AUTOMOTIVE INDUSTRY IN A STATE OF FLUX

Demand for automation solutions in the area of wire processing weakened in 2019. By contrast, solutions for new technologies in connection with trends such as autonomous driving and e-mobility remained very much in demand. Compared to previous years, however, there were significantly fewer orders for off-the-shelf products, which are dependent on the number of vehicles produced.

According to IHS Markit analyses, some 89 million cars and light commercial vehicles were manufactured worldwide in 2019. This is 5.7% or approximately 5.5 million fewer vehicles than in the previous year. Production figures were already down slightly in 2018, showing a 1.0% decrease after the 2.2% year-on-year growth seen in 2017.

The decline in production figures is largely due to developments in China, which – with 24.6 million vehicles produced – is still by far the biggest automotive market. Production figures have been trending downwards for two years, though. While 2018 saw a decline of around 4%, over 8% or 2 million fewer vehicles were manufactured in 2019. The weakening economy and the trade dispute between the US and China have had a negative impact on China's vehicle sales. IHS Markit is expecting China to stabilize at the 2019 level in 2020. It is, however, still too early to estimate the impact the coronavirus will have on the automotive industry. Fewer vehicles were produced not only in China, but in other Asian regions as well. Nonetheless, Asia still accounts for around 52% of all cars and light commercial vehicles made. This in turn reflects a decline in vehicle production on the other continents as well.

New vehicle purchases on hold

The automotive industry currently finds itself in a state of flux. Issues such as e-mobility, digitalization, and autonomous driving play a key role, necessitating very sizeable investments from automotive manufacturers. While it is exciting for motorists to follow this trend, many are left unsure as to the consequences. A great many consumers are presently uncertain about which drive technology to opt for when buying a new vehicle and whether the time is ripe to switch to a newer technology. The selection is large and automotive groups have announced a lot of new models for the years ahead. In addition to

fuel- and diesel-powered vehicles, there are alternatives such as electric, hybrid, plug-in hybrid, natural gas, and fuel cell vehicles. This uncertainty, combined with the economic downturn and various political question marks, is causing countless consumers to put new vehicle purchases on hold. That is why vehicle production volumes are down outside Asia too.

Higher production volumes from 2021 onwards

In Europe, 21.2 million cars and light commercial vehicles were produced in 2019, representing a year-on-year decline of 3.8%. In 2018, a decrease of 1.0% was recorded. IHS Markit is assuming a decline of 0.7% for 2020. In North America, IHS Markit is expecting an increase of 2.0% in 2020. This is after falls in production volumes in the preceding three years: in 2017 by 3.9%, in 2018 by 0.6%, and in 2019 by 3.8%. 16.3 million vehicles were produced in North America in 2019. South America also reported a decrease – by 2.9% to 3.3 million vehicles. With growth rates of 19.7% (2017) and 4.1% (2018), this region witnessed very strong momentum in the previous years, attributable mainly to the Brazilian automotive market. IHS Markit is projecting a return to growth for 2020 (2.3%).

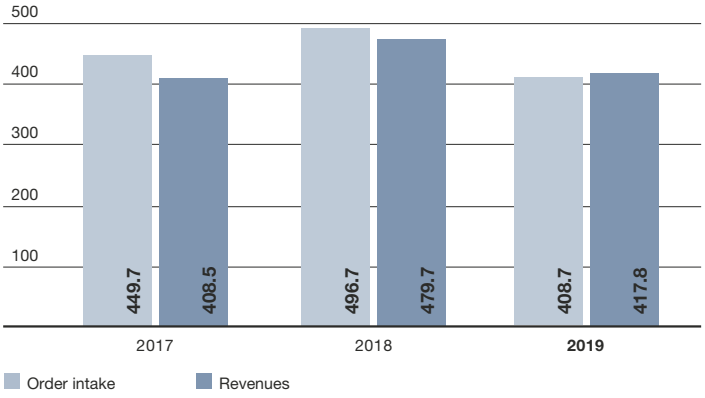
The prediction from IHS Markit for 2020 is that vehicle production will generally stagnate, with the number of cars and light commercial vehicles produced worldwide again in the vicinity of 89 million. It is forecasting a return to higher production volumes in the subsequent years.

