

CONNECT'20

The customer magazine for consistent process optimization in industrial production



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EDITORIAL

Here at Kistler, we make use of our know-how to support large numbers of OEMs and component manufacturers in the e-mobility sector. Our solutions and systems are deployed throughout the entire value chain: from production and quality inspection of individual components through to complete test stand systems and production lines for selected applications.

Read our Focus interview with Swiss e-mobility pioneer Designwerk to learn how electric vehicles deliver major benefits for the environment. Futuricum, the electric waste collection vehicle, is far superior to its diesel-powered counterparts – especially in inner city stop-and-go traffic: it is quieter, its consumption is lower and it produces fewer emissions.

Electric fuses play a key part in battery technology. Requirements in this segment are particularly high, so electronics manufacturer Schurter relies on our solutions for force-displacement monitoring. Systems from Kistler are integrated directly into the fully automated production plant for these safety-critical parts. The benefits? Reliable quality inspection, with fast cycle times as well as automatic sorting.

Our solutions are also making their contribution to green energy generation: for instance, they ensure that threaded joints in wind turbines are reliable. To meet the demanding quality requirements for this technology, REYHER of Hamburg deploys our ANALYSE system – the efficient way to carry out standard-compliant friction coefficient tests on large fasteners.

As usual, this issue also features our new products and more Success Stories from all over the world. I hope you will be inspired as you read about the vast range of potential applications for measurement technology, and the diverse opportunities for optimizing production that it opens up!

F.P. Kirgis

Frank Peter Kirgis, Head of Division IPC



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Our integrated force-displacement monitoring guarantees maximum quality in Schurter's production.



Ahead of the field – thanks to intelligent injection molding

The latest version of ComoNeo has been developed to provide a mature, versatile system that helps plastics processors to optimize their injection molding operations. Thanks to an extensive range of assistance systems – even including model-based artificial intelligence – users get the support they need to boost productivity and cut quality costs.

Injection molders are confronted with increasing requirements for part quality and complexity – but at the same time, they have to cope with shrinking margins and insistent demands for resource efficiency. To maintain their existing levels of cost-efficient production, many companies are opting for our ComoNeo process monitoring system: as well as helping them to avoid quality costs, this solution from Kistler enables them to boost productivity and achieve zero-defect production.

Cavity pressure measurement – the key to sustainable optimization

ComoNeo uses cavity pressure as the all-important variable for reliable statements about the quality of manufactured parts. A variety of functions and assistance systems take account of special requirements in each application: examples include multiple cavities, processing of composites using resin transfer molding (RTM), and hot runner balancing.

Users can take advantage of these functions to optimize their injection molding processes:

- **ComoNeoGUARD** helps users to define monitoring windows that allow even more reliable assessment of bad parts.
- **ComoNeoMERGE** ensures control of the more complex processing requirements when up to four components with different mold technologies are in use.
- **ComoNeoMULTIFLOW** allows hot runner balancing through individual control of the nozzle temperature for molds with multiple cavities.
- **ComoNeoSWITCH** ensures ideal timing for the automated switchover from the injection phase to the holding pressure phase.
- **ComoNeoCOMPOSITE** optimizes the processing of long-fiber composites with the RTM method – assisted by special RTM sensors from Kistler.

- **ComoNeoRECOVER** makes it possible to reproduce a proven injection molding process on a different machine – with step-by-step support from the integrated Assistant.
- **ComoNeoPREDICT** allows model-based prediction of the desired part quality based on the cavity pressure and temperature profiles.

ComoNeo's seven modular functions can be tailored to each individual plant and application for transparent, holistic optimization of processes and quality – and the same results are achieved when operating multiple interlinked machines and plants.

Online quality prediction with maximum accuracy

ComoNeo now benefits from the strength of artificial intelligence – thanks to our ComoNeoPREDICT function. Quality monitoring with process models represents the highest level of optimization that is currently achievable, because this approach correlates the key process values with the desired characteristics for the part. The models that provide the basis are generated ahead of production with the help of a

statistical test plan (Design of Experiments or DoE); thanks to supervised machine learning, they quickly attain a very high degree of accuracy that permits predictions about the characteristics of molded parts.

Networked injection molding production in the Smart Factory

As well as real-time monitoring of the injection molding process, our smart ComoNeo process monitoring system performs many other functions that range from analysis, optimization, documentation and control of injection molding to automatic identification and separation of defective parts. ComoNeo's intelligent assistance systems deliver another key benefit by creating the conditions for Smart Factories – networked, transparent and therefore resource-efficient. With ComoNeoRECOVER, for instance, tried-and-tested settings can be transferred from one machine to another. ComoNeoSWITCH handles fully automated hot runner switchover for multi-cavity molds, as required. ■

New White Paper on optimizing injection molding production

Our new White Paper, titled "Using cavity pressure measurement to optimize processes and quality in injection molding production," identifies the potential of cavity pressure-based systems in this context. These systems help users to optimize process efficiency and cycle times – and also to cut quality costs. The key: zero-defect production, which can be achieved by separating out scrap and gradually improving the process on the basis of cavity pressure.

info.kistler.com/cavity-pressure-whitepaper-download





Sensor technology installed in the mold is the basis for capturing all material-related and part-specific attributes – adding up to the part's fingerprint.

SARTORIUS

Understand more – achieve more

Sartorius deploys our ComoNeo process monitoring and control system for accurate quality monitoring of plastic parts for pipette systems at its facility in Helsinki. The system's ComoNeoPREDICT function delivers precise forecasts of part quality, as well as optimizing the injection molding process with the help of model-based intelligence.

Medical devices have to meet extremely high manufacturing requirements: processes must not only be very accurate but also repeatable and stable, so that production results can be verified and undesirable influences can be excluded. Sartorius is a German corporation with a lengthy tradition of leadership in laboratory and pharmaceutical products. Founded in 1870, this exchange-listed enterprise operates across the globe from its headquarters in Göttingen. Sartorius supplies laboratories and research facilities

with specialized equipment such as high-precision balances, filtration units and centrifuges. The company's Liquid Handling segment is located in the far north of Europe. Its mechanical and electronic pipette systems are developed in Helsinki, where around six million individual parts are also manufactured for them every year. Sartorius has another Finnish facility where it produces vast numbers of pipette tips – as many as 600 million units or more per year.

Accurate predictions of part quality while the process is still live

Tomi Villilä, Development Manager Injection Molding at Sartorius in Helsinki, shoulders responsibility for the quality of injection molding processes for up to 50 individual parts that make up one pipette. He and his six-strong team are keen to keep up with the latest technological advances, so they have opted for our ComoNeo process monitoring system with the ComoNeoPREDICT function. Online quality prediction allows

forecasting of part quality during the injection molding process, based on numerous learned process parameters and related part-specific quality criteria. The users at Sartorius are convinced by ComoNeo, as Villilä explains: "We started out with a fairly non-critical part – a fixture – so we could get to understand the system, practice using it and improve the process. But after just a short time, the results have been so good that we're planning to deploy six to eight additional ComoNeo units for critical components as our next step."

Intelligent optimization with no need for time-consuming quality measurements

ComoNeoPREDICT is especially suitable for processes where the quality requirements are very demanding. The first step is to use the integrated software to generate a test plan that includes all the parameters needed to determine the process. Which dimensions are to be achieved? How must the machine be set to achieve them? Might it be possible to reduce the cycle time? For convenience, the test plan can be generated on a PC and implemented on ComoNeo for real testing at a later stage.

Our sensor technology is installed in the mold to deliver data for transparent process management of all material-related and part-specific attributes – the part's fingerprint, so to speak. Based on the cavity pressure and measured characteristics, our system generates a prediction of part quality while the injection molding process is still in progress. The benefit: intelligent optimization, with no need for time-consuming quality measurements.

Fast setup and intuitive operation

It only took Sartorius two or three days' work to model the test plan for the fixture, and the results were highly accurate. Because such a large number of machine parameters are considered, users gain a clear understanding of the limits of the injection molding process for the desired

part characteristics – so intelligent monitoring becomes possible. Exactly what is happening in the injection mold? And how is the whole process developing? ComoNeoPREDICT quickly provides the answers to these questions. Villilä notes: "Even colleagues who do not have lengthy experience can achieve excellent results in next to no time!"

Based on the prediction model that is generated, ComoNeo can significantly reduce the percentage of bad parts; they can also be separated out automatically if desired. As usual with Kistler technology, simple operation and easy integration are the keynotes: "This system is really simple to handle – almost like a smartphone. You only need five or ten minutes to understand how it works," Villilä points out. "And setting up a test plan poses no problems thanks to the software that comes with the product. Users don't have to be mathematicians to understand the whole system – which is not the case with other programs. Once you've generated the test plan, you can simply upload it into ComoNeo, and then you get accurate feedback for process optimization – even in the test phase."

"This system is really simple to handle – almost like a smartphone. You only need five or ten minutes to understand how it works."

