JUMO

SENSORS + AUTOMATION

Issue 2/2019

Water – a very special element
물 – 특별한 요소
Raw material or liquid gold?
원료 또는 액체류의 보석

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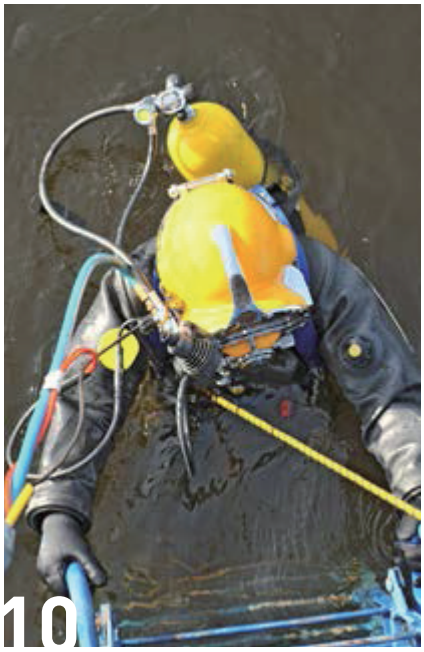

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COMPANY + SERVICES_기업+서비스

Dear Reader,

The reason why we have chosen "water" as the main topic for the latest edition of the JUMO customer magazine certainly is not due to the extremely hot summer in 2019. Although in an indirect way it does actually have something to do with the rising temperatures. The former US Vice President Al Gore famously once said: "The Earth has a rising fever." Human impact on the current change in climate can no longer be called into question.

People in Germany realize this when, once again, river shipping grinds to a halt, wild fires rage, and a short while later entire regions drown in heavy rainfall. However, compared with the effects of climate change in other countries, these are, at best, peripheral phenomena. India is suffering from the largest drought in its history. The supply of drinking water has collapsed in individual cities with millions of citizens, who now rely on mass-scale external water deliveries for survival.

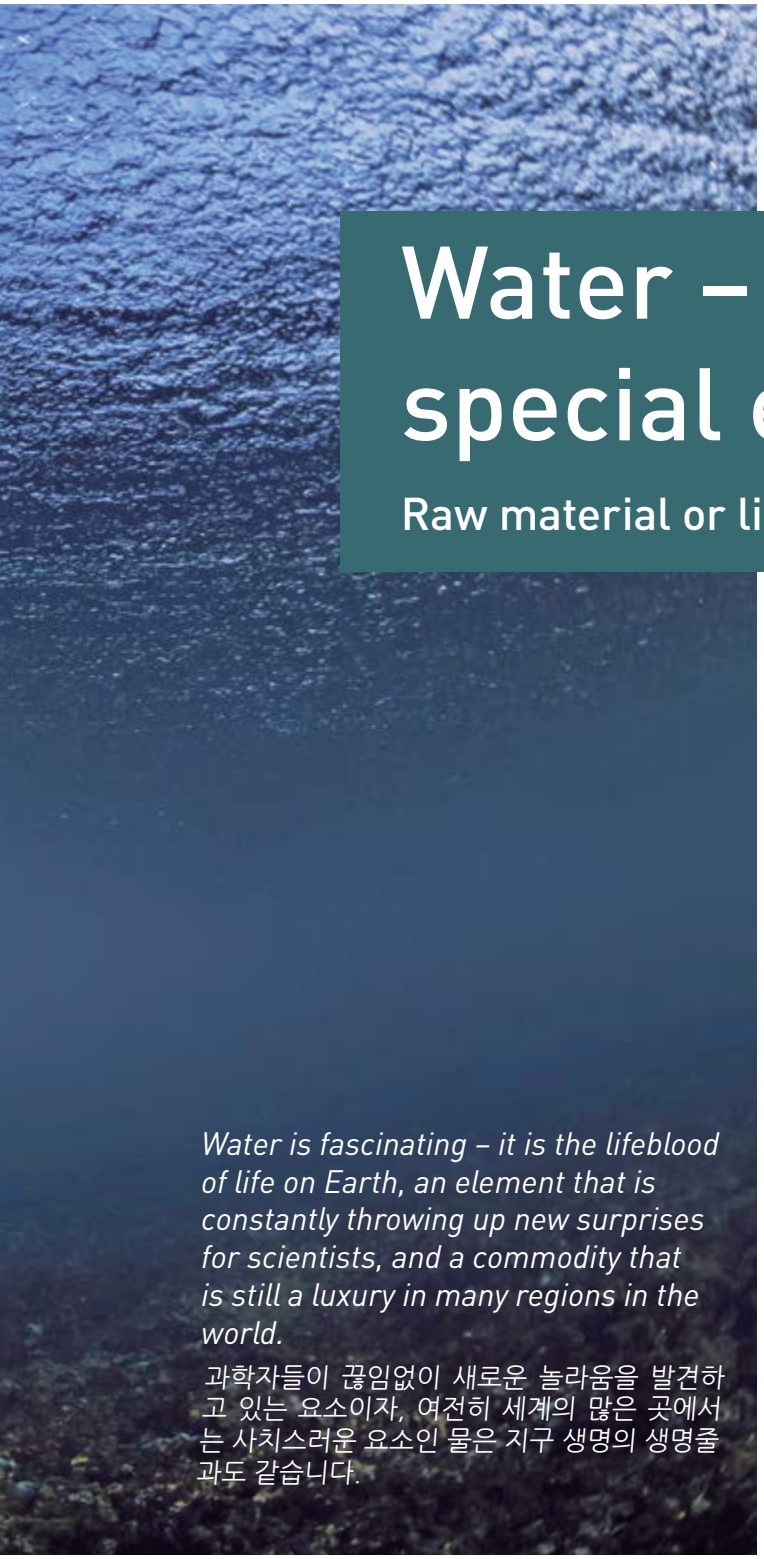
Yet at the same time, industrial nations continue to consume vast quantities of water. For example, when manufacturing just a single car, 400 000 liters of water are required for the entire production process. This same amount would provide 16 000 people in India with a day's supply of water.

