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Why a Swiss cheese dairy relies on sensors from ifm for the production of its specialties.

Even in times of fully automated food production, the Wildberg cheese dairy still uses a great deal of expert knowledge and craftsmanship during the crucial stages of cheese production.

In 2021, the cheese factory in Wildberg was upgraded to state-of-the-art process technology by staedler automation AG.

Here, in the Zurich Oberland, an exquisite taste experience is conjured up from high-quality milk provided by selected farmers in the area using sophisticated recipes, including cheese maturing processes that take several years.

The key to success is sophisticated automation in the background: A wide variety of sensors help to ensure that the numerous process parameters will be precisely adhered to. This is the only way to ensure consistently high product quality.



Magnetic inductive flow sensors in the permeate stage of the reverse osmosis system monitor and control the concentration of the whey.



Automation for the love of the craft



When you enter the new production halls with managing director **Roland Rüegg**, you will quickly realise that the staff at Wildberger Käsemanufaktur know their trade: everyone here knows their job and is a master of their profession, all processes interact like cogwheels. The cheese cellars reveal the enormous range of products and recipes. The portfolio ranges from popular specialities such as Emmentaler AOP and mozzarella to the company's own invention, the Cheebab, a cheese kebab.

The latter has enjoyed great popularity with customers from near and far since the first tastings at the in-house sales stand. The recipe for success: highest quality.

Production has been running in the new building since spring 2021. The cheese dairy is equipped with state-of-the-art process technology from staedler automation AG. The automation specialist is located only a few kilometres away and relies on products and solutions from ifm for plant monitoring with sensors.

■ Cheese and sensors

What, however, does traditional cheese-making have to do with sensors? A lot, because the production machines in the cheese dairy can only be controlled with the precision that is required to ensure the necessary quality if the control system itself is supplied with constantly accurate process parameters.

Example: From the milk feed into the separator via the heat exchanger to the cheese maker, especially temperature and pressure must be precisely kept at a specific

level in order to be able to treat the milk appropriately.

But, let's start at the beginning: The freshly delivered milk is cooled down and stirred in the storage tanks in the milk reception area. Here, level and temperature sensors monitor whether the milk is properly stored.

The CIP system that is used to regularly clean the piping and tanks is also monitored by sensors. Flow sensors, for example, control the water quantities during the rinsing processes.

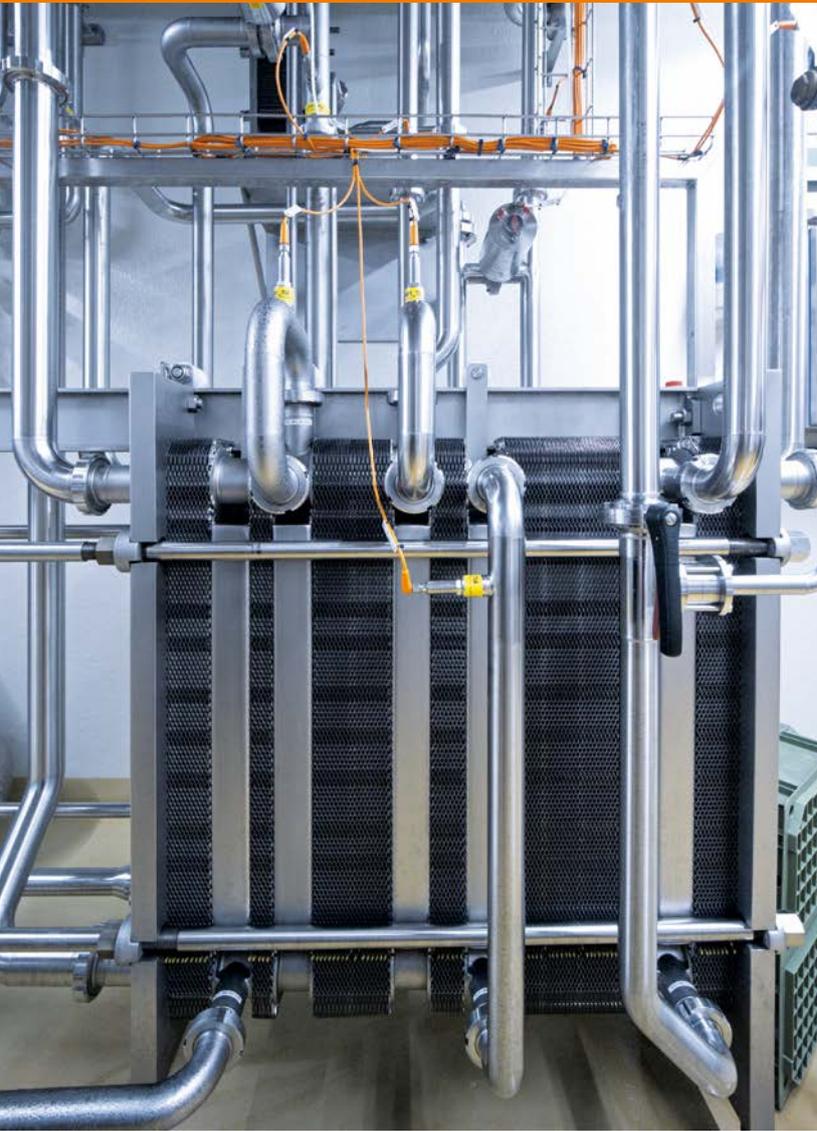
■ Maximum reliability for temperature-critical processes

During the thermalisation process, in particular temperature sensors are proving their strengths. Depending on the type of cheese, the raw milk will be heated in a plate heat exchanger in a precise and exactly timed manner.

Paired TA2502-type temperature sensors detect the inlet and outlet temperature in each of the three segments of the heat exchanger to enable the control system to precisely and immediately readjust the temperature in the corresponding downstream heat exchanger segments.

■ Self-monitoring temperature sensor

Without a doubt, the TCC501 temperature sensor bears the greatest responsibility in the entire process and is positioned at the heat retention section of the heat exchanger where the milk is microbiologically optimised and safely prepared for further processing by maintaining the temperature over time.



*The heart of the plant: plate heat exchanger
for accurate temperature control of the raw milk.*

*For particularly process-critical locations:
self-monitoring temperature sensor TCC
with visual status display.*



■ Permanent status checking

The special feature of the TCC: The temperature sensor not only measures with great accuracy, it also enables plant operators to react to drift behaviour on an event-related basis - and not only at the next scheduled calibration interval. Thanks to the calibration check technology, the TCC permanently checks its own drift behaviour. The sensor compares the temperature value to the simultaneously measured reference value. If the deviation is outside the tolerance range, which can be set between 0.5 and 3 K, the TCC provides an optical signal and sends a message to the central controller via IO-Link and the diagnostic output. The same applies to cases of serious malfunctions.

The TCC thus reduces the risk of losing entire production batches due to incorrect production temperatures, especially in the case of fresh products.

■ Quality assurance thanks to event-related measures

Particularly in production processes where exact temperature values are decisive for the product quality, it is important that the measured values are absolutely

accurate. Thanks to the inline calibration process, the TCC achieves an accuracy of ± 0.2 K across the entire measuring range. This makes it ideal for use in these temperature-sensitive processes. The microbiological process of the fresh products is thus reliably monitored at all times.

■ Transparent sensor communication

Visual and digital indication: The TCC thus communicates the current status transparently and unambiguously by any means: If the LED on the sensor is green, the unit operates reliably. Blue indicates a temperature deviation outside the tolerance range. Red indicates a serious malfunction, such as a failure of the main measuring element. Besides, the TCC automatically stores all the data required for consistent documentation via IO-Link: installation date, operating hours, temperature histogram as well as logbooks on event messages (operating hours and event number) and on the calibration check status (operating hours, temperature value, drift value, limit and status).



The company staedler automation AG has implemented the process control of the cheese dairy. All process values can be viewed on the control system.

■ Simulation mode: guaranteed reliability even before installation

The value from which the TCC provides a message can be defined via software. In the simulation mode, the process temperature and the reference temperature, among others, can be freely selected to verify whether the sensor has been correctly integrated into the controller. This process simulation completes the high level of reliability offered by the TCC.

■ Robust design for long-time use

Thanks to its fully welded and sealed housing and a new measuring probe design, the TCC is permanently resistant to external influences such as moisture, thermal and mechanical shocks and vibrations.

■ G½ pressure sensor with hygienic approval for small pipes

Another important sensor for the Wildberg cheese dairy is the PM15 pressure sensor. It monitors the pressure conditions in the heat exchanger with the aim of always ensuring that the pressures in the thermised (i.e. heated) aseptic milk are higher than on the opposite side of the heat exchanger plate where there is either fresh milk or hot water. In case of possible cracks in the heat exchanger plate, only the milk can escape due to the excess pressure. Then again, no foreign media can enter the highly sensitive production process.

If deposits form on the heat exchanger plate, causing the pressure to rise at an otherwise constant flow rate, the pressure sensor can make this circumstance transparent to the controller so that it can be readjusted accordingly or a maintenance interval can be initiated.

” We love cheese. And we need technology for it. This is where ifm helps us with its sensors.



*Compact and hygienic:
pressure sensor of the PM15 series
with flush ceramic measuring cell.*



*Ideal for small nominal widths: pressure sensor
of the PM15 series with G1/2 process connection
in the feed of the reverse osmosis system.*



■ Ideal solution for hygienic production plants

The new PM15 pressure sensor has a unique flush sealing system with Teflon and PEEK. For the first time, this allows the hygienic integration of small ceramic-capacitive measuring cells in small pipelines from DN25. Thanks to the minimised G 1/2 thread, installation is possible without requiring expensive adapters. The adaptation is certified for aseptic applications and is free of any dead space to prevent deposits and ensures optimum cleaning during the CIP process.



■ Maintenance-free and robust

The sensor is thus designed without an elastomer seal on the process side and is therefore maintenance-free. The flush, robust ceramic measuring cell is extremely stable in the long term and withstands pressure and vacuum impacts as well as the effects of abrasive substances. It is a "dry measuring principle" since no pressure transfer fluid is used, thus eliminating the risk of critical liquids being released into the medium. The sensor is thus practically wear-free. It can withstand medium temperatures of up to 150 °C (max. 1h), which would allow steam cleaning. The EHEDG certificate, FDA approval and 3A standard confirm its suitability for hygienic processes.

■ Improved performance thanks to IO-Link

Like almost all ifm sensors, the PM15 also has IO-Link. In addition to the classic analogue signal (4...20 mA), the process value can be transmitted digitally without loss. But, IO-Link offers even more: The sensor also has a temperature probe whose value the user can retrieve via IO-Link. Advantage: In non-critical applications, this non-invasive temperature measurement can be used to achieve more transparency and safety in the system "by the way" - this saves material and installation costs. Other convenient features of IO-Link are zero-point calibration and scaling of measuring ranges.

■ Conclusion

Not despite, but because of the automatic process monitoring, it is possible for the Wildberg cheese dairy to concentrate on the production of individual cheese specialities, while the required equipment fulfils its task reliably and precisely. Precisely designed sensor technology ensures simple and reliable monitoring of production, even in places with special challenges.



Managing Director Roland Rüegg:
"We love cheese. And we need technology for it.
And this is where ifm helps us with its sensors."

Precise forecast of wear limits

Boehringer Ingelheim is one of the world's top 20 pharmaceutical companies with over 130 years of experience. It is also the largest research-based pharmaceutical company in Germany.

The path to condition-based maintenance in pharmaceutical ventilation technology at Boehringer Ingelheim

Cleanrooms are indispensable for the safe production of sensitive products that have to meet quality requirements, such as those in the pharmaceutical industry. The importance of a properly functioning supply of low-particle air to the laboratory and production rooms is correspondingly high. That is why the pharmaceutical company Boehringer Ingelheim monitors its venti-



The pharmaceutical company Boehringer Ingelheim relies on vibration diagnostics from ifm for condition-based maintenance in its cleanroom ventilation systems.

lation systems around the clock to ensure trouble-free operation. Condition-based maintenance could take this process to a new level. Boehringer Ingelheim is on the way there with its partner ifm.



” After a thorough assessment, Boehringer Ingelheim decided to upgrade with ifm’s vibration and rolling bearing monitoring systems.



Since 2008, the Engineering & Technology department of Boehringer Ingelheim has been working together with the automation specialist ifm in the field of vibration and rolling bearing analysis. The VSE100 vibration diagnostic system plays a central role in process and ventilation technology, as it ensures trouble-free operation of GMP-compliant ventilation systems. GMP stands for Good Manufacturing Practice. These are internationally applicable guidelines for quality assurance that are primarily used in the manufacture of pharmaceutical products.

The heart of the system is the VSE100 evaluation unit. It offers inputs for up to four vibration sensors. The vibration behaviour is analysed and evaluated internally. Abnormal changes in the vibration behaviour are detected and signalled in several stages via switching outputs if the limit value is exceeded. This ensures reliable vibration monitoring of machines and plants. Wear, for example on the rolling bearings of drives, is thus detected at an early stage before critical conditions or even failures occur.



*Compact vibration diagnostics:
VSE series evaluation units for four vibration
sensors and additional analogue sensors.*

In the previous version of the vibration diagnostic system from ifm, the vibration behaviour and, thus, the status of the monitored fans was visualised in the building management system with a traffic light. When the colour changed from “green” to “yellow”, service technicians received indications of possible damage to the engine or fan. Thanks to the system, the ventilation systems have been running trouble-free ever since. However: In order to analyse a message further, the service technicians previously had to dock with a laptop to the evaluation unit in order to read it out and thus assess the damage in detail.

About three years ago, the Engineering & Technology department decided to make a forward-looking investment in vibration and rolling bearing diagnostics. This is associated with a change from purely preventive maintenance to condition-based maintenance.

Rafael Cannas, Maintenance Manager and a maintenance employee at Boehringer Ingelheim for 26 years, explains: “Our goal was to initially implement a combination of preventive and condition-based maintenance. An intermediate step on our way to condition-based maintenance is working in condition monitoring on our example equipment. On the IT side, we relied on the dashboard from ifm that we implemented a year ago. For the future, we are aiming for AI-based failure prediction. Algorithms are then supposed to calculate and inform us when which equipment has reached its remaining service life”.

■ Various systems tested

In the first consultations with ifm’s sales specialists, the existing VSE100 system has been modernised and replaced on a sample installation from 2008. In parallel, further trials were conducted with other suppliers in a wide variety of applications. Various remote systems were tested: In some of them, diagnostics could be completely outsourced while in other vibration and rolling bearing systems, technicians could take measurements on site.

After about a year, a résumé was drawn. After a thorough assessment, Boehringer Ingelheim decided to upgrade with ifm’s vibration and rolling bearing monitoring systems. The decisive factor was the reliable and positive experience with the system since 2008, but also the easy handling of the dashboard that is used for evaluation.

In addition, it was important for Boehringer Ingelheim to have a partner in ifm who has already gained experience with such systems in other industrial sectors.

■ Precise forecasting saves millions

The project “Setting up condition monitoring for rolling bearing vibration analyses” started in autumn 2019. The goal: Monitoring the ventilation systems selected for the project in a pharmaceutical production building in Ingelheim for the greatest economic risk of failure.

These ventilation systems supply rooms of “clean room class D” without exception. The aim was to monitor the plant only automatically via an analysis tool as early as summer 2020. Together with ifm, this goal has been achieved: The ventilation systems were converted and put into operation in the summer.

■ Short-term savings in the six-figure range

The VES004 dashboard has been used for preventive maintenance from this point on. Experts from Boehringer Ingelheim’s engineering unit and its own service centre jointly determined the condition of the component at six-monthly intervals and came up with a recommendation for action.

The success was remarkable: The conversion brought in savings in the high six-figure range in a short time because it was possible to avoid production downtimes due to coordinated or planned repairs to ventilation systems.

Rafael Cannas checks the status of the rolling bearings, which is clearly visualised on the dashboard.





” On our way to condition-based maintenance on the IT side, we have opted for ifm’s dashboard.

In the meantime, thanks to reliable forecasting, the rolling bearings of the plants are no longer replaced based on time, but only when their wear supply is actually exhausted. This requirement-based maintenance reduces material and maintenance costs while at the same time reducing the burden on the environment – and staff can also be deployed more efficiently.

■ Training rethought in times of COVID 19 pandemic

During the COVID 19 pandemic, Boehringer Ingelheim employees have been trained remotely by ifm in the use of the analysis software. This was an exciting experience for both sides since practical work on test objects is part of the training content.

The project team is currently on its way to mapping condition-based maintenance. The aim is to do this in an SAP cloud/PAI. There, one could then forecast the probability of failure of ventilation systems due to rolling bearing damage or an imbalance.

