The Bishop Report 30 Years ANNIVERSARY
Performance and Forecast of the World Connector Industry

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30 Years of the Bishop Report:
This is the 361st issue of the Bishop Report, celebrating 30 years of publication.

Market Size Then (1980) and Now (2021):
The connector industry has changed significantly over the last 42 years. In 1980, industry sales were $9 billion. In 2022, sales are forecast at almost $84 billion, a 42-year CAGR of 5.5%.

Top 10 Then (1980) and Now (2021):
In 1980, the top 10 accounted for 38% of total connector sales. In 2021, the top 10 captured 55.4% of the market.

Industry Consolidation:
Industry consolidation has played a significant role in the connector industry over the last 30 years.

Black Swan Events:
In the last 30 years, the connector industry has gone through several major black swan events.

Forty Years of Advancing Technology:
It would be difficult to overestimate the tremendous impact that the electronic technologies of the 1980s have had on our lives today.

Commemorating 30 Years of the Bishop Report

Bishop & Associates was founded by Ron Bishop as a market research firm to focus on the global connector industry. The firm's databases track the industry from 1980 to present (42 years).

In 1992, Bishop published the first copy of its newsletter, *The Bishop Report – Performance and Forecast of the Connector Industry.* In November of 2022, the 360th report was issued marking 30 consecutive years of publications.

To commemorate the 30-year benchmark, we thought it would be interesting to review the industry as it was in 1980 and now, 2022.

Market Size Then (1980) and Now (2022)

As the following table shows, the connector industry achieved a CAGR of 5.5% for the 42-year period 1980 to 2022F. We did not begin reporting on China until 1994 when Chinese sales were less than one million.

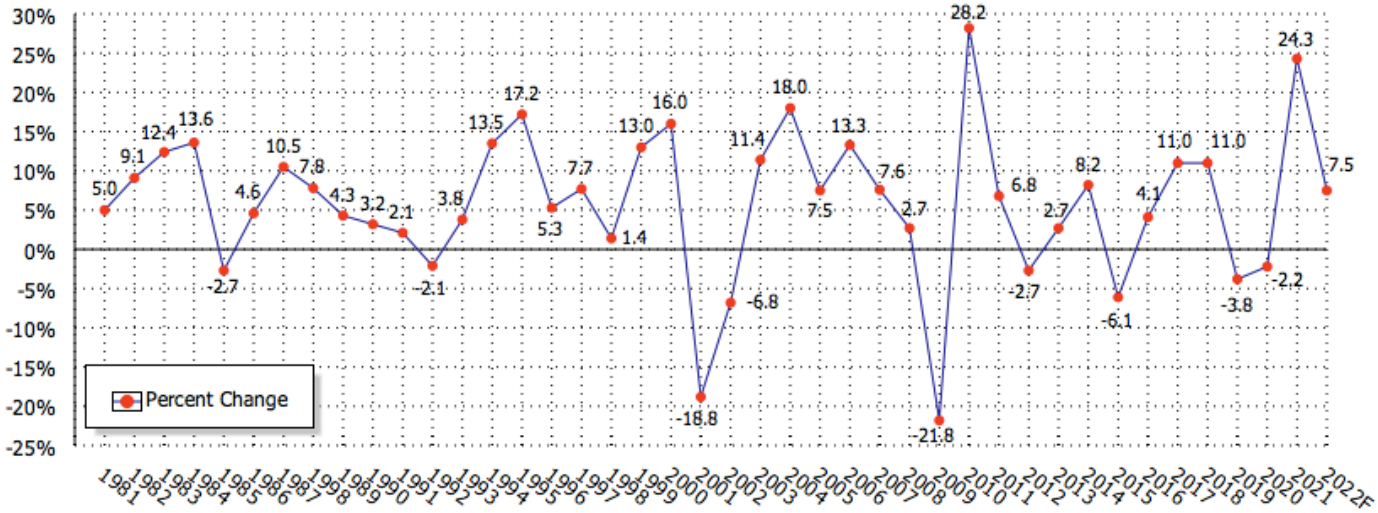
Total World Connector Sales
1980 to 2022F
With 42-Year CAGR

Region	1980	2022F	42-Yr CAGR
North America	$4,132.9	$18,718.7	3.7%
Europe	$2,556.7	$17,248.5	4.7%
Japan	$1,429.0	$5,172.8	3.1%
China		$26,494.3	NA
Asia-Pacific	$457.2	$12,194.7	8.1%
ROW	$413.2	$3,992.7	5.5%
Total	**$8,989.0**	**$83,821.7**	**5.5%**

$ Millions

Connector demand has fluctuated and occasionally has significant peaks and valleys. This is clearly shown in the following graphic.