With this customer magazine, we would like to heighten people's awareness to the value of water and at the same time highlight the contribution that JUMO is making in this regard. The spectrum ranges from greenhouses and well monitoring to the resource-saving treatment of industrial water.

We hope you enjoy reading this issue.

Bernhard and Michael Juchheim
Managing Partners

IN THE SPOTLIGHT



Water – a very special element_물 - 특별한 요소

Raw material or liquid gold?

Water is fascinating – it is the lifeblood of life on Earth, an element that is constantly throwing up new surprises for scientists, and a commodity that is still a luxury in many regions in the world.

과학자들이 끊임없이 새로운 놀라움을 발견하고 있는 요소이자, 여전히 세계의 많은 곳에서는 사치스러운 요소인 물은 지구 생명의 생명줄과도 같습니다.

"The principle of all things is water; all comes from water, and to water all returns." This famous quote from the philosopher Thales of Miletus may be well over 2 000 years old, but it is more relevant than ever.

"만물의 원리는 물이며, 모든 것은 물에서 나오고, 모든 것은 물에서 돌아온다." 이 인용문은 약 2000년 전, 밀레토스의 철학자 탈레스의 유명한 말입니다. 현재 우리의 상황과 관련 가장 관련이 있습니다.

Water is essential – both as a means of survival for each and every human being and as an ever more valuable commodity, which also makes it a geopolitical instrument of power.

But as always, everything depends on your point of view. A chemist would initially see a simple compound made from the elements oxygen and hydrogen – two gases that form a liquid. However, if you take two oxygen atoms instead of one, you get something very different: hydrogen peroxide, which is a powerful bleaching agent. Water can also dissolve more substances than any other liquid – even more than sulphuric acid. →

A physicist would wonder at some of the peculiar properties of water. Water is the only compound on Earth that is naturally found in all states of aggregation: as a liquid, solid, and gas. And, as if that were not enough, scientists are now claiming to have discovered another state of aggregation. They have discovered that when water is heated, various physical properties suddenly change. Between 40 and 60 degrees Celsius and under normal pressure certain measurement parameters jump from one value to another. This applies to, for example, electrical conductivity, the refractive index, surface tension, and the speed of sound. So far, the only explanation that has been given for this phenomenon is that water must have something like a second, thus far nameless, liquid state.

Water phenomenon: Mpemba effect
_ 음펨바효과 : 같은 냉각조건에서 높은 온도의 물이 낮은 온도의 물보다 빨리 어는 현상

And then there is Negative Thermal Expansion. Normally, materials contract when the temperature decreases and they become denser. However, in the case of water, this only applies up to 4 degrees Celsius. If the temperature sinks even further the water suddenly starts to expand again. In fact, if it freezes and turns to ice, it actually needs considerably more space. This is the reason why water pipes burst, ice floats in cocktails, and lakes freeze from top to bottom.

Things start to get really strange when the "Mpemba effect" occurs. This refers to the phenomenon where, under certain conditions, hot water freezes faster than cold water. This contradicts all of the known laws of thermodynamics and, to date, no one has been able to provide a satisfactory explanation for it.

Is a human being a “water animal”?
_ 인간은 물로 만들어진 동물

Physicians, in contrast, would come to the sober and scientific conclusion that humans are actually "water animals". At birth, 75 percent of the human body is water. This amount decreases as we age, although even in adults the percentage of H_2O in the body is still a remarkable 60 to 70 percent. Our brain alone

"After all, water is everything"

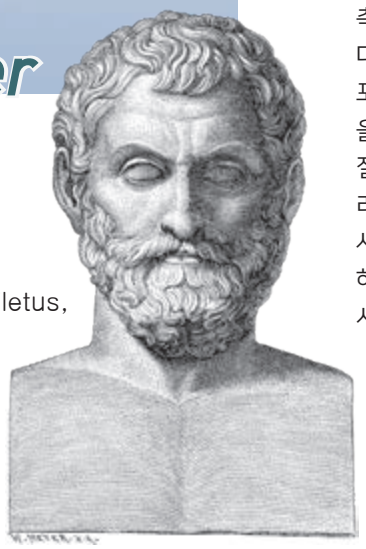


Illustration of Thales of Miletus, taken from a Swedish encyclopedia, 1875
Source: Translation of German Wikipedia article

is made up of 85 to 90 percent water, which it needs to keep us alive. Even bones (22 percent) and teeth (10 percent) contain a certain amount water.

However, even non-physicians realize that the human body cannot function properly without water. This article was composed on a summer's day in August, and while writing, its author drank two bottles of mineral water. This is a good thing, because although humans can survive for up to 60 days without food, without water the maximum is 4 to 6 days.

