b>\$1,903</b>	<b>\$1,986</b>	<b>\$3,116</b>
Inventory	\$2,264	\$3,113	\$3,552	\$4,101	\$5,757	\$12,839
Prepaid Exp.	\$268	\$366	\$713	\$1,091	\$1,305	\$2,483
Restricted Cash	\$155	\$193	\$246	\$238	\$345	\$294
Other Current Assets	-	-	-	-	-	-
<b>Total Current Assets</b>	<b>\$6,571</b>	<b>\$8,307</b>	<b>\$12,103</b>	<b>\$26,717</b>	<b>\$27,100</b>	<b>\$40,917</b>
Gross Property, Plant & Equipment	\$23,169	\$23,344	\$25,062	\$29,893	\$39,867	\$48,134
Accumulated Depreciation	-\$2,677	-\$3,653	-\$4,863	-\$6,518	-\$8,691	-\$11,499
<b>Net Property, Plant &amp; Equipment</b>	<b>\$20,492</b>	<b>\$19,691</b>	<b>\$20,199</b>	<b>\$23,375</b>	<b>\$31,176</b>	<b>\$36,635</b>
Long-term Investments	\$5	\$12	\$1	-	-	-
Goodwill	\$60	\$68	\$198	\$207	\$200	\$194
Other Intangibles	\$362	\$282	\$339	\$313	\$257	\$215
Accounts Receivable Long-Term	\$457	\$422	-	\$74	\$303	\$574
Other Long-Term Assets	\$710	\$958	\$1,469	\$1,462	\$3,095	\$3,803
<b>Total Assets</b>	<b>\$28,655</b>	<b>\$29,740</b>	<b>\$34,309</b>	<b>\$52,148</b>	<b>\$62,131</b>	<b>\$82,338</b>
<b>LIABILITIES</b>						
Accounts Payable	\$2,390	\$3,405	\$3,771	\$6,051	\$10,025	\$15,255
Accrued Exp.	\$1,207	\$921	\$1,190	\$1,632	\$2,951	\$3,773
Curr. Port. of LT Debt	\$964	\$2,284	\$1,399	\$1,758	\$1,088	\$1,016
Curr. Port. of Leases	\$15	\$428	\$614	\$660	\$869	\$971
Curr. Income Taxes Payable	\$186	\$348	\$611	\$777	\$1,122	\$1,235
Unearned Revenue, Current	\$1,015	\$630	\$1,163	\$1,458	\$1,447	\$1,747
Other Current Liabilities	\$1,897	\$1,977	\$1,919	\$1,912	\$2,203	\$2,712
<b>Total Current Liabilities</b>	<b>\$7,675</b>	<b>\$9,993</b>	<b>\$10,667</b>	<b>\$14,248</b>	<b>\$19,705</b>	<b>\$26,709</b>
Long-Term Debt	\$9,486	\$8,461	\$10,375	\$8,571	\$4,285	\$1,029
Long-Term Leases	\$1,666	\$2,655	\$2,188	\$2,348	\$2,662	\$2,732
Unearned Revenue, Non-Current	\$1,178	\$991	\$1,207	\$1,284	\$2,052	\$2,804
Def. Tax Liability, Non-Curr.	-	-	\$66	\$151	\$24	\$82
Other Non-Current Liabilities	\$3,018	\$1,327	\$1,696	\$1,867	\$1,820	\$3,084
<b>Total Liabilities</b>	<b>\$23,023</b>	<b>\$23,427</b>	<b>\$26,199</b>	<b>\$28,469</b>	<b>\$30,548</b>	<b>\$36,440</b>
Common Stock	\$0	-	\$1	\$1	\$3	\$3
Additional Paid In Capital	\$9,178	\$10,249	\$12,736	\$27,260	\$29,803	\$32,177
Retained Earnings	-\$4,974	-\$5,318	-\$6,083	-\$5,399	\$329	\$12,885
Treasury Stock	-	-	-	-	-	-
Comprehensive Inc. and Other	\$33	-\$8	-\$36	\$363	\$54	-\$361
<b>Total Common Equity</b>	<b>\$4,237</b>	<b>\$4,923</b>	<b>\$6,618</b>	<b>\$22,225</b>	<b>\$30,189</b>	<b>\$44,704</b>
Minority Interest	\$1,395	\$1,390	\$1,492	\$1,454	\$1,394	\$1,194
<b>Total Equity</b>	<b>\$5,632</b>	<b>\$6,313</b>	<b>\$8,110</b>	<b>\$23,679</b>	<b>\$31,583</b>	<b>\$45,898</b>
<b>Total Liabilities And Equity</b>	<b>\$28,655</b>	<b>\$29,740</b>	<b>\$34,309</b>	<b>\$52,148</b>	<b>\$62,131</b>	<b>\$82,338</b>