For this purpose, the data of the VSE100 has been embedded in a new IT architecture, and Boehringer Ingelheim is working in partnership with the data specialists of the ifm subsidiary statmath to bring this data into a usable quality for further use. “It suits us that statmath has already successfully implemented precisely these points in the automotive industry and thus has extensive experience,” says **Julia Kaufmann**, Maintenance Manager at Boehringer Ingelheim.

It is elementary for the pharmaceutical company to include good manufacturing practice as a basis in its maintenance. This requires, for example, a risk assessment when adjusting the maintenance type. This will also be taken into account in the pilot project.

Rafael Cannas: “In the context of digitisation, the topic of maintaining the validated state of the systems will continue to occupy us, as will the qualification of our own technicians to make them fit for the future. We have already demonstrated the benefits of condition monitoring in our pilot project. In the future, we envision predicting the equipment’s likelihood of failure so that we can use that knowledge to plan repairs in a way that won’t disrupt or interrupt manufacturing operations in their production time.”

■ Conclusion

The pilot project at Boehringer Ingelheim shows: Companies can benefit significantly from modern condition monitoring. Especially when the maintenance of highly relevant production facilities can be carried out according to the requirements and no longer on a time-based basis, savings can be achieved to a great extent: Targeted maintenance planning reduces downtimes, minimises material costs and relieves skilled personnel and, last but not least, protects the environment.

They have taken condition-based maintenance to a new level at the pharmaceutical company Boehringer Ingelheim (from left to right): Christian Ritz (Sales Engineer ifm), Rafael Cannas, Julia Kaufmann (both Specialist Maintenance Engineer at Boehringer Ingelheim)



STOPPING when the end is near



Reflection trick of O3D sensor solves rewinder application

Mobac GmbH specialises in wire and cable pay-out systems. In keeping with the motto of leading wire and cable manufacturers “If you want to produce wires and cables, you should be able to brake”, Mobac devotes special attention to the perfect braking point of their machines. The reason: If the rapid unwinding process is not stopped before reaching the wire end, the wire attached to the bobbin will inevitably destroy the winding mechanics and spools. To prevent this, Mobac uses a camera sensor from ifm, which reliably detects the last material layer on the bobbin and triggers a braking event in time.

Michael Will, Technical Manager at Mobac: *“We build winding, unwinding and rewinding machines for all types of materials. Originally at home in the classical wire and cable industry, we also wind film, extruder products, ropes or even fibres, such as carbon fibres, today. Basically every material that is wound and unwound in some way and must be versatile and flexible to use.”*

■ Welding wire rewinding

One of Mobac’s custom-built machines is a rewinder for processing different types of welding wires. The machine distributes the welding wire from a large supply spool to many small customer-specific spools.



Based on the reflectance value, the sensor detects whether it looks at the wire or at the bobbin.

Founded in 1981, the company based in Mielkendorf near Kiel builds components for drive technology such as brakes and clutches. However, their core business is special purpose machinery.

Michael Will describes the problem: *“Our customer’s request was to automatically stop the rewinding process before the wire end on the supply spool is reached. Usually, the wire end is firmly attached to the supply spool. If the unwinding process reaches the wire end at high speed, the spools or other components in the rewinding station will be destroyed as welding wires have fairly high tensile strengths. In the past, an operator watched the supply spool and manually stopped the process in time. The operator then unwound the remaining windings on the spool in manual jog mode or simply cut off the end and threw it away. This was neither safe or efficient. The challenge was to develop an unwinder that approaches the wire end at high speed and automatically recognises when the last layer on the supply spool is starting to unwind.”*

■ The sensor brakes

Searching for a solution, Mobac turned to automation specialist ifm. The requirement: a sensor that detects the last winding on the supply spool and causes the rewriter to break gently, but in time.

Having tested different types of photoelectric sensors to detect the wire end on various bobbins, the photoelectric O3D sensor from ifm proved to be the most reliable and universal solution for Mobac’s application. Originally developed for 3D detection of objects and scenes, a completely different feature of this sensor is used in Mobac’s application.

” Compact, robust and easy to use, the O3D from ifm is perfectly suited for our application.

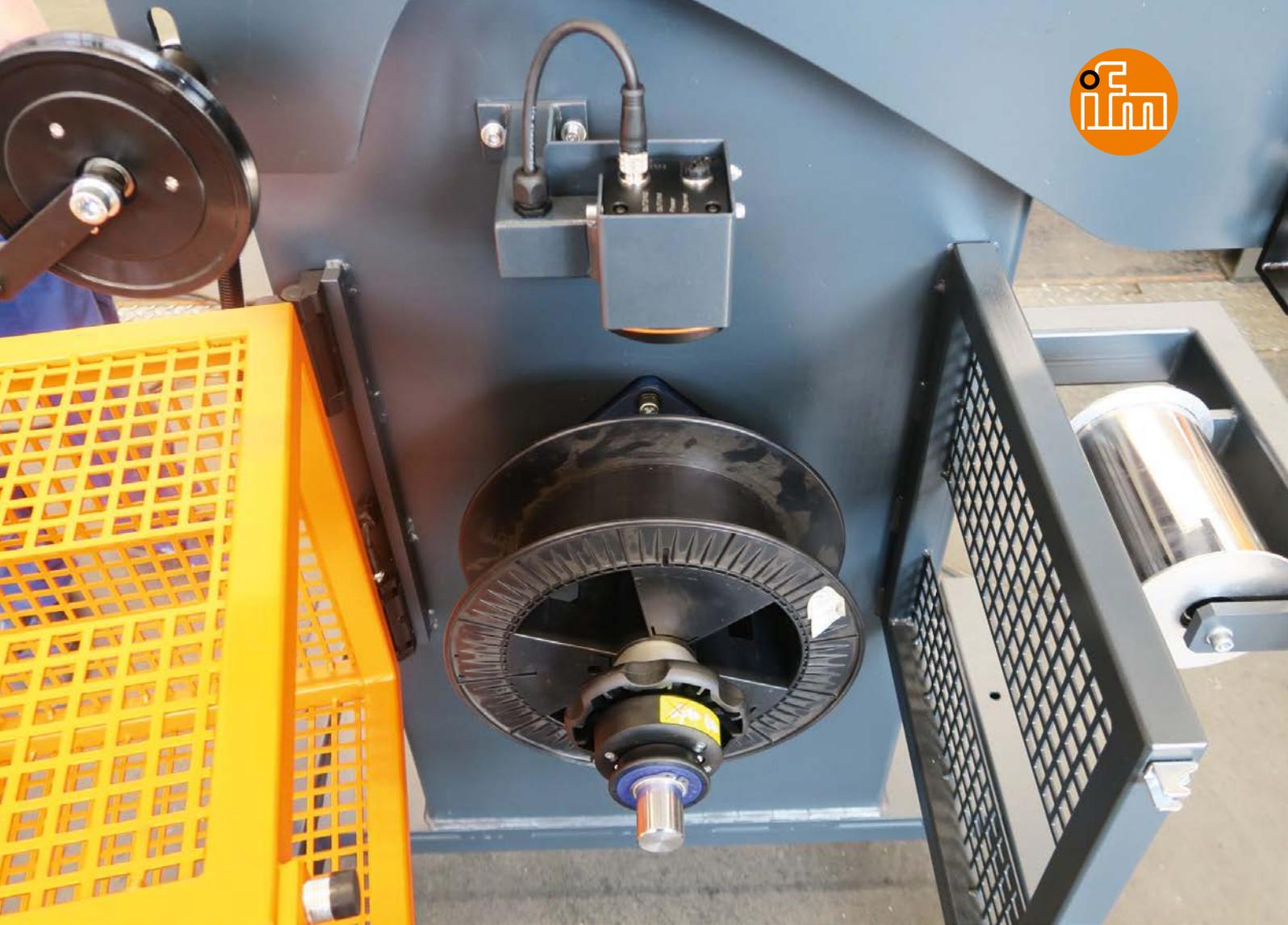
■ Reflectance values and ROIs

Stefan Leimann, Senior Sales Engineer Position Sensors at ifm, explains the trick: “For each pixel of the camera image, the sensor provides a reflectance value, which we use. In the sensor, it is represented as an amplitude value of 0...65,536. When the sensor looks at the wire, it sees a bright white line. This is the light reflected from the wire. It creates a very high amplitude value. If the value falls below a defined threshold, it indicates reduced reflectance. This is exactly what happens when there is

no more wire present. In the camera sensor, we have defined two Regions of Interest (ROIs): the left and right sides of the spool. This means that it is irrelevant whether the last layer is unwound from the left or right side. As soon as one of the sensor’s two ROIs “looks” at the bobbin, the reflectance value will drop. A sensor signal will cause the unwinding process to stop right before reaching the last winding, which is attached to the bobbin. This reliably prevents damage to the machine.”

Pay-off unit incorporating different types of spools.





The empty bobbin reflects significantly less light than the wire. The sensor signals "No wire present".

■ Maximum flexibility

A challenge that had to be solved: The supply spools consist of different carrier types. Sometimes they are plastic spools consisting of what is known as a solid body, sometimes they are welding wire spools made of wire mesh. In addition, there are different types of wire: blank wire or coated wire in various colours.

"Our customer processes wires with different diameters and carrier spools on this machine. Thanks to the universal parameter setting of the sensor, we don't have to adjust the parameters even with different wire/spool combinations. The last layer is always reliably detected based on the reflectance value. This is why we chose ifm's sensor. With it, we can cover the full range. Our customer is able to load any type of spool, even spools we haven't tested on this machine beforehand," said Michael Will.

Mobac intends to equip all future machines with this auto-stop function where required. *"Our machines are built according to the customers' requirements. The*

camera makes sense where no operators are present on site or where one operator manages several machines at the same time. In such cases, we offer our customers this sensor as an option."

■ Conclusion

Sometimes you have to think outside the box. It may turn out that a sensor developed for a different purpose is your ideal problem solver. **Michael Will** is thrilled: *"Compact, robust and easy to use, the O3D from ifm is perfectly suited for our application. A solution that meets all of our expectations. If only we had thought of it sooner. We could have saved ourselves a lot of time testing other sensors. For us, it was interesting to see which use cases the sensor can cover."*

The biogas plant was built on the farm, named Kögelhof, in 2004. The Müller family who owns the farm continued with dairy farming for another 4 years before switching completely to biogas production in 2008.



Biogas

Natural energy sources

The Kögelhof smallholding is situated in the Ravensburg district. It is a family-owned farm and has been dedicated to producing biogas that can be converted into energy since 2004.

Farmer Hermann Müller grows the required feedstock himself on 180 ha of arable land. The energy produced is sufficient to supply not only the farm itself but also another 1,400 households with electricity. The waste heat is used to heat the local school building.

■ Sustainable energy and heat for the neighbourhood

Hermann Müller compares the functionality of a biogas plant with the way a cow's stomach works, and he should know. After all, dairy cattle were once reared on the Kögelhof.

“Like the agitators in the fermenter, the muscles of a cow move the organic matter. It is decomposed by microorganisms in the warm, airtight environment and biogas is developed.”

In the Kögelhof plant, five engines which generate electricity with the help of a coupled generator – up to 4.5 million kilowatt hours per year – are run by the biogas. This power is fed into the electricity grid and can cover the energy requirements of around 1,400 households.



efficiently used

The resulting waste heat is also used in a targeted manner: The local utility company has laid a 1.4-kilometre district heating pipeline to the school centre. Both the building and the swimming hall are now heated in a biologically sustainable way, leading to an annual heating oil saving of 80,000 litres. An adjacent new development area will also be heated with biogas in the future.

Since the energy production at the Kögelhof farm is demand-driven, more is produced in winter than in summer.

“This inevitably increases the biomass throughput, which has not always allowed the full energy potential to be exploited so far,” says **Hermann Müller**. “With high production volumes, there is always a certain amount of residual energy in the end product of the biomass, the so-called fermentation substrate. For this reason, we were looking for a solution to produce really sustainably and get almost the entire energy from the biomass.”

Hermann Müller has found the right solution with the company Weber Entec.

■ Ultrasonic disintegration

Weber Entec specialises in plant construction for ultrasonic-based applications in the field of environmental technology, in particular disintegration – the ultrasonic treatment of biogenic substances.

This process increases the surface area of the fermentation substrate – in technical jargon, this process is called digestion. The increase in surface area accelerates the organic decomposition process and increases the energy yield.

In ultrasonic disintegration, the electrical vibrations produced by a generator are transformed by a converter into mechanical vibrations (sound transducer). These vibrations are transmitted into the surrounding medium via a so-called sonotrode. Here, they alternately cause high overpressures and underpressures in rhythm with the ultrasonic frequency, depending on whether the transducer is expanding or contracting. During the negative pressure phase, microscopic vapour bubbles form



*In the ultrasonic disintegration plant,
biomass is processed for maximum energy yield.*



*The ifm pressure sensor PM1604 with its robust
ceramic-capacitive pressure measuring cell is ideal
for monitoring the pump.*

” *The sensors are very
precise and reliable. IO-Link
in particular has enabled
us to improve our controller
significantly.*

in the sonicated liquid and implode in the subsequent positive pressure phase. This process is called cavitation. The implosions release high pressures and temperatures, further propagating the disintegration process in the biomass.

■ Pressure monitoring at the pump

Weber Entec relies on sensors and IO-Link masters from ifm to monitor the disintegration in this plant. For example, at the pump on the main fermenter, where the fermentation substrate is pumped into the ultrasonic system and back again. The sensors monitor the pump by measuring the pressure on the suction and discharge side. They also protect the ultrasonic generation and control the flow when the line pressure loss is too high.

The flush pressure sensor PM1604 is very well suited for this application thanks to its robust ceramic-capacitive pressure measuring cell. The measuring cell is resistant to particles in the medium, while the flush process connection prevents deposits on the measuring cell.



Several IO-Link sensors and actuators can be connected to the IO-Link master. The latter also serves as a gateway and communicates with the plant controller via PROFINET.

■ Added value thanks to IO-Link

The sensors are connected to the controller via IO-Link. In concrete terms, this means: The sensors communicate with the IO-Link master via IO-Link. Several sensors can be connected to the latter which bundles the signals and communicates with the controller via field bus, in this case Profinet. The wiring complexity is, therefore, considerably reduced.

This communication path, which is digitalised from end to end, allows more than just the loss-free transmission of the measured value. It is for example possible to use IO-Link for reading minimum and maximum values from the sensor, which provide information about possible critical short-term pressure peaks. The status of the sensor can be checked via diagnostic data at any time. All this data on top of the mere measured value helps to avoid unplanned failures of the system.

The parameters of the PM1604 are also set via IO-Link. The measuring range, for example, can be freely scaled within limits and optimally adapted to the application.

Christian Eichhorst, Managing Director of Weber Entec GmbH & Co. KG summarises it as follows: "The sensors are very precise and reliable. IO-Link in particular has enabled us to improve our controller significantly. IO-Link offers very great advantages such as reduced wiring complexity or the direct reading of various parameters, e.g. the peak pressure."

■ Conclusion

Efficient use of resources – this maxim applies to both the energetic utilisation of biomass and the sensor technology used, which outputs more than just measured values thanks to IO-Link. This provides maximum transparency in process monitoring and ensures an efficient and trouble-free operation of the biogas plant.



Kautex Maschinenbau is the world market leader for extrusion blow molding machines. The family-owned company was founded in Germany in 1935.

Kautex Maschinenbau simplifies plant handling and support with ifm solutions.

As the world market leader in their segment, Kautex Maschinenbau manufacture extrusion blow moulding machines that not only produce products of the highest quality, but also help to work efficiently and conserve resources. In order to realise this even more efficiently in the future and in even closer coordination with customers all over the world, Kautex Maschinenbau was looking for a way to easily digitise all relevant plant data.

“The processes that take place in our plants are highly complex,” says **Maurice Mielke**, Engineering Manager at Kautex Maschinenbau in Bonn. “In order to achieve the desired result in the end, it is not enough for the automated processes to mesh perfectly. It is also important to precisely maintain conditions such as temperature or blowing pressure.”

So far, this has been ensured by a multitude of sensors that Kautex implements in each plant. For example, the function of mechanical components such as extruders, heads or clamping units can be automated and monitored. Flow sensors ensure a loss-free and correctly metered supply of compressed air, while flow meters detect the flow rate and temperature of the cooling liquid flowing through the moulds.

All relevant measured variables are recorded and transmitted to the IT level via IO-Link.

