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sensors + automation

The Customer Magazine from JUMO

JUMO

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Safety-related compact solution.

Functional safety up to SIL3 with JUMO safetyM

Your advantages:

- Compact, single-channel safety control with selectable redundant input signals for standard signals and temperature sensors
- Minimal manual configuration due to device software
- Selectable security features such as limiter or monitor function
- Internal cyclical inspection of the redundant sensor technology and channel hardware
- Variable selection of sensor technology and actuators from various manufacturers

Welcome to JUMO.

Dear Reader,

For a long time, the terms "SIL" and "functional safety" have been crucial topics in trade media or at conferences and trade fairs. Much is written and spoken about them, but the topic remains clouded in mystery. Even if it is easy to read the definition of SIL as a measuring unit to quantify risk reduction, the corresponding implementation of this in concrete processes is often a great challenge. The vast number of underlying standards alone means that the user needs the detailed knowledge of a specialist.

This is why we support our customers with specialist market segment management on this topic. We can provide various innovative solutions in the field of functional safety and we would like to introduce you to these topics in this magazine.
Thinking about advice is also at the forefront of the new JUMO Engineering. We have bundled together all of our engineering services under this name and can provide our customers with complete solutions for comprehensive tasks in the field of automation. The high level of industry knowledge and many years of project experience at JUMO are thereby made available in an interface. This is an important step for our company on the path from being a supplier of components to being a supplier of systems. In this magazine, we therefore also introduce you to our different services in this field and demonstrate a concrete project. You will also find interesting reports on applications, product presentations, and news from the JUMO corporate group.
As always, we hope you enjoy reading the magazine.

JUMO. More than sensors + automation.

Your
Managing Partners,

Bernhard Juchheim *Michael Juchheim*

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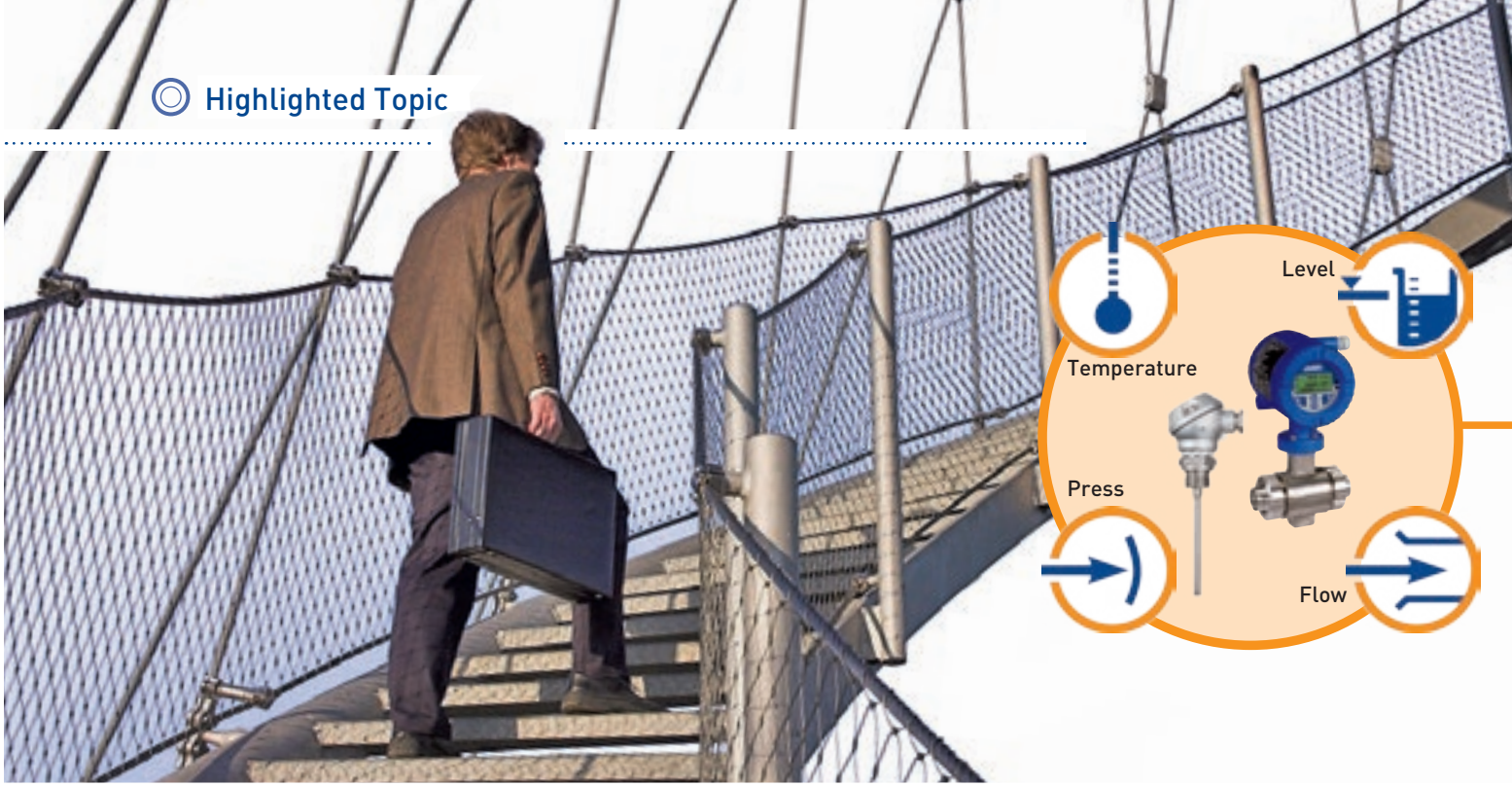
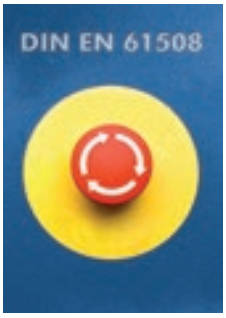