Substantial decrease in volume-based business

Declining production figures in the automotive industry had a considerable impact on Komax's order intake and revenues in 2019. Approximately one third of Komax's revenues hinges on the number of vehicles produced. This figure fell sharply in 2019. The year-on-year decrease in production volumes meant that many customers already had a sufficient stock of wire processing machines at their plants to handle their orders. The outcome for Komax was a 17.7% reduction in order intake to CHF 408.7 million and a 12.9% slide in revenues to CHF 417.8 million.

Order intake and revenues

in CHF million



If Komax were dependent entirely on the number of vehicles produced per year, the decrease in revenues in 2019 would have been much more severe. Demand remained solid for solutions which are linked to new technologies, such as autonomous driving and e-mobility, and/or which play a role in further increasing the level of automation in wire processing. Bearing in mind that rising wage costs, a lack of staff availability, the trend towards wire miniaturization, and the need for traceability in the individual process steps for quality assurance purposes are decisive factors, customers will continue to come under pressure to increase the degree of automation at their plants further (see also "Global megatrends" beginning on page 26).

Need for automation solutions in all four market segments

Not only in the automotive industry, but also in the aerospace, data/telecom and industrial market segments, customers are striving to increase the degree of automation in wire processing. Even though these three market segments are much smaller than the automotive sector, they nonetheless made an important contribution to Komax's revenues in 2019. The slowing economy is felt in these market segments as well. Komax has, however, benefited from having the broadest portfolio, which enabled it to offer its customers a wide spectrum of automation solutions.

Marked decrease in revenues in Asia and Europe

The development of revenues varied considerably in the individual regions in 2019. While revenues were down sharply in Asia (–22.5%) and Europe (–17.5%), Komax posted solid growth in North/South America (+5.7%). The greater part of Asian revenues is generated in China. The economic slowdown, combined with the excess capacity built up in 2018, led to a distinct falloff in investments in automation solutions in China. Already facing sizeable investments in connection with new technologies in the automotive industry, customers in Europe too adopted a cautious approach. In evidence for several years already, the trend continued among wire harness manufacturers towards relocating part of their production to North Africa to offset a growing lack of personnel in Eastern Europe. In North/South America, Mexico in particular proved robust. The 2019 acquisition of Artos Engineering (see pages 6 and 7) was also a factor in the growth in revenues witnessed by Komax in this region. As a result of this development, Komax again sold more in North/South America than in Asia for the first time in two years.

This regional difference in revenue trends also led to a change in the breakdown of revenues by individual currency from 2018 to 2019. While, for example, the share of revenues in USD increased by 16.8% to 21.4%, in CNY it fell by 13.6% to 10.3%. The changes in the key currencies and their respective sensitivities are set out on page 108.

Revenues by region	**2019**	2018	+/– in %
in TCHF			
Switzerland	**8 479**	8 454	0.3
Europe	**169 991**	205 936	–17.5
Asia/Pacific	**79 767**	102 929	–22.5
North/South America	**103 907**	98 270	5.7
Africa	**55 627**	64 109	–13.2
Total	**417 771**	479 698	–12.9

A percentage breakdown of revenues by region can be found on page 91.

Market segments and service

Komax focuses on four market segments. The core business is the automotive market segment, which accounts for around 80% of revenues. Komax is continuously strengthening its presence in the other three segments – aerospace, data/telecom, and industrial – and exploiting the synergy potential with the core business. All segments benefit from the global service network of the Komax Group and from service offerings such as the Komax Academy.

Automotive
The automotive segment is by far the most important market segment for Komax. There are a number of reasons for this. In no other industry is the volume of wires to be processed so large. With an annual production output of around 90 million vehicles, each containing on average some 1 500 wires with 2 500 crimp contacts, the demand for automation solutions is enormous. This is because the number of wires per vehicle is continually rising owing to an increase in electrical functions. Although the automotive industry has no peer when it comes to the degree of standardization and automation in the production process, there is still plenty of potential for additional automation steps, as wire harnesses are still manufactured by hand to a large extent.