Let us consider, for a brief moment, a highbrow perspective. An esoteric person would immediately point out that 70 percent of the Earth is also covered in water and say that this could not possibly be a coincidence in view of the percentage of water in the human body. That is why water can also be "revitalized" and as so-called "grander water" has astonishing therapeutic effects. But that is taking things a little far, especially when of this 70 percent humans can only use the 3 percent consisting of freshwater anyway.

We shall now depart from the realm of esoterics and get back down to the soggy facts. Other than for chemists, physicists, physicians, and esotericists water can even be a matter for accountants. Because to understand the logic of why, in Germany, there is a 19 percent tax on mineral water, but only a 7 percent tax on tap water, you would probably need an Economics degree.

So what does all of this have to do with JUMO? _ 그렇다면 이 모든 것이 JUMO와 무슨 관계가 있는 것일까?

물과 JUMO는 상당히 많은 관련이 있습니다. 물은 많은 것들이 측정될 수 있고, 측정되어야 하는 매체이기 때문입니다. JUMO의 다양한 제품들이 물과 관련된 측정에 적용될 수 있습니다. JUMO의 포트폴리오는 온도, 압력, 레벨, 유량, 습도 등과 같은 기본적인 측정을 바탕으로 pH, 전도도, ORP (Redox), 탁도, 용존 산소와 같은 수질분석 영역까지 포함합니다. 이러한 공정 파라미터들은 페이퍼리스 기록계, 멀티 채널 트랜스미터, 컨트롤러 또는 자동화 시스템을 사용하여 모니터링하고 기록됩니다. JUMO digiLine시스템을 적용하면 전체 공정 프로세스를 스마트하고 디지털화하여 미래의 산업 시스템에 최적화할 수 있습니다.

JUMO news:

JUMO의 물과 관련된 산업을 잠깐 살펴보면 이 매체의 중요성을 확인할 수 있습니다. JUMO의 측정 및 제어 기술은 난방 및 냉방산업, 상하수 및 정수, 폐수 엔지니어링, 식품 및 음료산업, 선박 및 해양산업 등 다양한 산업 분야에서 찾아 볼 수있습니다.

JUMO innovations

Seven products that make life easier

1 Temperature sensors with solderable rear part
SMD sensor
_후면 솔더링파트가 있는 SMD 온도 소자

JUMO의 새로운 센서 기술 덕분에 금 도금된 니켈층 구조를 적용하여 온도소자의 뒷부분을 금속화할 수 있게 되었습니다. 그 결과 센서의 솔더링(납땜)을 통해 다른부분(e.g.보호튜브)으로 직접적으로 열 접촉이 가능하여 반응 시간을 상당히 단축시킬 수 있습니다. 커넥팅 와이어가 장착 된 일반적인 필름타입 온도소자와 SMD디자인의 온도소자 두가지 타입 모두 후면 부분이 금속화되어있어 공정용 및 실험실용 기기에 적용하기에 최적화되어 있습니다.

2 Analog outputs
JUMO digiLine CR/Ci
_아날로그출력버전의 전도도센서

디지털센서와 통신을 결합한 스마트한 수질측정시스템인 JUMO digiLine CR/Ci 전도도센서를 이제 4-20mA 아날로그 출력버전과 함께 사용할 수 있습니다. 이러한 설계는 기존 공정들을 현대화하는 것을 용이하게 합니다. 또한 JUMO digiLine CR/Ci 전도도트랜스미터는 CIP 사이클과 같은 측정포인트에 대한 구체적인 데이터도 제공 가능합니다. 필요한 경우 이 데이터를 AMS(자산관리시스템)에 저장할 수 있습니다. 다양한 어플리케이션에 적용가능하며 거의 모든 수준의 수질측정에 사용할 수 있습니다. 설치조건에 따라 센서와 트랜스미터 일체형과 분리형으로 제공됩니다.

3 Low-cost and four-pole
JUMO BlackLine CR 4P
_합리적인가격의 4전극 전도도센서

전도성을 측정하는 또 다른 타입인 4전극방식의 JUMO BlackLine CR 4P 측정셀은 좁은 설치공간에 적용할 수 있는 합리적인 전도도센서입니다. 하우징은 PPE플라스틱으로 제작되어 견고하며, 전극방식으로 넓은 전도성을 측정하기위해 흑연(Graphite)재질을 사용하였습니다. 또한 통합된 온도프르브가 내장되어 있어 정확한 전도도 측정이 가능합니다. 측정범위는 1µS/cm에서 300mS/cm 입니다. 적용가능한 어플리케이션은 소금물 또는 바닷물, 헹굼수, 정화조, 필터솔루션, 식수, 우물물이 있으며 일반적은 수질측정시스템에적용 할 수 있습니다.

4 Multifunctional four-wire transmitter
JUMO dTRANS T06 Junior
_다양한 측정입력이 가능한 멀티기능 4-wire온도트랜스미터

다양한 측정입력과 전기절연(galvanic isolation), 고객맞춤 선형화 기능을 가진 JUMO dTRANS T06 Junior 4-wire 온도트랜스미터는 공정엔지니어링 대부분의 어플리케이션에 적용가능한 이상적인 솔루션입니다. 높은수준의 측정정확도와 빠른 시작동작, USB인터페이스를 통한 사용자 친화적인 구성을 통해 차별화된 서비스를 제공합니다. 다른 유용한 기능으로는 drag indicator와 작동시간 카운터가 있습니다. 17.5mm의 최소한의 너비를 가지고 있어 제어캐비넷의 공간을 거의 차지하지 않아 설치 공간에 제한없이 설치 가능합니다.