Functional safety

A systematic approach to minimizing risk

In 1976 in Seveso, northern Italy, a dramatic accident involving toxic gas brought about a development, the results of which we know today as the terms "functional safety" or "SIL". At the time, a serious overheating reaction took place in a plant which had neither automatic cooling systems nor warning systems, releasing large amounts of dioxin. 200,000 people required medical assistance and approximately 70,000 animals had to be put down. As a result of this catastrophe, the laws and regulations regarding the protection of people, living things, and the environment were tightened.

The first result was the standard IEC 61508 "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems" published in 1998, which has been applied as EN 61508 since 2002. For the first time, this standard comprehensively defined the safety requirements in automation technology.



While IEC 61508 is primarily aimed at the manufacturers of components for safety devices, IEC 61511 "Functional Safety - Safety Instrumented Systems for the Process Industry Sector" applies to the operators and planners of safety devices. IEC 61511 provides recommendations and guidelines for assessing the risk of damage in plants, and can be used to help select suitable, safety-oriented components. The aim of these standards is to reduce the risk to an acceptable level.

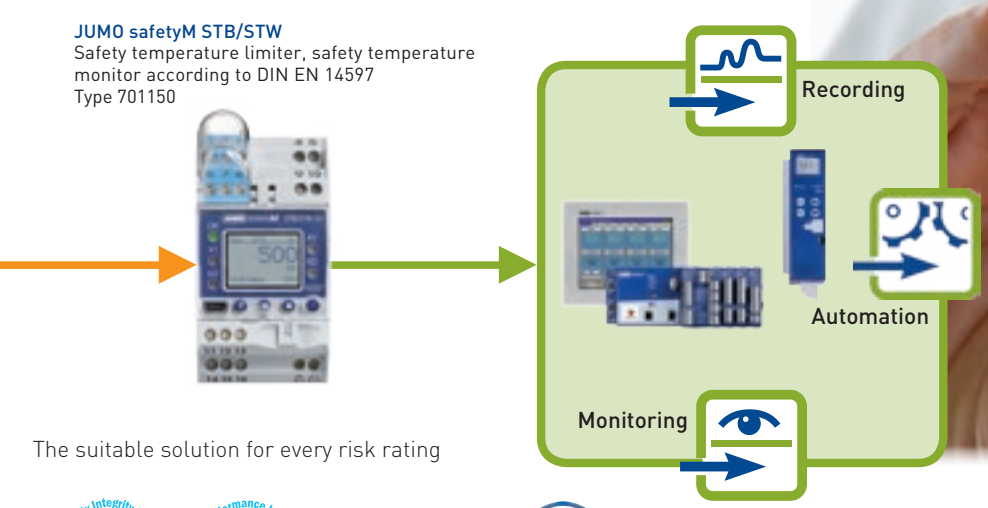
But what do we actually mean when we talk about "functional safety" or "SIL"? Functional safety refers to the part of system safety that depends on the correct functioning of safety-related sub-systems and external devices in order to reduce risk. Electrical safety, fire safety, radiation protection, or mechanics, among others, are not part of functional safety.

The term "SIL" ("Safety Integrity Level") serves as a measure of the safety-related performance or reliability of an electrical or electronic control system. SIL focuses on the evaluation of the safety chain, also known as SIF "Safety Instrumented Function". Typically, this safety chain comprises the safety controller, the actuator, and the sensor. The SIS – "Safety Instrumented System" – is made from one or more safety chains.

The required level of risk reduction is described using the four-level SIL scale. SIL1 represents the lowest level of reduction and SIL4 the highest. The first step to ensuring functional safety is always a risk analysis. The aims here include identifying the dangers as well as the events within the process and the relevant equipment that may result in danger. Additionally, the safety-related functions required to achieve the necessary risk reduction need to be determined.

For example, in a pipeline and instru-

JUMO safetyM STB/STW
Safety temperature limiter, safety temperature monitor according to DIN EN 14597
Type 701150



The suitable solution for every risk rating

SIL · PL · DGRL 97/23/CE · DIN Gepruft · c UL us · GL · Ex

mentation diagram in plant and process engineering, when assessing the safety of a process the individual components of sensor technology, evaluation electronics, and actuators need to be considered separately in order to devise a general solution.

Here, sensors measure the physical process variables such as temperature, level, or pressure and convert the measured value into the standard signal. Evaluation electronics generally include control units that convert, linearize, save, and further process the process variables according to rules and then forward them to the actuator for execution. Actuators then perform operations in the process by adjusting a wide range of functional variables.