Historical Percentage Change in Connector Demand
1980 through 2022F



Since 1980, we have achieved 33 years of sales increases and nine years of sales declines. The average growth cycle lasts four years with two years being the shortest growth cycle and eight years the longest. The industry's 42-year compound annual growth (CAGR) is 5.5%, up from 5.4% in 2021. The industry has only experienced two consecutive years of declining sales twice (2001-2002 and 2009/2010).

The following chart displays the business cycles the industry has experienced since 1980.

Connector Industry Business Cycles
Growth Cycles Highlighted

Time Frame	Number of Years	CAGR During Time Frame
1980-1984	4	10.0%
1985	1	-2.5%
1986-1991	6	5.5%
1992	1	-2.2%
1993-2000	8	10.4%
2001-2002	2	-6.8%
2003-2008	6	9.7%
2009	1	-21.8%
2010-2011	2	6.8%
2012	1	-2.7%
2013-2014	2	4.0%
2015	1	-6.1%
2016-2018	3	11.0%
2019-2020	2	-1.1%
2021-2022F	2	3.7%
Totals	**42**	**5.5%**

As the following table clearly shows, China began its rise as a major industrial country at the beginning of the 21st century.

Industry Sales by Region
2000 – 2022F

Region	2000	2022F	22-Yr CAGR
North America	$13,554	$18,719	1.5%
Europe	$8,723	$17,249	3.1%
Japan	$5,249	$5,173	-0.1%
China	$2,032	$26,494	12.4%
Asia-Pacific	$4,394	$12,195	4.7%
ROW	$1,741	$3,993	3.8%
Total	**$35,693**	**$83,822**	**4.0%**

$ Millions

The following table tracks regional share of the connector market. In 2000, the West (North America and Europe) had 62.4% of the connector market. This dropped to 42.9% in 2022. China captured only 5.7% of the market in 2000, but now has 31.6%.

2000 through 2022F

Year	North America	Europe	Japan	China	Asia Pacific	ROW
2000	38.0%	24.4%	14.7%	5.7%	12.3%	4.9%
2001	35.1%	26.4%	14.0%	8.3%	10.7%	5.6%
2002	33.8%	24.1%	14.0%	11.4%	11.3%	5.4%
2003	30.1%	25.4%	14.4%	13.1%	11.6%	5.3%
2004	27.9%	25.9%	14.5%	14.9%	11.5%	5.3%
2005	26.8%	25.0%	13.8%	16.8%	11.9%	5.7%
2006	25.5%	24.6%	13.0%	19.1%	12.4%	5.4%
2007	23.2%	25.6%	12.6%	20.8%	12.0%	5.9%
2008	21.2%	25.8%	12.6%	21.9%	12.2%	6.3%
2009	20.1%	23.4%	12.2%	24.6%	13.4%	6.3%
2010	19.4%	22.0%	12.8%	25.8%	14.4%	5.6%
2011	19.2%	22.7%	12.2%	25.2%	14.7%	6.0%
2012	20.4%	20.8%	12.8%	25.2%	15.2%	5.5%
2013	21.0%	21.7%	10.5%	25.5%	15.7%	5.6%
2014	20.9%	21.3%	10.1%	27.0%	15.5%	5.2%
2015	21.6%	20.1%	9.1%	28.3%	16.5%	4.4%
2016	21.4%	20.3%	8.1%	30.4%	15.3%	4.5%
2017	20.6%	20.5%	8.2%	31.7%	14.5%	4.5%
2018	20.8%	21.1%	7.6%	31.4%	14.6%	4.6%
2019	21.6%	21.1%	7.6%	30.4%	14.7%	4.6%
2020	21.5%	20.5%	7.1%	32.2%	14.4%	4.4%
2021	21.1%	20.9%	6.8%	32.0%	14.6%	4.6%
2022F	22.3%	20.6%	6.2%	31.6%	14.5%	4.8%

The following identifies market sector growth since year 2000.

Connector Industry Sales by End-Use Equipment Sector
for the Period 2000 through 2022F
With 22-Year CAGR

End-Use Equipment Sector	2000	2022F	22-Year CAGR
Computers & Peripherals	$6,998	$10,735	2.0%
Business/Office Equipment	$447	$921	3.3%
Instrumentation	$818	$2,422	5.1%
Medical	$582	$2,687	7.2%
Industrial	$3,762	$10,786	4.9%
Automotive	$7,384	$18,345	4.2%
Transportation	$1,410	$5,865	6.7%
Military/Aerospace	$1,724	$4,989	4.9%
Telecom/Datacom	$9,173	$19,969	3.6%
Consumer	$1,646	$3,955	4.1%
Other Equipment	$1,749	$3,147	2.7%
Total	**$35,693**	**$83,822**	**4.0%**

$ Millions

Telecom/datacom is the largest market for the connector industry accounting for 23.9% of world connector sales. Automotive is second, with 21.9% of the market.

Adding automotive and transportation together, connectors used in vehicles account for 28.9% of world connector demand.