**Exhibit 3: Country Risk Premiums by region (over and above the mature market premium)**

Region	Country Risk Premium (over and above mature market ERP)
Africa	9.64%
Asia	1.93%
Australia & New Zealand	0.00%
Caribbean	11.19%
Central and South America	6.57%
Eastern Europe & Russia	7.79%
Middle East	2.51%
North America	0.00%
Western Europe	1.51%
<b>Global</b>	<b>2.04%</b>

## Exhibit 4: Beta Information for Tesla

### Regression against S&P 500



<i>Tesla's Business</i>	<i>% of Tesla's Revenues in 2022</i>	<i>Unlevered Beta</i>
Automobiles	90%	1.15
Energy Solutions	8%	0.60
Software	2%	1.30

*Exhibit 5: Industrial Machinery Companies*

The data includes all publicly traded industrial machinery companies listed globally, with a market capitalization exceeding \$10 billion.

[Click on this link \(https://www.stern.nyu.edu/~adamodar/pdfiles/cfexams/mfgcomps.xlsx\)](https://www.stern.nyu.edu/~adamodar/pdfiles/cfexams/mfgcomps.xlsx) to get the data in an excel spreadsheet.

<b>Company Name</b>	<b>Market Capitalization</b>	<b>Cash &amp; Equivalents</b>	<b>Total Debt (including leases)</b>	<b>Beta</b>
Illinois Tool Works Inc. (NYSE:ITW)	\$72,621.50	\$708.00	\$7,949.00	0.973
Atlas Copco AB (OM:ATCO A)	\$56,883.80	\$1,079.60	\$3,485.50	1.140
Parker-Hannifin Corporation (NYSE:PH)	\$45,194.50	\$777.70	\$14,020.20	1.120
Otis Worldwide Corporation (NYSE:OTIS)	\$34,985.90	\$1,189.00	\$7,210.00	0.872
SMC Corporation (TSE:6273)	\$33,930.80	\$4,972.30	\$81.60	1.040
Fanuc Corporation (TSE:6954)	\$32,948.30	\$4,040.20	\$0.00	0.842
Shenzhen Inovance Technology Co.,Ltd (SZSE:300124)	\$29,142.80	\$1,160.10	\$659.90	0.599
KONE Oyj (HLSE:KNEBV)	\$27,228.90	\$2,100.70	\$570.60	0.755
Sandvik AB (publ) (OM:SAND)	\$26,043.70	\$1,006.20	\$5,325.70	1.180
Techtronic Industries Company Limited (SEHK:669)	\$25,054.80	\$1,672.70	\$3,960.10	1.380
Fortive Corporation (NYSE:FTV)	\$24,357.20	\$709.20	\$3,251.30	1.060
Ingersoll Rand Inc. (NYSE:IR)	\$23,254.90	\$1,490.30	\$2,791.40	1.100
Schindler Holding AG (SWX:SCHN)	\$22,763.70	\$2,134.60	\$0.00	0.857
Dover Corporation (NYSE:DOV)	\$21,753.30	\$380.90	\$3,895.40	0.953
Xylem Inc. (NYSE:XYL)	\$19,348.70	\$944.00	\$1,880.00	1.090
IDEX Corporation (NYSE:IEX)	\$16,996.10	\$430.20	\$1,468.70	0.794
Zhejiang Sanhua Intelligent Controls Co.,Ltd (SZSE:002050)	\$14,207.30	\$779.30	\$913.60	0.674
Nordson Corporation (NasdaqGS:NDSN)	\$13,876.00	\$163.50	\$860.50	0.965
Alfa Laval Corporate AB (OM:ALFA)	\$13,754.30	\$417.50	\$1,701.20	0.868
Jiangsu Hengli Hydraulic Co.,Ltd (SHSE:601100)	\$13,414.10	\$776.10	\$61.20	0.661
Snap-on Incorporated (NYSE:SNA)	\$13,395.50	\$757.10	\$1,269.00	0.802

Stanley Black & Decker, Inc. (NYSE:SWK)	\$13,190.50	\$395.60	\$7,457.00	1.100
Mitsubishi Heavy Industries, Ltd. (TSE:7011)	\$12,776.90	\$2,903.00	\$10,793.30	1.030
Graco Inc. (NYSE:GGG)	\$12,056.10	\$339.20	\$117.00	1.040
Ningbo Deye Technology Group Co., Ltd. (SHSE:605117)	\$10,946.40	\$647.90	\$237.50	-0.383
Spirax-Sarco Engineering plc (LSE:SPX)	\$10,656.90	\$370.50	\$691.90	1.080
Wuxi Lead Intelligent Equipment CO.,LTD. (SZSE:300450)	\$10,559.60	\$702.60	\$44.40	0.200
YASKAWA Electric Corporation (TSE:6506)	\$10,050.60	\$338.10	\$693.40	1.160
Lincoln Electric Holdings, Inc. (NasdaqGS:LECO)	\$10,040.70	\$141.30	\$826.20	0.845