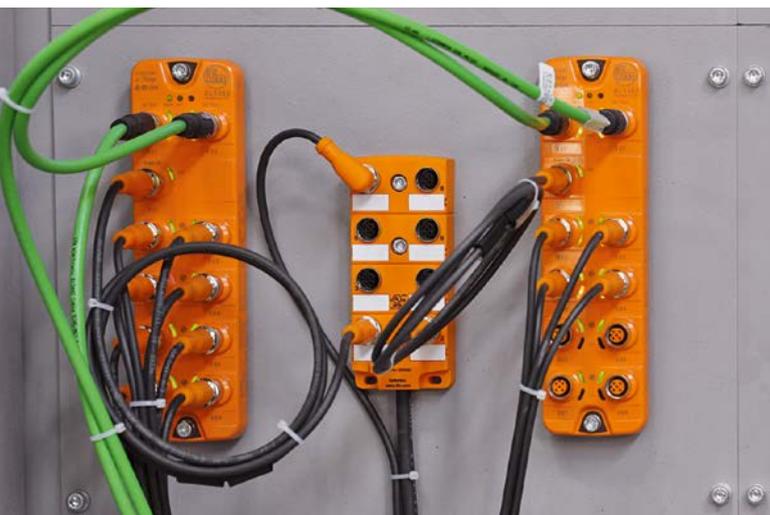


Digitalisation as a customer benefit





Even sensors without IO-Link can be integrated into the IT structure via data splitters.



The information from the sensors is bundled in IO-Link masters and forwarded from there via an IoT connection (green cable) for IT-based evaluation.

■ Collaboration for machine optimisation at customer request

“Digitisation has several advantages. First of all, the customer can view and evaluate all important plant information centrally on a computer in order to operate the plant as efficiently as possible,” says Mielke.

“At the same time, it is also possible to view the process data on site at the machine itself, which simplifies the work for the plant operator. If support from us is required, the customer can temporarily transfer the necessary data to a cloud with just a few clicks, where everyone involved can work remotely on a solution based on real-time data.”

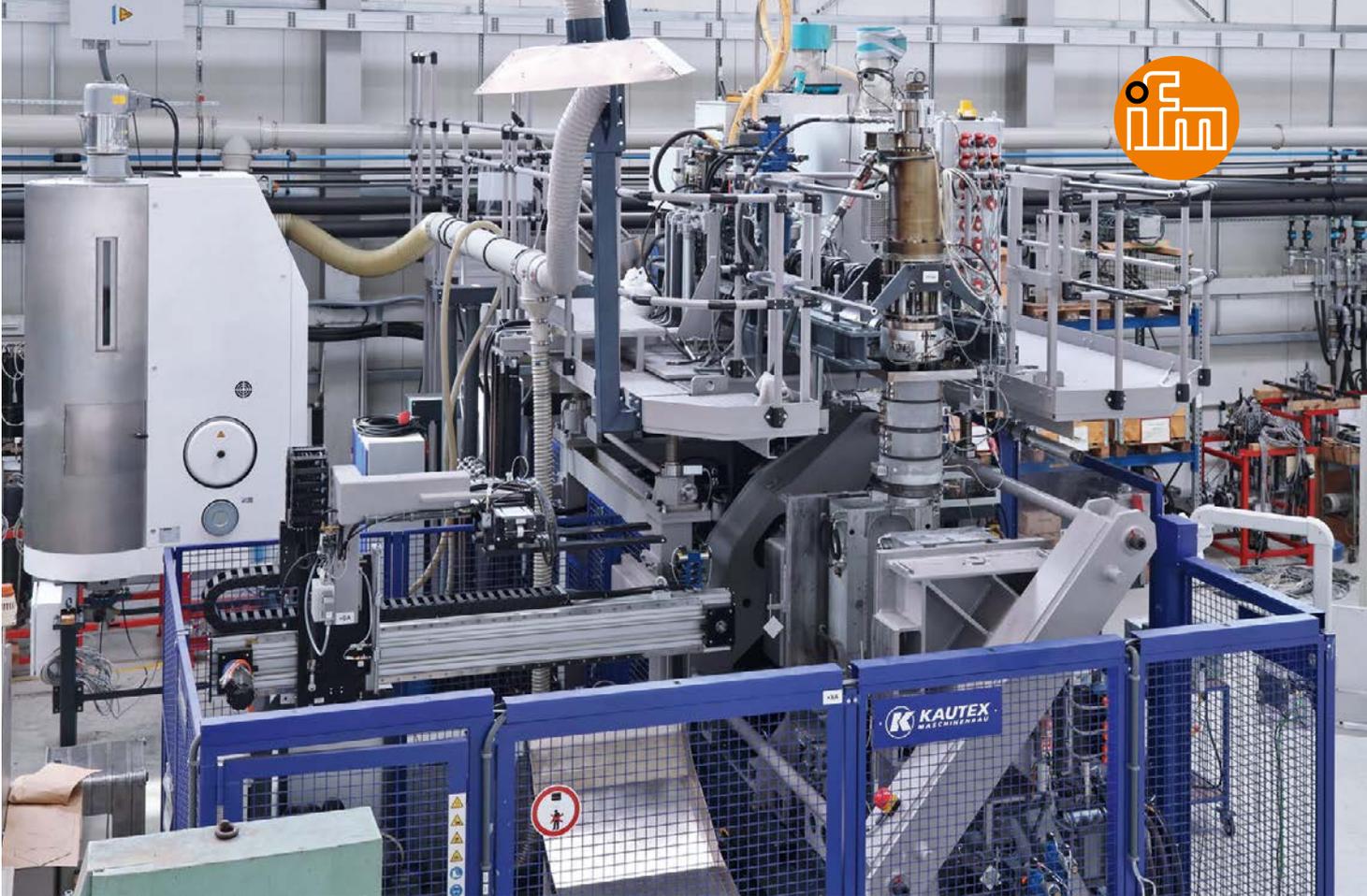
For the implementation of the plant digitalisation, Kautex Maschinenbau relied on hardware and software from ifm. The automation specialist offers a comprehensive portfolio of sensors, infrastructure and software to implement a project like that of the machine builder quickly and easily from the sensor to the IT level. The basis for this is provided by the manufacturer-independent digital communication technology IO-Link. Sensor data is transmitted purely digitally, i.e. without conversion losses and thus with high precision, to both the controller and the IT level.

■ Easy retrofitting thanks to the IO-Link data splitter

“In addition to the comprehensive product range for the implementation of our project, we were particularly convinced by the simple retrofit option,” says Mielke.

If IO-Link-capable sensors are already installed in systems, but have so far only been connected to the PLC in analogue form, digitisation can be easily implemented using an interconnected IO-Link data splitter. But even purely analogue sensors can easily be made fit for the digital age with a converter that is placed between the sensor and the splitter. Via the Y path opened up by the IO-Link data splitter, the digital signal from the sensor then reaches both the PLC and, via the IO-Link infrastructure, the IT level without any loss of time.

In the Kautex Maschinenbau plant, an edgeGateway collects the data transmitted by the sensors, processes it into readable values and makes it available locally or additionally on one or more cloud platforms, depending on the customer’s wishes. If necessary, this selection can be adjusted with just a few clicks – via a browser or on the unit touchscreen, where the most relevant information about the plant process can be visualised.



If necessary, the customer can contact the manufacturer's support and make specific data temporarily accessible. An enormous advantage, especially with complex machines, to ensure high efficiency of the plant.

” For the implementation of the plant digitalisation, Kautex Maschinenbau relied on hardware and software from ifm.

Kautex implements the local analysis of the data history with the IoT software ifm moneo. All the data collected is available here for detailed examination and evaluation. In addition, values can be linked with each other to make it easier to understand interrelations and to detect changes more quickly. For example, the temperature difference between the flow and return of the cooling circuit can be displayed as a calculated value. Pressure and quantity differences between compressed air input and total consumption at the end points can be quickly identified. This means that leakages in the compressed air system can be quickly detected and repaired. Tank levels can also be easily converted into litres and displayed in a dashboard, for example.

“However, true to our slogan ‘Be one with customers and partners’, for us the work on such a machine does not end with delivery to our customers,” Mielke emphasises.

“We want to offer our customers production reliability. This also includes continuous support when it comes to operating the system in ideal condition. With the digitalisation solution, we do not only meet our own demand for maximum efficiency and resource conservation. We also make it easier for our customers, as well as ourselves, to react to changes in the plants more quickly and in a more targeted manner. And that is exactly what Industry 4.0 should be about.”

■ Conclusion

With ifm's digitalisation solutions, Kautex Maschinenbau has been able to both increase process transparency for its customers and optimise its services if a customer needs support. With just a few clicks, the customer can temporarily release relevant plant data for joint evaluation with the machine manufacturer's specialists. A real win-win for everyone involved.

Modern pump monitoring with IO-Link

Although about two-thirds of the earth's surface is covered by water, there is an equally large proportion of the world's population living in areas that suffer water scarcity. The groundwater is increasingly polluted for different reasons. As a result, drinking water is the most common cause of illness worldwide. If current usage trends don't change, the world will have only 60 % of the water it needs in 2030.

To ensure a reliable water supply, Midvaal Water Company, from South Africa, relies on modern remote monitoring.

Therefore, ifm's goal must be to help their customers to save water. Innovative automation solutions are easy to implement and help companies to achieve savings in water, energy and maintenance.



The high-lift pump station of Midvaal Water. The five newer motor-pump sets (grey motor housing) were equipped with IO-Link sensors and condition monitoring solutions.

The Midvaal Water Company is a water service provider supplying potable water in bulk to South Africa, serving an area of some 900 km². Situated on the banks of the Vaal River, the company purchases raw untreated water and after purification, delivers it to consumers. In addition to this, Midvaal renders operation, maintenance and consultancy services for water treatment plants and sewage works.



“In addition, wiring failures could easily occur due to the significant amount of cables, resulting in complex reworking.”

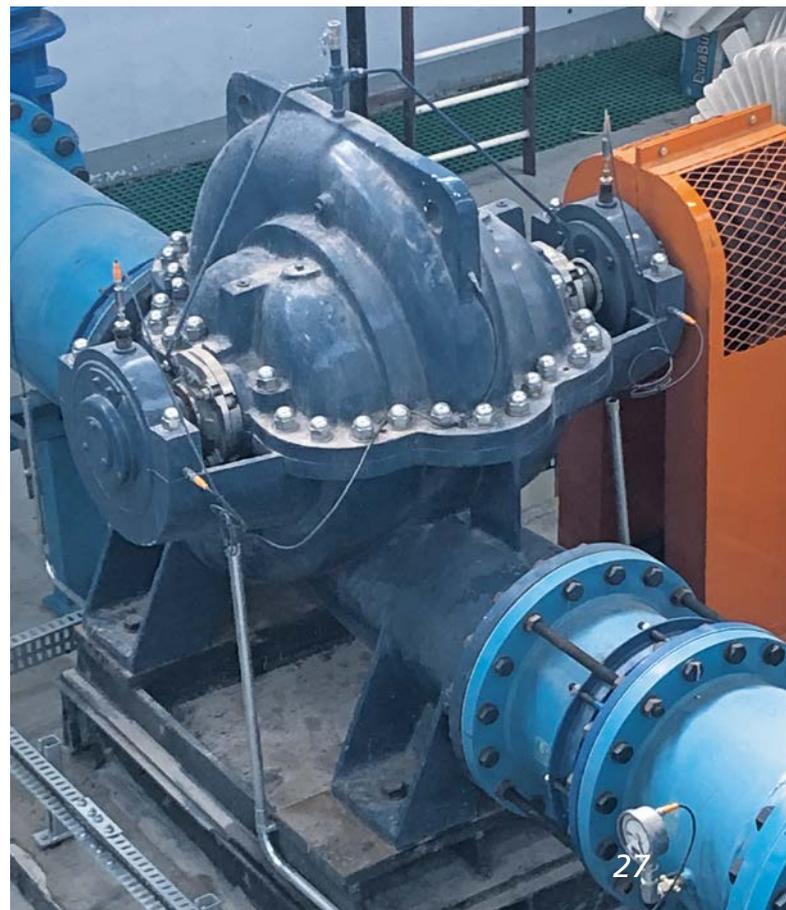
Midvaal wanted an innovative and easier solution that would enable reliable control of the pumps and motors of the high-lift pump station as well as remote monitoring to schedule timely maintenance tasks, ensuring performance and preserving the value of the pump station for the long term.

■ Contemporary, simple system for remote monitoring

In September 2019, the non-profit organisation decided to refurbish one of its high-lift pump stations. Traditionally, these stations were equipped with analogue sensors and standard infrastructure.

“In the past, it took our technician a week to connect a pump in the station to the PLC due to the complex wiring structure”, said **Mark Richards**, Maintenance Manager at Midvaal.

Several sensors measure the values of pressure, temperature and vibration.



The pressure sensor PG2454 shows the current value on an easy-to-read display on site and also transmits it digitally via IO-Link.

In a pilot project, five sets with motors and pumps were equipped with control and monitoring sensors as well as the corresponding infrastructure. Each of these sets consists of a 600 KW motor with 3.3 KV supply and a pump that can raise 43,000 litres of water per minute to a height of 60 metres. In addition, condition monitoring, sump level control and pressure monitoring of inlet and outlet was implemented.

■ Vibration monitoring expertise at ifm: everything from a single source

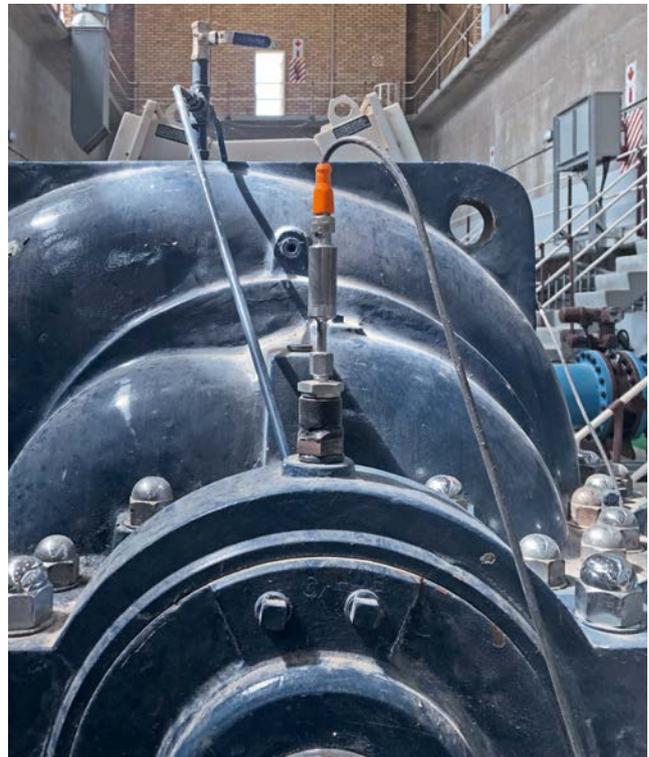
Several factors led Midvaal to choose ifm as their automation partner for project implementation.

“ifm initially presented their solution to us at a trade fair and we were convinced right away. The smart wiring with lower cable requirement, the possibility of transmitting data to the PLC via Ethernet and the storage of historical data in the diagnostic electronics all represented real added value for us,” said Richards.

“The collaboration also meant that we didn’t have to hire an external vibration expert, as ifm delivered professional advice and full implementation support, e.g. by ensuring that all limit values were set correctly. Even today, ifm’s experts assist us with their long-standing expertise in vibration diagnostics whenever we need help in analysing the historical data.”

Together with the engineering office Wasterspec cc and system integrators from APJ Automation, the ifm experts implemented the automation and condition monitoring solution. It comprises VSA001 vibration sensors whose data are evaluated by a VSE151 diagnostic unit. Combined with the temperature sensors, they provide the required data to ensure continuous monitoring of system health and visibility of the maintenance requirements of the motor and pump. In addition, PG2454 pressure sensors are used for pressure monitoring at the inlet and outlet of the pump – both remotely and on site via an analogue display.

The pressure and temperature sensors are connected to AL1122 IO-Link-Masters using standard M12 connection technology. This type of master features an EtherNet/IP interface enabling simultaneous data transfer to the PLC and IT system. The same applies to the vibration sensor data, since the VSE151 diagnostic unit also communicates directly with the PLC and the IT system via an EtherNet/IP interface.



To get a clear and transparent view on the health-state of the motor, the bearing temperature is measured...

...as well as the vibration behaviour at the bearings and the motor speed.



” From the sensor to the infrastructure to the IT level, ifm provides an integrated system, from a single source.



Before using IO-Link, two of these cabinets with analogue cards were needed to record the values of the sensors.



All values can be monitored on a display on site and remote.