Top 10 Then (1980) and Now (2022F)

The Top 10 Companies

In 1980, the top 10 accounted for 38% of total connector sales. In 2021, the top 10 captured 55.4% of the market.

Year	Top Ten	World	Top Ten Market Share
1980	$3,417.0	$8,989.0	38.0%
1990	$7,063.0	$17,166.5	41.1%
1995	$9,850.0	$23,700.5	41.6%
2000	$17,462.6	$35,692.7	48.9%
2005	$18,841.0	$38,185.4	52.0%
2010	$24,542.7	$47,938.7	51.2%
2011	$27,760.6	$51,193.0	54.2%
2012	$28,477.2	$49,814.9	57.2%
2013	$29,505.5	$51,183.4	57.6%
2014	$31,461.1	$55,402.0	56.8%
2015	$30,121.7	$52,049.8	57.9%
2016	$32,374.8	$54,163.7	59.8%
2017	$36,075.4	$60,115.8	60.0%
2018	$39,715.6	$66,710.1	59.5%
2019	$38,659.2	$64,169.1	60.2%
2020	$38,120.3	$62,726.7	60.8%
2021	$43,185.0	$77,990.6	55.4%

$ in Millions

The growth in top 10 market share is primarily the result of acquisitions, as will be shown later in this report.

The following table identifies the top 10 companies. The names change significantly over the 42-year span.

Top 10 Over the Decades

Rank	1980	1990	2000	2010	2020	2021
1	Amp	Amp	Tyco Electronics	Tyco Electronics	TE Connectivity	TE Connectivity
2	Amphenol	Molex	Molex	Molex	Amphenol	Amphenol
3	ITT Cannon	LPL/Amphenol	FCI	Amphenol	Molex	Molex
4	DuPont (Berg)	ITT Cannon	Delphi	Yazaki	Luxshare	Luxshare
5	3M	3M	Amphenol	FCI	Aptiv	Aptiv
6	Augat	Burndy	Yazaki	J.S.T.	FIT	FIT
7	Winchester	DuPont (Berg)	ITT Cannon	Foxconn	Yazaki	Yazaki
8	Cinch	J.S.T.	3M	Delphi	JAE	JAE
9	Burndy	Hirose Electric	JAE	Hirose Electric	J.S.T.	Rosenberger
10	Molex	JAE	J.S.T.	JAE	Hirose Electric	Hirose Electric
Base of Origin						
North America	10	7	6	5	4	4
Europe	0	0	1	1	0	1
Japan	0	3	3	3	4	3
China	0	0	0	0	1	1
Asia Pacific	0	0	0	1	1	1

A close examination of the table above shows how much the industry has changed in the last 42 years. Some highlights are:

- Amp remained the largest connector company from 1980 to current day. Amp was acquired by Tyco International in 1999, changing its name to Tyco Electronics. In 2011, the company changed its name from Tyco Electronics to TE Connectivity.
- TE Connectivity, Amphenol, and Molex are the only companies that remained in the top 10 from 1980 to 2021.
- ITT Cannon and 3M, although still among the top 50, dropped out of the top 10 ranking.
- Dupont (Berg), Augat, Cinch, and Burndy were ranked in the top 10 in 1980 but were acquired by larger companies.
- FCI was acquired by Amphenol in early 2016. Delphi changed its name to Aptiv and acquired Winchester Electronics in 2018. Hon Hai changed its name to Foxconn and spun off its connector group in 2013, creating Foxconn Interconnect Technologies (FIT).
- In 1980, all 10 companies were based in North America. In 2021, there are only four based in North America, one in Europe (Rosenberger), three in Japan (Yazaki, JAE, and Hirose Electric), one in China (Luxshare), and one in Asia Pacific (FIT).

- In 2021, one European company, Rosenberger was ranked among the top 10, with another 27 ranked among the top 100. It is important to note that TE Connectivity is an American Swiss-domiciled company and APTIV is an American Irish-domiciled company.

- In addition to those previously mentioned, other companies that prior to 2021 were in the top 100 include, ABB Entrelec (acquired by TE Connectivity), Cooper Industries (acquired by EATON), ERNI (acquired by TE Connectivity), FCT (acquired by Molex), Genesis Technology (acquired by ACES), Positronic (acquired by Amphenol), and Tri-Star (acquired by Carlisle Interconnect Technologies).

The following provides background on some of the companies that were important to the growth of the connector industry. Please note, we limited the number of companies included to manage the size of this report.

Top 10 companies include: Amphenol, Hirose Electric, JAE, Rosenberger, and TE Connectivity.

Family owned and operated companies include: LEMO, Samtec Inc., and HARTING.