Tomi Villilä, Development Manager Injection Molding at Sartorius

Villilä already has ambitious plans for the future: "I'm certain that the benefits we can achieve with ComoNeo will also be interesting to other Sartorius units – especially because this system is so flexible. I already gave a presentation to our colleagues about our positive experiences with ComoNeo at the company's gathering of experts in London. If it were up to me, all Sartorius technical parts that require high precision would be produced with the Kistler system in the future." ■



Mechanical pipette systems made by Sartorius



Experts in conversation:
Adrian Melliger, CEO of Designwerk,
and Frank Peter Kirgis,
Head of Division IPC at Kistler

FOCUS

POWERING AHEAD: A SWISS E-MOBILITY PIONEER

Designwerk is acknowledged as a front-runner in the electromobility segment. At its base in Winterthur, Switzerland, the company's initial focus was on mobile charging devices and contract development of small special-purpose vehicles such as a mail delivery vehicle for the Swiss Post. Nowadays, Designwerk manufactures products based on its own ideas such as the Futuricum, an electric truck for waste collection in urban areas.

In this conversation with Frank Peter Kirgis, Head of Kistler's Industrial Process Control (IPC) Division, Adrian Melliger explains how Designwerk accomplished the leap from contract developer to manufacturer. The CEO outlines the technical and financial advantages of electrified drives over their thermal counterparts. He also explains the obstacles that still have to be overcome.

Frank Peter Kirgis: Designwerk is acknowledged as a pioneer in the electromobility segment. What was the original idea that led to the founding of your company in 2007?

Adrian Melliger: Frank Loacker and Tobias Wülser, the two founders of our company, took part in the Zero Emissions Race back then. They completed their 80-day journey around the world in their electrically powered cabin motorcycle – and they actually won the race. As they circled the globe, the two pioneers realized that electromobility harbors many development opportunities. The world has more plug sockets than gas stations, for instance, but not all of them are equipped with charging devices. Designwerk responded to this fact by developing mobile fast chargers, partly to meet its own requirements. These devices are now marketed successfully in China and Europe.

At the outset, we were purely an engineering practice that worked on projects such as the four-wheel DXP mail delivery vehicle for the Swiss Post, and also the Microlino – a new, fully electric version of the BMW Isetta. Inspired by these initial successes, the two founders of our company decided to produce their own designs and ideas themselves. As a pilot project, we opted to develop and produce an electric truck to collect waste. The conventional diesel-powered trucks used for this purpose are a major source of environmental pollution: they drive around inner cities in stop-and-go mode,

using anything from 80 to 120 liters of diesel, so they produce very high CO₂ emissions. No other manufacturer was offering a solution to this problem, so we saw that there was an acute need to take action here. That prompted us to apply to the Swiss Federal Office of Energy (SFOE) for subsidies – which were granted. What's more, the SFOE specialists recognized how important our project was, and they gave us support with implementing it. That resulted in the production of the first four vehicles bearing the Futuricum name, two and a half years ago.

The energy density that electric trucks need shouldn't be underestimated. How did you approach that issue?

At the moment, our standard battery packs weigh about 2.2 tonnes. But that doesn't have a negative impact on the payload, because we also save some weight: a conventional diesel engine with all the auxiliary equipment and the complete emission control system is much heavier than an electric drive.

"A conventional diesel engine with all the auxiliary equipment and the complete emission control system is much heavier than an electric drive. If you take account of all those components, we save about 1.5 tonnes."

Adrian Melliger, CEO of Designwerk

If you take account of all those components, we save about 1.5 tonnes. Another point is that in most European countries, the permitted payload for electric trucks is one tonne more. So in that respect, we actually end up the same or even better.

A garbage vehicle is constantly driving in stop-and-go mode. So how do you calculate the range in that case?

The calculation depends to a great extent on the application area, of course. There are critical differences between a garbage truck and a logistics vehicle. Both of them drive through inner cities in stop-and-go mode, but the garbage truck also has an auxiliary drive for the compression process – and that consumes a lot of energy as well. This is why we differentiate between two or three main application areas for which we have calculation models: one is collection mode, which includes vehicles like the garbage truck. Then there is the logistics segment, where we can make a relatively reliable calculation of the energy consumption for 100 kilometers. There's also what we call super-local transport – concrete mixers are an example of

that category. On the one hand, these vehicles have a heavy drum – but on the other hand, they cover a certain number of kilometers at a stretch.

Are batteries the drive concept of the future? Or do you see any alternatives that we need to focus on?

That's a debate that's conducted almost as if it were a religious war! We don't take such a narrow view, because we believe that batteries are the most efficient solution at present – but they aren't suitable for everything. It hasn't yet been possible to use batteries for long-haul transport, to take one example. Nevertheless, we firmly believe that batteries have a future in local transportation. I think a lot will depend on how battery technology develops as time goes on. Right now, many people are talking about new cell chemistries – their energy

density is supposed to be potentially quite a lot higher. However, we're not a company that focuses everything on this single drive concept. It always depends on the application. Hydrogen offers impressive energy density, so it certainly has its advantages. But purely in terms of energy efficiency, a hydrogen drive isn't very much better than a modern diesel drive.

“When electric vehicles are used purely in drive mode, they are five times more efficient than thermally powered vehicles. But if we then include gray energy in the calculation, the result is still that efficiency is four times higher.”

Adrian Melliger, CEO of Designwerk



Adrian Melliger of Designwerk shows Frank Peter Kirgis (left) the cockpit of the Futuricum electric utility vehicle.



Designwerk points the way to the future with Futuricum, the 100% electrically powered municipal vehicle.

What's the picture if we compare the energy balance for diesel-powered and battery-driven trucks?

There isn't a really clear answer to that question. Many studies claim that energy efficiency is not achieved until a vehicle has clocked up at least 100,000 kilometers. For sure, we have to include gray energy in our calculations. We know very precisely that when electric vehicles are used purely in drive mode, they are five times more efficient than thermally powered vehicles. But if we then include gray energy in the calculation on both sides – diesel has to be pumped as well – the result is still that efficiency is significantly higher.

How do you intend to grow your market share, and how do you view the future generally in your market?

There's a very simple equation at present: if you can deliver, you're the king. Right now, we're more or less the only provider that can deliver reliably – and most importantly, we can deliver on time: in

other words, we can do exactly what was agreed with the customer in the contract. That's our biggest USP at the moment. But we can do more than just deliver: we also have access to enormous know-how in our company, covering areas such as charging, battery and drive technology. That means we can respond very rapidly to customers' requirements. One of our key strengths is the development of customized special-purpose vehicles and auxiliary drives. We've also developed our own battery system. We get the cells from BMW, but we ourselves developed and patented the entire battery system – including thermal management and the battery management system in particular. That's certainly a key factor that differentiates us from other providers. And in the future, we shall continue to concentrate on our current specialty: manufacturing special-purpose vehicles.

How do you view global competition – between Europe and China, for instance? What must Europe do to hold its own in the long term?

The only possible goal at the moment is to close the gap. But in my opinion, Europe has already accomplished this step: just think of the investments made by the major manufacturers, or the enormous subsidies that are available in certain countries. However, I also believe that Europe starts out from a different position. The Chinese urgently need to reduce environmental pollution in their inner cities; the air quality there is so poor that people are falling sick. Compare that to the European approach, which is quite different: it's more global, with the aim of really establishing something sustainable that isn't just based on the inner cities. Europe is doing what needs to be done on a defensive footing: we're trying to catch up with relatively large investments and attractive subsidies so that we can keep the gap within fairly manageable proportions. ■

REYHER

A diverse range of fasteners – reliably under control

REYHER aims to maintain its long tradition of professionalism in supplying and advising customers across diverse sectors of industry – and to achieve its goal, this Hamburg-based company puts its trust in one of our ANALYSE systems. One particular benefit of the system: it can perform standard-compliant friction coefficient tests on fasteners of sizes up to M48, such as those used in wind turbines.

If fasteners are what you need, you go to REYHER. For over 70 years, this company has offered fasteners and fixing elements for threaded joints of all types from its base in Hamburg, northern Germany. As a wholesaler, REYHER supplies over 11,000 customers across the globe from a range comprising 130,000 different articles. But that's not all: REYHER advises customers on selecting coatings and on how to implement the

most suitable threaded joint; aftercare and troubleshooting also feature in the company's portfolio.

Sound advice depends on analysis of friction coefficients

Frank Poggensee has been with REYHER for 14 years. As Head of Quality Technology, it is his responsibility to make sure that the characteristics of the company's fasteners are correct. "Wind power has

become an increasingly important factor for REYHER in recent years," he explains. Up to 11 tonnes of fasteners can be built into one single wind turbine plant. "This is an exceptionally demanding environment. Of course, safety is a priority in wind turbines – there's no telling what would happen if fasteners were to fail in one of these plants," Poggensee continues.



