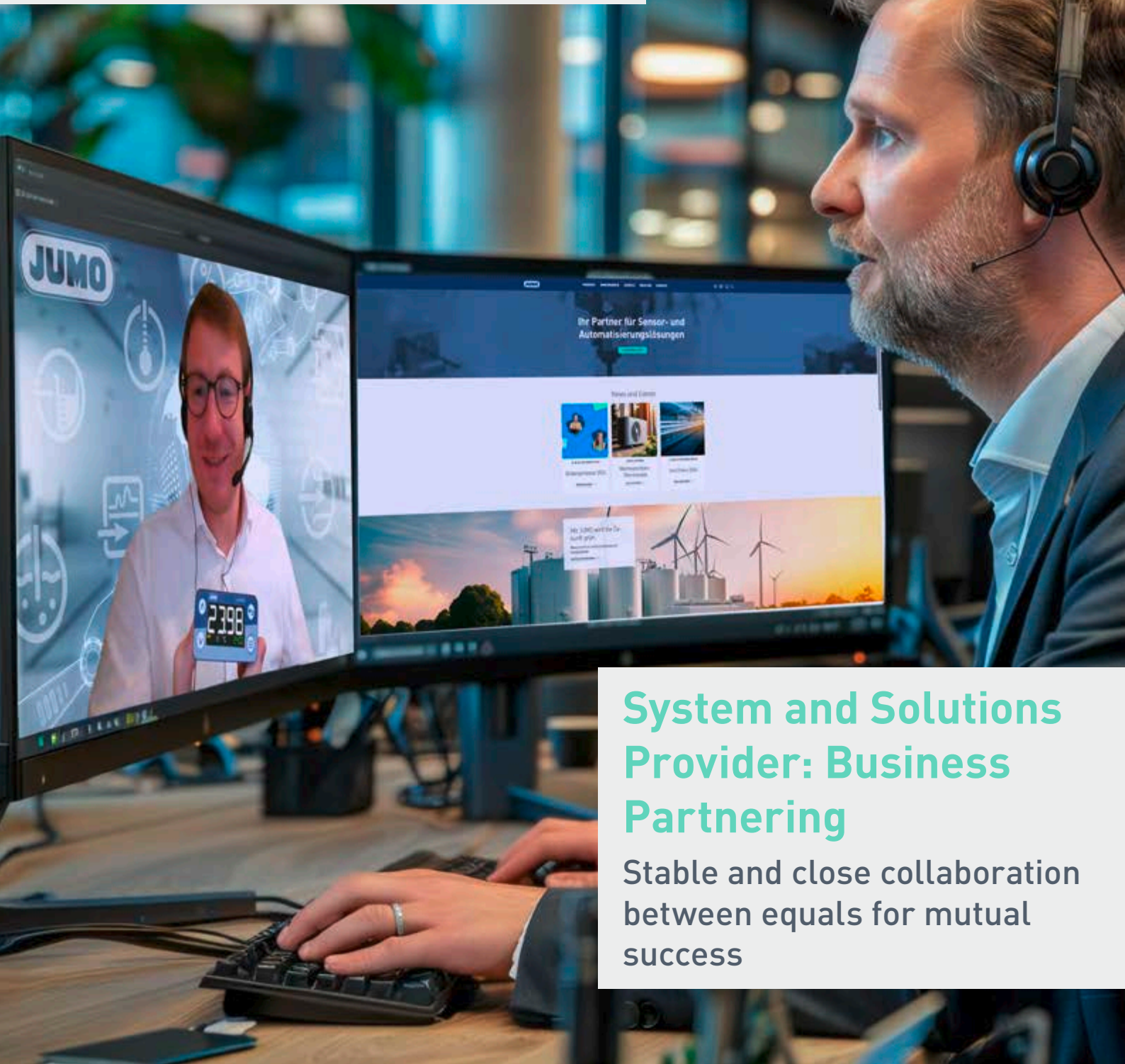




SENSORS + AUTOMATION

Issue 2/2024



System and Solutions Provider: Business Partnering

Stable and close collaboration
between equals for mutual
success



APPLICATIONS | KNOWLEDGE | BUSINESS PARTNERING

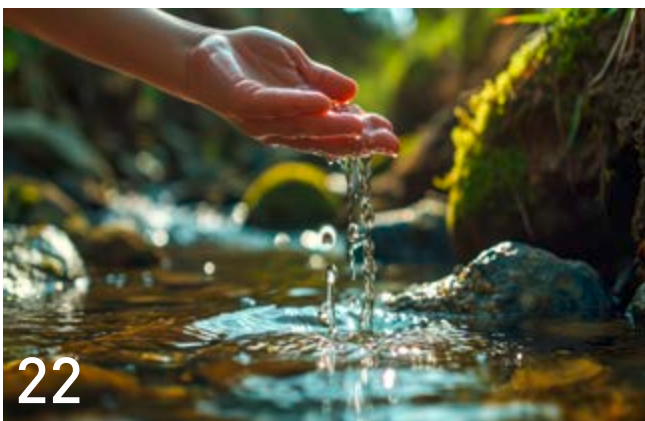
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Dear Reader,

"Systems and solutions provider: business partnering" – this is the motto of the current edition of our customer magazine. JUMO offers more than just products: we develop tailored systems and solutions that are specifically aligned with our customer's needs. One fantastic example of this is our collaboration with Jellyfish Farm, which is Europe's largest farm for these creatures. Here we implemented a precise and efficient solution for the specific requirements of aquaculture.

Collaboration with the Gießen Campus of the University of Applied Sciences Mittelhessen is another highlight. This project shows how our technologies are used in training and research to support future generations and develop innovative water treatment solutions.

In this edition, we also take a look at the reliable use of our systems in data centers, where they ensure the required cooling. This application underlines the versatility and capacity of our products in various industries and future-oriented markets.

Our long-standing partnerships with the companies FESSMANN and LAUDA illustrate how important stable and close collaboration on an equal footing is for mutual success. Together, we develop pioneering technologies and bring them to market maturity. Partnerships such as these are an essential component of our philosophy and the basis of our success.

We invite you to find out more about our projects, systems, solutions, and partnerships on the following pages. We hope that we can inspire you and that you discover the various opportunities that JUMO offers. Happy reading!

Dimitrios Charisiadis

Dimitrios Charisiadis
Chief Executive Officer

Steffen Hoßfeld

Dr. Steffen Hoßfeld
Chief Operating Officer

To improve readability, gender-neutral language has been used throughout. This language shall generally apply to all genders in order to be non-discriminatory. This language is not intended to suggest value judgment.

The fascination of jellyfish farming

High-tech solutions for delicate beauties



Even as a young child, Alexander Dressel was fascinated by the breeding of marine animals. Today, he runs Europe's largest jellyfish farm in Künzell, Germany and has turned his childhood hobby into a state-of-the-art profession. Dressel, a certified fish farmer and research diver, gained extensive experience in renowned aquariums such as the Sea-Star Aquarium in Coburg, the Sea Life Konstanz, and the Ozeaneum Stralsund – particularly in the breeding and presentation of jellyfish.



Further information

Webinar on November 19, 2024

English: 3:00 to 4:00 p.m. (German time)

<https://jumo.easyvtf.com/en>

MORE THAN SENSORS AND AUTOMATION

The data is transferred to the cloud in encrypted form

Combining aesthetics and science

In 2019, Dressel took his next professional step in the Fulda region. As a result he has been running the Jellyfish Farm full-time since the summer of 2021. "I am currently the only commercial jellyfish breeder in Germany and one of the few in the world," Dressel reports proudly.

"Our customers range from scientific institutes, zoos, and large aquariums to private customers who are fascinated by the delicate beauty and calming effect of jellyfish. My team and I are involved in all processes from consulting and planning of the breeding facilities to delivering the animals for research projects."

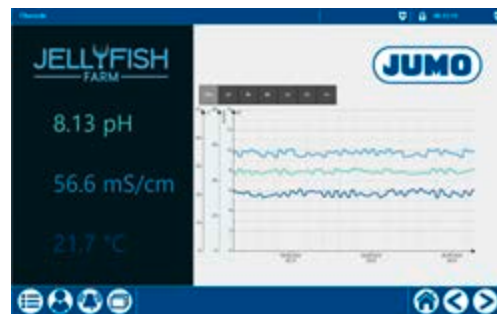
Dressel and his team offer 17 different types of jellyfish ranging from the easy-to-handle moon jellyfish to the impressive compass jellyfish. Up to 4 species are particularly suitable for private aquariums, while the others are bred for large and show aquariums. The required brackish or salt water is prepared in-house while plankton or special small jellyfish are used for feeding.

High-tech aquariums with JUMO systems

Around 50 % of the Jellyfish Farm's business volume is accounted for by jellyfish farming. Here, most of the jellyfish are purchased in large quantities by retailers and 90 % of these are exported. The second half of the business consists of aquarium systems that are planned as well as designed in-house and built in collaboration with a partner. The use of the latest technology is essential for water analysis to measure pH value or conductance. "We currently operate 10 breeding facilities with around 200 aquariums," says Dressel. "The 11th plant was equipped with a state-of-the-art water value monitoring system based on the JUMO variTRON platform, which is further enhanced by the use of AI. We developed this innovative solution in close cooperation with JUMO."