5 Robust cable transmitter for temperature
JUMO dTRANS T09
_진동 및 충격저항성을 가진 견고한 케이블 온도트랜스미터

JUMO dTRANS T09는 강력한 케이블타입의 온도트랜스미터로 4-20mA아날로그출력 또는 IO-Link통신버전으로 이용가능합니다. 트랜스미터는 M12커넥터 타입으로 쉽게 장착이 가능하며, 온도센서와 별도로 배치할 수 있습니다. 이러한 설계구조 덕분에 높은 진동이나 충격과 같은 프로세스 영향으로부터 분리하여 내저항성을 가집니다. 이 타입의 온도트랜스미터는 외기온도 85°C 까지 적용가능합니다.

6 Two-pole measuring cell
JUMO tecLine CR S01
_협소한 설치공간을 위한 2전극 전도도센서

JUMO tecLine CR S01 전도도센서는 컴팩트한 디자인형태와 넓은 측정범위 (1 to 5,000µS/cm) 및 온도범위 (-40 to 100°C)에 적용할 수 있습니다. 고품질의 스테인리스스틸(1.4404, 316L)바디는 세척이 용이하고 최대 6bar까지 허용압력을 가집니다. M20프로세스 커넥션으로 아주 협소한 공간에도 효율적으로 적용할 수 있습니다.

7 Optimized successor
JUMO LOGOSCREEN 601
_열처리시스템에 최적화된 스크린기록계

JUMO LOGOSCREEN 601은 터치스크린을 이용한 직관적인 작동 및 시각화컨셉으로 성공적으로 적용된 JUMO LOGOSCREEN 600의 후속모델로 기본 형태는 이전 버젼의 기능을 유지하였습니다. 새롭게 추가 된 기능은 PROFINET인터페이스와 ST코드를 적용하여 조금 더 고객맞춤형 어플리케이션에 적용가능하며, 배치제어를 할 수 있습니다. 또한 최대 2개의 유량과 2개의 고속카운터 입력이 가능합니다. 공정 스크린은 다양한 어플리케이션에 활용가능하도록 최대 100개의 이미지를 포함할 수 있습니다. AMS2750/CQI-9 열처리 시스템규격을 충족하여 관련 어플리케이션에 최적화된 스크린기록계입니다.

Under water, below ground, under pressure

Oxygen for divers and tunnel construction workers

One-day JUMO device course in Fulda
JUMO LOGOSCREEN 600/700 – paperless recorders
June 16, 2020

Special conditions require special measures, especially when one's health depends on them.

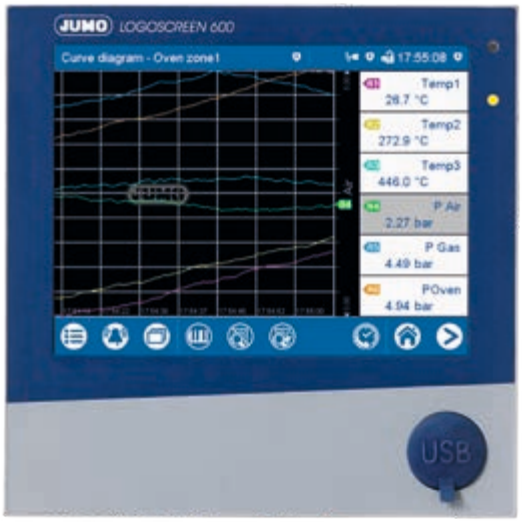
The Dutch company IHC Hytech B.V. specializes in high-quality and efficient overpressure equipment. Their product portfolio includes decompression chambers for the private and public diving industry (military and civilian sectors), hyperbaric equipment for tunneling, hyperbaric (increased ambient pressure) oxygen therapy chambers for the medical industry, and air-breathing solutions for suppliers to the petrochemical industry. The company, which is based in Raamsdonksveer, takes the pressure off customers during complex projects in difficult conditions: under water and underground.

Decompression chambers and hyperbaric systems

A decompression chamber or hyperbaric chamber is a room for preventing and treating decompression sickness – also known as "diver's disease" – using hyperbaric oxygen therapy. Being exposed to high ambient pressure for a long period of time can cause divers to take in more nitrogen than usual. In extreme cases this can lead to dangerous gas bubbles, which can be lethal if they enter into the blood or the brain.

In a decompression chamber divers are exposed to a high pressure as quickly as possible, which is then slowly decreased. Breathing in pure oxygen helps to accelerate the removal of any nitrogen in the bloodstream.

Hyperbaric systems are also used in pressure fields in tunnel boring machines (TBM). Just like professional divers, tunnel construction workers also have to take special measures for their health. This is where saturation systems made by IHC Hytech B.V. come in. They are equipped with various interconnected pressure chambers such as passenger shuttles, decompression chambers, and hyperbaric living spaces.



High pressure, high demands

In saturation systems and decompression chambers different values have to be measured, monitored, and recorded. These include in particular the amount of oxygen, the pressure, the temperature, and the humidity. Further measurands that can be determined using the measured values are also of vital importance in this instance. For example, oxygen partial pressure is calculated on the basis of the measurands of pressure and oxygen amount. Another requirement was that the measured values had to be able to trigger an optical and acoustic alarm, which also had to feature a mute function.

Instead of the conventional indicating devices a comprehensive system for carrying out the calculations, data processing, and visualization had to be devised, which also had to be easy to handle and did not require any lengthy programming. Furthermore, it needed to be reliable, safe, and stable to satisfy the demands of the maritime and petrochemical markets.