TE Connectivity

Headquarters – An American Swiss-domiciled company, TE Connectivity is headquartered in Berwyn, Pennsylvania

2021 Sales – TE Connectivity had total sales of $14.923 billion. Connectors accounted for $12.019 billion.

Connector Industry Ranking – #1

History – TE Connectivity, referred to as Tyco Electronics Ltd, prior to 2011, was founded in 2007. Prior to that, the company was part of Tyco International. Traded on the NYSE as TEL, the company initially conducted its business through three primary operating segments. Connectors fell under the electronic component segment. In 2011, Tyco Electronics received shareholder approval to change the company name to TE Connectivity.

Tyco International Ltd. entered the connector industry in 1999 when it acquired the world's largest electronic connector manufacturer, AMP Inc. Amp had been founded in 1941 by Uncas A. Whitaker, a former employee of Westinghouse Electric and the Hoover Company as Aircraft and Marine Products (AMP). Over the years, other acquisitions such as the acquisitions of Deutsch and ERNI, broadened TE's connector product offering.

Today, TE manufactures solutions that power electric vehicles, aircraft, digital factories, and smart homes. The company's innovation enables life-saving medical care, sustainable communities, efficient utility networks, and the global communications infrastructure. The company employs more than 89,000 and serves customers in more than 140 countries.

Amphenol

Headquarters – Wallingford, Connecticut

2021 Sales – Amphenol had total sales of $10,876 million in 2021, connectors accounted for approximately $8,605.5 million.

Connector Industry Ranking – #2

History – Amphenol was founded in 1932 by Arthur Schmitt in Chicago, as American Phenolic Corporation. It was listed on the New York Stock Exchange in 1957. The name Amphenol is a portmanteau of the original name. In 1967, the company was acquired by Bunker Ramo, which was later purchased by Allied. In 1983, Allied and Bendix merged, bringing together the two companies' strengths in the military/aerospace market. In 1987, LPL Investment Group acquired Amphenol in an LBO, and in 1992 acquired cable supplier Times Fiber. In 1997, KKR (Kohlberg Kravis Roberts & Company) acquired Amphenol for $1.2 billion. The company went public on the NYSE in 1991 under the ticker APH.

Over the last 25 years, Amphenol has made over 75 acquisitions. Some of their key acquisitions include:

- Acquisition of Positronic in 2021
- Acquisition of FCI in 2016
- Acquisition of Teradyne Connection Systems in 2005
- Acquisition of AMPs Matrix Science in 1997
- Acquisition of Sine Companies in 1996

Amphenol products can be found in all end-use equipment sectors. Today, the company has about 230 manufacturing plants and approximately 90,000 employees. Not only do they make a wide variety of connectivity products, but they also participate heavily in the sensor, antenna, and cable manufacturing business.

JAE

Headquarters – Shibuya-ku, Tokyo

2021 Sales – JAE had total connector sales of $1,835.0 million in 2021.

Connector Industry Ranking - #8

History – JAE was founded in 1953, reportedly to provide support to American military aircraft after the Korean War. The company was initially led by Minoru (“Min”) Numoto (PhD, physics) who was retiring as president of NEC (JAE’s major stockholder). In August 1955, JAE started manufacturing and sales of connectors under a technical license agreement with the Cannon Electric Company. The company was listed on the Tokyo Stock Exchange the Second Section in 1973 and the First Section in 1980.

From 1975 on, JAE has established 28 subsidiaries/Group Companies — 12 in Japan and 16 overseas. In 2016, for the first time JAE had annual sales that surpassed 200 billion yen. In 2019, JAE was awarded the Derwent Top 100 Global Innovators prize and received the award again in 2020. JAE focuses on three business lines: connector, user interface solutions, and aerospace. Today, the JAE Group has over 9,420 employees.

Hirose Electric

Headquarters – Kanagawa, Japan

2021 Sales – Hirose Electric had connector sales of $1,456.0 million in 2021

Connector Industry Ranking – #10

History – HIROSE SHOKAI (CO.) was founded in 1937 in Enokizaka-cho, Akasaka-ku, Tokyo and restructured into Hirose Manufacturing Company Ltd in 1948. In 1962, the first Hirose designed products, the RM series circular connector, 1300 rectangular connector, and MSS coaxial connector were launched and in 1963, the name was changed to Hirose Electric Co., Ltd. This was followed by distribution expansion in Europe in 1967 and in 1972, the company went public on the Tokyo Stock Exchange.

With advanced technologies and diverse development capabilities, Hirose continued to design ground-breaking connector solutions to meet global market needs. Notable connector innovations include:

- The launch of the industry's first flip lock connector, the FH12 Series, in 1994
- Development of the ZX Series in 2005, which the global Micro-USB standard is based on
- The creation of the industry standard U.FL connector design that is used globally in wireless technology in 1997
- The introduction of the ix Industrial connector in 2017, which was later specified as a new standard interface connector for Ethernet applications by PROFINET (Process Field Network) in 2021.