"From the very beginning, Alexander Dressel's focus was on maximizing automation and digitization for optimal jelly-

fish breeding. We got off to the best start here with our JUMO variTRON automation system. It is flexible and expandable in terms of sensors and functions so that it enables use of state-of-the-art digital sensors from our company. The data is transferred to the JUMO Cloud in encrypted form and is available worldwide. This is further enhanced by AI tools that are adapted to jellyfish farming by our experts and appropriate labeling. As a result, the plant will soon be running completely on its own, optimizing itself, and aware of how the jellyfish are doing at all times. Alexander receives prepared data – anytime and anywhere – and can therefore concentrate on strategic issues," explains Ralf Kappmeyer, Sales Representative in the JUMO Field Service. ■



Conclusion

The Jellyfish Farm impressively demonstrates how a passion for marine animals and state-of-the-art technology can go hand in hand to exhibit fascinating creatures such as jellyfish in all their glory and at the same time make scientific progress possible.



Contact person

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Digitization of a laboratory sewage treatment plant

Data from the sensor to the JUMO Cloud



*Welcoming the efficient solution:
Björn Seling, JUMO Field Service; Ole Schmandt, Master's student;
Dipl.-Ing. Ingrid Höne, and Dipl.-Ing. Gisa von Marcard,
all 3 from the LSE (Life Science Engineering) department,
Environment, Hygiene, and Safety Engineering course
(from left to right)*

JUMO shows its expertise as a system and solution provider during the digitization of a laboratory sewage treatment plant at Gießen Campus of the University of Applied Sciences Mittelhessen. JUMO offers the complete solution – from sensors, transmitters, and controllers to the JUMO variTRON 300 automation system – to ensure efficient processes.



JUMO presents its expertise as a system and solution provider

These days, the digitization of process technology plants is playing an increasingly important role in industrial applications today. Data can be acquired and analyzed in real time by integrating sensors and IoT devices into plants. This enables more precise control and monitoring of plant performance, early detection of malfunctions, and optimization of processes.

Data is stored in a cloud

How can students familiarize themselves with the topic and engage with industrial standards? Those responsible for the "Climate Protection, Environment and Safety Engineering" degree program approached JUMO with the request to store data collected during the internship in a cloud. Data stored in this manner can be accessed from anywhere and from different devices as long as an Internet connection is available. This would allow colleagues or student group members to easily share the data acquired. A laboratory sewage treatment plant operated independently by students in a wastewater technology internship was selected as the process technology plant. The plant was equipped with the JUMO AQUIS touch S, which is a modular multichannel measuring device for liquid analysis with an integrated controller. pH value, redox potential, and oxygen content are acquired with the ODO sensor as well as the pump switching cycles. Connecting the cloud to the JUMO variTRON 300 automation system now enables the data to be read and edited from any location. The manual writing down or passing on of USB sticks – as was previously done – is no longer necessary.

At the same time, students learn more about the acquisition and provision of data in a cloud, which is already common practice in industrial environments. Cloud storage eliminates the necessity of investing in expensive hardware or infrastructure to be able to save data in the long term. In the future, research projects are to be carried out at the laboratory wastewater treatment plant, for which this is a decisive factor. ■



The plant before installation



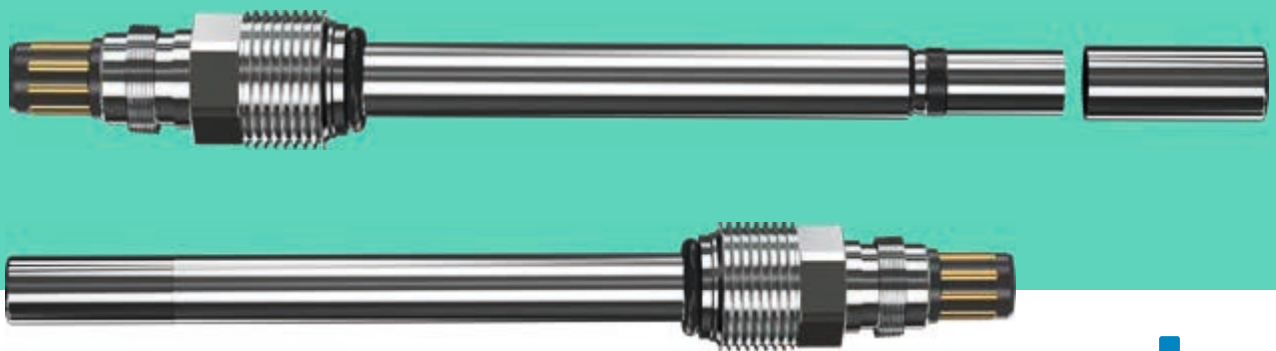
Gisa von Marcard familiarizes herself with the JUMO equipment



JUMO digiLine O-DO H10/H20

For hygienic and demanding applications

Process reliability in aqueous solutions



The JUMO digiLine O-DO H10/H20 is ideally suited for the reliable measurement of dissolved oxygen in both high concentrations as well as very low trace concentrations.

High-quality sensor versions enable use in hygienic and demanding applications.

The sensor can be used in application areas such as:

- Pharmaceutical industry
- Biotechnology
- Food and beverage industry

Thanks to state-of-the-art optical technology, the trace and saturation concentration measurement function quickly provides the customer with the required results. Reliable process control is possible in digital form via the JUMO digiLine interface.

This sensor is made from high-quality stainless steel. In the standard measuring range the measuring range is 0 to 22 ppm (mg/L) and optionally up to 45 ppm (mg/L); in the trace measuring range it is 0 to 2000 ppb (µg/L). The analog and the digital interfaces enable the connection to field devices and process control systems. Connection to the intelligent, bus-compatible JUMO digiLine

system occurs easily through Plug and Play. The sensor is calibrated in the factory so that it can be used immediately. Recalibrations can be performed at any time on the JUMO AQUIS touch S/P or conveniently on a PC using the JUMO DSM software.

"The precise measurement with long-term stability ensures high process reliability. The sensors are low maintenance and can be easily connected to different measuring systems," says Ulrike Storm, Product Manager at JUMO.

Operation via the JUMO digiLine interface allows access to sensor and process data such as the number of CIP/SIP cycles.

The evaluation of data enables predictive maintenance and thereby more efficient operation. As a result, the plant operator can procure spare parts in line with demand. The same applies to necessary cleaning and maintenance work, which is not based on fixed intervals but on demand. ■

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"Mr. Auth, to what extent will JUMO's new SENSILO plant in the Fulda-West Technology Park change the entire global JUMO production landscape?"

René Auth: "The SENSILO plant will become the primary plant in terms of efficiency and supply performance for the global production network. In conjunction with the construction of the new plant, we have fundamentally implemented a reorganization project for the entire production landscape and are piloting the findings in the SENSILO plant, meaning that production will be future-oriented."

"What specifically has changed? Can you describe what delivery to customers will look like in the future?"

René Auth: "In the new plant, we have the opportunity in the final expansion stage to double production capacities and therefore guarantee growth with market-appropriate delivery times and attractive manufacturing costs."

"How will you ensure that moving the previous machines and systems from the main plant in Fulda to Rodges will go smoothly?"

René Auth: "Yes, it's a Herculean task that requires structured planning. The following subprojects are the key to success: firstly, building up backup stocks for selected customers and products. Secondly, detailed planning for the move in line with the motto: 'As little production downtime as possible.' Thirdly, ensuring product quality. That means we will qualify before the move, and requalify after the move. We will therefore guarantee consistently high quality on the market. And finally, we will prepare our employees for the change of working in a new environment in a targeted manner."

"What exactly does that look like? Will it effectively be a step-by-step move? By which I mean will current orders be executed on other product lines while primary production is being set up in the new plant?"

René Auth: "Yes, we are moving step by step, always taking the relevant risk into account. We have certified and reliable suppliers as partners, who have completed moves like this in the past. We will gradually relocate the machinery and always have our focus on the customers' security of supply."

6 questions about the move to the new JUMO SENSILO plant for René Auth, Director of Production and Logistics at JUMO



"What are the next steps once the machines and systems are established in the new plant? What else needs to be done?"

René Auth: "After the move and successful startup, we will immediately enter an optimization phase. The new plant offers very different ways of realizing this potential that would not have been reasonably feasible in the current plant."

"When will you operate the new plant with the same capacity utilization as in the main plant in the Moritz-Juchheim-Straße in Fulda?"

René Auth: "As quickly as possible, taking into account time and cost as well as quality. The Sales department is involved and is working intensely to acquire new projects and new customers. The new plant will take JUMO into the future and will quickly support itself financially." ■

JUMO cooperates even more closely with narz systems

JUMO, as a system and solution provider, deepens its partnership with narz systems. The company based in Herbstein, Hesse, is a recognized specialist in the digitization of processes, machines, and plants.

Since the start of the collaboration in 2020, JUMO and narz systems have together developed solutions that enable companies to increase their efficiency and drive forward digital change.

"In the future, we want to work even more closely together to create combined added value for customers in different areas."

Christoph Trott,
Head of Product Management at JUMO

"We want to quickly and jointly implement digital solutions, tailored to the customer's respective business model."

Sebastian Narz,
Chief Executive Officer of narz systems

"First and foremost, subjects such as 'sensor-to-cloud' or 'condition monitoring' and 'predictive maintenance' should be advanced more vigorously."

Nico Müller,
Product Manager at JUMO



The company narz systems currently focuses primarily on the industry, energy, and buildings sectors as well as drinking water and wastewater.

"JUMO has been offering efficient products and services for these important economic sectors for years."

Matthias Kremer,
Market Segment Manager for Water and Wastewater

The partnership between JUMO and narz systems is a practical example of how technological collaboration and constructive partnering enable companies to quickly react to changing market requirements and at the same time offer sustainable, efficient, and future-proof solutions.