The solution comes to the surface

As the manufacturer was already using the indicator and the temperature controller JUMO di08 and JUMO iTRON 08, they got in touch with their contact person at the Dutch JUMO subsidiary. →

Decompression

In a diving context, decompression refers to divers swimming back up from the ocean depths to the surface. When returning to the surface, it is best to move slowly from the area of high pressure through areas with lower pressure. This enables the body to get rid of any nitrogen.
Treatment in a decompression chamber works in a similar manner.

Decompression chamber belonging to IHC Hytech B.V. based in the Netherlands

Together they came up with the optimum solution: a paperless recorder from the JUMO LOGOSCREEN range. These are reliable devices for monitoring and recording the measured values.

In addition to its analog and digital inputs the JUMO LOGOSCREEN also offers an array of universal measurement inputs. This degree of versatility is helpful for IHC Hytech B.V. when using it in different systems. The recorder also has math and logic modules with which the aforementioned requirements were able to be implemented. The math module makes it possible to calculate resulting values using the measured values from different sensors such as the partial oxygen pressure previously mentioned. The logic module triggers an alarm, if requested, when certain limit values have been reached.

The simple programming of the system enables the quick creation of new projects with a few simple steps. Another advantage is that the configuration data can be transferred via USB flash drive so that the obligatory programming with a laptop is no longer necessary.

A simple, yet impressive, programming concept

The company now uses digital devices from the JUMO diraTRON and diraVIEW ranges, which enables the temperature and pressure to be clearly displayed and controlled. The matrix display also provides the user with additional text-based information such as whether the cooling or heating is active. Even in this regard, the simple programming concept made a great impression and, as with the JUMO LOGOSCREEN, saved a considerable amount of time.

High degree of reliability for vital applications

Particularly when it comes to matters of health and human life, systems need to function in a safe and reliable manner. IHC Hytech B.V. has opted for such a system – the JUMO LOGOSCREEN – which also saves time during installation and, as a result, reduces costs. For the manufacturer, JUMO is a partner with whom they were able to develop a solution and implement it in its entirety. ■

JUMO news:

The JUMO LOGOSCREEN 601 is now available as the optimized successor model to the JUMO LOGOSCREEN 600 touchscreen paperless recorder.
See page 9 for more information.

습도측정에 관한 질문들

습도의 영향력은 종종 과소평가 됩니다. 개인 가정에서 사람들의 건강을 보호하며 곰팡이의 형성을 방지 하기 위해 습도 변환기를 사용하는 것은 더욱 더 일반화 되고 있습니다. 습도 측정에 대한 두가지 기본 질문에 답변합니다.

Head of Product Management for Sensors
Dipl.-Phys. Matthias Nau
matthias.nau@jumo.net

Question 1:

JUMO가 제공하는 측정 방식 중, 나에게 맞는 것은 무엇일까?

At JUMO, we rely on capacitive humidity transducers and the hygrometric measurement method using plastic fibers. Both are accurate and impervious to pollutants and dust.

Capacitive measuring probes are able to achieve extremely fast response times due to their inherently low mass. Another advantage is the temperature range: measurements between -40 to +180 degrees Celsius are possible. Condensation-resistant versions for highly humid areas and devices for pressurized systems (0 to 100 bar) are also available.

The measuring range has a relative humidity of mostly 10 to 90 percent, but 0 to 100 percent relative humidity is also possible. The measuring accuracy is normally between ±2 and ±5 percent relative humidity, although ±1 percent relative humidity is not uncommon.

They are used in the air-conditioning sector and in industry processes in which high concentrations of corrosive gasses and solutions do not occur.

Especially prepared plastic fibers are used in the **hygrometric measurement method**. In contrast to human hairs these can be used both at high temperatures (up to 110 degrees Celsius) and at low relative humidity over a longer period.

The measuring range is (0)30 to 100 percent relative humidity, but depends on the ambient temperature. The measuring accuracy is ±2 to 3 percent.

Hygrometric measuring probes are used for permanent measuring in industrial process engineering and in the air-conditioning sector.

Question 2:

어느 지역에서 습도 측정이 권장될까?

As a general rule, you should monitor humidity wherever chemical, physical, or biological processes are caused or affected by the content of water vapor in the air.

In industrial processes the right humidity level is often a determining factor for the quality of the products. This also applies to their storage. Similarly, a correctly adjusted humidity level can contribute to considerable savings in energy consumption.

As air humidity affects our sense of well-being and our state of health, it should be measured and controlled in any place frequented by people. ■

A brief guide:

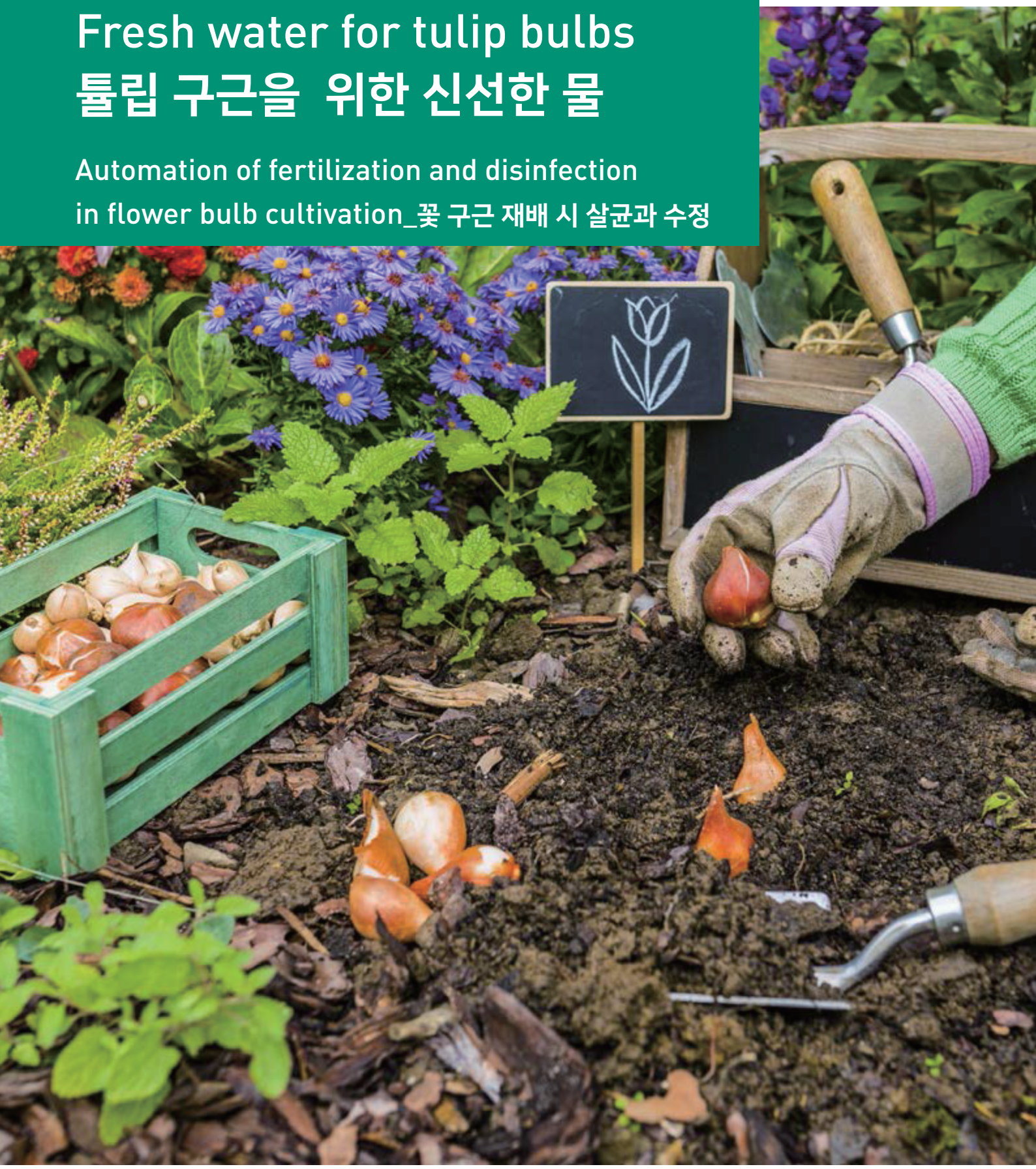
Relative humidity_상대습도

상대습도는 가스의 부분 수증기 압력(Pw)과 최대 수증기 포화 압력(Ps) 사이의 비율을 나타냅니다.

RH = 100 × (Pw/Ps (t)) [%]

Fresh water for tulip bulbs
튤립 구근을 위한 신선한 물

Automation of fertilization and disinfection in flower bulb cultivation_꽃 구근 재배 시 살균과 수정



One-day JUMO seminar in Fulda, Germany
JUMO AQUIS touch S/P – modular multichannel measuring devices for liquid analysis
May 27, 2020

The process water can be controlled from anywhere and at any time.
물은 언제 어디서나 제어 가능합니다.

Company KaRo, based in Zwaagdijk in the Netherlands, supplies modern electrical and water technology for both the greenhouse horticulture and outdoor cultivation sectors such as fruit and plant-growing farms.

The company from northern Holland was tasked by a flower bulb garden center to find a solution for regulating fertilizers and for disinfecting process water. After all, tulip bulbs are grown in water which needs to be refreshed on a regular basis.
For flower bulbs to thrive the water needs to meet specific conditions.

To ensure that this is the case, the correct measurement and inspection of various parameters is essential.

For example, the conductivity and pH value must be regulated accurately for the right fertilization. In addition, a directive for the disinfection of process water has been established for horticultural producers. The aim of the directives for the discharge of process water is to prevent emissions from entering surface water, sewers, and groundwater as well as to avoid contamination. That is why it is imperative that they are observed.

Other requirements included monitoring the fill level of the buffer tanks and digitally connecting the measurement and control technology as both the garden center and KaRo wanted to monitor the process sequence remotely.

Fertilization and disinfection digitized_디지털화 되는 수정과 소독

To overcome this challenge, KaRo went out in search of a comprehensive solution and found JUMO to be the perfect partner. It was soon clear that the JUMO AQUIS touch S multichannel measuring device, with its numerous inputs, control functions, and digital interfaces, was the best solution for the application. JUMO supplied the various electrodes for measuring the redox and pH values, chlorine, and conductivity. In addition, JUMO also provided a fill level sensor for monitoring the buffer storage.

Together with the tulip grower the relevant values were ascertained on site and processed in the JUMO AQUIS touch S. The relevant measurands are measured by the connected sensors in the process water. The disinfectant and fertilizer are regulated and dosed in the right quantities by the JUMO AQUIS touch S. The fill level in the buffer storage is also monitored.