Today, Hirose Electric offers more than 50,000 products, with new products accounting for more than 30% of sales. The company employs more than 5,000 and services a wide variety of markets, which include computers, peripherals, terminal equipment, mobile/wired/wireless communications, office automation, consumer technologies, control equipment, and products for the automotive market.

Molex

Headquarters – Lisle, Illinois

2021 Sales – Molex had total connector sales of $4,711.0 million in 2021.

Connector Industry Ranking – #3

History – Molex was established in Brookfield, Illinois in 1938 by Frederick Krehbiel, an immigrant who had emigrated from his native Switzerland to Germany and then to the US in the 1820s, "in pursuit of a country that would honor the pacifist ideals set forth by their Mennonite religion. They settled in Newton, Kansas, where the patriarch of the family, John Jacob Krehbiel, built a wagon- and carriage-making business and became one of the founders and chairman of Bethel College. His son, Frederick Augustus Krehbiel, would become the first of four generations of Krehbiels who would be responsible for creating and building one of the largest electronic connector companies in the world."

The company began by making flowerpots out of an industrial byproduct plastic they called Molex. This byproduct was developed by combining asbestos tailings, coal tar pitch, and limestone. They also produced plastic toys and saltshakers, before pursuing electrical connectors and sensors. The company's first connectors were used for appliances by General Electric and others.

Molex continued to utilize their proprietary material, as well as newer plastics they developed, expanding into the industrial market. By the 1960's Molex connectors were found in TVs, radios, consumer appliances, and cameras/video recorders. Molex expanded even further into the industrial sector with their 2000 acquisition of Beau Interconnect and their 2006 acquisition of Woodhead Industries. In late 2013, Koch Industries acquired Molex for $7.2 billion.

Today, with a presence in more than 40 countries, Molex employs more than 45,000 and its complete range of connectivity products are used in virtually every end-use equipment sectors.

Rosenberger

Headquarters – Fridolfing, Germany

2021 Sales – Rosenberger had total connector sales of $1,517.9 million in 2021.

Connector Industry Ranking – #9

History – Founded in 1958 upon the death of his father-in-law, Hans Rosenberger Sr. used his father-in-law's locksmith shop to start his own business, Hans Rosenberger Maschinebau. In 1967, the company moved into high-frequency technology. During the 1970s, Rosenberger made enormous investments in machinery as well as in production and measuring systems.

During the 1980s, Hans' sons, Hans Junior, Peter, and Bernhard, took over the management of the company and established Rosenberger's first international office. By the 1990s, the company had become a world leader in the manufacturing of high-frequency coax connectors and had established subsidiaries around the world. Expansion has continued during the 2000s, focusing extensively on the automotive market, and the development of high-voltage and magnetic connector systems. Today, Rosenberger is still owned by Hans, Bernhard, and Peter Rosenberger and their families, with numerous manufacturing locations and more than 6,000 employees.

Samtec Inc.

Headquarters – New Albany, Indiana

2021 Sales – Samtec had total connector sales of $967.9 million in 2021.

Connector Industry Ranking – #14

History – Samtec Inc. was founded in 1976 by Sam Shine and his wife Betty. Initially operating out of a couple of rooms in the back of their house, Samtec was founded on the principle of "Sudden Service", a mission to pioneer exceptional service in the electronics industry. With the "Sudden Service" approach lead times dropped monumentally, and Samtec grew, expanding rapidly not only in the U.S., but also abroad.

In the late 1990s and early 2000s, Samtec committed to becoming a leader in high-speed, high-bandwidth connector systems. In addition to a broad line of signal integrity connector products, Samtec set a goal to extend their service leadership to signal integrity solutions, by providing industry-leading engineering support and resources. This included free access to the Signal Integrity Group, a team of SI and PI engineers that assists customers with full system SI optimization, signal integrity testing, simulation and analysis, PDN/thermal modeling, simulation and testing and power architecture, system design, and routing, as well as other SI services all available free of charge. The availability of this type of information is one of the many reasons why Samtec's website is consistently ranked as the #1 website in the connector industry by Bishop & Associates.

Today, Samtec has over 40 locations worldwide, services 125 countries and has more than 8,000 associates. The company focuses on not only high-speed, high-bandwidth connector systems, but also fiber optic systems, precision RF, and millimeter wave technology, and has an extensive line of micro pitch, SMT connector systems.

HARTING

Headquarters – Espelkamp, Germany

2021 Sales – HARTING had connector sales of $856.7 million in 2021.

Connector Industry Ranking – #15

History – "Quality is when the customer comes back and not the product." This guiding principle of company founder Wilhelm Harting has been valid since September 1, 1945, when Wilhelm and his wife Marie opened the Wilhelm Harting Mechanische Werkstätten in a small repair shop in Minden, Germany. Their start-up, first located in a garage, focused on waffle irons, energy-saving lamps, hotplates, and irons — all scarce commodities after World War II. To deliver the products, Marie Harting hopped on a bicycle and exchanged them for bread, bacon, and eggs. The company grew rapidly and in 1950, the Harting's moved the business to the neighboring refugee settlement Espelkamp, offering jobs to many refugees and displaced persons during the difficult post-war period.