Our ANALYSE system ensures reliable design and accurate testing of threaded joints – no matter how small or large they are.

So that it can reliably meet its customers' growing quality requirements, REYHER has been using one of our ANALYSE systems since early 2018. Friction coefficient tests can now be carried out far more efficiently in house. "In the past, all we had was a mobile two-channel test system. We were gradually reaching the limits in terms of capacity as well as quality," Poggensee recalls. "Thanks to the ANALYSE system from Kistler, we have improved our ability to meet our customers' requirements, so we can guarantee a higher level of quality." For example, REYHER can now carry out in-house testing to ISO 16047 on bolts for the wind energy sector.

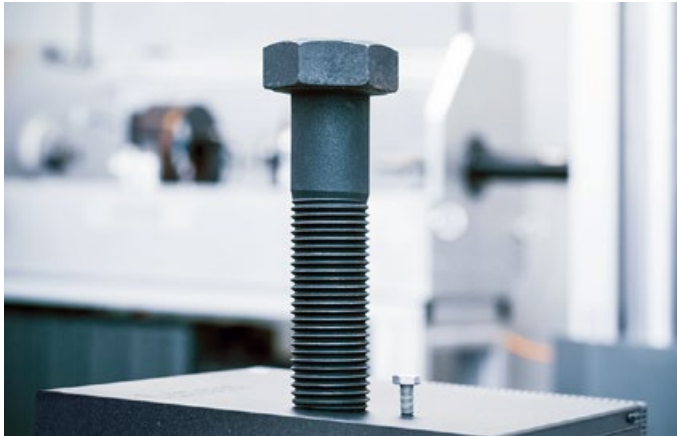
An investment that pays dividends

The result: important customers rely on REYHER to a very large extent. "In the past, these fasteners had to be sent out of house for testing. And that was how we first came into contact with Kistler," Poggensee remembers. "A cost-effectiveness analysis showed that an investment in a Kistler ANALYSE system would pay off in the long term, given the continuous increase in scope and requirements."

"In the past, fasteners had to be sent out of house for testing. A cost-effectiveness analysis showed that an investment in an ANALYSE system from Kistler would pay off in the long term."

Frank Poggensee, Head of Quality Technology at REYHER

Olaf Schuhknecht, Sales Engineer with Kistler, gives this explanation of the structure and characteristics of the new solution: "Every ANALYSE system is a three-channel measuring instrument that precisely determines the tightening torque, thread torque and preloading force for a threaded joint. Each system is individually designed to meet the



Tested quality from REYHER: class M48 bolts of the type often used in wind turbines

customer's requirements. For instance, we can align the test stand either horizontally or vertically, so either very small or very large fasteners can be tested. This approach creates a customized solution precisely tailored to the specific requirements." Performance scope is expanded with add-on modules such as ultrasonic measurement or vibration units to allow even more accurate analyses and simulations of real loads.

Higher quality despite greater complexity

Our ANALYSE system in use at REYHER offers maximum torque of 8,000 Nm. Screws, bolts and nuts from M5 to M48 can be tested thanks to the extensive range of sensors deployed for torque/rotation angle, preloading force and thread torque. "Our torque/rotation angle sensors measure directly on the test object, so they are not subject to any falsification due to drive shaft torsion," Schuhknecht adds.

How satisfied is REYHER with the test stand? Poggensee has no doubts: "This system fully meets our expectations in every respect, and it helps us to reliably meet our customers' quality requirements – which are increasing all the

time. We looked at several offers, but many factors persuaded us to opt for Kistler: the range of sizes we needed, their good reputation with suppliers, and the availability of service." ■

Generating power from wind energy

Wind energy is considered one of the most promising renewable energy sources thanks to its worldwide availability, low costs and advanced technological development. It now ranks as one of the mainstream technologies in electricity production, playing a key part in energy policies and strategies in a growing number of countries around the world – thanks to the technological progress that has been achieved, and also because wind energy is highly competitive in many global markets.

Connectivity is the key

All the steps in the process need to be adapted in real time in order to boost production efficiency. To achieve this, all components involved in production must be networked with one another. This is why process monitoring systems from Kistler are increasingly equipped with OPC UA – the standard that guarantees seamless communication between all the components.

Industry 4.0 is one of the key megatrends of our era. The objective: to interlink industrial production with the help of cutting-edge information and communication technology. Intelligent, digitally networked systems provide the technical basis to realize this ambition. They should make it possible to optimize an entire value chain, rather than just one production step as at present.

Networking all the components involved in the production process

When all the components involved in the production process are networked, all relevant data can be exchanged. This leads to a growing number of network

participants and a steady expansion of data volumes. At the same time, the information that has to be transmitted becomes increasingly complex because the production processes are monitored continuously. And in parallel, the processes should continue to be efficient.

Communication between all the components presents yet another challenge. Unless this communication is uniform, the data has to be exchanged via interfaces that users themselves must define and program. All of this adds up to high consumption of resources during commissioning and live production. The administrative effort during operation is also huge.

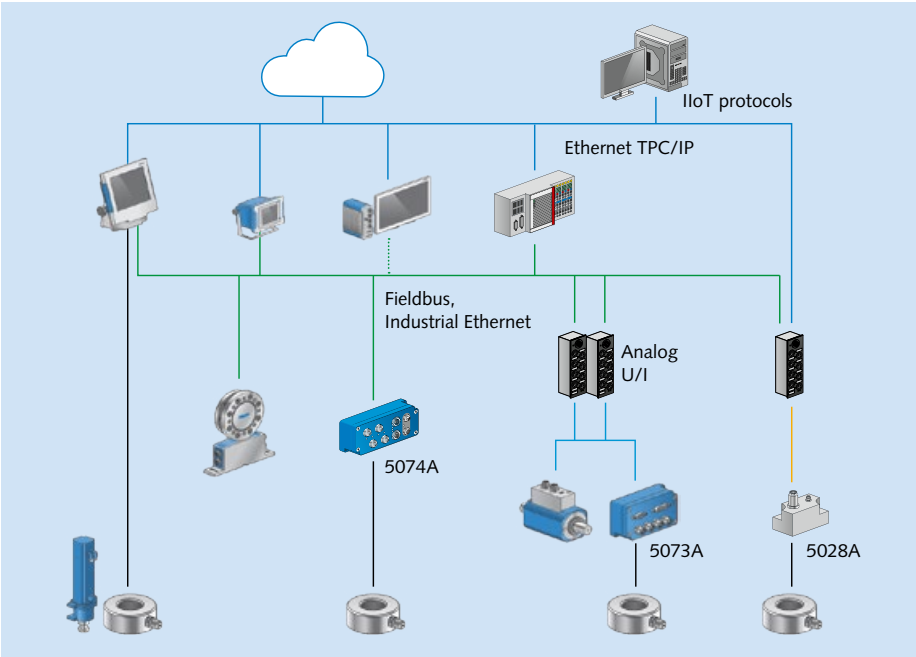
“After each production cycle, maXYmos and ComoNeo make relevant data available in a dedicated OPC UA event. This ensures data consistency – in other words, it guarantees that data belongs to the respective production cycle.”

Torge Bonert, System Architect at Kistler

Uniform communication with OPC UA

The Open Platform Communications Unified Architecture (or OPC UA) standard was adopted in 2006 to overcome these challenges. Based on intelligent networking of all the components involved in the production process, OPC UA allows a standardized interface and uniform communication. This means that complex information content can be uniformly visualized and transported. Because the process descriptions apply to all manufacturers, it is easy to integrate OPC UA into the production process.

With OPC UA, the individual components communicate with participants not only on the same level, but also on lower and higher levels. This allows information to flow from the process level to the corporate level, so it is inputted directly into ERP systems. These control and monitoring functions make OPC UA the central interface for measuring instruments. This is why many Kistler products – including the ComoNeo process monitoring system and the maXYmos quality monitoring system – are already compatible with OPC UA. ■



Consistent networking from sensor and field levels to the cloud: Kistler is committed to digital connectivity.

A successful merger

Vester Elektronik GmbH, based in Straubenhardt (Germany), joined the Kistler Group in 2017. Since then, the two companies have grown closer together and the integration process has been completed. To reflect these changes, Vester has now been renamed as Kistler Straubenhardt GmbH.



Vester Elektronik GmbH, based at Straubenhardt in Germany, can look back on a 50-year tradition of innovative measurement technology, all-round technical expertise, professional advisory support and many exciting projects. Vester's portfolio includes complete automatic testing and sorting systems for quality assurance, assisted by image processing software. The company became a member of the Kistler Group in 2017. This merger yields advantages for both companies – but the main beneficiaries are our customers. They now have one single source for industrial process monitoring solutions that range from optical image processing to the complete chain of sensors and measuring equipment.