Safety variants can be implemented in evaluation electronics using two approaches. Users can use a programmable safety logic controller. This solution is particularly well-suited for building special systems with a process control system and is characterized by comprehensive functional applications as well as a higher density and number of signals. This does, however, require more extensive programming applications and the inputs and outputs are coupled with card types and multichannel features. Investment costs vary depending on the number of channels and software expenditure. In addition, each application must be separately calculated and evaluated according to SIL. This allows the implementation of solutions up to SIL4.

The first step to ensuring functional safety is always a risk analysis

An alternative to programmable safety logic controllers is the use of safety monitors or limiters, such as the JUMO safetyM. It is ideal for smaller functional applications such as special machines and individual applications with a low density and number of signals. In addition to low investment costs, the advantages here include low parameterizing complexity for each application or control function. The solution operates with universal input signals and features a redundant internal structure with redundant sensor inputs. In addition, three different functional outputs are also available (analog/binary). This allows for solutions up to SIL3 or PLe. What's more, the entire SIL chain is already calculated in conjunction with defined JUMO sensor technology. Of course, sensors from other manufacturers can be easily connected and users are not limited to a specific actuator manufacturer – even though the use of products by the same manufacturer has its advantages.

At JUMO we have our own market segment management for the areas of "SIL" and "functional safety", which will gladly offer users advice for all questions relating to these important topics and will develop customer-specific solutions.

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"At JUMO we have our own market segment management for the areas of "SIL" and "functional safety", which will gladly offer users advice for all questions relating to these important topics and will develop customer-specific solutions."
Dipl.-Ing. Matthias Garbsch
Product manager for explosion protection & functional safety

SIL in practice

Continuous level measurement using differential pressure measurement on a tank system

Monitoring the pressure in tank systems is most vital safety aspect in the chemical industry. With the help of JUMO devices, particularly easy-to-use solutions can be implemented concerning functional safety.

At the core of this is the JUMO safetyM STB/STW. This safety limiter/safety monitor according to DIN EN 14597 has the primary task of reliably monitoring processes and putting the plant into safe operating status if a fault arises. Limit value exceedance is indicated by the installed LED K1 and K2 (red) for each channel and the integrated alarm relay output switches the plant to safe operating status (alarm range). The device concept meets the stringent requirements of DIN EN 61508 and DIN EN 13849. The 1oo2D structure ensures reliable detection of faults, meaning that it can also be used for applications subject to the new Machinery Directive 2006/42/EC. As the measured value at the analog input can be recorded using various probes or standard signals, the JUMO safetyM is also suitable for monitoring pressure. For this, one differential pressure transmitter is connected with the JUMO safetyM via two Ex-i repeater power supply/input isolating amplifiers (type 707530). With this solution, a limit shut-off up to SIL3 is possible for a set level. The user therefore has a compact, single-channel safety control with selectable redundant input signals for standard signals. Configuration is simple and easy thanks to the device software.

But this is not all. The JUMO safetyM can also be connected to the JUMO mTRON T measuring, control, and automation system. For this, either the binary signal of the pre-alarm or the analog output signal is used. Through this solution, the user has a clearly improved function range as well as broad options for visualization.

Further SIL solutions for which the JUMO safetyM can be used are temperature monitoring in heat treatment facilities, the monitoring of pumps, switch-off for overfilling, or monitoring of extruders.

JUMO products for level measurement:

1. **JUMO mTRON T**
   Measuring, control, and automation system
   Type 70500
2. **JUMO safetyM STB/STW**
   according to DIN EN 14597
   Type 701150
3. **JUMO Ex-i power supply/input isolating amplifier**
   Type 707530
4. **JUMO dTRANS p20 DELTA Ex d**
   Differential pressure transmitter
   Type 403023

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1 JUMO tecLine electrodes: Now in a heavy-duty version

JUMO tecLine electrodes are high-quality sensors for professional applications in process and industrial measuring technology. New additions to the range include a pH and a redox combination electrode in a heavy-duty version. The JUMO tecLine HD pH and the JUMO tecLine HD Rd are particularly robust and can even be used in difficult processes for temperatures of up to 135 °C and a maximum pressure of 13 bar. A newly developed, extensive PTFE ring diaphragm with improved structure enables a quick response time while at the same time being largely impervious to greater pollution loads or oily/fatty process water and wastewater. Typical areas of application for the new electrodes are air or gas scrubbers, processes in electroplating, industrial wastewater, as well as plants with increased medium pressure.

2 JUMO MAERA S29 SW: Highly resistant, maritime-proof, and explosion-proof

With the MAERA S29 SW, JUMO is expanding its comprehensive range of high-quality level probes. The JUMO MAERA S29 SW is available for relative and absolute pressures from 100 mbar to 10 bar. Due to the chemically high-resistant titanium design and the intrinsically safe ATEX approval, the probe can also be used in difficult environmental conditions. Along with the GL shipping approval, the MAERA S29 SW is suitable, among other uses, for continual level measurement in ballast water tanks or for functioning as an anti-heeling system which ensures the ideal depth of ships. The probe can also be used in swimming pool technology. One specific use here is in backwash water tanks as the probe is also suitable for media containing chloride. Furthermore, the JUMO MAERA S29 SW can be used in semi-liquid and highly-viscous media, such as heavy oil.