Aerospace
Issues such as safety, lightweight construction, and lower emissions have been at the forefront of developments in aerospace for many years. Komax can draw on the experience gained in these areas when it comes to its core business too, as these themes continue to gain in importance in the automotive industry. Komax secured expertise in the aerospace area in a targeted way through its acquisition of Laselec in 2017 (see page 34). There is very little automation of wire processing in the aerospace industry. However, as the barriers to entry in this market are very high for suppliers, it has taken several years for Komax to record its first major success. The breakthrough was made in late 2017. Following years of negotiations, Komax succeeded in winning new orders from two leading aerospace companies for several large-scale systems, which are currently being built and since 2019 delivered in phases.

Data/telecom

The transfer of large volumes of data and the permanent networking of people have become standard practice in the data/telecom market segment. The wiring used for these applications is being increasingly used in vehicles too, as cars become ever more interconnected, with comprehensive information systems that will facilitate autonomous driving in the future. Komax can therefore also use the experience gained from the data/telecom market segment in the automotive segment.

Industrial

The processing of wires for industrial applications such as control cabinets often involves working with very small batches. To ensure that automation is nevertheless a cost-efficient option for control cabinet manufacturers, Komax has developed specific machines of the Zeta type. These machines manufacture all the various wires that are needed automatically, ensuring that they are in the right sequence and of the right length. This has the effect of reducing manual labor to a minimum. Manual processes such as cutting, stripping, marking, and sleeve insertion are rendered obsolete. Automation of this kind has proven its worth in the area of wire processing in the automotive industry for many years, and is now increasingly finding its way into industrial applications.

Service

In all market segments, customers benefit from Komax's global distribution and service network. Among other things, the service offering includes the Komax Academy, which provides a modular training program, including final certification. The training modules are aligned with the various customer needs, e.g. those of service and maintenance personnel, shift managers, and quality control staff. Participants receive certification based on both theoretical and practical learning assessments – involving standardized global criteria with identical quality levels. Komax conducts On.Site training in nine countries: Brazil, China, Germany, Mexico, Romania, Switzerland, Singapore, Tunisia, and the US. The course languages are Chinese, German, English, French, Spanish, and Portuguese. Since 2018, Komax has also offered a wide spectrum of courses which are also available as On.Line training and accessible to employees 24/7.

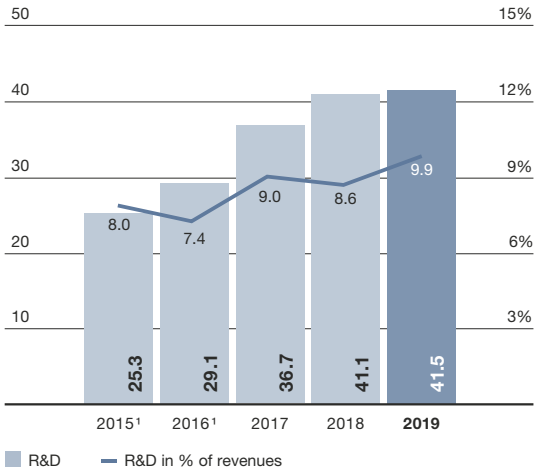
SECURING THE FUTURE WITH INNOVATION

Innovation is crucial to long-term success. This is why Komax has been channeling above-average investment into research and development for years. Global trends such as e-mobility, autonomous driving, and digitalization allow Komax to develop additional unique selling propositions and consolidate its technology leadership.

Innovation is a driver of success for Komax. In order to retain market and technology leadership over the long term and stand out with innovative solutions, the company spends 8%–9% of Group revenues on research and development (R&D) annually. Owing to the fact that Komax continued to work as intensively as ever on its numerous innovation projects in 2019 despite lower revenues, the R&D quota increased to 9.9% (2018: 8.6%). Komax invested CHF 41.5 million in the optimization of existing products and the development of new ones. This is CHF 0.4 million more than in the previous year. The figure includes expenditure on both internal development services (CHF 34.0 million) and the development services of third parties (CHF 7.5 million).

R&D expenditure

in CHF million



¹ Since the start of 2017, the consolidated financial statements have been drawn up in accordance with Swiss GAAP FER. The 2016 figures have been revised accordingly. 2015 is reported according to IFRS.