In the meantime, the two companies have grown closer together and the integration process has been completed. For this reason, we have now renamed Vester Elektronik GmbH: on 1 January 2020, the company began trading as Kistler Straubenhardt GmbH – a name that will also signal its membership of the Kistler Group from now on. This step involves no significant changes for our customers: they will continue to benefit from products of proven quality and solutions that meet industry's demanding requirements.

The automatic testing and sorting systems are the ideal complement to Kistler's product portfolio, and they deliver added value through process and quality monitoring within the industrial value chain. ■

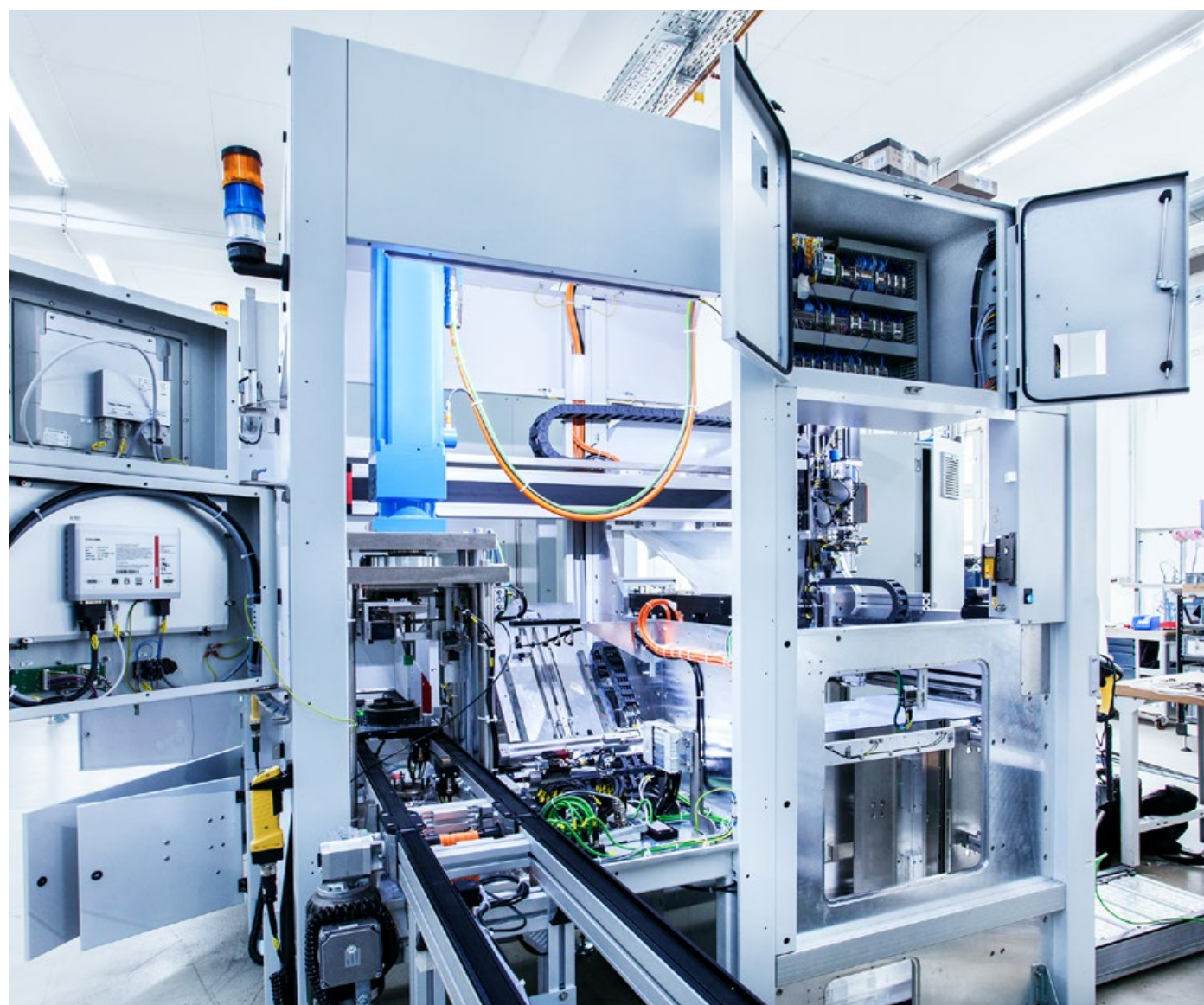
“This new technology is the ideal complement to Kistler's established range of measurement technology. It allows us to develop new applications so we can do even more to meet the expectations of both new and existing customers.”

Rolf Sonderegger, CEO of the Kistler Group

JONAS & REDMANN

Integrated process monitoring in the medtech sector

Special-purpose machinery manufacturer Jonas & Redmann puts its trust in our integrated process monitoring technology to guarantee the functionality of mixing nozzles for dental applications. A friction coefficient test – performed with the help of a torque sensor – ensures automatic separation of good and bad parts.



Automated separation of good and bad parts in a matter of seconds: Jonas & Redmann's plant features integrated process monitoring by Kistler.

Mechanical engineering specialist Jonas & Redmann was founded in Berlin almost 30 years ago. This company has made its name with high-caliber machinery and systems for assembly and process automation. It now has a workforce of 500 spread across five sites on three continents. The Berlin-based engineers offer an extensive portfolio of innovative automation solutions, ranging from integrated standalone cells through to highly automated production lines. As well as factory automation, the company has a special focus on sunrise industries such as medical technology, photovoltaics and battery production.

Frank Polak has been part of this success story for the last 22 years: he started out as a design engineer, and has since become the company's Head of Medical Engineering. "Most of our customers are large corporations with global reach, and several of them are DAX-listed. Requirements in the medical technology sector are always high, but this means that we have to meet even more demanding standards – after all, the patients' wellbeing and safety are at stake," Polak points out. This is why every plant built by Jonas & Redmann must be appropriately qualified and validated – and that also applies to all sub-assemblies and add-on components.

Automated quality testing – including traceability

Many projects revolve around "disposables" – single-use medical products that must be disposed of after use, so they need to be produced in large quantities. Consistently high quality is an absolute must here: "On behalf of a dental laboratory, we collaborated with a firm of consulting engineers to develop a highly automated production cell for a mixing nozzle. To ensure quality in the live process, we deploy a torque sensor from Kistler that communicates directly with the machine control." The mixing nozzle is used in dental laboratories to prepare

casting compounds for dental products such as those needed by dentists to prepare dental impressions.

To guarantee the functionality of the sub-assembly, a friction coefficient test is performed on the mixing mechanism of the assembled nozzle. "This product is a plastic sub-assembly consisting of four parts that are joined in the machine and then tested. Thanks to Kistler's solution, we can guarantee the quality of about five million units per year – and at the same time, we can ensure traceability," Polak explains. "Traceability is absolutely essential in today's medical sector."

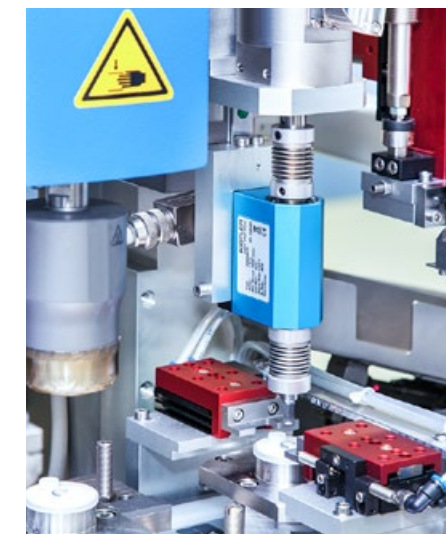
End-to-end inline process monitoring

The combination of our 4502A torque sensor and the maXYmos BL evaluation system ensures end-to-end inline process monitoring: the torque curve for each individual product can be tracked accurately on the maXYmos system's monitor. Separation of bad parts is also integrated into Jonas & Redmann's highly automated system: the value measured by the torque sensor is used to generate an OK/ NOK signal that is transmitted directly to the control. This ensures that any parts joined with insufficient torque are separated out directly.

"Thanks to Kistler's solution, we can guarantee the quality of about five million units per year – and at the same time, we can ensure traceability."

Frank Polak, Head of Medical Engineering at Jonas & Redmann

"With a production rate of 40 parts per minute, that presents a major challenge. We're highly satisfied with Kistler's solution – because it does exactly what we need for the application," Polak emphasizes. "Before we use any third-party components, we carefully check whether we could meet the requirement by



The integrated torque sensor from Kistler ensures functional testing of the part, and it communicates directly with the control – with a cycle time of just 1.5 seconds.

designing the solution ourselves. But in this case, Kistler's system was the better alternative for integrated process monitoring."