3 JUMO MIDAS S07 MA: New pressure transmitter with maritime approval

The JUMO MIDAS S07 MA has been developed especially for the shipbuilding industry. It has all of the required approvals and is characterized by its compact form, stainless steel design, and ease of installation. The pressure transmitter is available for relative pressures from 1 to 10 bar, and for absolute pressure ranges from 1 to 25 bar. The medium temperature can be between –40 and +125. In addition to numerous process and electrical connections, further options such as oil and grease-free versions, an inverted signal, or an enlarged channel bore can be ordered.

4 JUMO MIDAS S21 Ex: Versatile pressure transmitter with ATEX approval

The new JUMO MIDAS S21 Ex pressure transmitter is designed to be modular and is available with various process connections. The measuring system is completely welded and is certified for the use in ATEX areas. The transmitter is available for measuring ranges of 0.25 to 100 bar for relative and absolute pressure. The temperature of the medium can be between –40 and +85 °C. The JUMO MIDAS S21 Ex is made completely from stainless steel and is characterized by high chemical resistance. The high overload capability and long-term stability of the piezoresistibe silicium sensor ensure optimal process reliability.

5 New cases offer even better protection for temperature probes

A number of robust plastic cases conforming to protection class IP65 for temperature probes have now been added to the JUMO range. The cases are temperature-resistant from –50 °C to +60 °C and are particularly easy to install thanks to a lid with a quick-release fastener. The cases for interior use are available with an internal or external sensor and a protection tube for channel measurements. The integrated transmitter is also suitable for wireless transmission of the measured values with the JUMO Wtrans system. A contact probe with flexible measuring insert guarantees optimal thermal connection to reduce measurement deviations. The cases are available with different sensor types such as Pt100, Ni 1000, M235Z, and various NTCs.

1
Type 201021 (pH)
Type 201026 (redox)

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Type 404393

NEW

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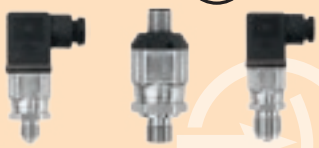
Type 401021



NEW

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4
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NEW

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NEW

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JUMO mTRON T
Measuring, control, and automation system
Type 70500

JUMO safetyM TB/TW08
Temperature limiter, monitor
according to DIN EN 14 597
Type 701170

Automation makes it possible!

The controlled annealing of plastic parts

Modern plastics are truly high-tech products, replacing traditional materials in more and more areas. They have played a key role in the automobile sector for decades, where they are exposed to particularly extreme loads. Coburg ROS GmbH & Co. KG specializes in the manufacturing of thermoplast and duroplast parts for this industry.

In order to live up to customer demand, uniform quality in the production process must be guaranteed even for large quantities. In a new annealing furnace made by caldatrac® Industrieofenbau GmbH & Co. KG, a JUMO mTRON T automation system helps to ensure constant quality. The challenge for the new plant is to anneal the duroplastics using an even and precise heat treatment. The tolerance limits provided by the customer for these materials are extremely narrow. The raw parts are pushed into the furnace using a tempering trolley. Up to eight different batches on six tempering trolleys can be simultaneously put into the furnace and processed. Due to its construction, an even distribution of heat is achieved inside the furnace to produce a temperature distribution with a maximum deviation of +/– 3 K.

Due to the variety of products, it was particularly important for ROS GmbH & Co. KG to be able to save and edit different annealing programs directly in the system. The caldatrac plant engineering firm chose the JUMO mTRON T automation system as the ideal solution.

The advantages are clear: the modular design of the JUMO mTRON T offers maximum flexibility. Different input/output modules are available, including a multichannel controller module, an analog input module with four or eight channels, a relay module in a 4-channel version, and the freely configurabledigital input/output module with 12 channels. The 4-channel analog input module is the special feature, and is equipped with universal and galvanically isolated analog inputs for thermocouples, RTD temperature probes, and standard signals. Different measurands, such as

A plastic part from ROS GmbH & Co. KG

The annealing furnace

temperature, pressure, and humidity can therefore be precisely recorded and digitalized using the same hardware. For individual control applications, the system has a PLC (CODESYS V3), program generator and limit value monitoring functions, as well as math and logic modules.

At ROS GmbH & Co. KG, the different programs for the annealing process are conveniently launched by the user via the multifunction panel. The creation of programs, which comprise up to 100 segments, can also be performed directly on the device.

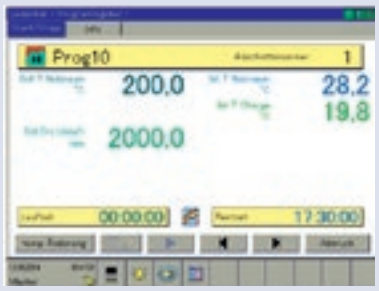
Each annealing process is not only controlled by the mTRON T system, but is also recorded. The batch reporting of the system enables continuous monitoring and evaluation of the individual furnace components. With a detailed evaluation of the temperatures and programs used, conclusions on quality can be drawn at any time under the influence of different factors.

The appearance of values in curve form is also carried out directly on the display. This recording function is integrated in the JUMO mTRON T and is available to the user for easy-to-use data recording. The graphs plotted here can be evaluated, printed out, and exported using special software. Upon request, an automatic batch report can be made available as a PDF-file, which is automatically produced by the system without user action. It also includes a detailed overview of all batches as well as the accurate representation of the recorded values.

The particular flexibility of the system also appears in the item management. Each item manufactured in the annealing furnace is created here and assigned to a program. A system plausibility test ensures that only items that were assigned to the program chosen beforehand can be annealed.