"An ideal addition: JUMO offers perfect sensor and automation solutions, while narz systems offers digital solutions at the field level. In concrete terms, we will now implement the customer requirements together with JUMO Engineering."

Matthias Kremer



At the IFAT trade fair in Munich, Jonas Flohr (left), Software Developer at narz systems, strengthened the partnership with Matthias Kremer, Market Segment Manager for Water and Wastewater at JUMO. Both are looking forward to continuing their collaboration.

JUMO as a reliable partner at FESSMANN's side

In June this year, the company FESSMANN GmbH und Co KG celebrated its 100-year anniversary with numerous dignitaries, guests, and employees. Only a few companies in Germany have reached this age and can celebrate such an anniversary.

FESSMANN was founded by Wilhelm Fessmann in 1924, in the economically, socially, and politically turbulent times of the Weimar Republic. Since then, the company has grown to become the leading manufacturer of smoking plants, smoke generators, and baking plants – always with the customer in mind. Their high-tech plants for smoking, cooking, roasting, baking, and cooling are used worldwide by craft trade as well as industrial companies so that they can provide culinary delights.

"Transparency, fairness, and honesty are the key to many years of shared success."

Uli Fessmann,
Chief Executive Officer and General Partner
of FESSMANN

The FESSMANN management has particularly positive memories of the cooperation on an innovative controller that absolutely had to be ready in time for the 2019 IFFA meat processing trade fair. Predictably, there were events associated with this new development that put the

entire schedule at risk. However, JUMO General Partner Bernhard Juchheim made the development a matter for the top management team and drove the project forward. And indeed, FESSMANN was able to present the new "FOOD.CON 2" controller at the trade fair as planned.

"This commitment further strengthened our mutual trust."

Denis Gabriel,
Managing Director at FESSMANN

Today, FESSMANN primarily orders the JUMO variTRON 500 as a control component as well as RTD temperature probes and thermocouples.

Experts from both sides are in regular dialog to implement the next successful partnering project. ■



- 1 Semi-continuous plant
- 2 Uli Fessmann and Denis Gabriel
- 3 JUMO variTRON 500 at the trade fair

LAUDA and JUMO: on course as a team – even in stormy seas

Since LAUDA was founded, the world market leader for precise temperatures has been working with JUMO as one of its largest circuit board suppliers. Even if the global economy weakens and the seas become stormy: LAUDA and JUMO remain on course together.



Modular bath thermostats



Both sides benefit greatly from the existing business relationship, as LAUDA has been installing JUMO circuit boards in a large number of its devices for over 20 years. JUMO in turn uses the high-precision bath thermostats from LAUDA to calibrate the measurement sensors.

“The long-standing collaboration between the 2 family companies has created a close relationship of trust. JUMO is one of our top 3 suppliers worldwide. We particularly appreciate JUMO’s expertise as a system and solution provider and the partnership on an equal footing,” emphasizes Dr. Gunther Wobser, Managing Partner of LAUDA.

High-performance LAUDA tempering equipment and plants are at the heart of important applications and make a significant contribution to a better future. This is especially so in the biotechnology and pharmaceutical technology field. As a full-service provider, LAUDA guarantees the optimum temperature in research, production, and quality control. LAUDA is also a professional and reliable partner for electromobility, hydrogen, chemicals, semiconductors, and medical technology. Founded in 1956, LAUDA today generates a turnover of around 120 million euro with over 600 employees.

LAUDA presented the new Universa device line at this year’s AICHEM in Frankfurt, Germany. It is characterized by its modular structure, which allows flexible combination of control heads as well as baths, and provides

a tailor-made solution for every laboratory requirement. The devices set new standards in terms of sustainability and energy efficiency: they work with environmentally friendly, natural refrigerants and have frequency-controlled compressors that enable highly energy-efficient operation, particularly in partial-load mode. This advanced technology significantly lowers operating costs while also considerably reducing the environmental footprint. LAUDA presented 3 different versions of the tailored laboratory solutions from the Universa device line at the trade fair, which minimize the required training and increase flexibility through their uniform, straightforward operation – all with “JUMO state-of-the-art technology inside”. →



The long-standing collaboration between the 2 family companies has created a close relationship of trust!

"Dr. Wobser, when you think back to your beginnings as a young Managing Partner at LAUDA, what were your biggest challenges back then?"

Dr. Wobser: "As Chief Executive Officer in my early 30s, I pursued the vision of a company in which all processes are organized efficiently and we are very close to our customers in all important countries. My biggest challenges at the time were process optimization and, above all, expansion through our own branch offices. The introduction of a CRM system and the ERP conversion initially met with resistance, but were decisive for our modernization. By focusing on innovation, digitization, and internationalization we as a global team drove LAUDA's success story forward, which culminated in the growth of the entire LAUDA group. An important milestone was the introduction of our Proline series, which relies on JUMO technology for circuit boards. These innovations have enabled us to sustainably strengthen our market position both in Europe as well as around the world and further expand our growth."

"Did your father introduce you to the world of business at an early age? Were you often at the table at home when the company was being discussed?"

Dr. Wobser: "My father involved me in company activities early on, but at home his main role was to be a father. After completing internships both in Germany and abroad, I initially worked for an international brand manufacturer after completing my business degree. On July 1, 1997, I started as marketing manager at LAUDA – the beginning of my career in the family company. This mixture of early involvement, solid training, and external experience was extremely valuable. It gave me deep insights into our family company as well as fresh perspectives from the outside, which I was able to bring into my work at LAUDA."



"Along with your father, did you also have additional advisors or 'old hands' who supported you at the top to help you get used to everything quickly and achieve success? Or did you have another mentor, perhaps even outside the company?"

Dr. Wobser: "I was inspired and supported by many companions and visionaries. In marketing, I was particularly influenced by Prof. Dr. Werner Kroeber-Riel with his motto 'argue rationally, impress emotionally'. For around 10 years now, Clayton M. Christensen's 'Innovator's Dilemma' has had a strong influence on me. These diverse inspirations have been decisive for my approach to challenges and innovations which have helped me to continuously grow LAUDA while always thinking outside the box.

Elon Musk's visionary ideas and his radical approach to innovation were extremely inspiring for me a few years ago. I reject some of his recent positions. But his ability to revolutionize entire industries and pursue seemingly impossible goals has broadened my perspective on entrepreneurship and technological

*5 questions for
Dr. Gunther Wobser,
Managing Partner
of LAUDA*

progress. Unfortunately, I have not met any of the 3. My doctoral supervisor, Prof. Dr. Margit Enke, was instrumental in my academic development.

A particularly important mentor is the jurist Prof. Dr. Dieter Salch, whose expertise in tax and corporate law as well as his entrepreneurial thinking in connection with social responsibility have had a lasting influence on me. I receive professional input from my entrepreneur friends in my circle of colleagues and the Main-Tauber entrepreneur circle, which I also chair. We meet with both of them twice a year at the member companies."

"What does partnership between companies mean to you?"

Dr. Wobser: "Partnerships are formed by people – this applies to both private and professional relationships. I am firmly convinced that family companies are strong and reliable partners with a tradition going back decades, sometimes even centuries. They offer the

opportunity to combine a pioneering spirit with sustainability. At LAUDA, we focus on long-term partnerships as equals, because as a family business owner, I am always driven by the long-term future. Our partnership with JUMO is an excellent example of this. We value the reliability and innovative strength that JUMO brings to our cooperation and see this as a key factor in our joint success."

"In your experience, have collaborations and partnerships between companies changed over the decades? Interacting with each other? Are we seeing a 'new partnering', comparable with 'new work'?"