Tried-and-tested technology – with fast integration

Polak's attention was drawn to Kistler by his colleague Andreas Nowak, Head of Mechanical Engineering and Operational Technology at Jonas & Redmann, who is thoroughly familiar with these components and systems. As Nowak explains, he has opted for our solutions in the past, and he is highly satisfied with them: "In our joining processes, we already use Kistler's electromechanical joining systems: they ensure effective automation because they are highly efficient and can be precisely controlled. But there could also be further applications for medical technology in the future, especially as regards process monitoring." ■



Integrated directly into the customer's production line, our test stand solutions offer a varied modular range of tests for electric motors and other powertrain components.

TEST STAND SYSTEMS

Integrated quality assurance generates added value

Integrated directly into production lines, our end-of-line-test stands offer an efficient solution to ensure the quality of electric motors, transmissions and other powertrain components.

Electrical powertrains are becoming more complex and more efficient, with improved performance and soaring production quantities – so quality assurance has a critical part to play here. There is demand for integrated, fully automated systems that can test and qualify each single product, with separation of bad parts if required. These end-of-line (EOL) test stands are an increasingly essential element in production plants. They guarantee high quality and transparency for all drive components – including motors, transmissions and inverters – and also for complete powertrains.

Turnkey customized test stand systems

Our test stands are individually designed to meet the requirements of each user's production line – and they guarantee maximum protection for the customer's investment thanks to modular design combined with cutting-edge measurement technology and customized software development. These systems can perform large numbers of different tests in the minimum of space, or they can be implemented in serial architecture – for example, with multiple separate cells for mechanical and electrical tests. In terms of measurement technology, they offer virtually limitless possibilities at both

the machine and software levels: each test stand system is manufactured as a turnkey EOL solution, in close liaison with our customers and precisely according to their requirements.

Modular concept to meet future challenges

All EOL test stands are structured so that they can be converted to handle different test objects with maximum flexibility. This gives customers the best possible protection for their investments, and they can modify or extend the testing scope as requirements arise. The modular structure is implemented throughout the system: for mechanical and electrical components, the integrated measurement technology and also for the software to control the test stand. Another benefit: the system concepts are scalable, so manufacturing lines can be expanded flexibly to cope with rising production volumes.

A reliable partner and system integrator

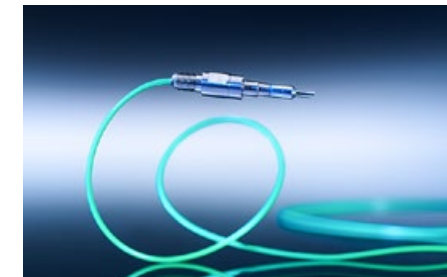
The Kistler Group has two engineering facilities for e-motor test stands in Germany and China – enabling us to implement EOL concepts flexibly in response to the varying requirements of different markets and customers. This applies to the entire process chain, from design, structuring and actual production of the test stand through to commissioning and service. ■

EOL solutions from Kistler are designed to match:

- Customers' specific test plans
- Planned plant throughput
- Desired degree of automation
- Required plant flexibility
- Desired scalability
- Requirements for networking with higher-level systems (such as MES)

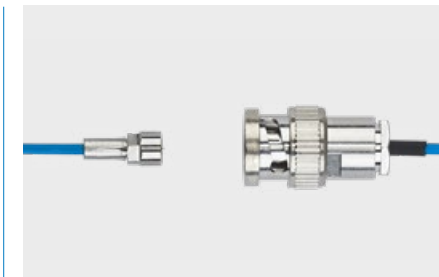
Solutions for Smart Factories

We never stop developing our products and systems – here are some of the outstanding new highlights from our industrial process monitoring portfolio.



Miniature sensors for cavity pressure

Small, extremely sensitive and capable of top performance: the latest versions of our 6178C, 6182D and 6183D miniature sensors achieve maximum precision for cavity pressure measurements – to deliver even more added value in the injection molding process. Thanks to UNISENS standard sensitivity, these sensors are easy to exchange – users are no longer required to enter data. The new titancar-bonitride coating also makes them highly robust and guarantees long service life-times: it provides significantly increased resistance against abrasion and chemical corrosion – ideal for applications with glass fiber-reinforced plastics or flame-retardant materials. ■



Highly flexible connecting cable

We have developed our new 1900A23A sensor cable to meet the specific needs of increasingly automated factories. This highly robust, low-noise, high-insulation coaxial cable is used for piezoelectric sensors in dynamic environments – drag chains are one example. Intensive laboratory testing has proven that this cable is extremely resistant to abrasion, and it can withstand at least 10 million bending cycles. The bending radius on the new cable has been minimized, so it is also an excellent choice for robotics applications. The plug connection is screwed (KIAG 10-32 pos. or BNC pos.) to guarantee protection class IP67. The cable is available in various standard and custom lengths. ■

maXYmos 1.7 boosts connectivity

With the new 1.7 version, process monitoring systems in the maXYmos NC series (joining systems) as well as the maXYmos TL series (force-displacement monitoring, torque measurement, etc.) now have OPC UA capability. This makes it easier to connect them to machine controls, and facilitates communication with higher-level control and management systems. maXYmos NC 1.7 also features a new Jogging mode to allow even more exact positioning. Last but not least, we have developed a new version of maXYmos TL 1.7 specifically for the med-tech sector: it is especially suitable for small measurement ranges, and includes FDA-compliant user management as well as an audit trail that allows traceability of all changes to the system with a time and user index. ■



Ben Passetti demonstrates how maXYmos functions when it is integrated into the automation system.

TESSY PLASTICS

Double process monitoring guarantees excellent quality for plastic products

Zero-defect production is the overriding goal for every plastics processing business – and reliable process monitoring is the key to achieving it. The solution: our piezoelectric sensors and systems. They measure and analyze cavity pressure directly in the cavity while injection molding is taking place, and they separate out any faulty parts.

Founded in 1973, Tessy Plastics has several facilities in the state of New York and is one of the largest contract manufacturers of medical devices and consumables in the Northeastern USA. The company develops, manufactures, assembles and markets an extensive portfolio of products. So that it can meet its customers' high quality expectations, Tessy deploys Scientific Injection Molding (SIM) as the key to defining and optimizing the injection molding process from start to finish.

Ben Passetti, a research and development engineer with 15 years of experience at Tessy Plastics, takes a very serious approach to the quality of the company's injection-molded parts. The critical factor: the assembly monitoring process must make it easy to eliminate faults and errors. Reliable and efficient measuring instruments play a decisive part here so

that Tessy can provide excellent quality assurance for the several million products it supplies to customers each year. Ben Passetti points out: "Half of our product portfolio consists of medical devices, and consumables make up the other half. We focus primarily on high-price, value-adding articles with very complex production processes and tight tolerances – from 720 tonnes down to micro molding. So the range of molds we use is both varied and extensive. One area we focus on is micro injection molding for the medical technology market – because this is a difficult segment that presents many challenges. Thanks to collaboration with our tooling partners, we're able to achieve tight tolerances here."

Gaining control of the complexities of injection molding

Continuous process monitoring and control of the entire measuring chain for production must be guaranteed in order to meet the demanding standards that today's market requires. As well as optimizing process efficiency and quality assurance, users of our process monitoring systems and sensors gain another key benefit: competitive edge. This point has been proven impressively at Tessy Plastics. Passetti notes: "The last five years have seen a major change in the market for molded plastic parts. Customers know more about the injection molding process nowadays than they did in the past, so they are actively seeking out more sophisticated technological solutions."

Jay Sklenka, Business Development Manager Medical at Kistler, explains: "Over the last five years, Tessy has deployed a number of Kistler products – not only for injection molding, but for assembly as well. These include ComoNeo and maXYmos together with the related piezo sensor technology."

Passetti continues: "From the technical perspective, we're pleased that the Kistler sensors measure the forces that

"We integrated the ComoNeo system to give us a better understanding of what the part actually looks like, and to make sure that it is completely injected so that 100% defect-free parts can then proceed to downstream production."

Ben Passetti, Research and Development Engineer at Tessy Plastics

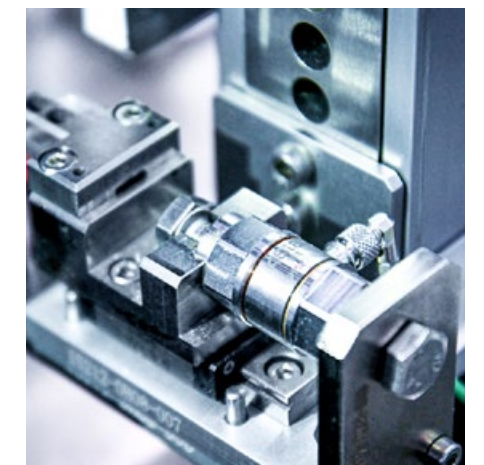
move the components to and fro. By analyzing the data with our maXYmos system, we can make all the necessary adjustments to ensure results that are reliable, visible and sustainable. We've also integrated the ComoNeo system to give us a better understanding of what the part actually looks like, and to make sure that it is completely injected so that 100% defect-free parts can then proceed to downstream production." He adds: "Another reason why we decided to install the ComoNeo process monitoring system from Kistler was that in the past, we had problems understanding what was happening in the injection mold itself, so it was difficult to achieve accuracy and process stability." By taking these steps, Tessy was able to implement quality assurance across the various stages of the value chain.