■ Installation time reduced by 80 percent to one week

The installation time of the sensors was significantly reduced thanks to IO-Link.

“The installation time of five pump and motor sets used to be five weeks with hardwired technology. With the modern wiring structure, which is primarily based on IO-Link, the time required is also one week – but for all five pumps,” said Richards.

In addition to saving installation time, the condition of the pump station can now be monitored remotely. The condition monitoring software is also provided by ifm.

“From the sensor to the infrastructure to the IT level, ifm provides an integrated system, from a single source. This means that we have a single point of contact at ifm for all questions that may arise and receive fast and competent support at all times.”



With IO-Link, fewer cables and less space are required. Midvaal Water was able to reduce installation time by 80 percent.

■ Conclusion

The motor-pump monitoring solution meets the customer’s requirements for predictive maintenance, online condition monitoring, sump level control and pressure monitoring of the inlet and outlet. Also, the fault-finding time is reduced thanks to IO-Link and less terminations. This helps to reach a reliable protection of valuable assets of motors and pumps. The Midvaal Water Company is rightly very proud of what it has achieved in owning a plant that is one of the most innovative pumping stations in South Africa.

Retrofit with IO-Link

Modernised equipment for the Meckatzer brewery

Meckatzer has been a family-run brewery in western Swabia since 1853. Beer connoisseurs from near and far appreciate Meckatzer's beer specialities. When it came to modernising, the company relied on IO-Link components from ifm.

The brewery has their own special equipment to produce the lemonade for their 'Radler' drink. Water, lemon essence, citric acid, glucose syrup and carbonic acid are mixed here in a predetermined ratio. Originally, the dosing process was performed with diaphragm pumps and a Simatic S5 controller. However, the correct dosing by means of diaphragm pumps was very error-prone and the control system had become outdated. So it was decided to modernise the plant. Now it has a brilliant new look with integrated IO-Link masters and sensors from ifm as well as speed-controlled metering pumps.

Tobias Rossmann, project manager and PLC programmer at the Meckatzer brewery in Meckatz, Germany, is in an interview with ifm.

” Mr Rossmann, how did you become aware of IO-Link?

The Meckatzer brewery has been closely networked with ifm for many years and already participated in several field tests in the past. Since ifm products have been consistently equipped with IO-Link the last few years and the technology is very interesting, it was obvious for us to use it also in a complete project. The plant was manageable in terms of size and it was a good point to start from.



The flow sensor transmits several measured values to the control system via IO-Link.

” Which components and systems do you use?

All sensors are connected to a Siemens SIMATIC S7-1500 via three AL1103 Profinet IO-Link masters. A Bürkert valve terminal with Profinet control is also used. Unfortunately, I was not aware of an IO-Link valve terminal at the time of starting the project, otherwise I would have used IO-Link here as well. Today I know that IO-Link valve terminals are also offered by Festo, among others.

” How did the set-up work?

I downloaded the Siemens S7 TIA manual from the ifm website. I must honestly say, well done! If you have a basic understanding of programming, you can quickly get to grips with the manuals and the IODD descriptions. I set up the equipment for the lemonade production from my office workstation.

The programme "LR Device" helped me a lot with the integration in S7, especially when it came to clarifying basic issues, e.g. which sensor is connected to which port at which position, does the process value of the display match the PLC module?



System for dosing the 'Radler' beverage (a mix of beer and lemonade) ingredients.

” How was the control cabinet set-up compared to conventional systems?

It is, so to speak, “foolproof”. Compared to a control cabinet set-up with conventional terminals, the error rate is zero. We were much faster when wiring the system with the prewired M12 cables. The control cabinet we chose is quite large and still offers enough space. What also makes the IO-Link system very attractive is the modular design with the IO-Link masters. If in future more recipes need to be mixed, such as naturally cloudy lemonade, we have space for additional frequency converters in the control cabinet.

” How was the selection of sensors and adaptations?

We did the piping and welding in-house. The Aseptoflex-Vario T-pieces (order no. E33252 in DN15 and E33250 for DN25) were a great help for the small pipe cross-sections. The mounting adapters (e.g. order no. E40230) for flow sensors of the SM series have been modified by our mechanic so that they blend in harmoniously with the overall the plant design.

Meckatzer, a traditional brewery in western Swabia, relies on digital process control technology to produce lemonade.

On the tanks, we decided to use Aseptoflex-Vario welding adapters and G 1/2 sealing cones for the LMT100 point level sensors.

” What future visions do you have with the IO-Link system in operation?

Throughout operations, we already have two IT networks running. The required effort to integrate another AL1103 Profinet IO-Link master somewhere in the building, for example as planned for the ifm field test devices at the chemical dosing system soon, is manageable. We will definitely pursue this further, especially with the topic of energy data collection throughout the brewery, including compressed air consumption and definitely all water meters, which we gradually want to convert to ifm flow sensors with connection via IO-Link.

Mr Rossmann, thank you very much for this interview!



The sewage sludge (left) is separated into water (centre) and dry substrate (on the tray on the right).

Compact plant for dewatering biomass

Sewage sludge is prepared for thermal processing by means of a centrifuge.

A comprehensive set of sensors enables precise monitoring of the plant, both on site and remotely. Moreover, thanks to IO-Link the installation, commissioning and service processes are particularly efficient.

Almost 2 million tonnes of sewage sludge annually are produced in around 10,000 sewage treatment plants in Germany. While previously most sewage sludge has been used as fertiliser in agriculture, more and more sludge is now being recycled thermally for environmental reasons. Legal requirements in Germany require that all sewage sludge must be used for phosphorus recovery in mono-incineration plant from 2029 at the latest.

The Langelshheim-based company ISV-Umwelt builds mobile biomass dewatering plants and rents them to customers either on a temporary or permanent basis.

However, before sewage sludge can be used as fuel in the first place, its solid contents must be separated from the high water content - which makes up over 97 per cent of the mass.

This is where the company ISV-Umwelt from Langelshheim in Lower Saxony comes into play. Founder and Managing Director **Sven Penkwitt** explains:

„We build mobile biomass dewatering plants and rent them to our customers either on a temporary or permanent basis.“

One of these customers is the municipal sewage treatment plant in Diepholz where ISV-Umwelt sets up one of its plants for a one week period about four times a year.

„In this period, around 72 tonnes of dry matter, which can then be used for thermal recycling, are separated from around 2,400 cubic metres of digested sludge that accumulates in large basins over a period of three months.“



clean separation achieved



The municipal sewage treatment plant in Diepholz is one of ISV-Umwelt's customers.

” The vibration sensor allows us to detect early on when a bearing needs to be replaced.



Almost 300 t of dry substrate are produced in Diepholz annually and thermally utilised.

■ Separation with centrifuge

The separation plant is a self-sufficient system and housed in a 12-metre-long mobile container. The centrepiece is a decanter centrifuge. Its drum rotates at 3,200 revolutions per minute, generating centrifugal forces equivalent to 3,000 times the gravitational acceleration. When the sewage is fed from the collection basins with pump and hose, the heavy solids are pressed outwards. From there, they are led to the outside by means of screw conveyors, while the lighter water remains in the centre of the drum and flows off. A conveyor belt then takes them to a collection container for transport to the CHP plant. A flocculant is added to optimise the separation. The type and dosage of this is adjusted to the respective composition of the sewage sludge.

To achieve an optimum dewatering result, it must be possible to adapt the process at various points, and this is where ifm comes in: As an automation specialist, ifm offers a wide portfolio of sensors and automation solutions that can be used to precisely adjust and transparently visualise and analyse the process operations down to the last detail.



This decanter centrifuge, which separates water and dry matter at 3,000 times the gravitational acceleration, is the centrepiece of the plant.

■ Monitoring the centrifuge

The two main bearings of the centrifuge are subject to extreme forces when the heavy drum spins the sometimes inhomogeneous sewage sludge at enormous speed. Therefore two VVB vibration sensors have been screwed into each bearing. They permanently monitor the vibration behaviour.

A vibration pattern that deviates from the norm allows to quickly detect whether the mass cannot be processed, i.e. separated, correctly because e.g. the consistency or viscosity is not right or coarse lumps get into the centrifuge. Then the service staff can intervene and, for example, reduce the speed of the centrifuge to prevent damage.

Wear on the drum bearings is also detected at an early stage via an increasing vibration amplitude and reported as a maintenance signal. What is more, the vibration sensor has an integrated temperature sensor. Increasing temperature values indicate increased friction due to wear.

„The vibration sensor allows us to detect early on when a bearing needs to be replaced. We can assess the urgency and, at best, plan the maintenance work on the affected plant to take place between two assignments at the customer site. In any case, we are always in the know. We can reliably prevent or at least reduce to a minimum any unforeseen damage associated with downtime at the customer’s premises“, says Sven Penkwitt.



A vibration sensor ensures that no critical vibrations occur.

■ Hydraulic power unit

A high-torque, hydraulically driven screw conveyor which compacts the solids and discharges them to the outside is located in the centre axis of the centrifuge. The pressure is generated by an electrically driven hydraulic unit. A PV8 pressure switch with a measuring range of 0 to 250 bar measures the hydraulic pressure to control the electric pump motor via a frequency converter. The pressure is therefore used to control the screw drive and ultimately the solids discharge of the plant.

There is also an LI5 series level sensor on the aggregate. It detects the oil level and also the oil temperature, and it gives a warning when permissible values are exceeded or fallen short of.

■ Feed flow monitoring

The precisely metered inflow of sewage sludge into the centrifuge is crucial for an efficient separation process. For this purpose, a magnetic-inductive flow sensor is installed in the inflow. This sensor reliably detects the flow of a wide variety of liquid and viscous media, in this case the amount of biomass or sewage sludge that is added and that ranges from typically 15 to a maximum of 56 cubic metres per hour. This measured value is combined with both the feed pump and the centrifuge control in the plant controller. The sensor operates on the magnetic-inductive measuring principle. It offers the following advantage: The measuring section is free of any measuring element or other component that solid components of the sewage sludge could adhere to, blocking the pipe.



The electrically driven hydraulic unit for the screw conveyor in the centrifuge.



Monitoring of the hydraulic aggregate with regard to pressure, oil level and temperature.



Central measured value: A magnetic-inductive flow sensor monitors the amount of sewage sludge entering the centrifuge.

In addition, the sensor also measures the temperature of the conveyed sewage sludge. The viscosity of this sludge is higher in the cold seasons – a decisive factor that must be taken into account when feeding the centrifuge.



The LR7000 level sensor uses a microwave to detect the level in the flocculant preparation tank.



” So you can say that IO-Link minimises the downtime of the equipment on site at the customer.

■ It's all about the mix

To achieve optimum phase separation (this is the term used by specialists for the separation of liquid and solids), a flocculant is added to the sewage sludge. The flocculant is individually adapted to the type of sewage sludge, i.e. the recipe varies depending on the sewage treatment plant. The flocculant consists of water and a polymer concentrate. Both are individually prepared ensuring an exact mixing ratio. A vortex flow sensor is used for this purpose. It precisely measures the water supplied to the preparation tank and thus regulates the recipe of the flocculant.

The preparation tank itself is monitored with the LR7000 level sensor, which has a probe with a guided microwave for level measurement. This measuring principle offers the advantage of not being affected by the foaming of the flocculant. In addition, the probe can be easily shortened and thus adapted to the height of the tank.

The capacitive sensor detects the level of the polymer concentrate through the container wall and signals when supplies need to be ordered.

The readily prepared flocculant is fed into the centrifuge together with the sewage sludge. A SM8020 flow meter operating on the magnetic-inductive measuring principle precisely monitors the quantity supplied. Unlike the vortex sensor, this flow meter can not only detect water but any liquid media accurately, including the highly viscous polymeric flocculant.





Various flow sensors help with the dosing of the flocculant.



Simple screw connections instead of cumbersome wiring: All sensors are connected to the IO-Link master, which transmits the signals via Profinet to the plant controller.

■ Measurement at the storage tank

The storage tank with the polymer concentrate is monitored via the KQ1000 level sensor. This sensor is mounted on the outside of the tank and detects the fill level through the tank wall. Three switching signals with different priorities remind you to refill the tank.

Sven Penkwitt has found a particularly pragmatic solution here: „Depending on the delivery time and the required quantity of the product, the sensor’s installation position on the supply tank may be higher or lower, which gives us flexibility in the lead time of the order.“

■ Simple and easy with IO-Link

All sensors in this plant use the IO-Link communication protocol.

Sven Penkwitt explains the advantages for his company: „IO-Link reduces the wiring effort and allows a much leaner commissioning. Structured wiring essentially consists of screwing connectors to sensors and

modules. Sources of error, such as incorrectly connected cables, are eliminated. Our first plants were wired conventionally and we needed about 2 ½ days for this. Today, with IO-Link, it’s done in 2 hours.“

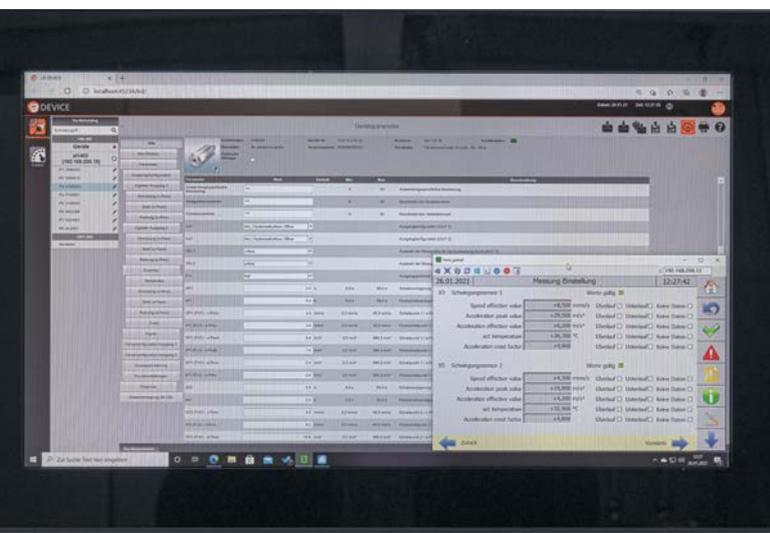
According to **Penkwitt**, one relevant advantage of IO-Link is in service: „I no longer need an electrician to replace a defective sensor; with the simple M12 connection, basically anyone can replace the sensor.“

Once the new sensor is inserted, it automatically receives its parameters from the IO-Link master: Limit values or counter readings are thus simply transferred from the old to the new sensor.

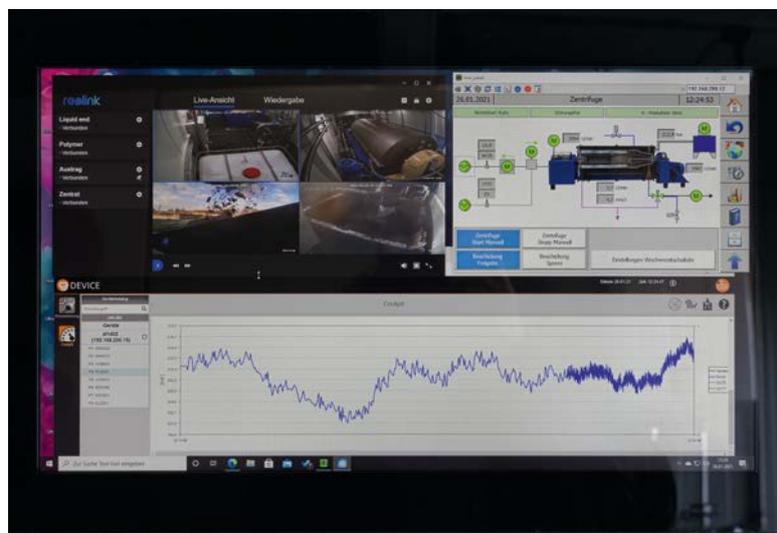
„So you can say that IO-Link minimises the downtime of the equipment on site at the customer.“

While conventional sensors only have switching or analogue outputs, IO-Link sensors also offer communication right into the sensor. For example, the complete parameterisation of the sensor can be carried out

” Our first plants were wired conventionally and we needed about 2 ½ days for this. Today, with IO-Link, it’s done in 2 hours.



Thanks to IO-Link, the user can read measured values, change parameters and view min./max. values and diagnostic data for each sensor via a dashboard.



All of the plant can be controlled and viewed remotely. Last but not least, IO-Link ensures maximum transparency.

remotely – either manually by the operator via software or automatically by the controller, for example when a recipe is changed. This makes it easy to optimise the process remotely, right down to the sensor level.