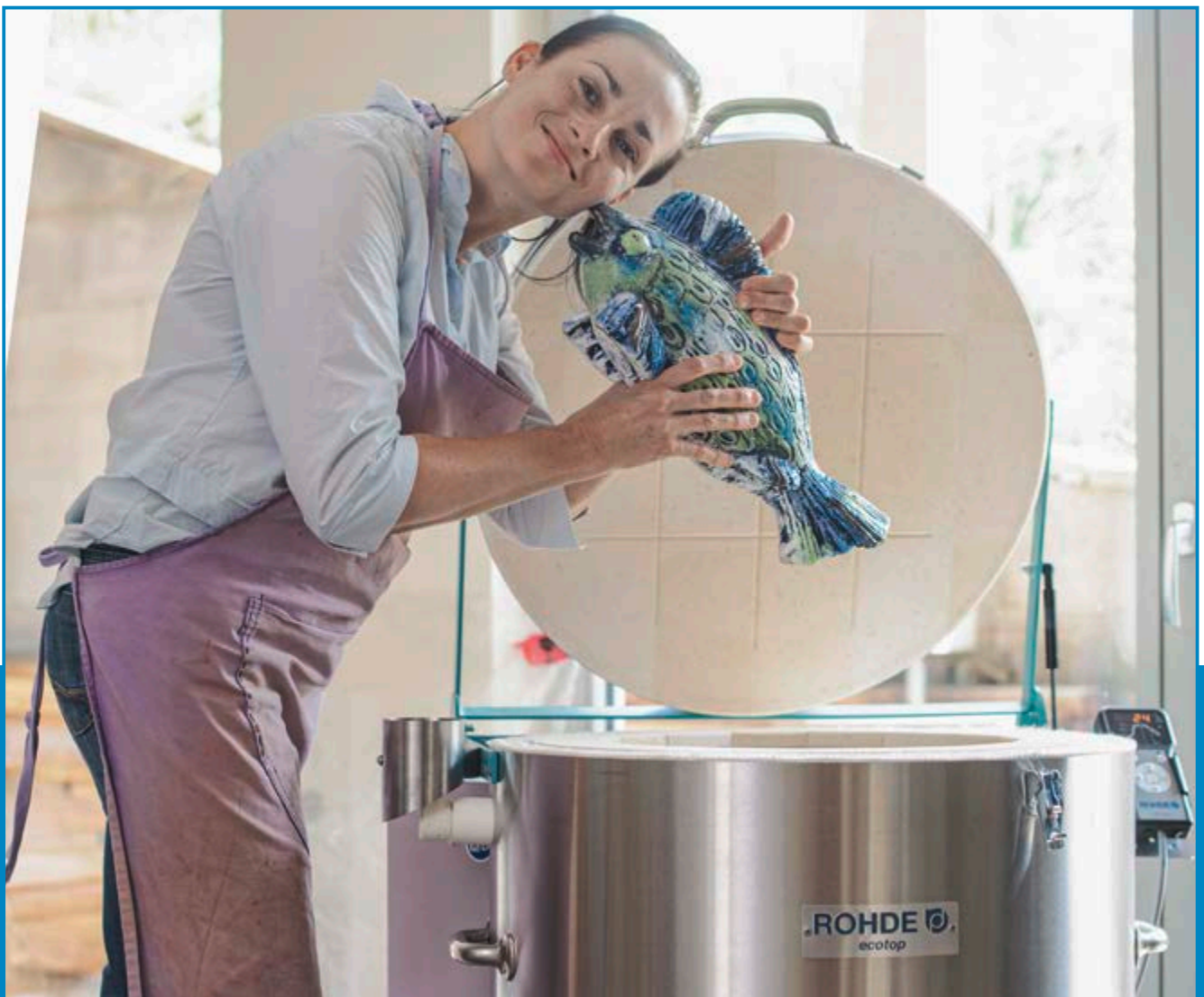
Dr. Wobser: "Corporate cooperation is a must, because no company today can do everything on its own. At LAUDA, we rely on targeted partnerships in the spirit of open innovation. In projects, we combine technology and market-oriented collaboration for agile innovation management. Flexible, project or technology-related cooperation enables us to react quickly to market changes and even expand our core business. Our product Mobifreeze – the first of its kind in the world – is the first mobile freezer and the result of a close collaboration with a pharmaceutical service provider. Other examples include the collaboration with a regional robotics and automation company and with a university for the application of AI, or investments in the startup companies Better Basics for 3D printing, Magnotherm in the cooling industry, and watttron for digital heating systems. This strategy enables us to offer our discerning customers innovative solutions and strengthen their market position." ■

42 years of ROHDE: “You have to be passionate about your profession!”

More than 40 years have passed between the idea and the success of the family-run company in Chiemgau, Germany. ROHDE, with its corporate headquarters in Ried near Prutting, Germany offers international customers solutions in the field of furnaces and machines for ceramic as well as glass. Today it is one of the leading furnace manufacturers in Europe.

JUMO has been a close partner and supplier of ROHDE since 2009. “A partnership that is becoming more trust-based every year,” says General Partner Benjamin Rohde. In June, ROHDE representatives met with JUMO in Fulda and discussed further cooperation with JUMO Chief Executive Officer Dimitrios Charisiadis.

In 1982, Helmut Rohde had a vision that would revolutionize the ceramic trade and at the same time establish the family company. As a certified mechanical engineer and amateur ceramist, he was initially employed by Siemens in Munich and also worked in his ceramic workshop. His knowledge and experience enabled him to develop



the long-awaited technical solutions for the craft trade, with which he ventured into self-employment in 1982 by founding Helmut ROHDE GmbH.

He developed professional devices such as the first Raku furnace and the electric top loader, which were presented for the first time at a trade fair in Munich in 1985. In 1990, the company developed its first own furnace for industrial applications, followed by the founding of a production plant in Dyjákovice in the Czech Republic in 1992. After the company had been operating from a former farmhouse near Prutting for a long time, a new building in Ried in 2007 gave the company the sought-after space for further growth. In 2016, the decision was made to build a new production hall in Dyjákovice as the order volume and number of employees grew. The company now employs around 170 people at its sites in Germany and the Czech Republic.

JUMO supplies ROHDE with controllers from the JUMO IMAGO 500 and JUMO DICON touch series as well as JUMO LOGOSCREEN 601 and 700 paperless recorders. These are used in industrial heat treatment processes as well as in the large art and craft sector.

One outstanding example is the Sydney-based company Mud Australia, which is known for its individually man-

ufactured, high-quality tableware. Each piece is painstakingly handcrafted and kiln-fired using JUMO control technology in the ROHDE bogie hearth furnace and the innovative Ergo Load System 1000. Mud Australia sells its ceramics worldwide through its own stores in such locations as London, New York, and Copenhagen. Timeless design, outstanding craftsmanship, and social commitment characterize Mud Australia. →



- ❶ Pottery as a hobby
- ❷ Loading in a ROHDE furnace with JUMO technology

APPLICATIONS | KNOWLEDGE | BUSINESS PARTNERING

ROHDE

“Everything fits at ROHDE. We strive for a strategic partnership with ROHDE as equals instead of a simple customer-supplier relationship,” says JUMO Chief Executive Officer Dimitrios Charisiadis. *“You have to be passionate about your profession. You can feel that at JUMO. Both partners contribute their expertise and the result is a win-win situation,”* adds ROHDE General Partner Benjamin Rohde. Both companies pursue the same values, such as working in the spirit of partnership with others.

ROHDE focuses on international markets

Helmut Rohde’s passion for ceramic and technical expertise live on today in the second generation. In a very dynamic market environment, the 4 sons of the company founder react with foresight to the new requirements for ecological as well as economic sustainability and implement their visions accordingly.

In recent years the 4 brothers have pushed ahead with international expansion. Mud Australia relies on the quality of ROHDE furnaces and the installed JUMO technology. Established in 1994, Mud Australia is one of Down Under’s oldest and best-known craft businesses producing high quality porcelain wares for household use.

In the Sydney studio, each piece is handcrafted in a highly nuanced and hands-on process. Limoges porcelain, quality pigments, and clear glaze are used here. These items have a minimalist style and are deliberately designed to last a lifetime, long after seasonal fashion trends have passed. The Mud Australia collection offers appealing porcelain goods with over 90 silhouettes and 19 colors. JUMO and ROHDE intend to expand their partnership over the next few years and regularly exchange information about the latest developments on the market. ■

ROHDE



Ansprechpartner

michael.klose@jumo.net



- 1 ROHDE furnaces with JUMO technology
- 2 Chief Executive Officer Roland Müller, Chief Executive Officer Florian Rohde, Chief Executive Officer Manuel Rohde, Authorized Officer Stefan Rohde, Chief Executive Officer Benjamin Rohde

The new TUS/SAT recorder from JUMO for AWW

Glass, ceramic, clay, steel, and sheet metal are materials that we encounter every day. All of these are subject to heat treatment in the manufacturing process. Manufacturers are aware of the requirements the furnaces have to meet and the kinds of extreme process conditions they have to withstand during treatment and processing. What's more, aspects of legal conditions have drastically tightened in some industries in recent years, meaning that manufacturers are having to have their heat processes very precisely reviewed and audited to ensure they are not liable.

For example, leading manufacturers in the automotive industry know that metals only acquire many of their important properties, such as hardness or tensile strength, through targeted and sophisticated heat treatment. To guarantee these properties, automotive manufacturers have collectively drawn up corresponding regulations for their suppliers. Nevertheless, there is often uncertainty in the industry as to how these regulations are to be im-

plemented and how the process can be set up efficiently and cost-effectively.

The person responsible for carrying out the heat treatment process and who is under contractual obligation must demonstrably comply with these regulations. The Continuous Quality Improvement (CQI) directive is the automotive industry's absolute standard. →



*One of the 3 chamber furnaces at Aluminium-Werke Wutöschingen:
Heat output: 1000 kW,
Furnace size: 87 m³,
Working volume: 43 m³,
Calibration according to process table CQI-9*

AWW produces high-quality aluminum products

Aluminium-Werke Wutöschingen (or "AWW") is a medium-sized family company now in its fifth generation. As aluminum pioneers from the very beginning, they have been developing and producing innovative lightweight construction solutions since 1914. They have done so in particular from aluminum profiles, mechanically processed extruder products, and products for cold and warm converters.

To guarantee consistent and high product quality, AWW relies on JUMO LOGOSCREEN 700 as a TUS recorder (Temperature Uniformity Survey, or "TUS"). AWW uses the mobile field test device to check the temperature uniformity in the oven cavity and logs the measurement results fully automatically in PDF format. In addition to the important TUS measurement, the option of checking the system accuracy of the furnace in accordance with the normative specifications (System Accuracy Test, or SAT) is one of the most significant strengths/functions of the JUMO LOGOSCREEN 700. The fact that the JUMO LOGOSCREEN 700 is equipped for major tasks is also demonstrated by the size of AWW's furnaces. The chamber furnaces have a working volume of approx. 43 m³.

JUMO offers the system solution consisting of sensor and measurement technology

Choosing the right sensor technology and the associated measurement technology in heat treatment can result in increased expenses and sometimes also exasperation for

customers due to normative specifications such as CQI-9 or AMS2750 (aviation industry). JUMO offers considerable added value for customers worldwide through its focus on thermoprocess technology as well as its high level of expertise in consulting and support.

By using high-quality temperature sensors and the appropriate measuring equipment, JUMO is able to offer a complete solution from a single source, which allows the customer to carry out simple and uncomplicated project planning. The global service engineers round off the complete package with on-site services and support, which makes JUMO a unique partner in thermoprocess technology.