Our systems and sensors make the future secure

By partnering with Kistler, Tessy was able to significantly reduce scrap and improve its overall success rate. Looking back on the reduction in the return rate that these measures achieved, coupled with an increase in ROI over the years, Passetti comments: "We're highly satisfied with the solutions from Kistler. They made it possible for us to overcome the previous restrictions on plant size for our machines. We know that Kistler is working continuously to meet this need by offering smaller systems and sensors, especially in the micro range – and we're

pleased that this simplifies integration into our machines."

By opting to enter into a partnership with Kistler, Tessy has been able to safeguard the success it has already achieved – and now the company is well on the way to writing more success stories. Passetti concludes: "I'd say that the market is tending to give preference to intelligent technology solutions, such as those offered by Kistler. Here at Tessy, we're planning to integrate more pressure sensors and systems from Kistler into future molds and plants – and what's more, we also intend to equip existing molds with cavity pressure sensor technology. There are only a handful of companies in the USA that are currently using micro injection molding in combination with sensor technology. I'm convinced that Tessy will retain its leading edge thanks to Kistler technology for sensor integration in the micro range and in micro injection molding machines." ■



In conjunction with the maXYmos process monitoring system, our integrated sensors test the finished components.

Software grows to meet the challenges it faces

Our portfolio now includes a platform for industrial image processing – and its name is KiVision. Thanks to its user-friendly design and optimized algorithms, KiVision can easily and reliably accomplish even the most demanding tasks. It also allows integration of individual customer requirements and complex application-specific routines.

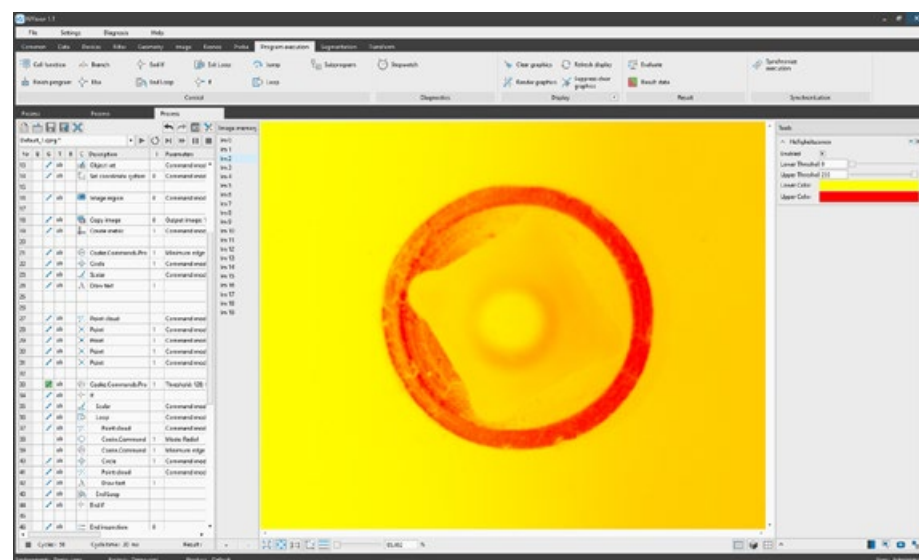
Industrial image processing has made enormous advances in recent decades – especially when it comes to measuring and testing mass-produced and series parts. Automatic image processing systems are now in widespread use, and they play a critical part in production automation and quality assurance. Thanks to their speed and cost-efficiency, they allow 100% inspection that can even detect sporadic faults. These are major advantages, given that the growth in quantities manufactured by industrial producers is also matched by a consistent increase in quality requirements.

The self-empowered customer: KiVision opens the way to autonomy

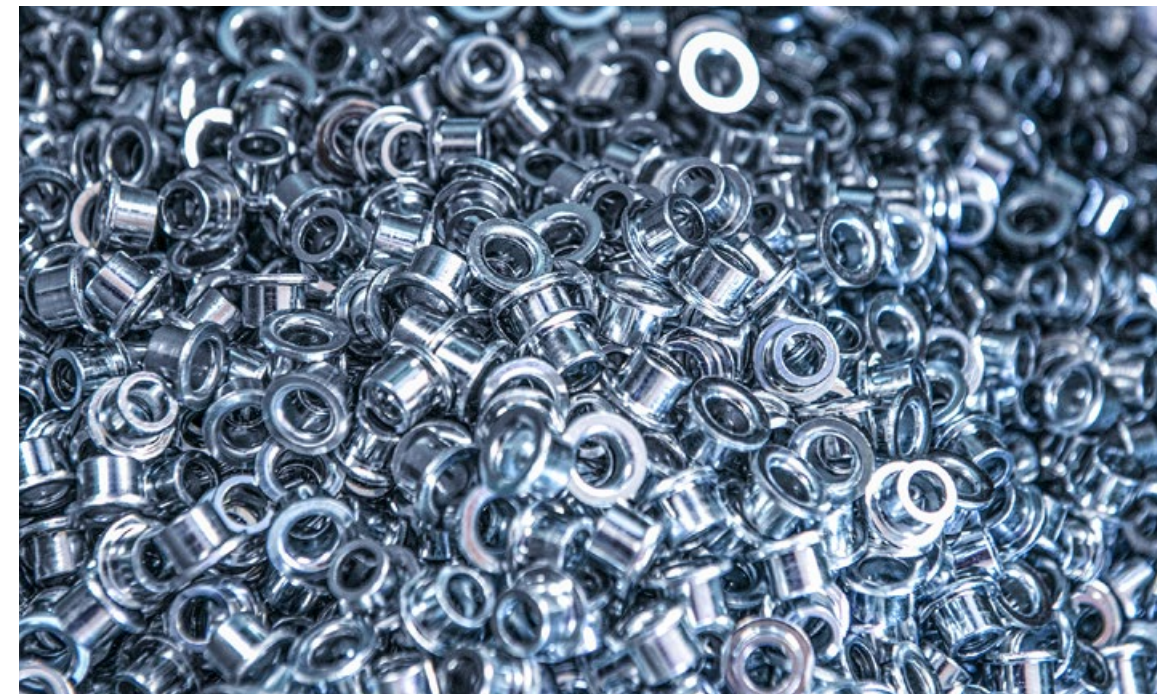
More demanding requirements for industrial image processing present challenges for the software. Our high-performance automated test systems, for instance, use up to eight cameras that generate huge volumes of data. "As a key component of industrial image processing, the software has to play its part in overcoming these obstacles," according to Ferenc Toth, Head of Competence Center Vision Systems, Kistler Group. Thanks to optimized algorithms, high-performance image processing software such as KiVision can cope with soaring throughput rates in series production. Today's automatic punching presses, for example, quite often operate at frequen-

cies of 1,200 strokes per minute – also for multiple falling or double track driven tools. This means that only about 30 milliseconds (with respective reserves) are left to capture and evaluate the images. Advances have also been achieved in terms of accuracy. Precise measurement of series parts with transmitted light inspection has now become standard, and accuracy requirements in the micrometer range can be implemented here with no problems.

"Customers who have the appropriate solutions are now themselves able to perform many of the tasks that were still reserved for specialized providers just a few years ago," Toth notes. "Expectations of the performance and operability of new software are therefore very high. So as we continue to develop our software, our claim and our objective will be to simplify the difficult problems faced by users. This will eventually enable them to accomplish the tasks



KiVision can be used for simple dimensional checks as well as highly complex testing assignments. Test programs are generated with the help of the editor (left), using the camera images (right).



Fully automated test cells from Kistler can efficiently handle inspection of enormous quantities with no errors.

themselves, just as if they were standard procedures." For surface inspection with reflected light, this presents the particular challenge of translating complex algorithms into software modules that are simple to use.