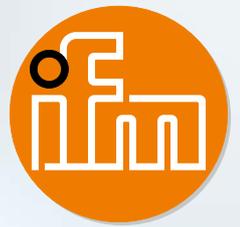
In addition, IO-Link sensors offer additional diagnostic functions beyond the actual measured value, e.g. operating hours counter, min. and max. value memory or values on the quality of the measured signal.

„All control and monitoring activities on our plants can take place remotely. This is where IO-Link comes in very handy, as it gives us maximum transparency right into the sensor. This enables us to adapt the process optimally and quickly locate the source of the error when faults occur“, says Sven Penkwitt.

Conclusion

The broad product portfolio makes it possible: with sensor technology from ifm and all the advantages of IO-Link, even a complex plant with many variables that have to be taken into account for maximum efficiency can be completely automated. However, it is not only the „hardware“ that makes a difference, service, too, counts.

This is how **Sven Penkwitt** sums it up: „The people at ifm understand what is at stake. They understand and support you, whether by phone and on site. The availability is also excellent: I call by 3pm and have my sensor the next day. This is of major importance for us in maintenance and service, because ultimately I am responsible towards my customers. I know of hardly any supplier in the electrotechnical sector that comes even close to this performance. That’s why we rely on ifm wherever possible. Because we get everything we need from them: competence, reliability and speed.“



IO-Link – we connect you!

More functions: Smart IO-Link sensors from ifm

IO-Link devices protect against tampering, transmit the measured value as a digital value, ensure easy replacement without parameterisation on site, and are available without surcharge. You see, there are many reasons for using IO-Link sensors.

ifm as the technology leader for IO-Link offers the highest number of smart sensors with IO-Link in the market. Take the right step into an innovative future and benefit from the many years of experience which have set benchmarks in functionality and service. ifm – your IO-Link system partner. ifm – close to you!

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Vibration analysis saves maintenance costs



How South West Water achieves its business goals with vibration monitoring.

South West Water provides reliable, efficient and high-quality drinking water and wastewater services for a population of around 1.7 million in Cornwall, Devon, the Isles of Scilly and parts of Somerset and Dorset. To meet the needs of its customers the company stores water in more than 20 reservoirs and treats it in around 40 water treatment works to produce drinking water for the region.

South West Water also operates 650 wastewater treatment works. Among them is the Marsh Mills facility on the outskirts of the city of Plymouth. Around one third of the wastewater of the city's 230,000 inhabitants is treated here in several stages before being fed back into the water cycle. After initial mechanical treatment, South West Water relies on a biological treatment using the activated sludge process at Marsh Mills. Microorganisms decompose the organic substances dissolved in the water.

„As these are aerobic microorganisms, it is crucial that sufficient oxygen is permanently added to the water so that the decomposition process can take place in the required quality,“ says **Brendon Teague**, Condition Based Maintenance Manager at South West Water.

This task is performed by nine blowers, which pump up to 390 cubic meters of air per minute into the aeration basins with a total output of 615 kW.

■ Fans – an unjustly overlooked piece of equipment

„So far, each blower and motor were checked about once a month in terms of their need for maintenance. Nevertheless, plant failures between maintenance intervals could not be excluded, as bearing damage was either unforeseen or developed between the intervals.“

Another problem exists in that the noise which could indicate deterioration of the motor condition cannot be heard from the outside.



„The motors are soundproofed, so people can literally walk past them undisturbed. Perhaps this is also one reason why fans and blowers in the water and wastewater treatment industry are often overlooked, even though they perform a task that is just as critical as, for example, the work of the pumps used in the drinking water supply.“ **Brendon Teague** finally decided to equip nine blower units in Marsh Mills with vibration diagnostics from ifm. This first step is, therefore, logical and does not come as a surprise.

■ Condition monitoring: keeping an eye on the health of the plant

„I have been working with ifm for a long time to safeguard South West Water’s plants against unforeseen downtime by using condition monitoring,“ says **Brendon Teague**.

South West Water provides drinking water and wastewater services for a population of around 1.7 million.

Together with his team, he has installed over 200 VSE100 evaluation unit devices, plus the acceleration sensors connected to it, in South West Water’s water and wastewater treatment works.

The vibration monitoring system consists of acceleration sensors and an evaluation unit. The sensors – South West Water uses sensors of the types VSA001 – are positioned at relevant positions in the system and transmit the data to the evaluation unit, in this case the VSE100. The latter permanently evaluates information from up to four sensors and sends corresponding switching signals to the control system when limit values are exceeded. The data and alarms can also be transmitted to a central control room via an Ethernet interface.

” I have been working with ifm for a long time to safeguard South West Water’s plants against unforeseen downtime by using condition monitoring.



Air is pumped into the aeration basin via powerful blowers – up to 390 cubic meters per minute at Marsh Mills.

■ Easier troubleshooting and maintenance planning remotely

By means of vibration diagnostics, the state of health of a machine is permanently recorded. Thanks to the monitoring of the occurring vibrations in the time and frequency range, incipient damage is registered at an early stage and can be analysed in real time by ifm’s own software in a more detailed FFT analysis (Fast Fourier Transformation). As an exact frequency can be assigned to the individual plant components or damage patterns, the sometimes time-consuming troubleshooting on site is no longer necessary and maintenance work can be prepared effectively, even remotely. This drastically minimises the amount of work and downtime.

■ Sensors help to achieve the company goals

„It is a real benefit to have a central overview of the status of all relevant machines via the software and to be notified as soon as a value exceeds a critical limit,” says **Brendon Teague**.

The site Maintenance Manager can thus quickly get an update of the situation, assess the need for action and, in an emergency, inform the maintenance team on site.

„Condition monitoring in this form is already helping us to achieve the company goals relating to the environmentally friendly handling of water and wastewater. By detecting damage at an early stage, we have often been able to react in time and thus avoid downtime and costly repairs. Overall, we expect that due to the implementation of condition monitoring, we can reduce the cost of maintenance and replacement of damaged assets on average by between £100,000 to £150,000 per year.”



Vibration sensors on the motors of the blowers detect incipient defects well before major damage occurs.

■ Condition monitoring: standard on newly installed machines

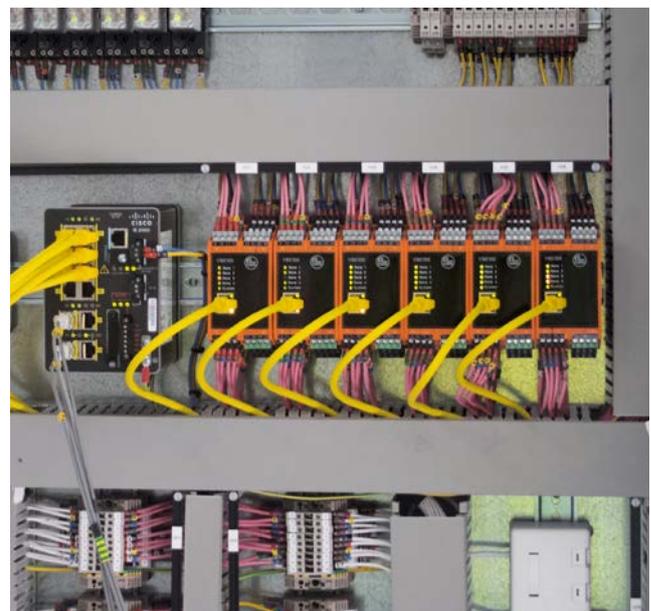
In order to benefit even more comprehensively from the advantages of condition monitoring in the future, South West Water has defined condition monitoring on pumps and fans as a technical standard.

„Every new plant must be equipped accordingly with sensor and evaluation technology that can be integrated into our existing infrastructure. This not only creates more operational certainty for large, important treatment works, but also helps us to efficiently and effectively maintain the quality and keep everything in perfect condition at smaller treatment works in rural areas.“

■ The future: collaboration via the IoT platform

As a further development step, **Brendon Teague** can very well imagine switching to the new ifm moneo IoT platform. With moneo, even complex sensor infrastructures can be easily mastered, while the optional **moneo|RTM** module offers far-reaching possibilities for an even more comprehensive vibration analysis.

„In combination with the new edgeGateways from ifm and thus the possibility of making the data available in a cloud environment, I would be able to share the relevant data even more effectively with my maintenance colleagues in the supply area, so that the maintenance quality and the reaction speed in the event of an alarm would again increase significantly.“



South West Water uses around 200 VSE100 evaluation units to monitor the machines in its water and wastewater treatment plants.

■ Conclusion

South West Water has been able to effectively prevent serious failures of critical water supply and wastewater treatment equipment such as pumps, centrifuges and fans with their comprehensive condition monitoring system. This saves the company significant costs for repair or replacement of equipment. At the same time, plant monitoring supports the company's goals regarding the responsible use of water as a resource.

A clear view for clear



Lower Murray Water is a regional water service provider with headquarters in Mildura in the Australian state of Victoria.

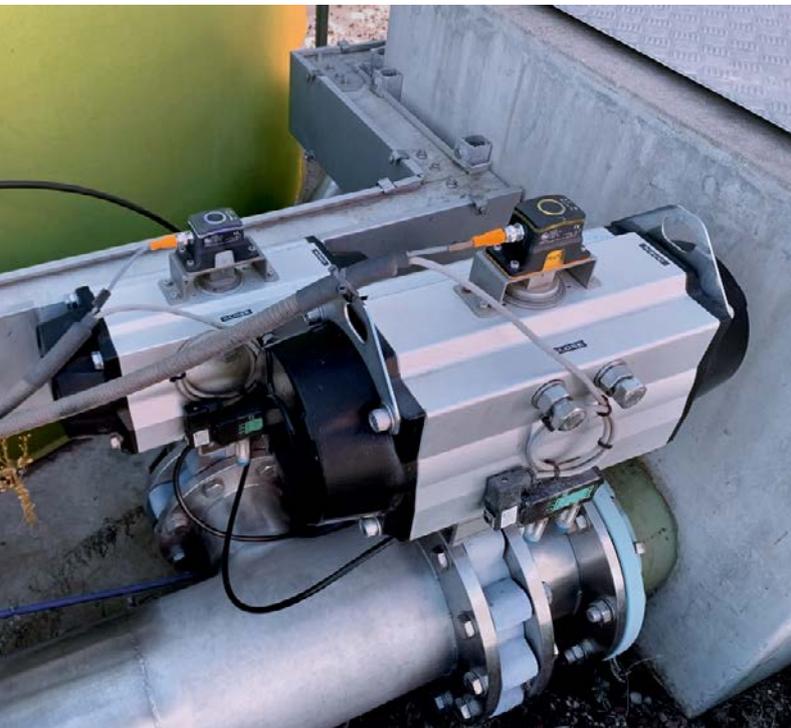
water

Lower Murray Water is a regional water service provider with headquarters in Mildura in the Australian state of Victoria. To cover the supply of approximately

80,000 customers in an area of about 14,600 square kilometres reliably, the company treats raw water from the Murray River in nine plants to produce drinking water.

The untreated water passes through several stations as it is treated to become drinking water, including filtration. During this step in the process, tiny suspended particles that have not already been removed from the water by flocculation, precipitation and sedimentation are filtered out. Since the filters become increasingly blocked as particles settle on them, they must be cleaned regularly by means of backflushing. This is the only way to retain functionality and the flow of water.





The MVQ101 ensures a reliable separation between drinking water and industrial water. The sensor detects even the smallest opening of as little as 0.1 degrees.

Thanks to IO-Link, the installation and replacement of an MVQ is really easy. Plus, the MVQ even resists the direct influence of the Australian climate.

” With the MVQ we can make certain before every flushing process that all the valves are actually closed and sealed.

„To do this, the filtration process is stopped, then water that has already been filtered is directed through the filter in the opposite direction at an increased flow rate to release trapped particles“, explains **Mark Blows**, Team Leader, Electrical Maintenance at Lower Murray Water.

To ensure that the backflushing runs in a self-contained process and no dirty water gets into the drinkable water that has already been treated, it is important for the necessary valves to open and close reliably.

„Until now we have ensured this by means of limit switches and that has allowed us to trace whether the valve is open or closed.“

When a new backflushing system was installed in the water treatment plant in Mildura, Lower Murray Water decided to use the MVQ101 valve sensor from ifm instead of limit switches.

■ Recognising what happens in the valve

The Smart Valve Sensor MVQ101 is a position sensor for valve actuators that provides a transparent view of what happens in the valve. The MVQ not only transmits via IO-Link that the end positions have been reached. Thanks to continuous recording of the position, the user can also keep an eye on the current valve position, accurately reported in degrees, as well as opening and closing times. For example, slower movement patterns point to accumulations in the valve or pipe. Blockages or adhering residue that prevent the flap from actually closing completely are detected by the sensor with a valve opening of as little as 0.1 degrees and a corresponding message is generated. The information is available via switching outputs and IO-Link and also on the device itself, thanks to a distinctive status LED with clear all-around visibility.

” Installing the sensors on the valve is really easy, as are commissioning and connecting to the controller thanks to IO-Link.

„In systems conducting water, even a minimal valve gap that cannot be reliably recorded by conventional limit position switches can be enough to effectively eliminate the separation between drinking water and industrial water”, says **Mark Blows**.

„With the MVQ we can make certain before every flushing process that all the valves are actually closed and sealed. The additional diagnostic possibilities such as the actual movement time of the valve help us to maintain our systems based on actual need. This prevents unnecessary downtimes and the risk of endangering drinking water quality is also minimised.”

■ Resilience proven under the Australian sun

Another advantage: The MVQ is low-maintenance – and extremely resilient.

„Previously the feedback for the valve position was provided by sensors with mechanical switches. The many movable parts were a potential source of errors which could lead to a plant stoppage. With the MVQ, we are able to reduce the number of movable components and also work digitally, which significantly lowers the risk of a plant stoppage caused by an error.”

It should also be mentioned that Lower Murray Water operates the Smart Valve Sensor outdoors, where it is largely unprotected from the Australian climate.

„Dust and rain have had as little effect so far on the MVQs we installed as direct sunshine and temperatures between minus two and plus 45 degrees Celsius.”

In addition to the information and process reliability gained, Lower Murray Water employees also appreciate the accelerated installation process.

„Installing the sensors on the valve is really easy, as are commissioning and connecting to the controller thanks to IO-Link.”

Thanks to the IO-Link digital communication technology, up to eight MVQs can be connected to a single IO-Link master, which forwards the bundled data to the IT level as well as the controller. When a replacement is made,



the time for implementation is reduced thanks to the master connection, because the parameters are saved on the master and are automatically written to the new device after the sensor is replaced. For Lower Murray Water that means seamless and reliable monitoring of the backflushing process is guaranteed at all times.

■ Conclusion

Now that the MVQ101 is installed, Lower Murray Water has a continuous and transparent view of the condition of the valves in the backflushing system of the water treatment plant in Mildura. The digital transmission of the valve position, opening and closing time via IO-Link as well as digital and visual alarms on site in the event of blockages ensure drinking water quality and give the company the ability to recognize the need for maintenance early on and to carry out maintenance measures.



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1D

2D

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ifm Vision: from selective distance measurement to industrial imaging

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Sorting with

Up to 6,000 packages per day can be handled with the solution, consisting of a collaborative robot arm, a 3D sensor from ifm and software from Unchained Robotics.

Depending on the customer's requirements, other robots can be used to achieve higher frequency rates or move heavier loads.

3D sensor as the heart of a pick & place solution

Christmas time is calendar time. When the turn of the year approaches, the production of personalised calendars reaches its peak. Individually designed calendars are appreciated as a year-round reminder of happy moments. By means of their pick & place solution in a printing shop, the start-up Unchained Robotics help to deliver the personalised calendars to the customers as quickly as possible. The central elements: a collaborative robot and the 3D sensor from ifm.

The young company Unchained Robotics aims at simplifying the configuration of cobots and their process integration.

An industrial area on the outskirts of Paderborn in East Westphalia: this is where large quantities of calendars are produced. Whether 100 copies for business customers or individual copies for private individuals who create their own personal calendar on online portals: a great variety of calendars in different formats from DIN A5 to DIN A3 are packed for shipment and fed to the pick & place station from Unchained Robotics. Here, a laser scanner automatically detects the bar code to allow tracking via track & trace, before the calendar is picked from the conveyor belt by a collaborative robot and placed on a transport pallet or in a post box – neatly sorted by size.



unfailing Precision

■ Convinced by the 3D sensor – and ifm’s technical support

The heart of the robot installation is the 3D sensor from ifm, the O3D. The operating principle of the O3D is based on the time-of-flight principle.