Komax reduced external development costs by CHF 1.3 million year-on-year. Higher internal expenditure, resulting in part from additional R&D investments by the companies Artos Engineering and Exmore acquired in 2019 (see pages 33 and 34), more than compensated for this reduction. Since 2015, Komax has spent CHF 173.7 million on R&D, securing a leading position from which to further drive forward the automation of wire processing and actively shape the transition underway in the automotive industry.

More than 440 staff employed in research and development, and engineering

As at 31 December 2019, the Komax Group employed a total of 241 employees (2018: 217 employees) in the research and development area. The majority of these staff (185 employees) work in Switzerland, which is why the lion's share of R&D expenditure is incurred there. In addition, Komax has development units in Belgium, China, Germany, France, Japan, Singapore, and the US. The Group's innovative strength is further bolstered by 203 engineers (2018: 173 engineers), who make an important contribution through the development of customer-specific applications. The personnel costs of these engineering employees are not contained in research and development expenditure if the staff in question have worked directly on customer projects.

The number of employees working in research and development has risen by around 45% since 2016. Since the takeovers of Laselec and Practical Solution (both in 2017) as well as of Artos Engineering and Exmore (both in 2019), Komax has had additional development teams in France, Singapore, the US, and Belgium. In 2017, Komax increased expenditure for research and development from 7%–8% to 8%–9% of Group revenues. This increase in headcount represents a form of investment in an opportunity to leverage further unique selling propositions and to secure the company's future.

Wire harness production of the future

The technological transformation of the automotive industry not only means substantial investments for automotive companies, it also poses a challenge for suppliers, since they need to develop solutions to meet new customer requirements. Issues such as e-mobility, autonomous driving, and digitalization will shape the automotive industry for years to come. Wheels are already being set in motion that will have long-term technological implications. This is why Komax is striving to play an active part in shaping this development. The acquisition of company Exmore strengthened Komax's position in the autonomous driving sector. Exmore focuses on the development of applications relating to the processing of sensor cables. Sensors are essential for making vehicles smarter. When it comes to current trends, Komax also works together with leading companies in the automotive industry.

ARENA2036

One such collaborative project is taking place at the ARENA2036 (Active Research Environment for the Next Generation of Automobiles) research campus of the University of Stuttgart. ARENA2036 brings science and business together to conduct interdisciplinary research into manufacturing the car of tomorrow. "What does the car of the future look like?" and "How do production processes need to be adapted?" are among the key questions.

The goal of a pre-competitive initiative launched in 2019 under ARENA2036 is to expedite automation in wire harness development and production from initial definition to installation in the vehicle. This goal includes increasing product quality, saving costs over the long term, and reducing CO_2 emissions, for instance, by shortening transport routes between the wire harness manufacturer and the automotive manufacturer. In order to achieve this, care must be taken from the point at which the complete wire harness is defined to ensure that the harness can be produced on an automated basis by, for example, breaking it down into smaller units. Komax is well aware of what is required to attain a higher level of automation. Feeding this awareness into ARENA2036, the company cooperates with such notable automotive manufacturers and suppliers as BMW, Daimler, Porsche, Aptiv, Dräxlmaier, Kromberg & Schubert, Nexans, and Yazaki.