Complete control from near and far _근거리나 원거리에서의 완벽한 제어

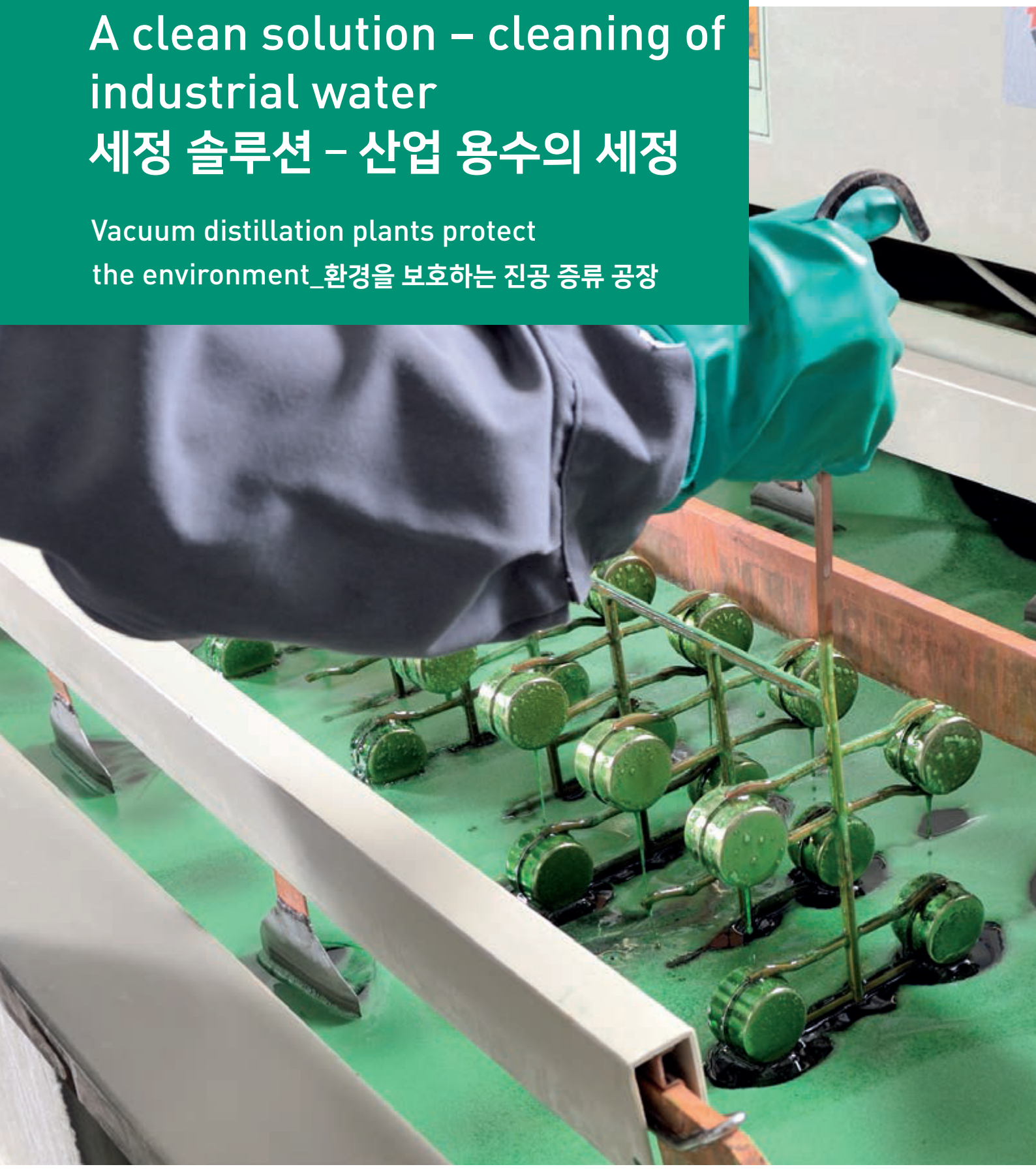
With the JUMO AQUIS touch S, the flower bulb garden center has a central platform for displaying and regulating the water quality. The device comes with a large 5.5 inch color display which helps to provide a clear overview of the entire water treatment process in the flower bulb garden. The remote connection to the JUMO AQUIS touch S was established by connecting it to an IXON router. This way, the process water can be checked via PC, tablet, or smartphone from anywhere and at any time.

Worth knowing:

네덜란드에서는 꽃 구근 재배가 지난 35년동안 거의 75% 증가했습니다.
Drenth, Flevoland, 그리고 Overijssel 지방에서도 꾸준히 증가하고 있지만 Northern Holland는 여전히 꽃 구근 재배에 앞장서고 있습니다. 튤립은 재배 식물의 거의 50%를 구성하며 가장 일반적으로 재배되는 식물입니다.

A clean solution – cleaning of industrial water
세정 솔루션 – 산업 용수의 세정

Vacuum distillation plants protect the environment_환경을 보호하는 진공 증류 공장



One-day JUMO basic course in Fulda, Germany
Analytical measurement technology for the practitioner
May 26, 2020 + November 17, 2020

In many processes water is used as an aid – whether this be ultrapure water in rinsing and purification plants, cooling water, or as a solution for treating chemicals in electroplating or acid baths. Contaminated wastewater from production is usually collected in tanks where it is decontaminated, filtered, and any chemicals neutralized in an often time-consuming and costly manner.