The JUMO LOGOSCREEN 700 as a TUS/SAT recorder features browser-based TUS/SAT software. AWW can use this to start the TUS test fully automatically, enter all process-relevant parameters such as setpoint value and tolerances, and track the test in all established web browsers. The unique feature of the JUMO solution is that it offers not only the actual measured temperature value but also the correct temperature value (taking into account the correction factor of the sensor and device) in a visualization. However, the fully automatic assessment of the heat treatment process (measurement passed or failed) creates absolute added value for AWW. After completing the TUS measurement and the data has been loaded into the PCA3000 evaluation software, the service technicians responsible for the test can have a fully automatic report generated as a PDF file. This facilitates straightforward, fast, and uninterrupted documentation for AWW.

Customer benefits – in a nutshell

- Intuitive, easy operation thanks to icon-based menu navigation and user-friendly setup program
- Highest degree of security during data acquisition through manipulation detection based on the latest hash algorithms with digital certificate
- Data recording compliant with FDA 21 CFR Part 11, AMS2750, and CQI-9
- Individual creation of proprietary applications thanks to the ST code option as well as 10 customer-specific process screens
- Flexible system connection through a multitude of different interfaces and protocols

Various application possibilities for the field test device

This solution has been tried-and-tested at Aluminium-Werke Wutöschingen. Other areas can also benefit from the JUMO LOGOSCREEN 700. JUMO identifies its primary target group

here as furnace construction companies (OEMs) as well as furnace users (tier 1, 2, and 3) that supply the automotive, aviation and aerospace industries. Other markets include the pharmaceutical industry, energy production and distribution, semiconductor industry, or any industry in which process values need to be recorded with a high degree of precision. ■



*Intelligent solutions for industrial furnaces:
JUMO LOGOSCREEN 700 sets
new standards in data recording
and evaluation*

The JUMO LOGOSCREEN 700 paperless recorder

The device is characterized by simple, intuitive operation. This is ensured by the icon-based operating and visualization concept. A high degree of scalability enables flexible adaptation to different customer needs: from the device version without measurement input to versions with a maximum of 18 universal measurement inputs, 3 analog outputs, 18 digital inputs, 24 digital inputs or outputs with single switching, and 7 relay outputs.

The JUMO LOGOSCREEN 700 also features an impressively high degree of connectivity. In addition to the Ethernet, USB, mini USB, and RS232/485 interface that come as a standard feature, the recorder can also be equipped with an optional PROFINET interface. This high level of connectivity means that the JUMO LOGOSCREEN 700 is a powerful all-rounder that can record a total of 60 channels in analog and digital form while also enabling

the visualization of up to 120 external analog and digital inputs.

Since the backup of process-relevant data is becoming more and more important in the changing digital age, every plant operator strives for secure and seamless documentation. The JUMO LOGOSCREEN 700 offers the highest degree of security during data acquisition through manipulation detection based on the latest hash algorithms. It allows batch reports to be created for up to 5 plants simultaneously. Batch control can also be used individually and flexibly here via touchscreen, control signal, or interface (Modbus or PROFINET). The Windows-based software package PCA3000/PCC enables quick and reliable evaluation of the recorded process data with optional automatic report generation.

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GWP: the network of the German water sector

German Water Partnership e. V. (GWP) unites around 300 companies as the only network of the internationally oriented German water industry. Members range from university institutes, construction companies, and consultants to globally represented component manufacturers. JUMO has been on board since September 2016. Matthias Kremer, Market Segment Manager for Water and Wastewater at JUMO, maintains close contact with the organization.

Water is a shared challenge

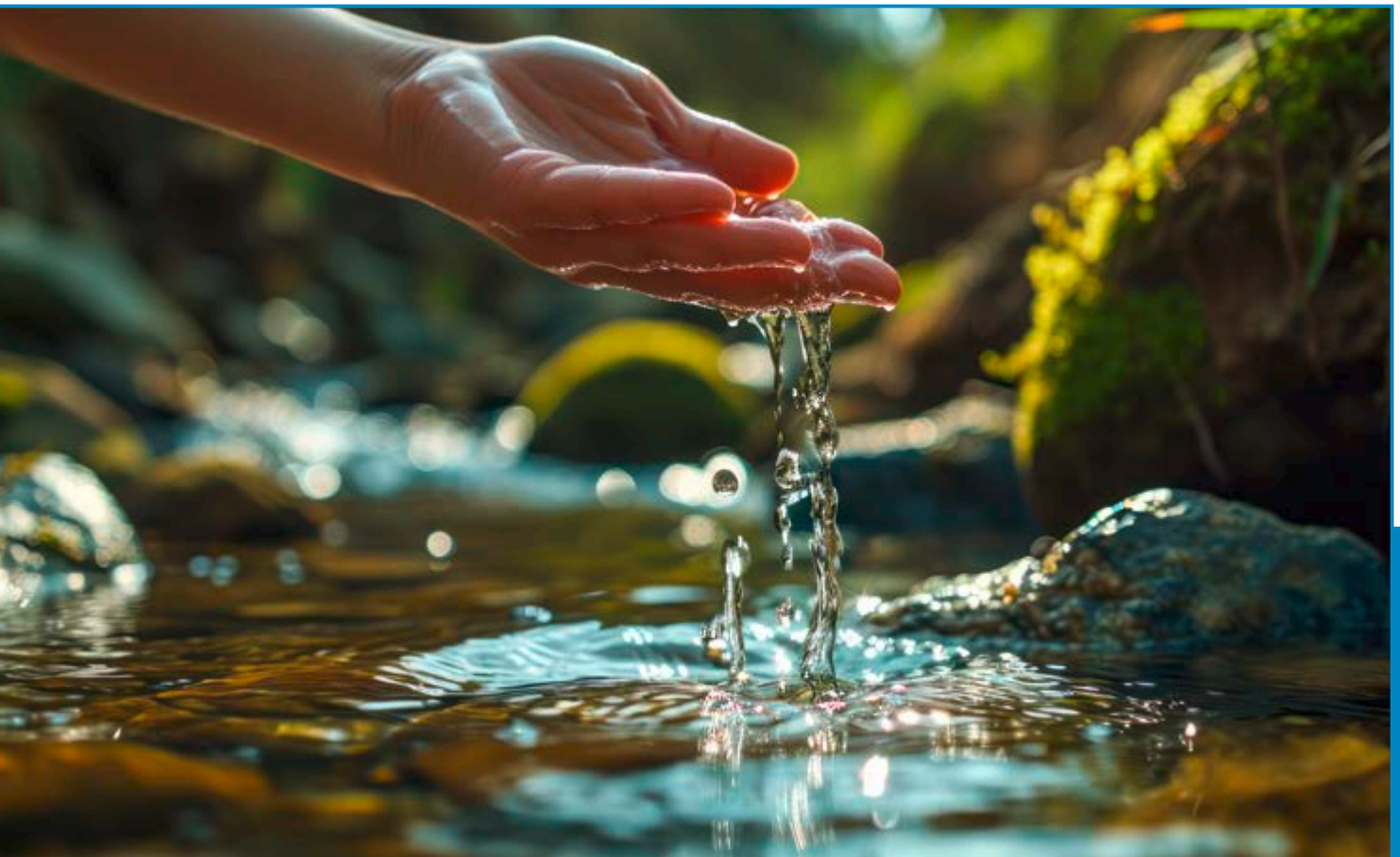
Around 1.8 billion people live in regions with water stress and 2.3 billion have no access to sanitary facilities. Increasingly frequent extreme weather events are resulting in flooding and droughts worldwide. Global population growth, urbanization, and climate change are continuously exacerbating the situation.

Sustainable water management is not only a question of environmental protection, health, and social justice, but

it also plays a decisive role in key economic fields such as infrastructure, agriculture, and industrial production.

Visibility and project development in the GWP network

In the GWP industry association, German stakeholders in the water sector work against the trends set out above



– with tried-and-tested expertise and new technologies. The network offers its members opportunities to increase visibility within and outside Germany, provides assistance with establishing business relationships outside Germany, facilitates space to discuss and share experience, and supports collaboration between members and partners on specific topics including joint project development. At the IFAT Munich in May, JUMO presented its services together with 27 other GWP members at a large joint booth organized by GWP. Matthias Kremer represented JUMO at the event and took the opportunity to exchange ideas with Gunda Röstel, who served as the chairwoman of the board for many years. In addition, JUMO is actively engaged in various work groups of the association on the topics of industrial water management, agricultural irrigation, water 4.0, and water and energy. JUMO is also active in joint project development and, with the State Agency for Environmental Technology and Resource Efficiency Baden-Württemberg (*Landesagentur für Umwelttechnik und Ressourceneffizienz Baden-Württemberg*), the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB as well as other industrial partners in Solapur, India, implemented a showcase project in 2021/2022 for simple monitoring of water quality. The Ministry of Economic Affairs, Labor, and Tourism Baden-Württemberg (*Ministerium für Wirtschaft, Arbeit und Tourismus Baden-Württemberg*) is the body funding the project.

Partnerships and international networking

One highlight in the association's calendar is the GWP annual conference, which again attracted over 150 GWP members, partners, and guests from the worlds of politics, civil society, and business to Berlin on July 3, 2024. The conference motto this year was "Global Water Responsibility – *Gemeinsam für die globale Wasserwende*" ("Global Water Responsibility – Together for the Global Water Transition"). Other than discussions, themed sessions, and product and project presentations it also offered plenty of opportunity to network.