Industry 4.0: interconnectedness thanks to a uniform language

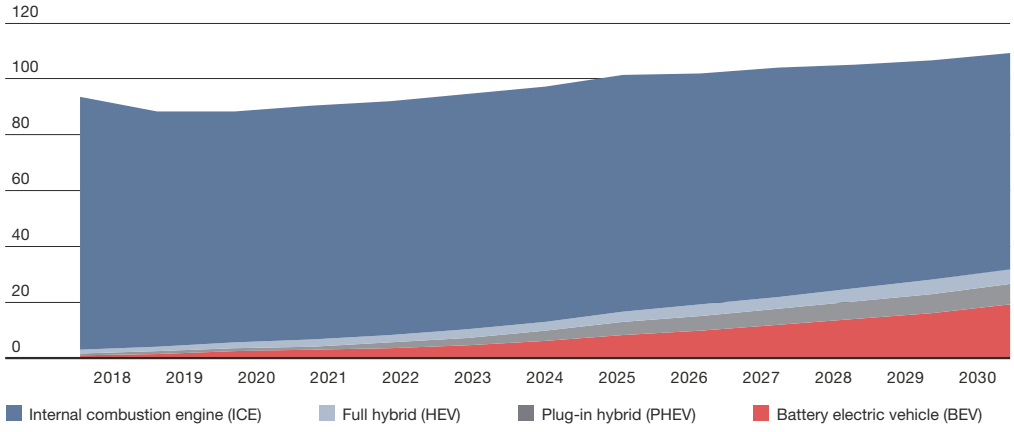
Komax also works with leading companies in the area of digitalization. It is a member of the Open Industry 4.0 Alliance, founded in 2019 by companies in the mechanical engineering, factory automation, and IT industries. The Alliance's goal is to ensure that up to 80% of machines in a smart factory can communicate with each other. This means that all the networked units in a factory's value chain – from the production systems and the intralogistics to the IoT cloud – must speak a uniform language. To this end, the Alliance does not itself develop standards, but draws up a framework which is based on existing guidelines and facilitates compatibility between the units. Komax brings to the network its core technical competencies from the mechanical engineering sector. This Alliance gives Komax an opportunity to actively play a part in shaping Industry 4.0 and so ensure the optimum interconnectedness of newly developed Komax solutions. Alliance members include such companies as Beckhoff, Endress+Hauser, Fujitsu, Kuka, Samson, and SAP.

Number of electric vehicles continually rising

Another area where Komax demonstrates its innovative strength is e-mobility. Of the 89 million vehicles produced in 2019 "only" around two million were electric vehicles, i.e. pure battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). However, with volumes rising continuously, consulting firm McKinsey is expecting this number to double to some four million electric vehicles by 2021.

Number of produced cars and light commercial vehicles by drive technology

in million



Source: McKinsey and Komax

Innovative leap forward in the processing of high-voltage cables

Komax's e-mobility center of competence in Hungary (see page 8) is already feeling an increase in demand for automation solutions for the processing of orange high-voltage cables. Up until now, production has been largely by hand, entailing complex quality controls and costly remachining. In order to ensure the efficient and economic processing of the growing volume of shielded and unshielded high-voltage cables, it is becoming increasingly crucial to automate processes. In 2018, Komax already boasted a portfolio of solutions covering the entire value chain from processing high-voltage cables to testing harnesses. Plug manufacturing called for multiple machines from the Lambda 2 series. These are semi-automatic, with every machine needing an operator. Optimum productivity therefore requires a team of several people to process the high-voltage cables in parallel on multiple machines.

Komax took the next innovative step forward in 2019 and presented the Lambda 440, the first machine for the automated production of high-voltage cables. The Lambda 440 is made up of process modules from the Lambda 2 series. The system automatically manufactures the cable in a straight-through process from preparation stage to housing assembly. The precise sequence depends on the types of plug to be processed and is always developed in close collaboration with customers.

The Lambda 440 automates the processing of high-voltage cables.

Komax does more than just offer solutions for processing individual high-voltage cables. Its portfolio also contains the Omega 750 MEB, a machine capable of automatically producing complete wire harnesses for electric vehicles. Under a joint project with Leoni, Komax adapted its Omega 740 fully automatic block loader machine to manufacture high-voltage wire harnesses. The aim of the venture was to manufacture the wire harness for the auxiliary unit for the new modular electric drive matrix (MEB) from Volkswagen in a process as fully automated as possible. Being used in the VW ID.3 for the first time, this wire harness connects the battery with various systems such as air conditioning, battery heat management or the direct current converter. In 2019, Leoni used the Omega 750 MEB to produce countless high-voltage wire harnesses for the ID.3, which was unveiled in the year under review.