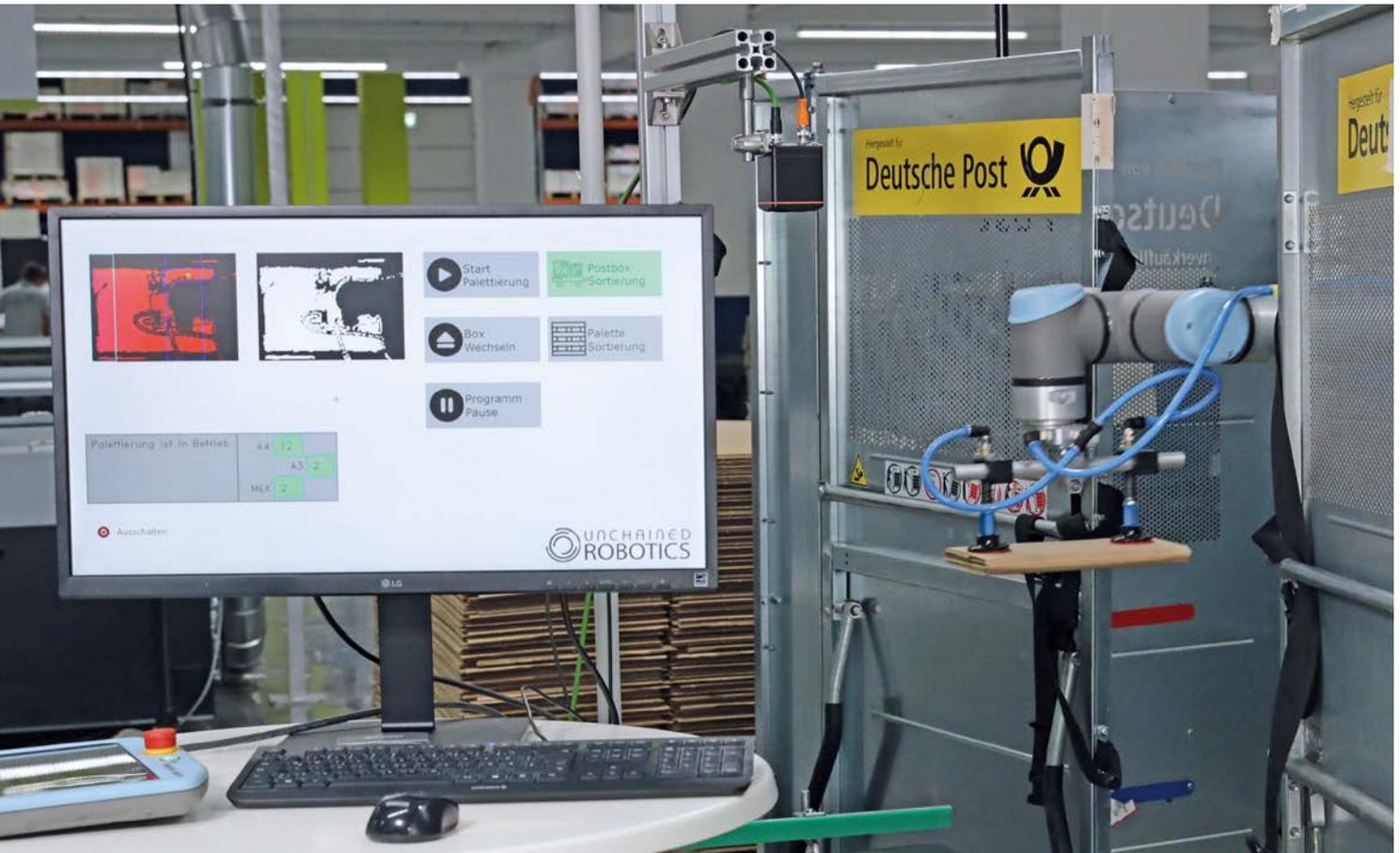
By means of 23,000 pixels arranged in a matrix, the 3D sensor detects the time needed by the light emitted to reach the sensor again as a reflection per capture. Based on this data, the O3D precisely calculates the spatial dimensions of objects and scenes.

*“This aspect played an important role in our decision for the O3D,” says **Mladen Milicevic**, one of the founders of Unchained Robotics. “No other equipment or process stops are necessary, because the sensor exactly detects the height, basic form, angle and displacement of each package. This means that the packages can be placed on the conveyor belt without observing a particular arrangement or orientation. This reduces the strain on the employees and accelerates the manual process,” explains **Milicevi**.*



Based on the data transferred by the sensor, the software calculates the robot arm’s movements to ensure precise positioning of the package at the placement location.

” We particularly opted for the O3D and for ifm because of the easy integration into our in-house developed software



Exact data and precise calculation are required to avoid collisions when space is at a premium.

■ Easy integration into existing software

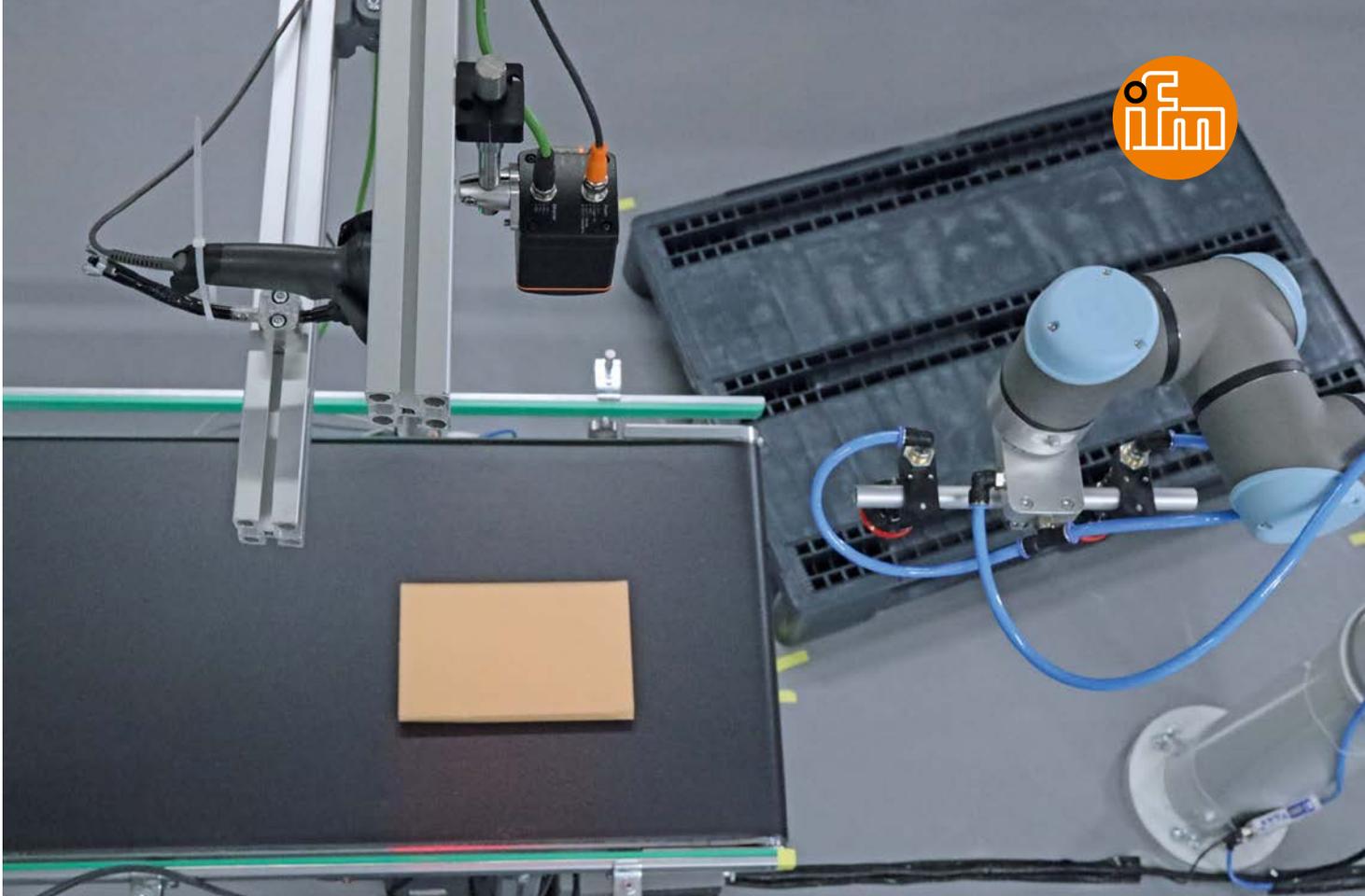
“We particularly opted for the O3D and for ifm because of the easy integration into our in-house developed software,” Milicevic continues. “And if we had questions, ifm’s support helped us quickly and competently.”

Based on the data, the software from Unchained Robotics can exactly calculate where the robot has to place its suction cups on the package to be handled. This ensures that the calendar is always picked up at equilibrium and at optimum orientation.

■ Precision prevents collisions

The high precision obtained by the 3D sensor is indispensable for the pick & place task carried out by the robot.

“Particularly if the calendars are placed in post boxes, space is at a premium. The robot has to move with great precision and within small tolerance values to prevent its arm or the calendar from colliding with the metal walls.” explains Milicevic.



The sensor exactly detects the position and height of the package – by means of 23,000 pixels.

Depending on the format, the robot places up to 12 calendars in a 3 x 4 pattern at the placement location. Thanks to the precise positioning, a stack height of up to 70 centimetres is possible even on open pallets.

“The reliable and precise detection of the height also plays an important role when it comes to selecting the placement location within the pattern,” says Milicevic. “The robot places the packages according to a special height algorithm taking into account the individual package heights. The packages are sorted so that the highest point is always furthest from the robot. Besides, the packed calendars form a virtually homogeneous, flat surface when the maximum stack height is reached.”

■ The camera and the software are the core of the solution

With a frequency rate of eight seconds, the pick & place solution of the start-up also masters the high requirements placed on it in the time before Christmas, when up to 6,000 calendars per day leave the printing shop. The packages can have a weight of up to eight kilograms.

“This is within the limits of the technical data of a collaborative robot arm,” explains Milicevic. „If heavier weights were to be moved or faster frequency rates were required, we would use a more powerful industrial robot. This would be no great problem, as the robot only plays a minor role in our solution. The core of our universal solution is the combination of camera and

software, which makes the solution not only suitable for calendars: It is also suitable for any pick & and place process in which products are placed on or picked up from pallets.”

Another advantage of this powerful combination of sensor and software: As no other system components are required besides the robot arm, the costs for implementation are kept to a minimum.

■ Conclusion

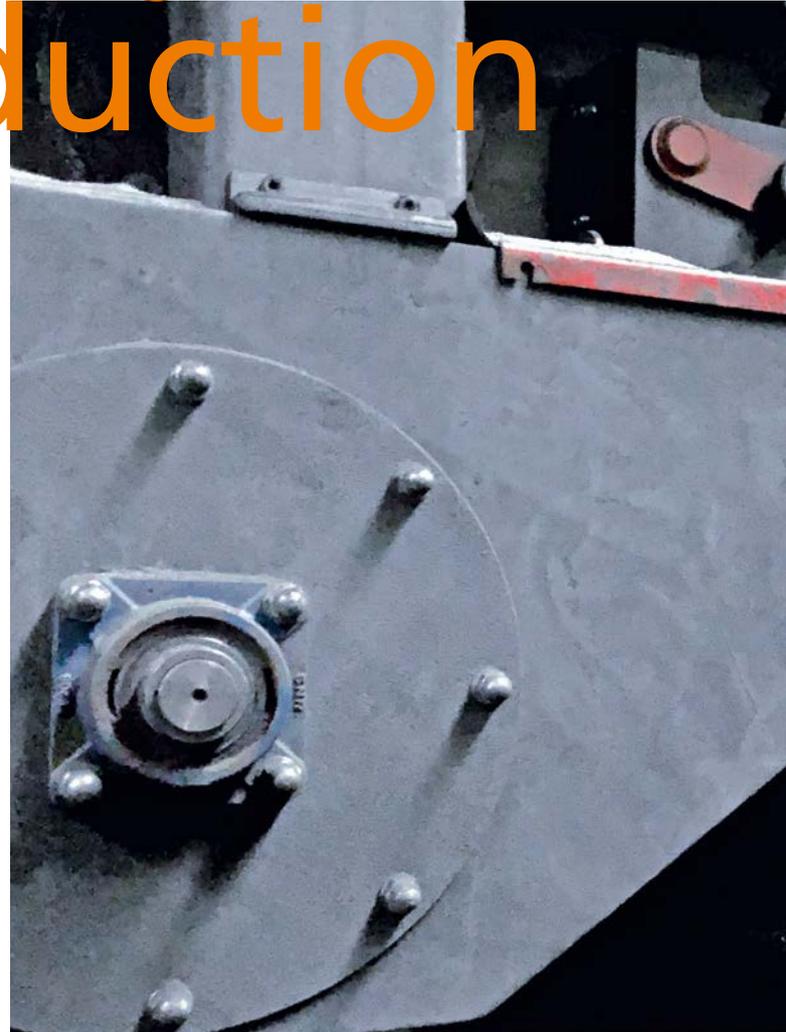
The O3D is a central element of the pick & place solution from Unchained Robotics. Thanks to the exact detection in three dimensions of the packages, the 3D sensor provides reliable information to the software which helps to precisely control the robot arm. Even during the printing shop’s busiest times, the calendars are reliably put in the correct placement location – and reach the customers in time.

Detecting flaws in production

The company “ia: industrial analytics GmbH” from Aachen offers a comprehensive solution for the digitisation of production plants – from data acquisition to visualisation.

Transparent processes: looking into the black box

ia: industrial analytics use IO-Link sensors from ifm which enable easy, plug & play data extraction from production processes. The goal: By visualisation in an OEE waterfall, the causes of a bumpy transition between production steps are shown transparently with their respective effects. Based on these insights, individual production steps can be optimally interlocked. This leads to increased efficiency, as the application example from the steel processing industry shows.



The heart of the plant is the ia:factorycube. With its computing unit, router and evaluation software, it contains all the IT components required to collect, evaluate and visualise generated data – and to transfer it to the cloud if required.

Jeremy Theocharis, founder and CEO of industrial analytics: “Via the factorycube we can connect the different IO-Link sensors or use completely different data sources, for example camera solutions for quality assurance or barcode scanners for product tracking. In this plant, however, the focus is on IO-Link sensors, which

Increasing performance



The ia:factorycube collects the data of the connected sensors, processes it and, if required, transfers it to the cloud.

give us a very good opportunity to digitise plants very quickly and very efficiently in order to derive key figures.”

The complete information processing is done in the factorycube. In addition, the system can be modularly adapted to the customer's wishes.

“It is possible to store the data on the factorycube or to integrate the device into the customer's own IT infrastructure. The third option is the storage and evaluation of the data in our cloud system, which we make available to our customer if desired.”

Nicolas Altenhofen, Marketing Manager at industrial analytics, adds: *“Our approach is not only about data storage. Much more important is the second step, the processing and visualisation of the data. We are less concerned with optimising production processes. We focus on performance figures. For example, we use an optical sensor to find out whether the machine is running or not, or to determine the number of pieces. We want to know: When did the machine stop? When did the machine run? What were the reasons for a machine downtime? This data is then prepared and visualised in different ways.”*

In order to make the use of the factorycube as versatile and thus as efficient as possible, industrial analytics deliberately rely on open interfaces. This means that extensions can be easily implemented. Currently, for example, solutions are being developed for quality assurance with camera systems and machine learning as well as for capacity planning, capacity distribution or predictive maintenance with high-frequency vibration analysis. Thanks to the great modularity, every customer receives exactly the solutions they need on their way to Industry 4.0.

Jeremy Theocharis explains what it is all about: *„We can uncover optimisation potential. There are expensive plants that are not used efficiently. Many customers simply lack transparency on how long, for example, order*



Measure utilisation: ifm sensors detect whether machines are running or in a waiting state.

processing takes. The actual capacity utilisation of the plant is also often unknown. We open this black box and enable the customer to make data-based decisions and gain relevant insights, for example that the bottleneck is not the machine but the material procurement.”

One example is the case of a major customer in the steel processing industry whose machines at two locations were retrofitted by industrial analytics within a few weeks, so that comprehensive performance management is now possible.

■ No data transparency on the shop floor

The customer’s machine park consists of plasma cutting machines, oxyfuel cutting machines and blasting machines, among others. These machines are used to cut steel plates and rework them.