The batch data input is carried out directly on the multifunction panel. In this case, the operation masks were adjusted especially for ROS.

Different displays: JUMO mTRON T – multifunction panel 840 (705060)



Program display on HMI

Input mask of the item management

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The Welter winery: A family-run business in Engelstadt, Germany

The finest wine thanks to automation

JUMO develops a complete solution for wine production

Germany is a country of wine – for 2,000 years the finest wine has been produced on the banks of the Moselle and Rhine. Today in Germany, around 80,000 wine growers produce more than nine million hectoliters of wine per year. During wine production, monitoring the temperature plays an increasingly important role. On behalf of Hüttenhein GmbH & Co. KG Anlagenbau, JUMO took on the role of service provider and developed an innovative automation solution for a wine grower in the Palatinate region, taking on planning and project management tasks.

The Welter winery in Engelstadt is a third-generation family-run business producing high-quality wine using organic methods.

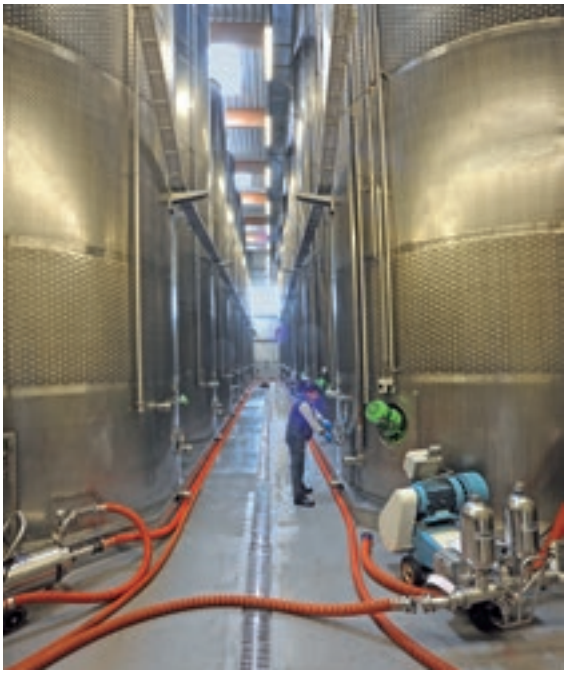
Furthermore, the Ortwin Welter Weinkellerei GmbH & Co. KG winery has gained an excellent reputation for the refinement of wines from contractual vintners. When the cooling system for various tank systems was recently modernized, the winery chose a solution developed by the company Hüttenhein GmbH & Co. KG Anlagenbau from Wittlich, Germany. Hüttenhein Anlagenbau has been a partner in the development of professional overall systems since 1978, particularly for the food and beverage industry. Since it was founded, the company has been developing and implementing tempering stations including the corresponding pipeline construction in stainless steel for wineries. For the project with the Welter winery, the plant engineering company chose to rely on the technology and expertise at JUMO.

Monitoring the fermentation of wine has become a highly relevant subject in the last few years. The better the temperature in the storage containers can be kept within the optimal temperature range, the higher the quality of the wine. This is particularly necessary immediately after filling the tanks with the grape must because so much heat is generated during the fermentation process that artificial cooling is required. In a special method known as cold fermentation, the temperature must constantly remain between +15 and +20 °C to allow particular yeast strains to work. The resulting wines are extremely fresh, pure, and simple with a relatively high alcohol content.

For the cooling solution which was realized for the Welter winery by Hüttenhein Anlagenbau, the tanks are cooled in different zones using thermowells through which glycol flows. In this way, it is possible to generate almost any desired low temperature in the tank. The current project

Installation situation of the JUMO mTRON T

One of the tank systems whose temperature is controlled through the JUMO mTRON T system.



Hydraulic module

Fuel gauge

phase contains 70 tanks which are in different storage rooms, some of which are outside. Hüttenhein Anlagenbau used the modular measuring, control, and automation system JUMO mTRON T as a central control element.It analyzes the data from the JUMO probes, which are attached to each tank, and with the help of JUMO controllers controls the temperature. Furthermore, the pressure in the entire cooling system is monitored. With the help of the recording function of the JUMO mTRON T, important actual values are also recorded.

The central processing unit sits in a control cabinet which is located in a container outside of the winery and which houses another tank for the coolant as well as several pumps for the 650 KW chilled water units. The main operating panel, which is used to control the temperature, is located in the office of the operations manager. Furthermore, a total of 29 JUMO mTRON T input/output modules are used. A special feature is the five subdistribution units which are dissipated around the company's premises and which are controlled by router modules. With the help of separate operating panels, individual process steps can be controlled directly on-site.

For all of this, JUMO not only delivered the different components but also supported the entire project with engineering services from the remit to startup on site. This meant that, among other things, individual process screens were programmed by the JUMO application team. Hüttenhein Anlagenbau and the Welter winery were, above all, impressed by the simple parameterization and configuration of the system on site, which are possible even without extensive PLC knowledge. The flexibility of the JUMO mTRON T system, which can be expanded modularly at any time, is also a clear plus. This is also the reason why Hüttenhein is now also using the system for other customers. Expansion of the plant at the Welter winery is also being planned.