Open platform with individual user interface

KiVision image processing software is integrated into all our test cells. However, it can also be used outside of the automated testing environment, and it can be combined with other measurement systems that we offer. Operators can generally make productive use of this Windows-based application after just a few hours of training, so they can perform their first measurement tasks. Thanks to an intuitive user interface, structured test commands and parameter visualization, beginners can even teach in testing tasks for new parts on their own. Complex testing sequences (which mainly occur in connection with surface

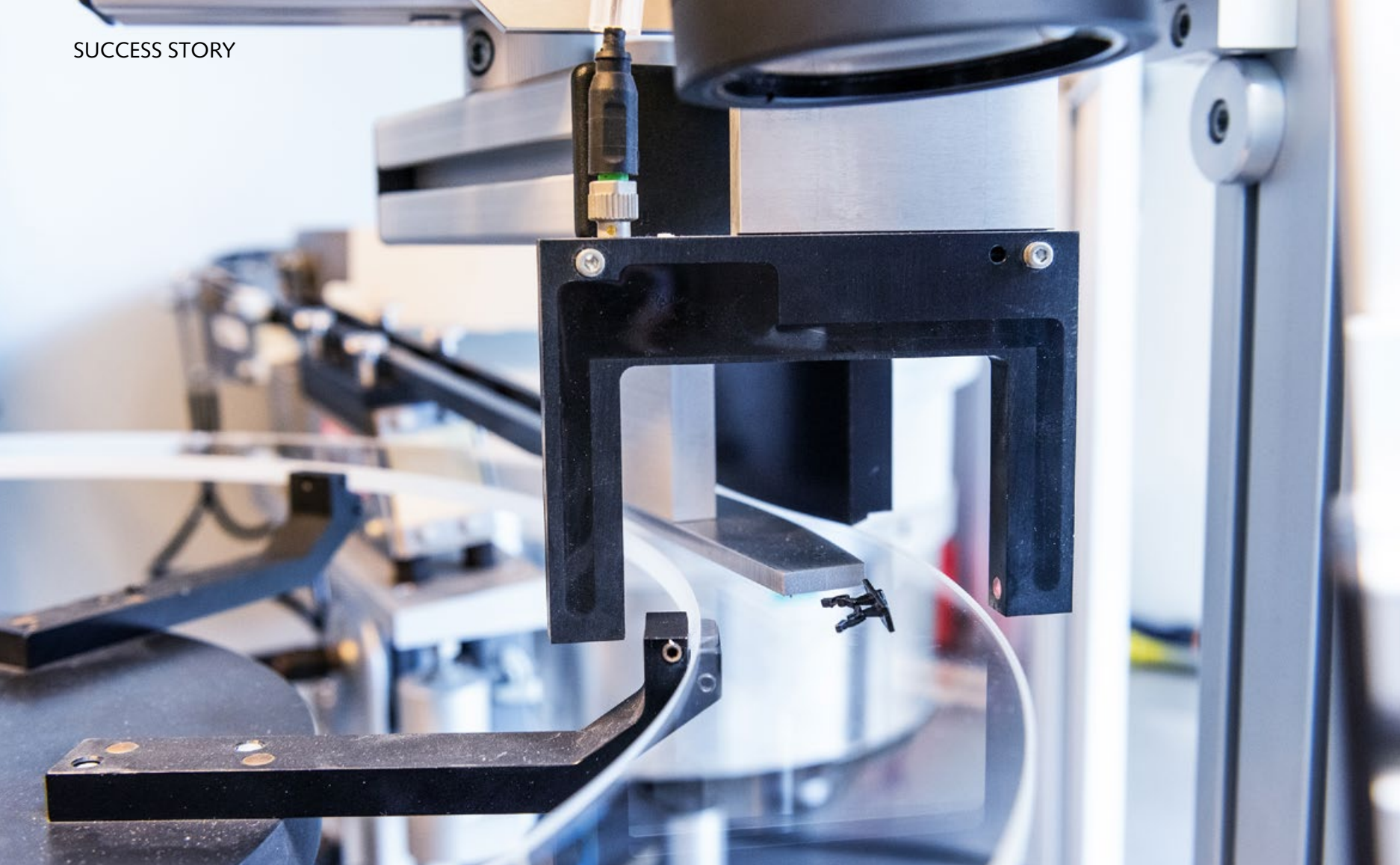
inspection) can be made simpler with the help of reusable subprograms and function blocks. The integration of the Vester parameterization software KVC Visu with the image processing software KiVision enables operators to manage all machine, program and statistical data in the same user interface and to store them in a plant- or workpiece-specific way.

Continuous development guaranteed

To make sure that we stay fit for the future so we can offer solutions for special and more advanced customer requirements, we are continuing to develop KiVision at our Competence Center Vision Systems in Karlsruhe, where we also offer comprehensive training courses. In these areas, the industrial image processing specialists at Karlsruhe collaborate closely with our test automation experts at Straubenhardt. Individual feasibility analyses and intensive dialog with customers generate new impetus to develop innovative solutions. Toth concludes with a summary: "We are making use of our expertise in optical sensor technology and image processing to offer efficient software solutions that increase our customers' autonomy and the scope available to them. The vast potential of industrial image processing is far from being exhausted, especially in connection with Industry 4.0." ■

“Operators can generally make productive use of KiVision after just a few hours of training, so they can perform their first measurement tasks. Thanks to an intuitive user interface, structured test commands and parameter visualization, beginners can even teach in testing tasks for new parts on their own.”

Ferenc Toth, Head of Competence Center
Vision Systems, Kistler Group



TEST AUTOMATION

High-performance quality testing for intricate components

A renowned German manufacturer of small electrical appliances puts its trust in our automatic testing and sorting systems to ensure high throughput rates with maximum precision – several million plastic and metal parts are tested each year. This guarantees the quality of the company's electric shavers and epilators, thus safeguarding the overall success of its brand.

Electric shavers are complex products. Depending on the particular model, they can consist of 200 to 300 individual parts – some of which are very intricate. Every single one has to be produced with the maximum possible degree of perfec-

tion. Thanks to our automatic testing and sorting systems, this company – the market leader in its sector – can guarantee that the parts in its end products meet very high quality and functionality standards. These automated systems are

the key to comprehensive quality monitoring during and after the production process. They enabled this company to continue reducing its internal complaint rate, and the percentage of warranty cases also decreased.

Precision – even with high throughput rates

Three automatic testing and sorting systems from Kistler are currently operating on the company's plastic production lines, and a feasibility study for a fourth unit is already in progress. Eight more systems are installed in the automated turning shop, where their tasks include testing outsourced metal parts such as the pins built into shaver heads and electric toothbrushes.

The testing rates and speeds required are exceptionally high, and the necessary precision must not have an excessive impact on throughput targets. Correct positioning of individual parts as they are fed into the test line is therefore a critical factor. The aim is to exclude

measurement inaccuracies such as parallax errors that occur because the camera's angle of view is distorted.

Systems for universal use

At present, several million plastic parts are tested and automatically sorted in the plant. Two VVC 120 systems (based on the inclined-plane principle) and one VVC 811 system (with a continuously rotating glass plate) supply answers to questions such as these: Do the parts have any tiny deformations that are barely visible to the naked eye? Is there any flash formation? Do dimensions adequately meet the specifications? Testing focuses on particularly critical parts that are crucial for the function and performance of the end product.

This electrical appliance manufacturer sees two factors as decisive: the flexibility of our systems, and their high performance. For this reason, we collaborated closely with the customer to adapt the automated test systems to each application in order to meet the high requirements for complex geometries, test criteria and quantities. With a suitable setup, multiple parameters can be tested on one component. But that's not all: different components can also be tested on one system with minimum effort. In all these ways, quality assurance based on high-performance test automation plays its part in this company's success: models of this high-quality German brand regularly occupy the top places in independent consumer tests.

Test results: the basis for process optimization

This manufacturer of shavers and epilators can look back on many years' successful experience of using our automated test systems for both metal and plastic parts. We continuously develop our solutions with the focus always on individual customer requirements. In-house testing is another advantage for this customer. Because users acquire know-how about certain repeated devia-

“Our test automation has satisfied the high requirements for complex geometry and large quantities. This has made it possible to increase the quality of the individual parts – and, therefore, of the end product as well. The result is that the customer benefits from an efficient, cost-optimized solution.”

Samuel Ganzhorn, Application Specialist

tions on the plant itself, they can draw conclusions about the production process and initiate steps to optimize it. For instance, the Kistler systems installed in this plant make it easy to check which cavity was used for a defective part – simply by reading out the relevant identification code. The customer can then use the test results to track down specific problem points in the process.

High-performance quality assurance also plays a key part in ongoing optimization and automation: it ensures that the company's shavers and epilators will inspire end customers, now and in the future – and the manufacturer can also guarantee lifetimes of up to seven years for its appliances. As a reliable partner, we support this customer with our technologically mature solutions that deliver highly efficient quality testing for plastic and metal parts – a major contribution to customer satisfaction. ■



Nothing is left to chance in the production of electric shavers.

SCHURTER AG

Integrated process monitoring for highly automated electronics production

Schurter AG is reliant on first-class production processes to meet the high requirements set by the automotive industry. Schurter's fully automated plants to produce complex safety-critical parts incorporate four of our systems for force-displacement monitoring – including features such as fast cycle times, automatic sorting and testing the capability of the measuring instruments.

Schurter, the Lucerne-based Swiss electronics manufacturer, employs a workforce of over 2,000 at eleven production facilities and companies in seventeen countries – and the company is clearly on course for further growth. Schurter's portfolio has two cornerstones: electronic components (including connectors, switches and circuit breakers) and input systems such as HMIs, touch panels

and membrane keypads. The range has grown in recent years with the addition of custom solutions based on a high level of vertical integration.