Jeremy Theocharis: *“Our customer’s problem was that they had no transparency regarding their production processes and performance. For example, the company didn’t know how long it actually takes to produce a particular workpiece on a particular machine”.*

” *At the beginning we compared many suppliers of sensor technology. We ended up in the ifm webshop.*

Although theoretical target times existed for the various products, these were not compared with the actual time required. There was also a lack of knowledge about the availability and capacity utilisation of the machines. Machine downtimes and their causes were not recorded. Without this valuable information, the company had no way to monitor production performance, identify problems and make data-driven decisions to improve production processes.

■ Real-time data through ifm sensors

With the help of the factorycube and various sensors from ifm, it was possible to collect the non-existent data and achieve the necessary transparency of the production processes. A total of 14 optical distance sensors of type O5D100 and O1D108 were installed on eight plasma and oxyfuel cutting machines. These sensors are used to determine whether the respective machine is in operation and how long this has been the case. The sensors were positioned so that the light beam points to the cutting head of the machine. As soon as the machine is started, the cutting head is lowered and the distance to the distance sensor changes. Through this change in distance, the system detects that the machine is in operation. In addition, vibration sensors of type VTV122 and optical sensors of type O5D100 were installed on three blasting machines. These sensors also help to determine the operating status of the machines.



The distance sensor O1D108 detects whether the cutting head is in operation or in the rest position by means of time-of-flight measurement.

■ Reduced machine downtime and increased productivity

The data collected by the ifm sensors is processed in the factorycube, sent to a cloud and visualised in a dashboard. The company's decision-makers can check machine conditions and production key figures, such as OEE (Overall Equipment Effectiveness), in real time. Based on the data, measures can be taken to optimise the production processes.

Success was not long in coming: A few weeks after installing the sensors, the company had considerably increased its efficiency and productivity.

■ Simple order process

The fact that industrial analytics relies on sensor technology from ifm is mainly due to their good search engine presence and the ifm web shop.

Jeremy Theocharis explains: "At the beginning we compared many suppliers of sensor technology. We ended up in the ifm webshop. I was very enthusiastic

about the fact that you could see the prices right away and that you could simply click on "Order" without having to spend ages defining a project. Then we ordered the sensors. Thanks to IO-Link, they were quickly set up, and they work well and provide precise results. Maybe the sensors are a bit more expensive, but they work reliably, and we can simply order sensors at the press of a button in the shop."

■ Conclusion

*"It doesn't matter what industry 4.0 solution you're looking for – without reliable and accurate data, you won't get a satisfactory result," says **Jeremy Theocharis**.*

With powerful IO-Link sensors, ifm creates the database which is collected, processed and visualised by means of the factorycube from ia: industrial analytics. This interaction makes it possible to create transparency, improve performance and ultimately reduce production costs.



The Olching brewery currently produces four own types of beer for catering establishments and markets in the vicinity.

The Olching brewery

World-class beer produced by the Olching brewery. Co-founder and brewing engineer Julius Langosch explains in an interview how the company, still in its infancy, came into being, how the traditional amber fluid is brewed and what role ifm sensors play in this.

The Olching brewery: the local brewery north-west of Munich can currently produce up to 2,500 hectolitres of its own four types of beer.

” Mr Langosch, what gave you the idea to start your own brewery?

The idea for the Olching Brewery was born during a ski trip in 2016. We came up with it because there had been no local brewery here in Olching, Bavaria, a town which now has 30,000 inhabitants.

To find out whether an Olching beer would be well received, we started by marketing our lager through licence brewing. This means that we rented a brewery where we brewed according to our own recipes. The result was our “Olchinger Naturhell” pale lager, a naturally cloudy, untreated and unfiltered beer. Shortly afterwards, we started producing wheat beer, too, due to the high demand. These two brands were well received. We now also offer two other types of beer, the “Olchinger Dunkel” ale, served for the first time at the Olching folk festival, and our “Hopfn Bua” hop beer. This is a special type of lager to which hops have been added again for a particularly fresh and fruity note.



Modern art of brewing meets

tradition

These are the four varieties we currently have on offer. Since April, we now also have our own brewing facility planned in parallel over the past few years. We purchased it from the brewery equipment manufacturer JBT (Joh. Albrecht Brautechnik in Munich, editor's note), where I had previously worked for 8 years. I had the chance to take charge of the equipment planning and incorporate my own experiences. It goes without saying that some special requests could be fulfilled, too, in the process. Among other things, there are a lot of ifm sensors, as I already knew ifm from my work at JBT and have always been very satisfied with them.

” How big is your brewery?

There are currently four of us. My business partner and co-founder Dr. Guido Amendt takes care of marketing and sales, whereas I am responsible for all

brewery-related technological questions. Then we have somebody for the office work and a trainee because we are also a training company for brewers and maltsters recognised by Chamber of Commerce and Industry.

Our medium-term target is 1,000 hectolitres per year. The equipment, as it is now, allows us to produce up to 2,500 hectolitres, and even up to 4,500 hectolitres per year with a tank extension.

” Where can I buy your beer?

The beer can be purchased in local retail outlets or beverage stores here in the district. Moreover, you can get it at the brewery or order it online. Since Corona times, we have also introduced a delivery service, which has made a promising start in the vicinity and with which we also supply people at home. We also supply various restaurants in Olching and Munich.



Julius Langosch,
co-founder and brewing engineer
at Olching brewery.

” Can you roughly describe the brewing process?

Producing beer starts traditionally with malt and water, which is mashed in the brewhouse on brew day. Lautering is the next step, i.e. the liquid that we call wort is separated from the grains and afterwards boiled in the brew kettle. This is also where the hops come in. At the end of the boil, the solid particles in the hopped wort are separated out in the whirlpool. For the separation of the solids a tangential inflow is used. Then the wort is cooled before yeast is added in the tank. At this point, we start calling the liquid beer. Depending on the type of beer and yeast, fermentation takes 2 to 12 days. After the fermentation, the beers are conditioned for 10 to 80 days in cold storage.

” Temperatures play an essential role in the brewing process. How much leeway is there in this?

During mashing, precision to the degree is required, because the enzymes have a narrow temperature optimum. While deviations do not make the beer undrinkable, they nevertheless affect its taste, changing it for example from light and fine to rather malty or bread-like.

And I also have to keep a close eye on the temperature during fermentation. If the temperature is too high, the yeast ferments too quickly and produces too many fermentation by-products. If the temperature is too low, fermentation can come to a complete halt.

Therefore we monitor the temperatures very closely in the different process steps. For this purpose, we use TA and TN temperature sensors from ifm.

ifm pressure sensor for hydrostatic level measurement in tanks.





” Which other important points in the brewing process are monitored by sensors?

We use the SM8100 flow meter to measure water quantities, for example at the mash tun. The meter counts the amount of water supplied to the exact litre. This is important, because too much water dilutes the brew, while an insufficient water supply would lead to an overly thick mash.

Another application for the SM8100 is the cleaning process, i.e. the cleaning lye preparation. I need a defined amount of water for this to make sure the lye concentration is as required. The flow meter ensures control of the inflow.

The second flow meter is the SM6050. It is also of essential importance because it measures the flow during lautering and controls the coupled drain valve to ensure that the liquids neither drain too quickly nor too slowly.

That is why, besides temperature measurement, these two flow controllers are certainly the most important sensors in the brewing process.

The SM8100 flow meter not only transmits the flow rate via IO-Link but also the temperature value of the beer flow.

” Do you also use the integrated temperature measurement in the flow sensors?

Yes, exactly. I can query the flow rate and also the temperature values via IO-Link. Although the temperature is not necessarily relevant to the process at this point, it is a very good indicator of the speed and quality of lautering. For example, the information that the wort runs through at only 50 degrees tells me that the lautur tun is already much too cold. If it runs through at 70 to 75 degrees, however, the process is supposed to go well and fast. The additional temperature value I get with the SM6500 is therefore a good extra reference point provided via IO-Link.



” Are there any other sensors integrated in the brewing process?

We also use the LMT100 point level sensor. You can find it in three places, in the kettle, in the lauter tun and in the tube. It informs the controller whether a vessel is empty and initiates the subsequent process step, for example in the plant control system.

We also have pressure sensors for level measurement in the brew kettle and lauter tun. They give me information about the quantities in the vessels.

” What about the digitalisation of the equipment?

Our method of choice in this respect is IO-Link. We use it to connect all sensors and actuators directly to the control system. A CODESYS V3 controller application ensures that our brewhouse can operate fully automatically.

There is a 24-volt power supply for various parts of the equipment and we use electronic circuit breakers from ifm here. The latter can be monitored and switched via IO-Link.

” Where do you see the advantages of IO-Link?

With IO-Link, I can get additional information from the sensors. One example is the SM6050 flow meter. In addition to the flow rates, it also provides me with a temperature value via IO-Link. This saves me the effort of installing another temperature sensor at this point.

Another advantage of IO-Link becomes apparent when a sensor breaks down and I have to replace it. The parameters of the broken-down device are automatically transmitted to the new sensor. I do not have to set its parameters manually and it works immediately.

” What parameter settings do you make via IO-Link?

For example the LMT100 settings for transmission of the “empty signal”. Using IO-Link, we have set the switching point such that it provides empty or full signals reliably even in case of deposits or soiling.

Or take the SM8100. We have set its parameters so that it provides both flow and temperature information. What is more, the sensor now emits a switching pulse for a defined quantity of litres.

As for the temperature sensors, there was no need to set their parameters. We access the process values directly via IO-Link.

” One final question: How do you see the cooperation with ifm?

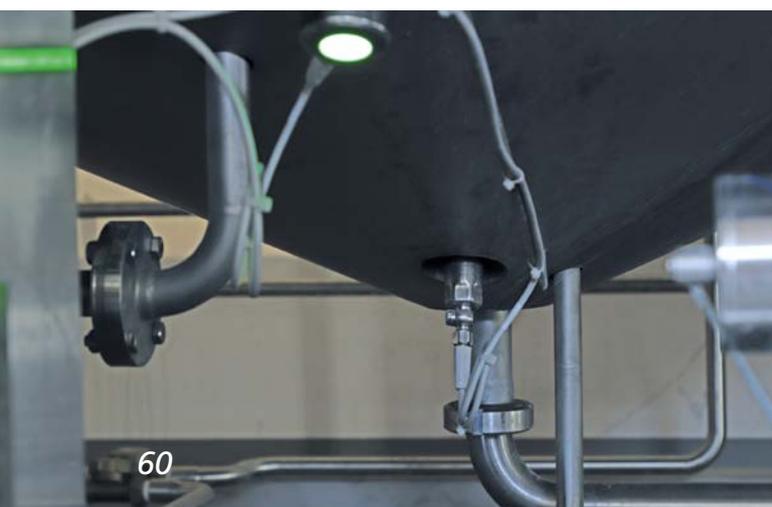
ifm’s sales specialists on site have always been very motivating and proved incredible expertise in advising me.

What I have noticed, too, is that suggestions are often taken up. Three years ago, for example, we repeatedly asked for a flush mount temperature sensor. Eventually, ifm provided one. I am of course well aware that we had not been the only customer with this requirement. But still, suggestions have been taken into account.

And the same goes for the new SM8120, which has an extended temperature range. We asked for it, the idea has been taken up and is now reflected in the sensor. In brief: ifm sensors are developed on the basis of practical requirements and also improved over time.

Moreover, the price-performance ratio at ifm is good. You may buy sensors that are three times more expensive, but also break down three times as often. Or find sensors that are five to eight times more expensive than their ifm counterparts, but not suitable for our application. Hence we get on well with ifm.

Mr Langosch, thank you very much for this interview!



Temperature transmitters of the TD series monitor the various process steps.



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In Love with Detail

How the PMD Profiler ensures error-free construction of car bodies.

Automation in the automotive industry is closely associated with Henry Ford. His Model T was the first vehicle to be produced on a conveyor belt system – thus paving the way for mass car production. Following in the spirit of its founder, Ford continues to focus on innovative technologies and automation solutions to combine and increase quality and efficiency in vehicle production. This also applies to the plant in Valencia, Spain, where ifm's contour sensor PMD Profiler looks very closely during the production of the Ford Kuga.

In 1903, Henry Ford founded the Ford Motor Company, which is still one of the leading automobile manufacturers today. The European locations are managed from Cologne.



Even back then, Henry Ford recognised the importance of maintaining strict quality assurance standards, using components of the highest quality throughout and with as few deviations as possible to ensure efficient mass production and consistent vehicle quality.

These principles have remained to this day, but car body construction alone is now much more complex and multifaceted. Quality assurance in modern vehicle production involves many rigorous procedures.

A particular challenge emerged in the production of Ford Kuga, which is manufactured alongside other models at Ford's plants in Valencia, Spain. The actual work step involves welding a small, completely flat reinforcing sheet onto a larger assembly.

"The machine operator inserts a large body shell component into a turntable before placing a smaller metal sheet on top," explains **Mario Eschweiler**, Manufacturing Engineer Bodyside at Ford Europe. He oversaw the corresponding quality assurance project from the German Ford site in Cologne.

"It's important at this stage to be able to reliably recognise whether the smaller metal sheet is positioned correctly or not. Further, you also need to make sure that two or more of the reinforcing sheets have not been



” **The number of errors per thousand was just 0.2 during the first month of regular operation.**

loaded inadvertently. During the next step, the turntable is rotated and a robot welds and removes both components.”

■ A task where camera systems give up

Due to this fixed production sequence, a conventional photoelectric distance sensor for presence detection was not an option. The reason: It would not have been possible to install the sensor without it getting in the way of machine operators or robots.

When explaining the selection of suitable solutions, **Eschweiler** says: *“Inductive and mechanical sensors were not suitable for the same reason. Single-sided inductive double sheet detection was ruled out due to the diminutive dimensions of the small part and also the associated positioning capability.”*

Further: The diminutive dimensions and the flat surface already posed a demanding challenge. In addition, strongly fluctuating lighting conditions caused by sunlight during the day and artificial light at night made the task even more difficult.

“As initial tests showed, these requirements pushed conventional camera systems to the limits of their capabilities and beyond,” explains **Eschweiler**.

During the commissioning phase, the tested camera solutions generated a misreading rate of one percent and over.

“However, the criterion that made use of the camera system impossible was another aspect: We couldn’t make sure that only one reinforcing sheet was inserted at a time.”

All in all, the perfect challenge for the PMD Profiler from ifm.

The PMD profiler reliably ensures correct usage and assembly of components. To do this the optoelectronic line scanner projects a laser line on the working area that is being tested and determines the height profile by means of the reflected light. If the height profile matches the profile specified during teach-in, the PMD profiler detects a correct assembly. If the profile deviates beyond a freely definable tolerance value, the sensor generates an error signal.

With a measuring accuracy of 500µm, the PMD profiler detects even the smallest deviations – and thus also whether the thin reinforcing plate is missing, or if too

” By using the PMD Profiler, we have been able to solve the task in a technically proficient way, thereby effectively minimising downtime through reliable error detection.