At the event, Ingo Hannemann, Chief Technology Officer at HAMBURG WASSER, new Chair of the Board and successor of Gunda Röstel, made the relevance of the subject clear, telling the audience that the consequences of climate change such as extreme rainfall events and drought are felt all over the world. He went on to say that Germany, as an industrial nation, has a global responsibility in this respect.

It was not easy for Gunda Röstel, Commercial Managing Director at Stadtentwässerung Dresden, to say goodbye to GWP. She used the opportunity to say a few meaningful words. Access to water is becoming increasingly difficult at the international level. This universal resource is often unevenly distributed, overused, or polluted. For this reason, Röstel called on the participants to develop international networks, as is already the case in chamber and association partnerships or on international operator platforms. ■

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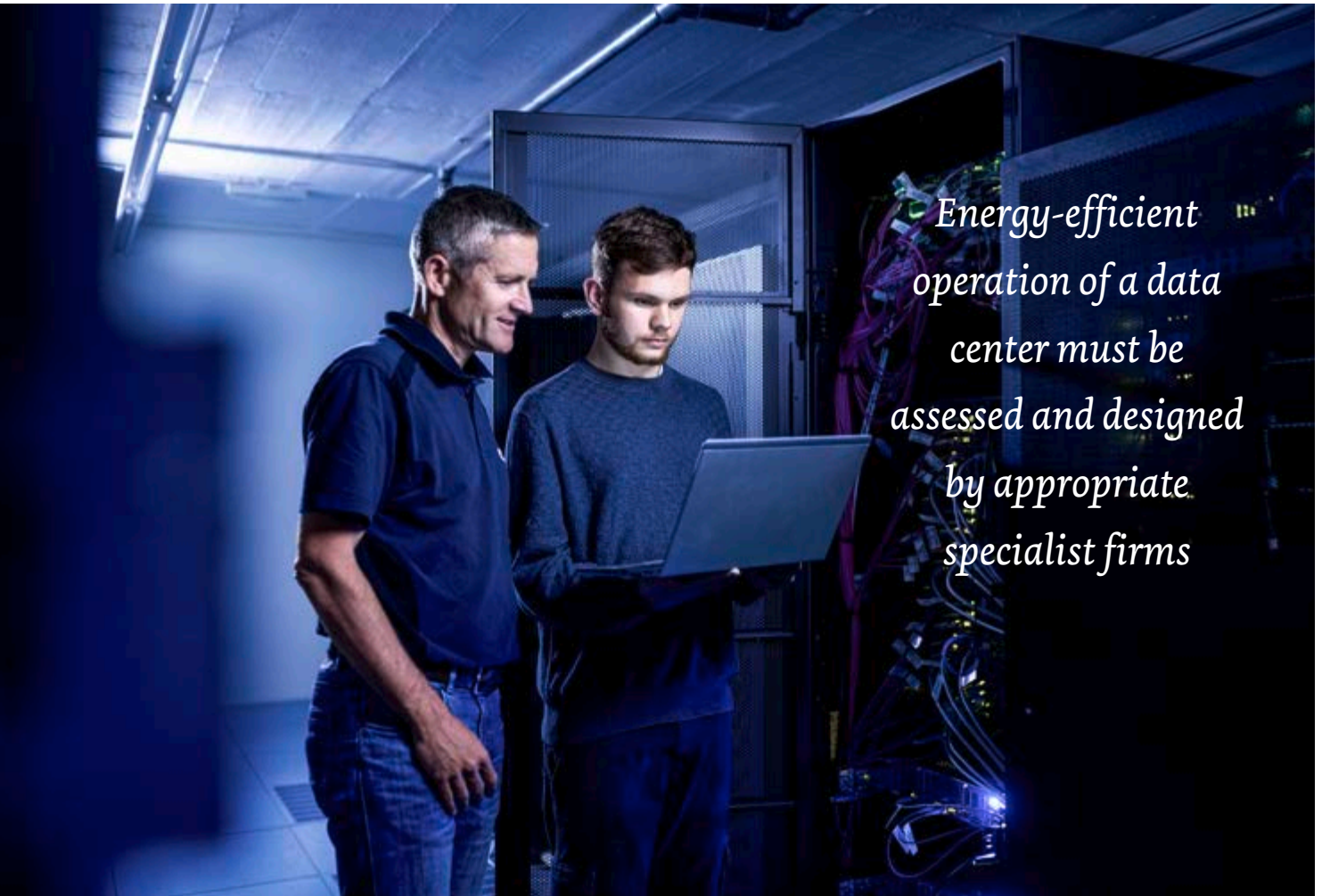
1 Change in the chairmanship of GWP: Gunda Röstel passes the torch over to Ingo Hannemann
 2 Gunda Röstel and Matthias Kremer at IFAT 2024



X-factor: no thick air in the data center

In pursuit of optimal server cooling

No, the X-factor is not to be confused with The X-Files, an American TV series about mysterious stories somewhere between truth and illusion, though belief and reality are often mixed up when it comes to the X-factor described here.



*Energy-efficient
operation of a data
center must be
assessed and designed
by appropriate
specialist firms*

Since the beginning of the Internet age and the associated, ever-increasing global networking of computers and telecommunications equipment, the density and number of IT data centers has increased rapidly. AI is giving this

trend another powerful boost – server computing output and data volumes are increasing at an incredible rate. We are already familiar with the effects of greater computing output from our home laptops or PCs: processors, power

supply units, and batteries produce more heat. Today's data centers are modular and highly integrated. The consequence of this is extreme heat generation that can no longer be handled with a simple fan. Today, rooms have to be climate-controlled at great cost to protect materials and achieve optimum processor computing output. However, climate control also means energy consumption, costs and – last but not least – environmental pollution from waste heat or chemical coolant additives in the refrigeration plants.

The supply of cold air protects valuable hardware

Back in 2014, an expert panel of server manufacturers tried to further optimize the optimal server cooling using what is referred to as the X-factor. 20 °C was defined as the "optimum" and this temperature was given the factor 1.0.

It was defined that the factor being fallen short of meant a lower likelihood of failure in server electronics. Therefore, an X-factor of 0.8 would reduce the risk of failure by 20 %. Today, a good 10 years after this initial definition, the reality is in some respects different. Server room temperatures of 22 to 25 °C are entirely standard today, as any other temperature would require too much cooling and therefore energy. As well as the X-factor, the optimum air humidity in the server rooms also plays a major role for ongoing operation that is as error-free as possible.

In the server rooms or containers, the valuable hardware is protected by a constant supply of cold air. There is also processor cooling, during which a cooling agent in tubes sits directly on the heat sources and dissipates the heat. Mechanical cooling units (similar to a domestic refrigerator) can be used to create cooling. However, this is extremely energy-intensive as it needs to run on a continuous basis and uses energy in the process. →



All measured values are collected and processed centrally

Cooling tower monitoring by the JUMO AQUIS touch

The use of free cooling is a better method. In this process, the air or water is cooled as part of a traditional method using the outdoor climate. With outdoor temperatures of below 12 °C, the temperature difference from the dissipated heat is generally sufficient to achieve data center cooling without major expense. Adiabatic wet cooling towers are used during seasons with higher ambient temperatures. Unfortunately, closed cooling towers that are operated with a water and cooling agent mixture are also still used. These coolants are extreme greenhouse gases (more dangerous than CO₂) and often enter the atmosphere when leaks occur or when the plant is demolished.

Danger of legionella growth



Legionella can be harmful to human health

The classic compact industrial cooling tower works with water and uses evaporation cooling. From a base tray, water is sprayed over the incoming hot air or over hot water pipes. In this process, the hot air cools significantly and can be used for plant cooling again. In Germany, wet cooling towers are subject to the 42nd Ordinance on the Implementation of the Federal Immission Control Act (or "42. BImSchV") as the danger of legionella growth

comes from them as open water-bearing systems. The hot plumes of exhaust air could endanger the health of anyone in the area of influence.

Regulations such as those stated above exist in practically all countries – with differing interpretations. To follow them, the process water in wet cooling towers is constantly subject to water analysis measurements, either continuously online or by means of regular laboratory samples. The classic core measurement variable when water is used as a cooling agent is electrolytic conductivity. If water evaporates in operation, it rises (resulting in what is referred to as an increase in salinity), and fresh water is fed in by means of automated controls.

The ideal measurement method here is inductive electrolytic conductivity measurement during which pollutants or coatings on the sensor do not result in measured value deviations. As an additional analysis parameter, the pH value provides important information about changes in the water. If the pH value is too low, the risk of corrosion in the plant increases; if it is too high, the water "saponifies" and loses its ideal cooling effect. Depending on the design and on-site requirements, turbidity measurement and possibly chlorine or bromine measurement may also be used for disinfection monitoring. The water transported in the circuit is monitored by a flow monitor or flowmeter. According to 42.

BImSchV, the measured values should be recorded (recorder), partly to be able to prove that the cooling tower is always operating correctly.

One ideal solution here is a multichannel measurement, controller, and recorder device such as the JUMO AQUIS touch S. All the important parameters can be measured and recorded. The addition of biocides to avoid algae formation in the water, the addition of freshwater, and pH and chlorine/bromine control can be centrally controlled with this device. In addition, all measurement data can be sent

to a cloud via a gateway such as the JUMO variTRON 300 so that it can be remotely monitored. If several cooling towers are operated near one another in an industrial complex, a central controller such as the JUMO variTRON 500 can also be used – in this case, all measured values are collected and processed centrally.

JUMO offers the measurement technology solution for monitoring ambient air and humidity as well as for hygienically flawless operation of the wet cooling tower. ■



The JUMO hydroTRANS series can be used to determine the optimum indoor climate in data centers

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Air versus liquid cooling? The answer is D2C or immersion technology!