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JUMO Engineering

From the idea to the complete solution – all from a single source

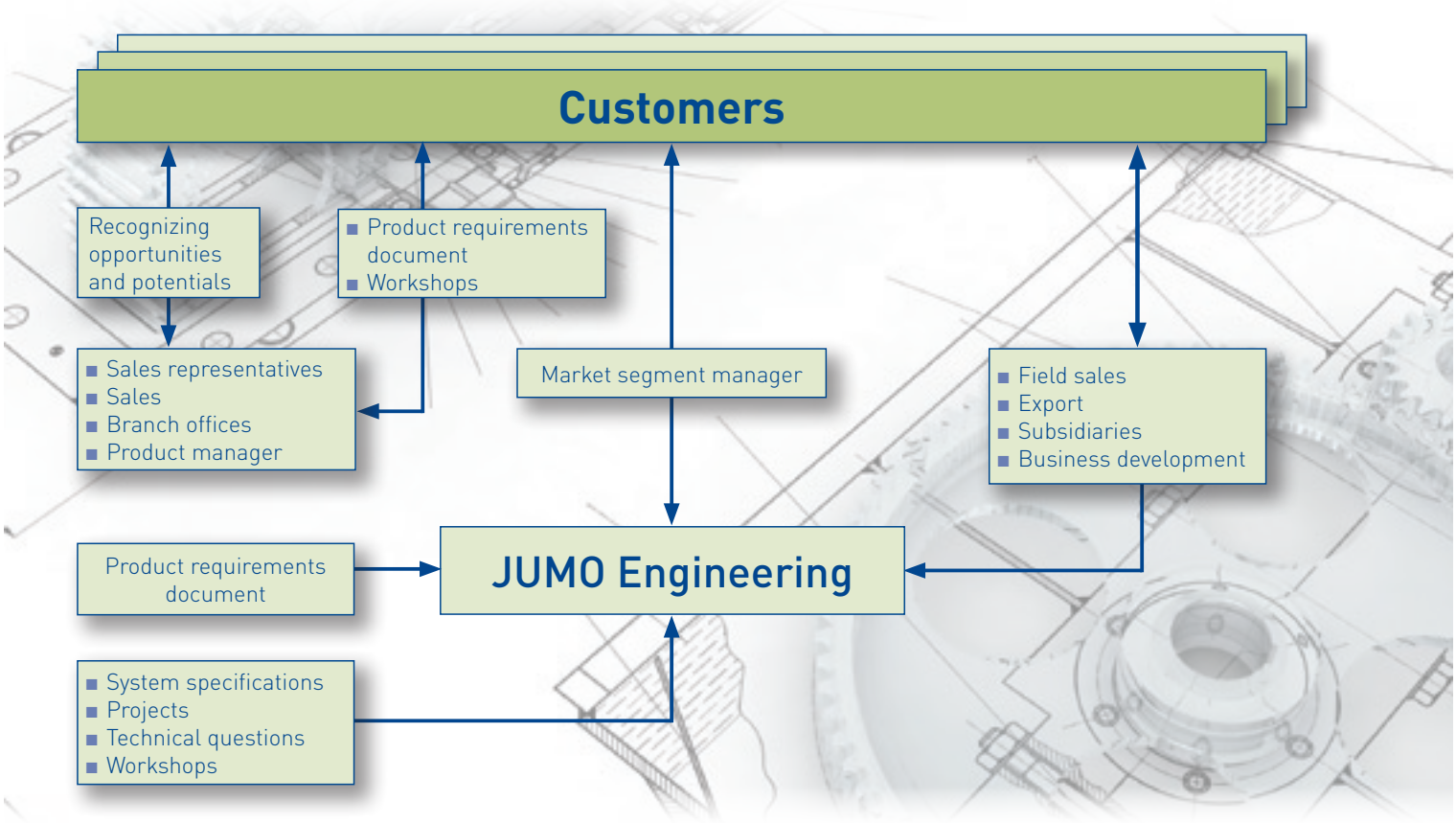
Technology is becoming more and more complicated – this is something that you will often hear people sigh, and it is also not wholly incorrect. The on-board computer which was used for the first moon landing had 74 kilobytes of memory, a working memory of 4 kilobytes, and a processor with a clock speed of 1.024 MHz. A chip today is ten thousand times faster and, in terms of computational power, every smartphone beats the 30 kg computer giant built by NASA.

In every normal car, several hundred sensors perform their duties and take more and more decisions away from the person driving. However, due to the various displays and setting options, driving is not necessarily any less stressful, but perhaps even more complicated. And the average smartphone owner also only uses a fraction of the technical options that they have at their disposal.

Any of these things that can be found in everyday life. They can also be found on a much larger scale in the field of industry. More and more plants and processes are being controlled and monitored completely automatically. In the course of Industry 4.0, this trend will only increase. Revenue in the German automation industry has increased by more than 70 percent since 2002, and with a global market share of around 10 percent, Germany is number four in the list of the most important manufacturing countries in the field of automation.

The demands of the user also increase with the complexity of machines and plants. They are no longer looking for individual sensors or controllers.

JUMO mTRON T system and built-in device in the control cabinet



JUMO Engineering as service

JUMO Engineering as a service wants optimal complete solutions to its own problem. This is why the focus is no longer on the individual product used, but rather on the optimal interaction of all the components used.