SMART FACTORY by KOMAX

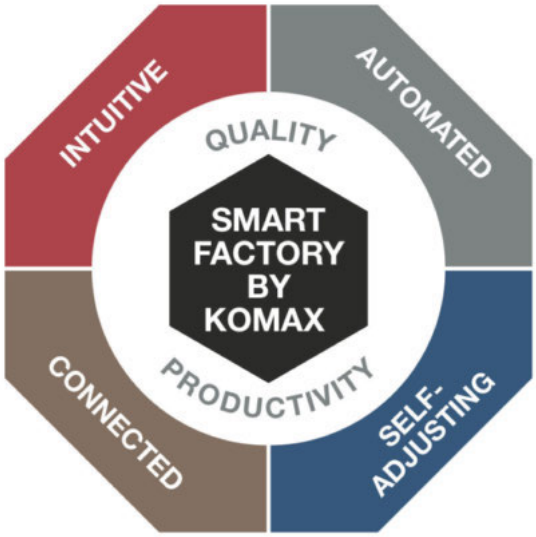
For decades, Komax has been renowned for its innovative products and leading market position. But what does Komax want to achieve and accomplish with its work? And what contribution is it making to society? Komax's purpose can be summarized in just a few words:

> As a driver of innovation and market leader in automated wire processing, we develop and produce intelligent, reliable, and optimally cost-effective wiring solutions for smart mobility and smart city applications. We work closely with our customers to make life simpler, more convenient, and safer.

Komax understands smart mobility to mean today's increasingly diverse range of mobility options, which are used in very different ways. Many of these means of transport – from e-bikes to electric cars and trains – are increasingly powered by electricity. Where electricity is used there are wires, and where there are wires there are fields of application for Komax. What's more, the optimal usage of these mobility options is supported by smart city solutions, be they traffic management systems or intelligent power usage, distribution or storage systems. These solutions also need wires, for transmitting either power or data.

The challenge: sustained high quality at low costs

The megatrends of smart mobility and smart city are increasingly becoming part of everyday life. And a large number of products are becoming increasingly more intelligent and power-hungry. Komax's customers are involved in these trends and supply key components, so they have to overcome huge challenges: despite the increasing complexity, they have to deliver sustained high quality while keeping costs as low as possible. To make this possible, Komax provides its customers with SMART FACTORY by KOMAX, which encompasses products and solutions that substantially reduce quality costs and significantly increase wire processing productivity. In specific terms, this means demonstrably fewer faults and greater efficiency, even in complex production tasks. In this way, Komax – together with its customers – is providing consumers with intelligent products that are not only continuously improving, but also operate reliably and are affordable.



SMART FACTORY by KOMAX is characterized by four attributes: it is intuitive to use, it automates production as well as material and dataflows, it is connected within a network, and it self-regulates its production processes.

What benefits does SMART FACTORY by KOMAX have to offer?

If operating Komax machinery is intuitive, human error can be largely eliminated because the system specifies the settings and the correct operating procedure. This minimizes not only the operator's influence and scope for decision-making, but also the need for customer training. The products are also automated to such an extent that they can instigate and complete increasing numbers of tasks themselves. Once they are started up, significantly fewer human-led intermediate steps are needed. This applies not only to material flows but also data exchanges.

Smart factory solutions are integrated into a network, with all the stages of production being linked to each other. Connectivity standards and the use of cloud technology enable full transparency and make it possible to achieve fact-based increases in productivity and quality. Komax is working towards enabling its systems to adjust themselves, thereby autonomously controlling the production process. This could be the case for simple process and monitoring tasks, but may also extend as far as optimizing entire production processes. And this could even conceivably take place across different plants. Customers would be able to reduce bottlenecks, downtimes, scrap, and rejects. At the same time, smart factory solutions can systematically track and register any number of production stages so they can be traced back if problems occur with deliveries.

Smart factory solutions 2019

Komax has been developing intelligent products for years, well before the existence of terms such as Industry 4.0, Smart Factory, and Industry 2025. SMART FACTORY by KOMAX is therefore the continuation of a long tradition. It is helping Komax to continue fulfilling its role as a pioneer and technology leader, thereby enabling its customers to benefit from an additional competitive edge. In 2019, Komax launched several smart factory solutions onto the market. One of these is the Q1250 quality tool – the digital eye. With its intelligent image analysis, the Q1250 module monitors crimp quality completely automatically (intuitive and automated), thereby eliminating the need for laborious visual checks by the machine operator. Other important new elements of the smart factory include the Komax Connect range of products (intuitive and connected) and the Sigma 688 ST. These products feature the maximum degree of automation for manufacturing twisted-pair wires (automated). These three smart factory solutions are described in more detail on the next two pages.