Today, pure air-flow cooling is no longer sufficient for high-end data centers containing servers with very high output density. Additionally, the electronic components or microprocessors are directly cooled by liquids. This is familiar from gaming PCs, which are already available with water cooling in personal computers as well. This liquid cooling is also referred to as direct-to-chip (D2C technology). Clean water or water with additives is used as a cooling agent. In professional data centers this "internal" cooling circuit is monitored for temperature and electrolytic conductivity. JUMO offers scalable solutions in this respect, from simple DIN rail devices to complex multichannel analytical transmitters. Conductive conductivity sensors such as the JUMO BlackLine EC are suitable as sensors in this partial cooling section. The latest generation of servers that are immersed in non-conductive cooling agents (immersion technology) are even more powerful. In this process, the waste heat from the hottest components is distributed over the entire liquid environment, which protects the equipment as

a whole. The cooling agent is a special non-conductive agent that has a very high thermal conductivity. Both methods complement the classic air cooling of data centers. In some cases they significantly reduce the cooling effort for the entire plant and therefore the costs, while at the same time increasing the achieved detailed cooling.



Electrolysis

Safe and proven technology for the future

Electrolyzers have been in use since the 19th century and their areas of application have been constantly expanded since then. The invention of the alkaline electrolyzer in the 20th century helped to improve the efficiency of electrolysis and paved the way for the commercial application of electrolyzers for the production of hydrogen.



At the beginning of the 21st century, the technology is competing with new electrolysis technologies. The electrolyzers available on the market today are alkaline electrolyzers (AEL), PEM electrolyzers (Proton Exchange Membrane), high-temperature electrolyzers (HTE), and AEM electrolyzers (Anion Exchange Membrane). All of these play a crucial role in the energy transition and the development of sustainable energy systems. They offer a way to store long-term and transport renewable volatile renewable energy such as solar and wind energy in the form of hydrogen, thereby helping to lower carbon emissions and

reduce dependence on fossil fuels. Each electrolyzer type has specific advantages and disadvantages as well as areas of application. Choosing the appropriate electrolyzer depends on various factors including the required production capacity, operating conditions, availability of energy sources, and costs.

Qualitative and reliable measurement technology to increase efficiency and save costs

An electrolyzer with the necessary peripherals is a complex system that requires suitable and coordinated measurement technology. As hydrogen is an explosive gas, the explosion protection regulations must also be observed. JUMO supplies products from the sensor via the automation level all the way to evaluation through the cloud. Pressure and temperature sensors tested specifically for use with hydrogen enable safe use in the electrolyzer periphery.

The JUMO SIRAS P21 AR process pressure transmitter with SIL/PL and Ex approval measures the relative and absolute pressure of liquids, steam, and gases reliably and precisely. It was developed for use in safety-related plants with Safety Integrity Level (SIL) according to DIN EN 61508. As a result, the transmitter is perfectly suited for safety measuring chains in the process industry and mechanical engineering.

JUMO PROCESStemp – the RTD temperature probe for process technology with SIL/PL and Ex approval is the tool of choice for temperature measurement in liquid and gaseous media. It consists of a protection fitting according to DIN 43772 with various process connections, a terminal head, and an interchangeable measuring insert.

The compact and user configurable safety temperature limiter/monitor according to DIN EN 14597 with SIL/PL

and Ex approval – JUMO safetyM STB/STW Ex – enables early and reliable detection of risks in Ex areas which could potentially result in personal injuries, environmental damage, or destruction of production facilities and production goods. If the 1-channel safety controller of the JUMO safetyM is combined with RTD temperature probes or thermocouples, an SIL 3 compact solution is created that JUMO can certify with a declaration of manufacturer.

Electrolysis is an integral component of our industry

As the historical introduction has shown, electrolysis as a technology for producing hydrogen is fundamental to today's industrial landscape. Electrolysis in conjunction with renewable energies has the potential to develop considerably in the coming years, particularly in the context of the energy transition and the associated goal of reducing dependence on fossil fuels. A decisive long-term success factor will also be economic efficiency in competition with fossil fuels. Further efficiency increases and innovations, the use of economies of scale, and intelligent system solutions are approaches for successful market penetration. ■



Certified compact system for temperature



Thermocouples and RTD temperature probes



JUMO safetyM STB/STW



Declaration of manufacturer

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Measurement of hotspot temperatures

Reliable measurement in stators

DIN EN 61800-5-1 plays an important role for temperature measurement in engines, particularly in the context of electric high-performance-drive systems with an adjustable speed. This DIN standard forms a comprehensive framework for safe and reliable temperature measurement in engines within electric drive systems. It ensures that temperature monitoring meets the required safety standards and therefore contributes to the protection of the engine and the entire drive system.

In the past, engine manufacturers mainly used KTY-84-130 sensors, but these are only rarely used today. Not only have the standard's requirements for temperature measurement in high-performance drive systems increased, but also some of the KTY versions have been discontinued by the manufacturers.

These days, Pt1000-type temperature sensors are predominantly installed in these engines. The structure of this type of temperature sensor with a Pt1000 has been retained in line with the KTY. Here, manufacturers like to apply heat-shrink tubing to the measuring point as insulation materials with single or multiple layers. Given the increased requirements of the standard, this design type only partially meets the more demanding requirements for the stipulated insulation system. The heat-shrink tubing is made of PVDF (polyvinylidene fluoride). PVDF is part of the per- and polyfluorinated alkyl substances (PFAS) group. These substances are subject to criticism due to their persistence in the environment.

Challenges for new temperature sensors

PGT Thermprozesstechnik GmbH, a full subsidiary of JUMO, has developed new types of temperatures sensors for measuring hotspot temperatures in the engine and motor industry. The task was to ensure that the new standard requirements for electric strength and the insulation system in the power drives were also met by the temperature sensors.

The key requirements here were

- The use of a platinum measuring resistance Pt1000 according to IEC 60751
- Ensuring surge voltage safety to resist short-term voltage peaks or transient surge voltages (DIN EN 61800-5-1 standard requirement)
- Achieving normative partial-discharge stability to guarantee the safety, reliability, and long life cycle of the insulation system of the new temperature sensors in the engine
- Developing a measurement method for reproducible measurement of partial discharges in the sensor, on the connecting wires, and in the manufacturer's engine system
- Specifying a temperature-resistant connecting wire that has high electric strength and yet an external diameter of just 1 mm maximum
- Selecting all components in the light of harmonization according to UL 61800-5-1 and CSA 22.2 No. 274
- Developing a functional recyclable and heat-conducting modified thermoplast material
- Developing an injection mold tool concept and an injection mold process that ensures that plastic melt neither thermally nor mechanically destroys the sensing element during injection molding
- Scaling the tool concept from a single-impression mold tool prototype to a multi-cavity tool (4-fold)

- Optimizing the manageability of inlay modules through mechanical decoupling with the help of developed fixing aids
- Validating connection technologies in terms of the connection of stranded wires with the sensor connection to ensure narrowly tolerated component heights and contacting positions so that the sensor's insulation system complies with the standard
- Defining the air and creepage distances in the sensor head to ensure electric strength according to the standard
- Developing a multiple test device to measure the sensor signal at the cold end of the sensor, after the injection molding process, for all common line ends

PGT with an impressive solution

The innovative PGT solution contains a thermoplastic polymer developed especially for this product. This polymer is used to injection-mold the sensor measuring head using an injection molding process that has also been newly developed. This means that PVDF heat-shrink tubing is no longer needed. The injection molding process is very well suited to produce the high quantities required on the market with a reproducible sensing element position in the sensor head. Currently, the sensors are produced in a PGT 4-fold injection molding tool.

The following new product features have been implemented through this new process

- UL-approved components
- Free choice of design for the sensor head (standard diameter 3 to 4 mm, length 16 to 18 mm)
- Connecting wire with a 1 mm diameter and an electric strength of up to 13 kV
- Thermoconductive sensor head made of thermoplast (2 to 6 W/mK)
- Very high shock resistance and vibration resistance
- Designable withstand electric strength in the range of 4 to 10 kV according to DIN EN 61800-5-1
- Surge electric strength according to DIN EN 61800-5-1

- Temperature approval for all insulation systems A, E, B, F, H, N (105 up to 220 °C)
- Safe partial discharge strength of the sensor module < 10 pC at 1.5 × UPD (15 sec.)
- Temperature range -40 to +240 °C
- Rapid sensor head reaction time/response time in the range of a few seconds (t90)
- Use of a Pt1000 measuring resistance as an SMD design type or as a wired version (JUMO)



- 1 Example of a wound stator with a rotor insert
- 2 Bending-resistant 4-mm geometry
- 3 3 mm/3.4 mm Pt1000 oval sensor head structure
- 4 Customer-specific sensor design

Thanks to the innovativeness of PGT, which is integrated into JUMO group, the engine market now has temperature sensors available that meet not only the current requirements of the DIN EN 61800-5-1 standard but also the increased requirements of the future standard. The sensors are currently being produced in high quantities for industrial, but also vehicle engines. They are used to safely detect temperature increases in or on engine winding packages. Measurement is performed directly on the live conductors.

The newly developed technology of plastic sheathing for sensitive sensing elements is also used for solutions on a cross-industry basis. For example, analog measuring resistances can be processed and even digital temperature sensors can be produced. ■

Pt100 or Pt1000?