Several years ago, JUMO already made the first important step from being a provider of components to a systems provider when the JUMO mTRON T modular measuring, control, and automation system was introduced. In the period that followed, it turned out that consulting services were also being carried out for many of the implemented systems. The next logical step, therefore, was to bundle available skills together under the term "JUMO Engineering" and to expand this to other JUMO products.

The Engineering Team comprises employees with years of automation experience and it develops tailored applications for numerous industries. These are, for example, the food and beverage industry, water and wastewater engineering companies, the pharmaceutical industry, the heating and air conditioning industry, the chemical industry, or the rapidly expanding field of renewable energy.

The great advantage for the customer: they can manage everything with just one contact person. This is because the innovative JUMO product range already encompasses the entire measuring chain from sensors through to automated solutions for the measurands temperature, pressure, liquid analysis, flow, level, and humidity. This range is constantly being expanded. A large number of the desired applications can be implemented with tried-and-tested JUMO products. This means that efficient solutions which are optimally aligned with each other can be created – and all from one service provider. Customers can therefore concentrate on their core skill areas and completely outsource concept and development.

The JUMO service portfolio is extensive. It ranges from basic feasibility analysis to project planning, to the creation of requirement and functional specification documents. Great expertise is also available in project planning (including PLC programming), visualization, and in network engineering.

The applications are, of course, put into operation and documented at the customer's site. The comprehensive carefree package is topped off by service and support as well as specific training. Customers can choose between individual elements or the implementation of the entire project. JUMO Engineering works nationally and internationally.

By introducing JUMO Engineering, the company is taking another large step to being a systems partner for customers around the world.

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Welcome to India!

Partner country of the HANNOVER MESSE 2015

India is among the fastest growing economies in the world. So it is not without cause that the country is in partnership with this year's HANNOVER MESSE trade fair. India's part in world trade has grown by 43 % since 1980, while annual trading volumes with Germany total more than 16 billion euro. Since 2008, JUMO has been represented by its own subsidiary in India in order to make the most of the vast opportunities for growth on site.

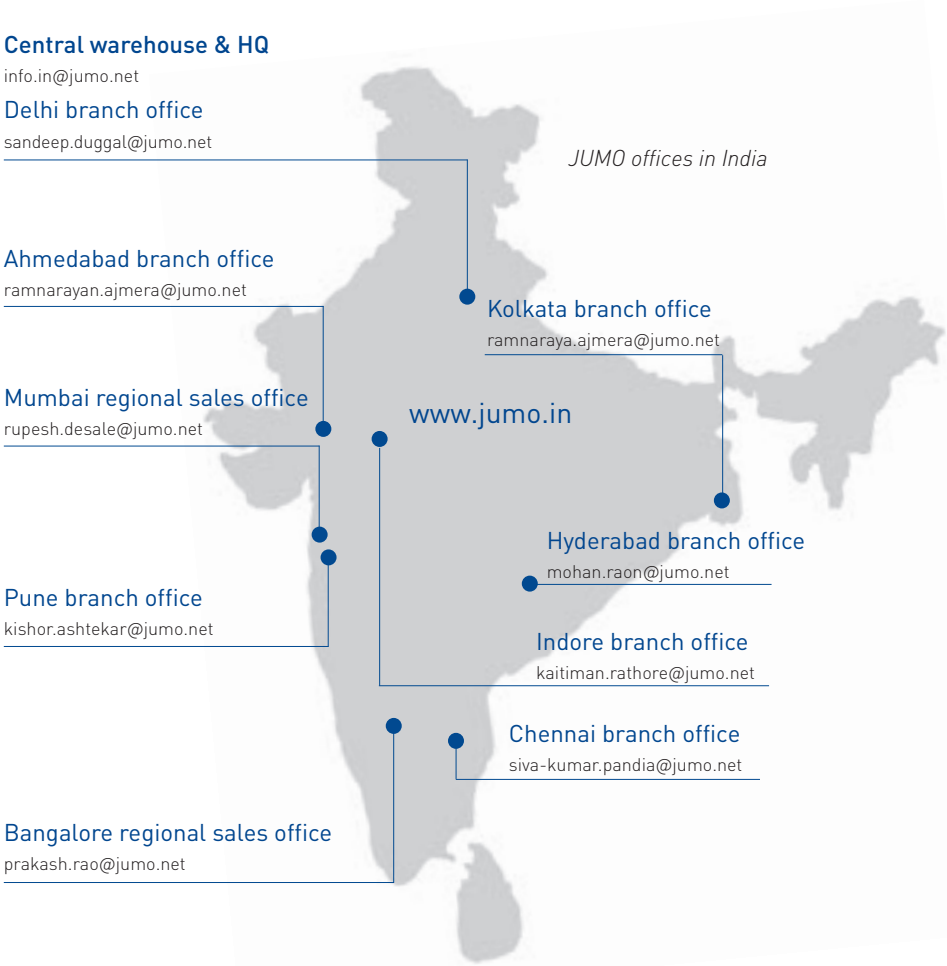
There is enormous potential for JUMO products, particularly in the water and wastewater engineering sector. India possesses over 5 % of the world's freshwater resources, but has to provide 16 % of the global population with drinking water. As a result, over 200 million people have no access to clean drinking water. The daily wastewater production of the 1,000 cities with more than 500,000 inhabitants amounts to 26 million cubic meters, with a daily maximum treatment capacity of 7 million cubic meters. Consequently, every day, almost three quarters of the total wastewater produced flows into the water system untreated.