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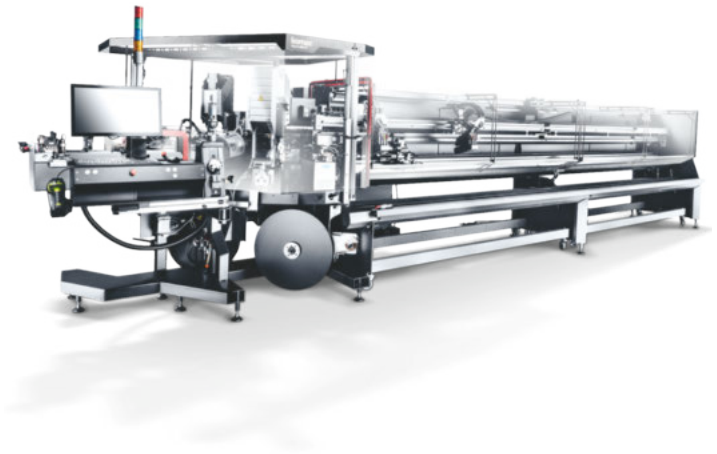
New products

Thanks to its targeted investment in research and development, Komax succeeds in bringing a variety of new products and product enhancements to market every year. 2019 was no different in this regard. Komax was able to demonstrate its technology leadership impressively, setting new standards with numerous market launches. We provide a selection of these new products below.



Sigma 688 ST
The Sigma 688 ST is the first automated solution to deliver fully automatic wire processing with twisting and simultaneous spot taping of both open wire ends. For UTP wires (unshielded twisted pairs) for applications with high data transfer speeds, vehicle manufacturers (OEMs) demand the spot taping of open wire ends for quality reasons. This prevents the unintended opening of the ends in downstream logistics steps or during manual insertion processes. Marking a first, the Sigma 688 ST provides a fully automatic solution that meets these OEM quality requirements. The automated overall process allows Komax customers to improve performance, productivity, and cost effectiveness. At the same time, the integrated spot taping function simplifies logistics and guarantees the quality of downstream work processes.

Komax Connect
The modular Komax Connect service transmits production data from Komax machines to the Komax Cloud, where they are processed in real time and presented in a clearly structured visual format. Customers get a snapshot of the productivity of their machines and can react immediately if necessary, so preventing a machine that has been less than optimally set up from producing a lot of expensive scrap. A further advantage of the cloud solution becomes relevant when problems occur: the customer loses no time because the Komax service technicians can analyze the production data of the machine in question online and propose solutions. Komax Connect is particularly attractive for customers manufacturing wires using Komax machines at different plants. This is because those in charge of the machines have global access 24/7 and can compare and systematically optimize productivity, efficiency, and quality between the different sites.

Gamma 450

The compact, fully automatic Gamma 450 processes crimps and seals on both sides and takes up minimum space. It guarantees high production availability and traceable quality. The wire processing machine has all the necessary key functions and can also be extended for specific purposes using an extensive range of options. High-performance modules ensure seamless quality monitoring. Optimized quick-change systems reduce setup and changeover times. Handling is intuitive and ergonomic as well as easy and error-free thanks to the Komax HMI operating software.

Komax Smart Stock

Komax Smart Stock is a delivery program for spare and wear parts that follows the consignment principle. The key component is a vending machine set up at the customer's facilities and managed by Komax. The vending machine is individually configured and stocked with spare and wear parts required to maintain and repair Komax machines installed on-site. As it is connected to the Komax Direct e-commerce platform, Komax is always aware of the current stock levels and will replace the relevant parts in good time. This means considerably shorter machine downtimes because spare parts are immediately available. Parts taken from the vending machine are logged in real time and subsequently invoiced by Komax.

Q1250

Used on Alpha series machines, the Q1250 module automates the optical inspection of the entire crimping process, largely eliminating the need for visual checking by the operator. Since the intelligent system is far superior to the human eye in terms of precision and speed, the quality of the monitoring of the crimping process is significantly higher. This also lightens the operator's workload and frees up time for other tasks. Prior to crimping, the fully automatic Q1250 checks each wire end for correct seal quality and seal insertion. After crimping it inspects the quality of the crimps. The camera system provides superior-quality traceable images and process data. A must, for instance, when it comes to wiring for autonomous driving.