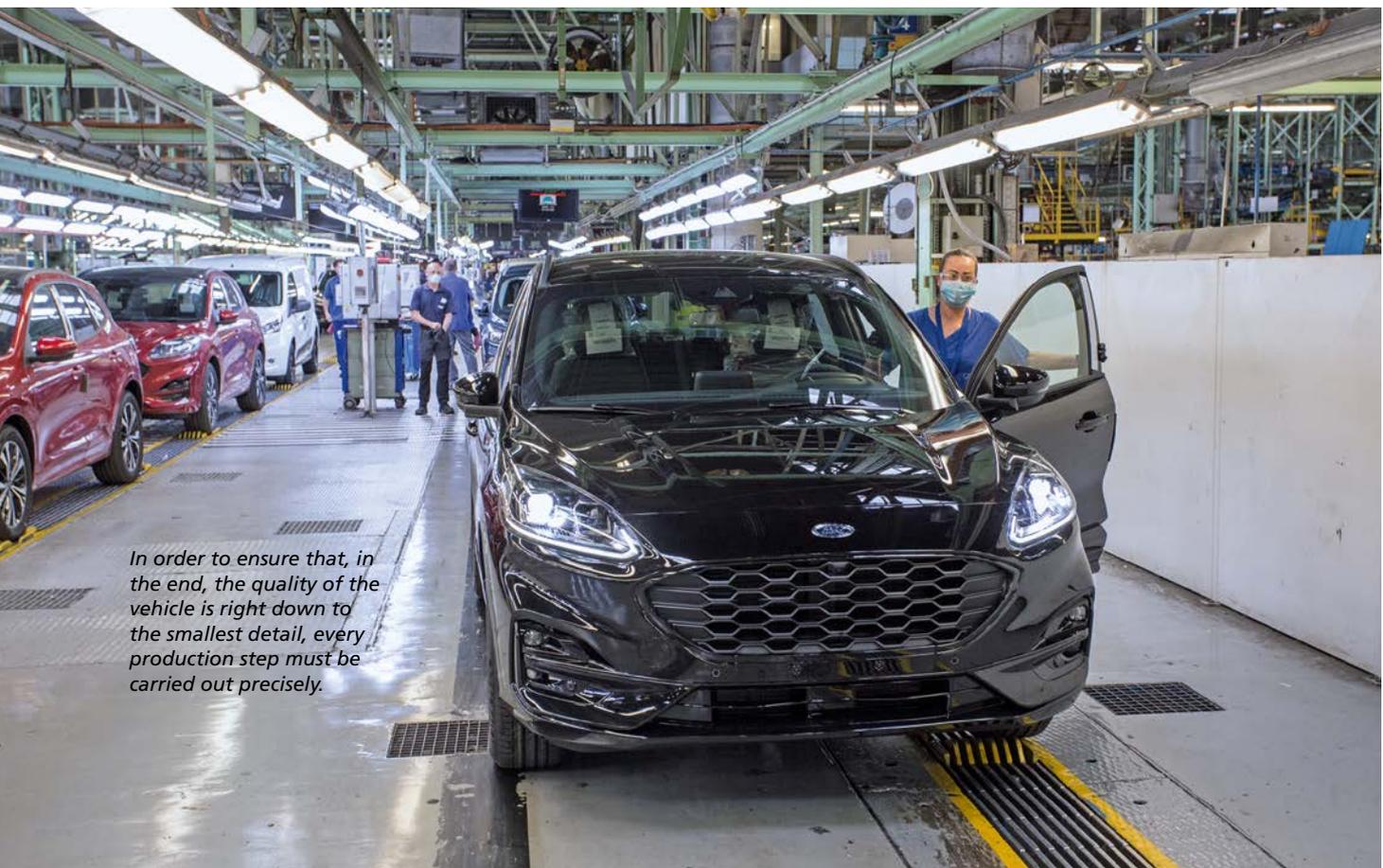
many of them have been placed. Correct alignment of the component can also be tested by comparing the actual height profile with the specified height profile. The PMD profiler’s working precision is matched by its tolerance in terms of its working environment: Immunity to extraneous light, independence of distance and flexibility in positioning of the component along the laser line.

■ A technically robust solution

Both in an initial test setup and during a functional demonstration by ifm’s German automotive experts as well as in the actual test phase, which was supervised by

ifm’s Spanish subsidiary, the line scanner managed to convince the project participants at Ford.

The result: “By using the PMD Profiler, we have been able to solve the task in a technically proficient way, thereby effectively minimising downtime through reliable error detection,” says Eschweiler. “Today, the task is solved excellently during ongoing operation. This point is underlined by the fact that the number of errors per thousand was just 0.2 during the first month of regular operation. It is quite likely that these were real incorrect loads where the Profiler correctly pointed out the incorrect load.”



In order to ensure that, in the end, the quality of the vehicle is right down to the smallest detail, every production step must be carried out precisely.



Strongly fluctuating lighting conditions caused by sunlight during the day and artificial light at night made the task even more difficult – the PMD Profiler solved it.

” We experienced consistent, competent and personal support from the industry experts of ifm throughout the entire project.

Conclusion

With the PMD profiler, Ford was able to reliably ensure the quality of the manufacturing step.

However, the German project manager attributes that to more than the high performance level of the line scanner alone: *“We experienced consistent, competent and personal support from the industry experts of ifm throughout the entire project – both here in Germany and also on site in Spain. That is also a crucial factor as I see it, which contributed to finding the ideal solution and implementing it successfully.”*



The PMD Profiler detects whether the smaller metal sheet is positioned correctly or not.





Spaetzle al dente

Precise control of the cooking process.

Cook the dough in hot water, drain and refresh with cold water, ready. The spaetzle cooker from staedler uses the same method we all know from home but on industrial dimensions, accurately controlled using sensors from ifm – to ensure the product quality remains at a high level.

staedler automation AG is located in Henau, Switzerland and has over 10 years of experience manufacturing systems for process automation.

Among other things, the company staedler automation produces fully automated cooking systems for the food industry. The system illustrated here is for a customer who makes spaetzle, a special southern german pasta.

Lukas Staedler, the CEO of staedler automation AG, explains how the system works: *“You have to imagine a saucepan which is continually on the go. That means the fresh dough is loaded at the beginning of the cooking line and is passed through during a defined period so that at the end you have a product which is cooked to the right degree. Using a defined cooking time we ensure constant product quality.”*

The foodstuff which is being cooked is transferred to hot water using a paddle. As there are hardly any mechanical contacts between the machine and the product during the cooking process this minimizes any damage



Cooking system type staedler CK1600, manufactured by staedler automation AG. This system will be used to cook spaetzle.

to the product. At the end of the cooking process the product is transferred quickly over a waterfall edge to the cooling zone. This blanching with cold water stops the product from cooking any further.

“In principle, systems like this can cook anything that floats” emphasizes Lukas Staedler. “In this specific line we process fresh pasta such as ravioli, tortellini or in this case spaetzle. But it could also be cold meats or vegetables. This system reaches a product output of 2.5 tons per hour”.

■ Maintaining the exact temperature

When cooking at home and we see the water starts to boil we know this is the right temperature, however, in industrial cooking processes the temperatures used have to be more accurate. Only in this way is it possible to provide the constant product quality the customer requires.

In this system the temperature is measured at two points providing the most important process values also known as Critical Control Points, in short CCP. One is the temperature of water which is nearly boiling. In this case it



Temperature sensors type TA monitor the required temperature values in the cooker as well as in the cooling bath.

has to be exactly 95 °C. The other is the temperature of the cooling bath where the cooking process is stopped. Two temperature sensors control the heat exchanger ensuring exact temperatures.

For these critical points staedler relies on temperature sensors type TA2502 from ifm. These sensors have a highly accurate, fast response Pt1000-measuring element covering a wide temperature range of -50 ... 200 °C. Also the sensors have a high repeatability and long-time stability which are pre-requisites for optimum and stable product quality.

” Basically automation means more effort but IO-Link provides a definite added-value.

In the future staedler plans to use the self-monitoring temperature sensors type TCC from ifm to monitor these points. The special feature of this unit: It has two independent measuring elements with opposing temperature characteristics that counteract each other. Deviations in accuracy are thus recognised immediately and signalled by alarm switching signals. They are also clearly visualized via a LED directly on the unit. This simplifies reliable product quality enormously, as between calibration intervals the temperature is safe at all times so long as the sensor does not detect a drift which it then signals. With other industrial temperature sensors deviations in temperature or a drift can occur even a day after calibration has taken place. They are not recognized and only detected during the next calibration. Worst case would be an expensive product recall which would have a negative effect on the manufacturer's reputation.

■ Monitoring CIP-cleaning process with conductivity

After each production charge the system undergoes a CIP-cleaning process. A separate pump is used to rinse the product lines with alkaline and acidic cleaning agents. They are then rinsed with clear water before production is restarted. During this process the ifm conductivity sensor LDL200 plays an important role. Based on precise conductivity measurement it is possible to confirm if the line contains a cleaning agent and at which concentration. According to the measurement values the control system recognizes, for example, if further cleaning agents are to be added or if the pre-, intermediate and final rinsing has taken place. The final stage of the cleaning process is rinsing with clear water. Only when the exact conductivity of the final rinsing water is reached, is the system then released for production. This ensures clear phase separation during the CIP-process.

Simultaneous to the conductivity, LDL200 measures the medium temperature and transfers the values using the communication protocol IO-Link to the control system. This is also used to control the heat exchanger to ensure that it always has sufficient energy to regulate the temperature of the boiling water.



The conductivity sensor LDL200 reliably recognizes if clear water or cleaning detergents from the CIP process are in the lines. Simultaneously it also measures the temperature and transfers both measuring values using IO-Link to the control system.



Pressure sensors type PM use the hydrostatic pressure to detect the level in the cooker and the cooling bath.



■ Level at a glance

The system has two large water tanks: The bath with the hot water and the cooling bath at the end of the process. Pressure sensors are installed at the bottom of each tank. They are used to measure the hydrostatic pressure. The ifm sensors which are used have an ideal pressure range 100 mbar ... 2.5 bar. They determine the exact level and are used to regulate it. It is therefore possible to avoid the tank overflowing when it is refilled with water.

Will be used in future by staedler: The temperature sensor TCC is self-monitoring which means that calibration intervals can be extended. Deviations in accuracy are recognised automatically and signalled using a switching signal and LED.

■ Detect water supply

Water is lost during the cooking process. One reason being that the product itself, in this case spaetzle, absorbs water, and also water escapes in the form of steam during the cooking process. For those reasons water has to be continuously added.

Lukas Staedler: "We use the magmeter SM2100 from ifm to regulate the replenishment of fresh water. It continuously measures the flow during the cooking process. This takes place in cooperation with level sensors. When the level sensors signal that the level of the water is decreasing then fresh water is added and the flowmeter determines how much water has been lost, having been absorbed by the product or as steam. Water is also lost during the removal of residual sludge. Used water is drained off and fresh water is added. This takes place during a time factor which is determined by the recipe. Also in this case the SM is used to measure the quantity of water which is to be added."

The flowmeter also plays an important part during the cleaning process as it monitors the quantity of fresh water used for rinsing. In doing so it provides transparency throughout the entire cooking process.



The magmeter SM2100 is used to detect the current flow velocity as well as the total quantity of the feed water supply. Both values are transferred using IO-Link to the control system.

” We are very satisfied with ifm. We have also used ifm in earlier projects.

■ Position monitoring with inductive sensors

Inductive sensors for position detection are also installed. Even though they are not directly part of the cooking process they have an important monitoring function. The cooling band with which the product is transferred to and from the cooling bath can be lifted out of the bath using a lift for the purpose of being cleaned manually. Two inductive sensors are used for non-contact detection of the top and bottom position. They also ensure that the system can only be restarted if the band is in the correct lower position.

A third inductive sensor is mounted on the slot screen. This is also removed for manual cleaning purposes. The sensor checks if it is correctly fitted before production can be resumed.

■ Sensor communication using IO-Link

All sensors are connected to the control system via IO-Link. This digital communication protocol transfers the measuring values to the control system in digital form. This means that measurement errors caused by conversion loss are reliably avoided. However, IO-Link can do more.

Lukas Staedler: “Each sensor which is a CCP sensor has to be checked on an annual or six-monthly basis. The temperature sensors are placed in a reference tempera-

ture liquid and calibrated. We calibrate temperature sensors using IO-Link. With the conductivity sensor LDL we use both process values, temperature and conductivity over a single wire. The flowmeter SM transfers the counter values as well as the current velocity over one output via IO-Link to the control system.”

In reply to the question whether IO-Link simplifies automation, **Lukas Staedler** has a clear opinion: “Basically automation means more effort but IO-Link provides a definite added-value. It is possible to transfer several signal values over one wire. That saves mounting costs. Or if we look at the temperature sensors: Calibration takes place directly on the sensor and not as before using corrective values in the control system. This simplifies programming the controls. All in all the advantages of IO-Link are greater by far.”



After the slot screen has been cleaned manually and returned in place, production can only be resumed after it has been released by the inductive sensor.



The cooling band can be lifted out for cleaning purposes using a pulley. Inductive sensors are used to detect the relevant top and bottom position.

■ Conclusion

staedler is convinced by the automation solutions provided by ifm.

Lukas Staedler summarizes: “We are very satisfied with ifm. We have also used ifm in earlier projects. The reason being that ifm has a comprehensive sensor concept, from inductive sensors, magmeters, temperature sensors, pressure sensors through to conductivity measurement. In short: We can cover all our needs in the system with ifm sensors. A further reason is that the price performance ratio is right. The sensors make sense for this type of system and are also affordable. We will also use ifm for future projects.”



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Retrofit your vehicles with collision protection



The 3D camera monitors the rear area of the forklift truck.

Forklift drivers need a high level of concentration when manoeuvring in reverse. The camera-based anti-collision system from ifm, which automatically detects persons and obstacles in the rear area of the vehicle, warns the driver and stops the vehicle, if necessary, provides support. The innovation: Existing vehicles can be easily retrofitted with this plus in safety.

The cold rolling mill Risse + Wilke Kaltband GmbH in Iserlohn produces metal sheets of different thicknesses and qualities. The unmachined steel strips, wound into coils, are repeatedly rolled by means of cold rolls until they have the required material properties. Then saw blades, clutch plates and other metal parts are punched from them.

Heavy forklift trucks transport the coils from the storage location to the rolling stand and back. Enormous masses have to be moved: The forklift trucks and their freight can weigh up to 30 tons. One steel sheet roll alone can weigh more than 12 tons. This means that the trucks' braking distance is quite a bit longer than that of a regular car.

■ Caution when manoeuvring

Particularly when reversing, e.g. after the coil has been picked up from the storage location or the rolling stand, the drivers need to be very cautious to avoid collisions with other forklift trucks or persons when turning into the lane. They do not only have to keep an eye on the rear area of the vehicle, but must also ensure that the carrying ram, with its load swaying from side to side, does not collide with anything.

Florian Rolf, production manager at Risse + Wilke, explains the enormous challenges the drivers have to face: *"The forklift trucks are equipped with aids such as mirrors and cameras. Nevertheless, the drivers must still be fully alert at any time, they must always have 360° vision and monitor their load and where they are going. At the same time they have to be aware of what is happening around them, e.g. colleagues and contractors crossing their path. Otherwise it can easily come to critical situations which we want to avoid."*



For more than 100 years, Risse + Wilke has been based in the western Sauerland region where the traditional steel processing industry goes back a long time.

Special coil forklifts transport loads of several tons. A high level of concentration is required from the drivers due to limited visibility.

The 3D camera of the anti-collision system is mounted at eye level and monitors the rear area of the forklift truck.

■ Collision warning system

In order to avoid such critical situations, the sensor specialist ifm from Essen has developed an automatic collision detection system. By means of a 3D camera, the system permanently monitors the rear of the forklift truck and gives the driver visual and acoustic feedback. Depending on the configuration level, the assistance system can even stop the vehicle, if necessary.

All obstacles are reliably detected. Thanks to a special classification of reflective materials, e.g. reflective vests or clothing, the collision warning for persons can be given priority over other objects. This increases the safety of persons and leaves the driver enough time to slow the truck down and stop in time. This provides maximum safety when manoeuvring.



” The system is very good at minimising risk. This means that the anti-collision system, which can be integrated very easily, provides maximum safety for all types of mobile machines.



The driver sees the rear area of the forklift truck on the monitor. Colour-graded frames indicate objects in the path and display further warnings up to an e-stop.

■ Easy retrofitting

ifm offers the anti-collision system as a ready-to-start application package (order no. ZZ1103). The package includes all components to set up a fully functioning collision warning system on a mobile machine, e.g. a forklift, wheel loader, excavator, reach stacker or transport vehicle within a few minutes.

In addition to the camera, the monitor and the controller, the package contains all necessary cables and mounting accessories. This means it can be easily retrofitted on all mobile machines with 24 V on-board system voltage.



Persons behind the forklift truck are difficult to see for the driver. The anti-collision system helps to avoid critical situations when reversing.

Commissioning the system is very easy: After mechanical installation of the system and plug & play wiring, set-up is carried out within a few minutes via the pushbuttons and the colour display of the control unit. Only a few parameters (height and inclination angle of the camera, vehicle width) are required in the intuitive set-up process. Then the system is ready for operation. In contrast to other systems, no PC is required for parameter setting.

Different zones can be defined so that the driver is only warned when it is really necessary. This means that the O3M can be used to its full potential depending on the situation, which helps to reliably prevent accidents. At



Via extended parameter setting, different warning zones can be defined which will trigger certain output signals.

the same time, false alarms are virtually impossible due to the patented PMD time-of-flight technology.

For special requirements, expert settings are available during set-up. Pre-programmed inputs and outputs are available for an additional signal light, buzzers, standby operation or the ready status of the system.

The 3D sensors are suitable for robust applications in indoor and outdoor areas. A high protecting rating and shock and vibration resistance as well as a wide temperature range meet all requirements for use in mobile machines.

To set up the system, the user only needs to measure the height and inclination angle of the camera as well as the vehicle width and enter them in the controller.

■ Conclusion

Florian Rolf, summary: *"The system is very good at minimising risk. I can use it on forklift trucks to prevent employees from entering the danger zone and to prevent a dangerous situation or risk situation from occurring in the first place."*

This means that the anti-collision system, which can be integrated very easily into existing vehicles, provides maximum safety for all types of mobile machines and supports the daily work of the drivers.



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