And the situation is becoming increasingly serious. Both ground and surface water is scarce in many regions. It is estimated that by 2030, half of the country's demand for water will not be met. By 2030, therefore, approximately 110 billion euro must be invested in this sector. As early as 2016 the equipment market for water supply and wastewater treatment is already expected to be 130 million euro.

In the area of liquid analysis, the portfolio includes sensors for measurands such as pH-value, redox and conductivity measurement, chlorine, ozone, hydrogen peroxide, and dissolved oxygen. With a new generation of modular multichannel measuring devices, the various measurands can be monitored, controlled, and recorded.

JUMO products for liquid analysis can be used, among other things, for industrial water treatment in wastewater plants, for drinking water and bathwater monitoring in the pharmaceutical industry, or for desalination of seawater.

India is still counted among the smaller JUMO subsidiaries. Approximately 20 employees supervise nine sites in a country that is 10 times as large as Germany. The large number of sites is significant, since, as a federal-type organization, India is more comparable to Europe than to Germany. The individual Indian states are



JUMO offices in India

predominantly independent and in part even operate according to their own laws, taxes, and internal tariffs. The on-site presence is therefore absolutely indispensable.

The JUMO head office is located in Gurgaon – a satellite city close to New Delhi, which alone has more than 800,000 inhabitants. While the economies in European countries are mostly formed by a balanced blend of small, medium-sized, and large companies, the situation in India is completely different. Large companies tend to be the exception and are generally operated by foreign investors. On the other hand, there are countless small companies whose working methods may appear unconventional. The knack for endless improvisation is a widespread phenomenon. A solid infrastructure of standards, rules, and regulations, such as the one we are familiar with in Europe, simply does not exist in this sector.

In India, planning is not popular. It is often seen as a restriction on flexibility, and plans are therefore seldom specific, stringent, detailed, or complete. Unmet objectives in business rarely trigger pressure or activity. Changes to plans are often and readily made. In addition to an understanding for unconventional solutions, investors in India often also need to have a great deal of patience.

Economic life in India is strongly characterized by personal contacts and strict hierarchies based on the caste system. Business transactions are hardly possible before solid interpersonal relationships are established. Harmony is a determining factor in communal life, while negative criticism should preferably not be given openly. Praise, on the other hand, should be given as much as possible, as a lack of it immediately implies criticism.

The important role that religious belief plays in India should not be underestimated. For example, the diversity of beliefs is reflected in almost 50 regional and national holidays, 16 of which are federal holidays.

Further information
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The JUMO India employees at a team building event

www.jumo.net

JUMO at trade fairs 2015

Germany

HANNOVER MESSE
World's premiere industrial technology showcase
April 13-17 *Hanover*

SENSOR + TEST
The measurement fair
May 19-21 *Nuremberg*

VISION PHARMA
Modern processes, innovations, and solutions
May 19-21 *Stuttgart*

ACHEMA
World forum and leading trade fair for chemical engineering and the process industry
June 15-19 *Frankfurt/Main*

THERMPROCESS
International trade fair and symposium for thermo process technology
June 16-20 *Dusseldorf*

HeatTreatmentCongress
Colloquium for heat treatment, material, manufacturing, and process technology
October 28-30 *Cologne*

BrauBeviale
Trade fair for the beverage industry
November 10-12 *Nuremberg*

SPS IPC Drives
International exhibition and conference for electronic automation, systems, and components
November 24-26 *Nuremberg*

Austria

SMART Automation Austria
Trade fair for industrial automation
May 19-21 *Linz*

Azerbaijan

Caspian Oil & Gas
Caspian oil and gas exhibition and conference incorporating refining and petrochemicals
June 2-5 *Baku*

Belgium

INDUmation
Trade fair for industrial automation technologies and solutions
May 6-8 *Kortrijk Xpo*

China

IEexpo
Asia's leading trade fair for environmental technology solutions, water, waste water, air and soil
May 6-8 *Shanghai*

ISH China & CIHE
International trade fair for sanitation, heating, ventilation, and air-conditioning
May 13-15 *Beijing*

France

SEPEM
Trade fair for services, equipment for measurement, control, and regulation technology
June 2-4 *Avignon*

POLLUTEC HORIZONS
International trade fair for air, noise, and waste management technology
October 13-16 *Paris*

Netherlands

AQUATECH AMSTERDAM
Leading trade fair for process, drinking, and waste water
November 3-6 *Amsterdam*

Norway

NOR-SHIPPING
Exhibition of ship technology
June 2-5 *Oslo*

Poland

ENERGETAB
International power industry fair
September 15-17 *Bielsko-Biala*

Russia

MIOGE
Trade fair for energy, oil and gas
June 23-26 *Moscow*

Sweden

ELFACK
Trade fair for the electronics and energy industries
May 5-8 *Gothenburg*

United Arab Emirates

WETEX
Exhibition for water, energy technology, and environment
April 21-23 *Dubai*

United Kingdom

Sensors & Instrumentation
Trade fair for test, measurement, and control
September 30-October 1 *Birmingham*

USA

Sensors Expo
Leading industry event focused on sensors and sensor-integrated systems
June 09-11 *Long Beach (CA)*

Uzbekistan

OGU
Trade fair for oil and gas
May 12-14 *Tashkent*

We look forward to your visit!

Further information
www.fairs-international.jumo.info