The type of connection is critical

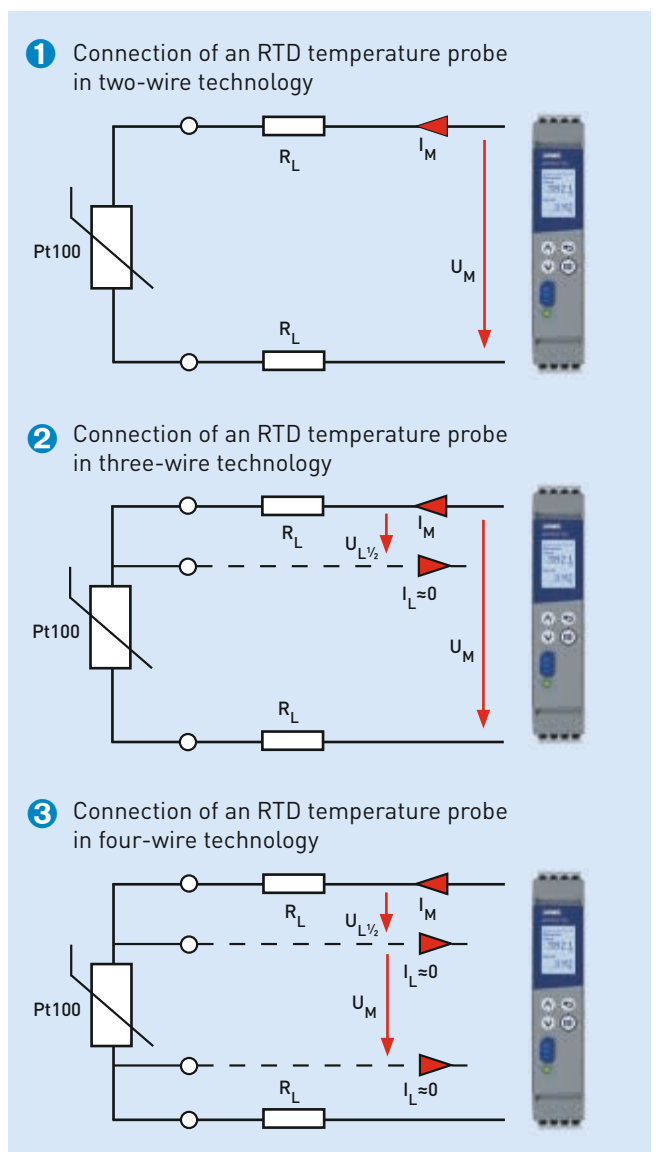
RTD temperature probes with a platinum sensor are the number one choice for temperature measurement up to 600 °C. In many cases, it is incidental whether a Pt100 or a Pt1000 is used as sensor element – it is in fact the type of connection that is critical. This article sets out the details.

Let's start with resistance sensors that are generally found in thermometers in the heating, ventilation, and air-conditioning industry (HVAC). At 0 °C, **Pt1000** platinum sensors have a resistance of 1000 Ω. Starting from 0 °C, its resistance increases by approximately 3.9 Ω/°C*. Evaluation devices in the HVAC industry often only permit connection via 2 wires ❶. The evaluation unit then creates a measuring current I_M in the measuring circuit and determines the voltage U_M . Based on the current and voltage, the resistance and from this in turn the temperature is determined on the Pt1000.

In the case of a two-wire connection, the line resistances ($2 \times R_L$) are also integrated directly into the measurement result. For example, 2 cores made from copper (0.22 mm² cross section) with a respective length of 20 m have a total resistance of approximately 3.2 Ω (approximately 0.16 Ω/m). The evaluation unit measures a correspondingly higher resistance and the determined temperature is approximately 0.82 °C ($3.2 \Omega / 3.9 \Omega \times 1 \text{ °C}$) higher than the actual temperature. To display the actual temperature, a measured value offset of -0.82 °C can be set on the evaluation unit.

Now let's take a look at the conditions for the **Pt100** sensors. These are often used in RTD temperature probes in process technology. In the sensors, the electric specifications are each one tenth: at 0 °C, their resistance is 100 Ω and it increased by approximately 0.39 Ω with each degree of temperature rise. If this type of RTD temperature probe was connected via the stated line, the line offset would be approximately 8.2 °C(!). The deviation must be reliably remedied by the evaluation unit. If it is possible to determine the line resistance, this can be divided by 0.39 Ω/°C and the determined temperature set as a negative offset.

Line compensation is not applied if the Pt100s are connected via 3 wires ❷ – this is the standard connection in process technology and it is also recommended for the Pt1000. With



*The characteristic line of the platinum sensors is slightly non-linear. For comparison: at 200 (400) °C the resistance of a Pt1000 increases by 3.7 (3.5) Ω/°C. This applies correspondingly for the Pt100. In this article, we refer to a temperature of 0 °C.



MORE THAN SENSORS AND AUTOMATION

The revised "Electrical Temperature Measurement" technical literature is available now for download. It gives practical and helpful tips on the application of RTD temperature probes and thermocouples.



the aid of the third wire, the voltage drop is measured at a line core ($U_{L/2}$). With this technique, it is assumed that there is the same voltage decrease on the second core, and therefore double the amount of $U_{L/2}$ is subtracted from the total voltage U_M . The voltage that decreases on the resistance sensor is determined in this way, and its resistance can be calculated.

There is remaining uncertainty in the case of connection with three-wire technology: if the line cores do not have exactly the same resistance, this results in a measurement error.

If the connection technology does not in any case cause further measurement uncertainty, the RTD temperature probe is operated in a four-wire technology ③. Here, the falling voltage on the resistance sensor (U_M) is determined precisely – different resistances of individual cores also do not influence this.

In the case of Pt100 RTD temperature probes with connection line ④ in the two-wire technology, there is already high line resistance with relatively low line length, the displayed temperature is too high, and there often has to be line compensation. However, the line resistance cannot be measured and no offset can be determined from this. Temperature comparison measurements are often necessary – and this is a cumbersome task. The conditions are more favorable with a Pt1000 here, the temperature offset is simply a tenth. However, it is generally recommended that the RTD temperature probes are obtained with a connection line with at least three-wire technology, as lead compensation is then not required. Lead compensation is simpler with temperature probes featuring a terminal connector or terminal head (as in ⑤). The line's resistance can be measured before the connection and the offset to be applied determined based on this. If a Pt100 is used for example, and the line resistance is 4.6Ω , the temperature offset is set to $-11.8 \text{ }^\circ\text{C}$ ($4.6 \Omega / 0.39 \Omega \times 1 \text{ }^\circ\text{C}$). RTD temperature probes with a terminal connector or terminal head are often designed with two-wire technology; however, the evaluation unit also enables connection with three or four-wire technology. The RTD temperature probe can then be connected to the evaluation unit via 3 or 4 wires (⑤ left). There is only a slight temperature shift due to the connection line in the thermometer, and compensation is generally not needed.

In the case of more demanding requirements in terms of accuracy, the RTD temperature probes should be designed in three or four-wire technology and the wires should be connected through to the evaluation unit (⑤ right). RTD temperature probes for temperatures over $400 \text{ }^\circ\text{C}$ should be constructed with at least 3 wires. This is because with these, the connection lines are made from nickel or nickel-chromium and the specific electrical resistivity of the materials is relatively high. Otherwise, the probe line results in a notable temperature offset in two-wire technology. ■

Mineral-insulated RTD temperature probe ④ with connecting line



⑤ Connection of an RTD temperature probe



Conclusion

Whether you are using a Pt100 or Pt1000 is of secondary importance, unless two-wire technology is used for connection. Here, with the Pt100, a 10x higher line offset (with the same connection line in each case) is created, and a line compensation must be made accordingly even with shorter connection lines.

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Exclusive training for our customer EnviroFALK

EnviroFALK, a leading provider of water treatment plants for hospitals, laboratories, and industrial sectors, took part in an exclusive training at our site in Fulda.

The event on the topic of "Analytical measurement technology – conductivity and pH value measurement" was especially geared toward the needs of JUMO customers. Participants gained valuable insights into the basic principles of measurands, the structure of measuring chains, and configuration and calibration. The training also included practical workshops. One highlight was the tour through our high-tech electrode production area, giving participants an insight into cutting-edge production processes.



Added value through training

Update your skills with our free, practically oriented training courses

JUMO has designed a variety of training courses with a particular emphasis on the current topics of our focus industries, which also offer real added value in day-to-day business.

Free webinars

From theory to practice – IO-Link and SPE in the JUMO brewing plant: November 6, 2024

3:00 to 4:00 p.m. (German time)

The JUMO brewing plant is used as an example to explain how the digital sensors are used in beverage technology and industrial applications as well as what specific benefits they offer.

Registration and further information: digitalsensors.jumo.info

Intelligent water monitoring for jellyfish farming: November 19, 2024

3:00 to 4:00 p.m. (German time)

Here you will find out more about AI-supported automation and cloud-based sensor monitoring with efficient JUMO solutions.

Registration and further information: solution.jumo.info

Dangerous ignition sources and explosion protection: January 23, 2025

10:00 to 11:00 a.m. (German time – in German only)

You will find out how you can effectively monitor plants and potential sources of ignition as well as how to mitigate risks to people, the environment, and equipment.

Registration and further information: safety-en.jumo.info

Further exclusive trainings (trainings available upon request)

Analytical measurement technology for practitioners

Control technology for practitioners

JUMO automation systems JUMO variTRON 500 and JUMO variTRON 300

Extension of JUMO components through PLC functionality

Missed an online event? No problem.

Further information and recordings are available on our JUMO Xperience platform at: <https://jumo.easyvtf.com/en>.

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