Wilhelm Harting recognized industry trends at an early stage and geared the company towards the production of connectors. The Han® industrial rectangular connector (HARTING norm) was patented in 1956 and was featured as a registered trademark since 1957. Since then, the Han range has expanded and integrated additional requirements to serve industrial sectors such as automation, mechanical engineering, transportation, and robotics. At the end of the 1990s, the Han went modular, offering over 60 different inserts in various enclosure sizes. With the introduction of the Han-Modular® Domino Modules in 2022, it is possible for the first time to transmit compressed air while simultaneously halving the required installation space. Today, HARTING ranks as the connectivity specialist for power, data, and signal, and continues to set new benchmarks and standards.

After the death of Wilhelm Harting in 1962, Marie Harting continued to run the business alone until her son Dietmar came on board in 1967; after Marie Harting's death in 1987 he has strongly been supported by his wife Margrit. Some 12 years later, he ensured a milestone in HARTING's history: internationalization in 1979, marked by the first European subsidiary opening in Paris. One year later, Great Britain and Belgium followed suit. Today, HARTING has 44 sales offices worldwide.

The reason for the steadily growing success of this company? It is not a company. It is a FAMILY business that is run with passion. From day one, it was in family hands, and this still holds true today, with the third generation at the helm. And one thing is for certain: sooner or later, the fourth generation will also follow in their parents' footsteps.

LEMO

Headquarters – Ecublens, Switzerland

2021 Sales – LEMO had total sales of $332.6 million in 2021.

Connector Industry Ranking – #34

History – Léon Mouttet, a Swiss precision mechanic, founded LEMO in 1946 in Morges, on the shores of Lake Geneva. It was in his first small workshop that he created innovative electric contacts and devices for the watchmaking industry, assembling them around the lounge table with his wife and daughter. In 1954, the first LEMO connectors were produced for the electronics market. Mouttet was an engineering genius, an inventor with an inexhaustible treasure trove of ideas. He managed the company until 1978. Three generations of the same family have been at the helm of LEMO. This has been one of the keys to the Group's continuous success. Mouttet appointed his son-in-law, Marcello Pesci, to succeed him. Immersed in the world of connectors, this born entrepreneur created COELVER (coaxial and fiber optic miniaturized solutions), before taking over LEMO's management. A devoted and well-organized leader, Pesci transformed the family enterprise into a worldwide company.

Son and grandson of the first two LEMO directors, Alexandre Pesci is the company's third and current CEO. Alexandre Pesci followed in his father's footsteps. He first gained experience as the marketing director for LEMO HQ and LEMO USA. Next, he structured, further developed, and strengthened the Group's footprint to underpin its continued growth. As a visionary leader, he oriented his enterprise towards emerging markets and sectors (renewable energies, high-precision medical robotics, autonomous vehicles, drones, etc.). He anchored the brand into high-end and harsh environments. He also broadened the business scope to complete interconnection solutions, namely through the acquisition of U.S. cable manufacturer NORTHWIRE.

A family company, LEMO has always been independent. As a result, LEMO has shown 76 years of controlled regular growth, despite the sometimes turbulent economic or global health issues encountered along the way.

Industry Consolidation

Industry consolidation has played a significant role in the connector industry over the last 30 years. During that time the connector industry has reported over 500 acquisitions.

As mentioned previously, acquisitions have played an important role in defining the top 100 connector manufacturers. More than 25% of the companies listed on the top 100 list in 2000 have been acquired. Some companies sold off their connector line, redirecting focus to other product types. This is apparent when you compare the 2000 list of top 100 companies with the 2021 list. Fifty different names appear on the latest list! That is over 50% of all manufacturers falling within the top 100 connector companies in 1999.

By far, the company that has completed the most acquisitions in the last 30 years is Amphenol. During this period, Amphenol has made more than 75 acquisitions. Although a high percentage of them are connector companies, Amphenol has also recently acquired several sensor and antenna companies.

Acquisitions that played a major role in the landscape of the connector industry over the last 30 years include:

- Amphenol's acquisition of Positronic – 2020 sales of approximately $80 million.
- Eaton's acquisition of Souriau and Sunbank – 2019 sales of approximately $320 million.
- Aptiv's acquisition of Winchester Electronics – 2018 sales of approximately $250 million.
- Amphenol's acquisition of FCI (Framatone) – 2015 sales of approximately $600 million.
- TE Connectivity's acquisition of ERNI – 2020 sales of $178.5 million.
- Aptiv's (Delphi) acquisition of FCI's Motorized Vehicle Division - 2011 sales of $893.3 million.
- Motherson Sumi Systems acquisition of PKC Group – 2016 total sales of $846 million.
- Molex's acquisition of Philips-Midsize – 2015 total sales of $700 million.
- Delphi's acquisition of Hellermann Tyton – 2014 total sales of $659 million.
- TE Connectivity's acquisition of SEACON Group – 2013 sales of $115 million.
- Amphenol acquisitionacquired Holland Electronics – 2011 sales of $60 million.
- Eaton's acquisition of Cooper Industries – 2011 total sales of $5,400 million.
- Belden's acquisition of PPC – 2012 sales of $238 million.
- Yazaki's acquisition of Cablelettra – 2010 sales of $232.2 million.
- Bel's acquisition of Cinch – 2009 sales of $60 million.
- Lear's acquisition of Grote & Hartmann – 2003 total sales of $275 million.
- FCI's acquisition of Berg Electronics – 1997 sales of $785 million.
- Thomas & Betts acquisition of Augat – 1995 sales of $535 million.

In addition to these notable acquisitions, many much smaller acquisitions have occurred. Connector companies are continually looking for ways to expand their product offering, the territories they serve, the markets they serve, and the way they bring their products to market. Acquiring another company is the one of the easiest and most efficient ways to do this.

Black Swan Events

Defined as an unpredictable negative event that has a significant impact on the business environment. In the last 30 years, the connector industry has gone through several major black swan events.

- The dotcom bubble was the result of overinvestment in internet-based companies in the late 1990s and their downfall in 2000, when they failed to meet expectations of their value. The NASDAQ fell by over 75% wiping out $5 trillion in market value. Massive layoffs occurred in the technology sector and many tech companies declared bankruptcy or were acquired by other companies. Connector industry sales fell by 18.8% in 2001 and 6.9% in 2002 as a result.
- The impact of 9/11 on the general financial markets was very transitory, lasting just a few weeks. It did have a long-term effect on airline stocks, however, resulting from major stock selloffs, and initially on gas and oil prices, as imports from the Middle East were curtailed. The industry that suffered the most from 9/11 was the insurance market. It is estimated that the attacks themselves resulted in $40 billion in insurance losses.
- The financial meltdown of 2008/2009 was precipitated by predatory mortgage lending practices in which subprime mortgages were issued to individuals that were not credit worthy. These loans were then sold to financial institutions that bought or issued mortgage-backed securities. When the borrowers started defaulting on their loans, the whole bubble collapsed, bringing down institutions like Lehman Brothers. This caused a significant weakness in PC's, networks, and the wireless market. Also down was the automotive industry, with U.S. auto sales down 34% in the 4th quarter of 2009. The connector industry shrank 21.8% in 2009, but then bounced back 28.2% in 2010. During this time, the two market sectors that saw the least impact were medical and military/aerospace.

  The financial meltdown affected not only North America, but also other countries. Japan, Germany, Great Britain, Latvia, Estonia, Lithuania, Hungary, Bulgaria, Romania, Turkey, Ukraine, Pakistan, Indonesia, South Korea, Argentina, and Venezuela were also on the verge of financial crisis.

  The 2008/2009 financial meltdown also caused a spike in unemployment, which carried over into the connector industry. In a 2-year span starting in December 2007, the unemployment rate rose sharply, from about 5% to 10% in December 2009.
- Occurring in 2011 was the 8.9 magnitude earthquake and its resulting 100-foot tsunami that hit Japan, precipitating the Fukushima Nuclear Disaster, which created a major financial headache for Japan and the neighboring region. Worldwide stock markets recorded sharp losses after the incident. Many key ports in Japan were closed and the country had to import oil to replace generation capacity. It would take Japan many years to overcome the devastation to its economy.

- Not as significant, or as long-lasting as other black swan events, the 2015 Chinese Black Monday also had a significant effect on the financial market. The U.S. stock market shed more than 1,000 points in early trading, the biggest sell-off in four years. The same was felt in Europe, where the stock market saw it worst trading day since 2011. But the key change was seen in China, where Chinese stocks fell 8.5%, the biggest fall since 2007.
- COVID-19 brought another black swan event to the connector industry. Industry sales went down 3.1% in 1Q20, then plunged 17.2% in the second quarter as countries and companies worldwide were shutdown. Amazingly, the industry came back with 1.3% growth in the third quarter and 10.2% growth in the four quarter to finish the year only losing 2.2% from 2019.

Forty Years of Advancing Technology

It would be difficult to overestimate the tremendous impact that the electronic technologies of the 1980s have had on our lives today. Research investments made in that decade have enabled development of new products and services in such diverse industries as medical, communications, transportation, entertainment, military, and aerospace. In an industry where product lifecycles can be measured in months before being superseded by the next generation, the explosion of innovation has been exceptional.