Fully automated production of large quantities

As the trend towards electromobility gathers pace, electric fuses are now playing a key part – especially in the production of batteries for electric automobiles. Each battery cell requires individual fuse protection, so the total number of fuses in a vehicle can quickly reach four or five hundred. An end customer in the automotive sector commissioned Schurter to produce large quantities of fuses for use in safety-critical areas.

To tackle this unusual challenge, Schurter invited special-purpose machinery manufacturer Robomat AG to come on board. André Schürmann, Head of Automation & Maintenance at Schurter, takes up the story: "Robomat presented us with a very detailed offer for the development of the plant, including a 3D-layout and exact pricing. Combined with their proximity and a close working relationship right from the start, their entire package convinced us."



Every hour, about 3,000 electrical fuses are produced on the new plant.

High-precision testing in seconds

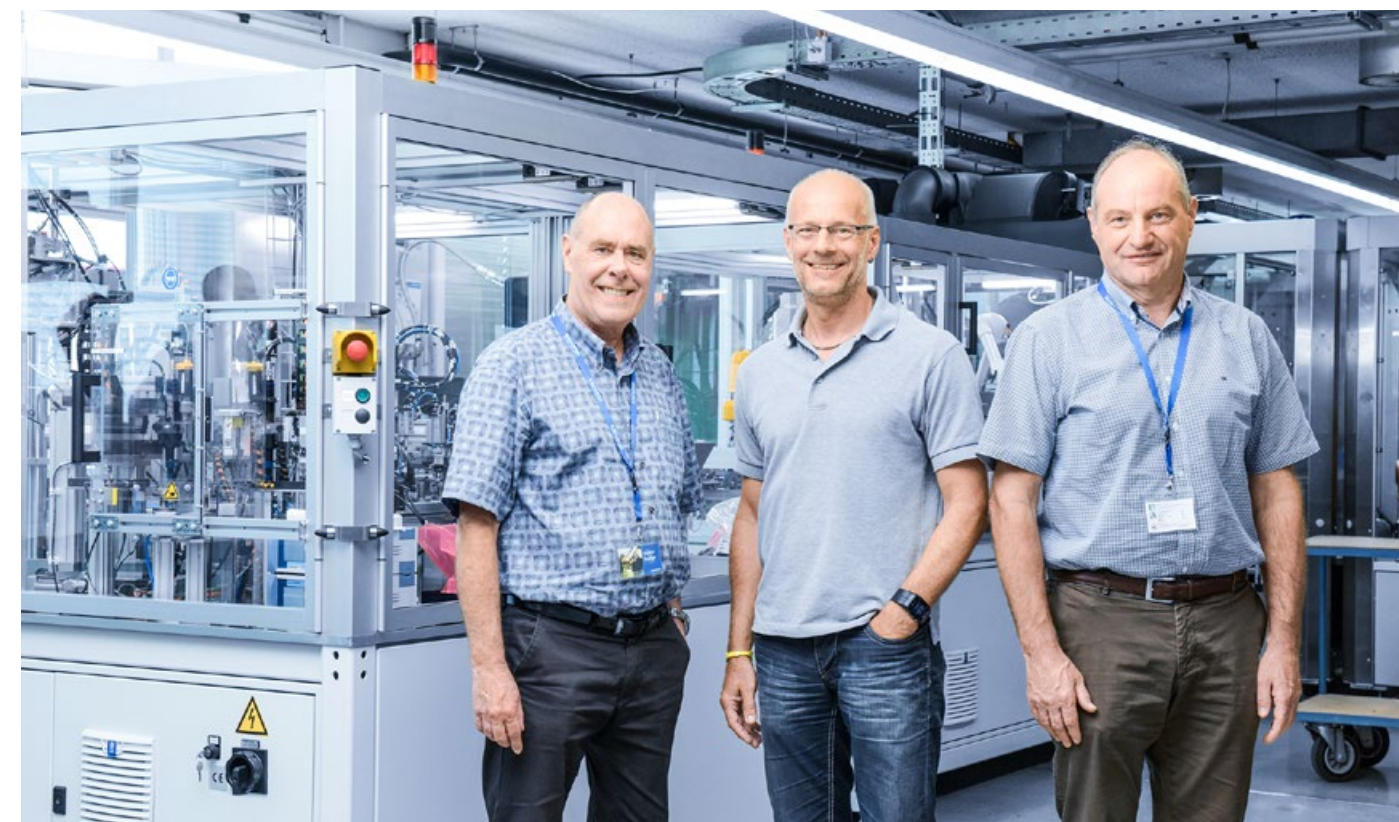
Markus Zimmermann, owner and CEO of Robomat, explains the project: "Two fuse variants are produced on this plant, at rates of about 3,000 parts per hour and with a cycle time of 2.7 seconds. The product passes through 16 different stations in that brief period of time. Designing the plant faced us with the challenge of coordinating the process steps so as to achieve the short cycle time.

Schurter enlists our force-displacement monitoring systems to meet the demanding requirements for traceability and quality in the automotive industry. A total of four piezoelectric small force sensors are deployed in the new plant, together with matching maXYmos BL evaluation systems. "As well as our favorable experience in the past, the main factors that persuaded us to opt for Kistler were the small force range and the very low response threshold," Zimmermann notes. The measured key variables are recorded and visualized during the process; in addition, the defined criteria are used for automatic in-process sorting of good and bad parts. Testing includes the spring force as well as the force used to position the covers on the fuses.

Most comprehensive recording of quality data

The sensors themselves are also tested: "What's really special about this plant is that the measurement equipment itself is counter-checked during the process. The sensor technology is measured about once in every 100 parts," Zimmermann explains. "This development is driven by requirements in the automotive industry. According to the International Automotive Task Force's IATF 16949 standard for safety-critical parts, the capability of the measuring equipment has to be verified regularly during the production process. The end customer specifically audited this particular point on site in our plant," Schürmann adds.

An unprecedented level of quality data acquisition was attained in response to



The team that led the project to success: Markus Zimmermann, owner and CEO of Robomat, André Schürmann, Head of Automation & Maintenance at Schurter, and André Signer, Sales Engineer at Kistler (left to right)

"We enlist Kistler's force-displacement monitoring systems to meet the demanding requirements for traceability and quality in the automotive industry."

André Schürmann, Head of Automation & Maintenance at Schurter

this combination of demanding customer specifications, compliance with the standard and a highly complex plant: "For each fuse, 76 specific datasets are captured and stored in a central database – as well as force and displacement, these include many other variables such as furnace and air temperature. This is the most extensive acquisition of quality data that we have implemented on one plant until now," Zimmermann explains.

Intuitive measurement technology generates added value

But there was still some way to go before series production could begin. Acceptance by the end customer was completed after a development period of about one year. Phase two focused on intensive testing and optimization of critical factors such as materials, plant settings and other parameters. "The measurement technology didn't need very much effort because the systems can be operated intuitively," Schürmann notes. "We'd already used Kistler products in the past, so we know we can rely on performance, service and value for money," Zimmermann comments.

"But other parts of the plant are so complex that commissioning and optimization involve substantial effort. The advantage is that once the target has

been attained, the settings are transferred directly to a second plant so as to cover the planned high quantities," Zimmermann continues. maXYmos and the rest of Kistler's technology will be on board again at that stage, with double testing to ensure that the fuses keep their promises. ■



You can view the video for this Success Story here.



During 2020, Kistler will showcase its product innovations at over ten leading trade shows for the automated industrial production sector.

Experience Kistler – live!

**Which technologies will shape the markets of the future?
In Shanghai, Nuremberg or Rosemont – visit us at the leading
trade fairs for automated industrial manufacturing.**

Since day one, Kistler's corporate success has been founded on a combination of premium products, outstanding technical know-how and top-quality service. As a renowned manufacturer of sensors and process monitoring systems, we shall continue to devote our efforts to one goal in the future: ensuring that our customers all over the world always have the best possible access to our technological expertise.

You'll find us at these trade shows in 2020:

MD&M West, Anaheim, USA	11 – 13 February
Fastener Fair, Istanbul, TR	27 – 29 February
M-Tech, Nagoya, JP	15 – 17 April
Control, Stuttgart, DE	5 – 8 May
KUTENO, Rheda-Wiedenbrück, DE	12 – 14 May
Automatica, Munich, DE	16 – 19 June
Stanztec, Pforzheim, DE	23 – 25 June
AHTE, Shanghai, CN	8 – 11 July
Chinaplas, Shanghai, CN	3 – 6 August
Fakuma, Friedrichshafen, DE	13 – 17 October
SPS IPC Drives, Nuremberg, DE	24 – 26 November

KISTLER NEWSLETTER

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Published by:
Kistler Group
Eulachstrasse 22
8408 Winterthur
Switzerland
Tel. +41 52 224 11 11

Concept and design:
TBS, Zurich

Published each year
© 2020 Kistler Group