Advances in the fabrication of semiconductors have been key in enabling the ability to scale from 7600 transistors per square mm to modern chips that pack several billion on a single die. Process centerlines have shrunk from 3000 nm to the most current 3nm with projections to 1nm. Only recently has Moore's Law, which defined the progression of chip integration, begun to reach its limits. Semiconductor packaging evolved to include Very Large Scale Integrated (VLSI) circuits and ushered in the decade of the microprocessor. 3D stacked die now rule high-performance processor designs. Each of these advances reduced the price and increased the yield of the chip manufacturing process, while dramatically increasing performance.

System speeds increased from megabits to the recent demonstration of 112+ Gb/s channels. Hard disk memory capacity that relies on creating ever smaller magnetic spots evolved from 3.75 Mb on multiple disks that were nearly two feet in diameter to new solid-state memory that sport capacity to 30Tb in a 3" X 4" X 0.6" profile. The 8" floppy disk introduced in the early 1970s was replaced by the 5.25" floppy disk in the 1980s with a maximum capacity of 1.2 megabits. The 3.5" disk in a rigid shell became popular in the late 1980s with a capacity of 1.44 MB. USB thumb drives with 1 Tb of capacity are now a common consumer product.

A host of technologies we take for granted today are the fruit of R&D initiated in the 1980s. A classic example is the development of wireless Wi-Fi networks. An FCC ruling issued in 1985 provided access to unlicensed wireless bands, enabling the development of a prototype wireless local area network (WLAN) in 1992. The IEEE 802.11 protocol was released in 1997 and provided the standardized framework for short range network communications. In 1999, the Wi-Fi Alliance trade association was formed to manage the trademark, encourage adoption, and verify compliance to the specification. Apple Inc. incorporated Wi-Fi in their iBook laptops in that same year, igniting Wi-Fi adoption as a mass consumer product. Wi-Fi has become a channel by which millions of global users access the internet.

A few examples of entirely new product categories enabled by advanced semiconductors and introduced in the 1980s era include:

- The Apple II (1977) and Commodore 64 (1982) were the first computers designed specifically for the consumer market.
- The IBM 5150 (1981) and Apple Macintosh (1984) sparked the revolution of personal computing.
- The Sony Walkman (1981) played audio cassette tapes and opened the world to mobile music.
- The first implantation of the Jarvik 7 artificial heart in 1982 signaled the beginning of advanced electronics in medical applications.
- The Motorola Dynatac 8000X (1983) was the first "brick phone" and demonstrated the market potential of mobile communication. It paved the way to advanced smart phones, including a series of Blackberry devices beginning in 1984.

- The format battle between VHS and Betamax was finally won by VHS in the early 1980s and created the market for consumer video recording and playback.

- The compact disc (CD) was introduced in 1982 and created a new media for prerecorded high-fidelity music, while threatening vinyl records and killing cassette tapes.

- The personal entertainment industry got a huge boost with the introduction of Nintendo‘s Game Boy in 1989.

- The first cable TV service appeared in 1948 and expanded rapidly during the 1960 to 1980 period, reaching peak subscriptions in 2000. The rise of the internet enabled streaming video and illustrated how technologies constantly evolve and may eventually be replaced. The first Blockbuster Video rental store opened in 1985, but its business model was another victim of streaming video.

- In the early 1980s the National Science Foundation funded development of a high-speed data network that was one of several predecessors of the global internet we rely on today.

- The first commercial liquid crystal display (LCD) was released in 1968, and began replacing cathode ray tube displays in the 1980s. The first color flat LCD TV was demonstrated in 1984. LCD displays appeared in watches, notebooks, instrumentation, and mobile phones in the 1990s and beyond.

- The Polaroid Sun 600 LMS instant camera (1983) confirmed the popularity of instant photography.

- Although the first commercial fax machine was introduced by Xerox in 1964, it was the early 1980s before they became common business and consumer devices.

- Dot matrix and daisy wheel printers ruled the 1980s market until replaced by inkjet and laser printers in the early 1990s.

The electronic connector industry responded to engineers’ demand for higher speed, system packaging density, and reliability with upgrades of existing products and entirely new interface families. The transition from single-ended to differential signaling resulted in the replacement of open pin field connectors with shielded differential pairs featuring tightly controlled impedance. Connectors designed for parallel signaling were replaced by smaller, consumer-friendly, high-speed serial interfaces such as USB that continue to evolve today. Compliant pin and surface mounted connectors improved performance and reduced assembly time. Printed circuit board materials, processes, and design rules were upgraded to support increased bandwidth and signal integrity.

As systems consumed more power, robust blind-mate power distribution connectors were introduced with current ratings of 200 amps per pin. Laminated molding technology allowed quick and cost-effective manufacture of custom connector configurations. At the other end of the scale, subminiature wire-to-PCB connectors now feature coaxial contacts on 0.25 mm centerlines.

The incredibly innovative decade of the 1980s set the foundations on which so many of the technologies that shape our modern world today were built upon. Bishop & Associates will be watching as the 2020s unfold to see what comes next.