Using water resources responsibly is becoming more and more importantin industrial production areas.
책임있는 수자원 사용이 제조 산업에서 점점 중요 해지고 있습니다.

More and more industries are now paying special attention to the unavoidable creation of this wastewater. JUMO was also faced with the challenge of completely modernizing its own outdated, traditional wastewater system.

The system consisted of a collection basin and a batch treatment unit in which the pH value was elevated using lime milk and chromate decontamination was carried out using sodium dithionite. The solids were separated using a chamber filtering press. The disadvantages of this solution included high personnel costs and large amounts of hazardous waste in the form of unusable sludge.

An ecological and economical solution_생태 및 경제 솔루션: A vacuum distillation plant _진공 증류 플랜트

This is why JUMO decided to acquire a vacuum distillation plant for the general sanitation of this area. In this process, the wastewater is firstly vaporized under negative pressure at approximately 85 degrees Celsius. Next, a vapor compressor compresses the water vapor to normal pressure (at approx. 120 degrees Celsius). The water vapor can then provide the surplus energy for the vaporization of the wastewater again. This conserves around 95 percent of energy compared with atmospheric distillation.

Since JUMO generates excess energy through solar power and its own cogeneration plants, the implemented water-energy process also makes sense from an energy point of view. We were able to construct the new plant so that it was considerably more compact. Virtually no pollutants exist and only one IBC container to collect the condensate is included. The distillate is returned to the production areas as industrial water of pure water quality.

The new solution also makes use of JUMO measurement technology. An important key parameter is the pH value. Cyclical temperature and pressure changes, and an operating temperature of 95 degrees Celsius at the pH installation measuring point, place particularly high demands on the pH electrode. That is why the high-quality JUMO tecLine HY with a zirconium dioxide diaphragm is used. The particular design on the inside as well as a special high-temperature and high-pressure gel electrolyte ensure that the measurements are reliable.

The JUMO tecLine pH electrode is operated using a new JUMO digiLine digital transmitter. It is screwed directly on the head of the electrode so that it digitizes the measured values close to the measuring point itself. The sensor and measuring head form a unit for as long as the pH electrode wearing part is in a functioning condition. If it reaches the end of its natural life the electronic head can continue to be used with a new electrode. Other measurands in this type of plant include pressure and temperature. This is where the resilient JUMO dTRANS p30 pressure transmitter and the JUMO Pt100 RTD temperature probe come into play.

The craft beer revolution

Fresh taste for a drink with history

One of the oldest food laws in the world involves water. To be more precise, it deals with a boiled and fermented mixture of grains and water. We're talking about beer, of course.

The Bavarian Beer Purity Law from 1516 decreed that beer could only consist of malt, hops, and water. That is why, for more than 500 years, every beer that has been brewed according to this law has consisted of 90 percent water.

But not all beers are alike. In the last century the market was largely dominated by beer produced on a mass industrial scale. But by the 1980s the USA started to experience a counter movement, which, in the new millennium, also spilled over into Europe. The craft beer revolution was here. Germany has always had a high number of so-called microbreweries with a maximum annual beer output of 1 000 hectoliters, but since 2015 no fewer than 130 new ones have been added. Although these small breweries have less than a 1 percent share of the market, this trend appears to be increasing at an unstoppable rate – especially in cities. Berlin alone has almost 30 breweries.

But what exactly is a craft beer? A craft beer is beer brewed with artisan techniques and which is focused on reviving the ancient art of brewing. This involves the use of high-quality and special ingredients such as aroma hops, coffee beans, and orange peel. This result in flavors of a most unconventional nature.

Traditional brewing process

When it comes to the three essential steps of mashing, boiling, and fermenting the brewing process is no different to a conventional beer. During the mashing stage the shredded malt is mixed with water. The mixture then undergoes a temperature-time program, during which the starch in the malt is turned into sugar by enzymes.

Exotic, handmade beers are very trendy.

During boiling, aromatic components from the hops are extracted. At the same time, any components that could later result in a bad taste in the beer are evaporated. The wort is freed from turbidity which denatures and separates at high temperatures. The positive side effect of boiling is that the wort is sterilized.

Finally, during fermenting the wort is mixed with a certain amount of yeast cells. At the start of the fermenting process, the yeast is aerated well and subsequently fermented at an optimum temperature for the yeast. During subsequent storage, the green beer is stored at a particular temperature and for a defined period – depending on the type of beer.

JUMO ensures perfect quality

JUMO products have a key function throughout the entire process. For example, the temperature has to be monitored carefully during every stage to ensure that the final product has a consistently high level of quality. Furthermore, the pressure in the storage tanks is measured. The pH value is important during the mashing and boiling stages as well as when cleaning the brewery. Various individual JUMO controllers, multichannel measuring devices for liquid analysis, or process and program controllers can be used for process control.

If the master brewer uses the right technology and has the necessary creativity then exotic products such as espresso beer, a smoked beer with raspberries and habanero chilies, or chocolate beer can also taste truly delicious in the end. ■

Well monitoring made easy

Automation in a paper mill

Together with the JUMO Engineering team a paper mill in Fulda has devised an automated solution for monitoring groundwater wells.

Manufacturing paper requires a significant amount of water. As this water is taken from wells and rivers it affects the balance of water in the region. That is why both the quantity of water that is taken and the water levels in the wells have to be monitored accurately.

The paper mill in Fulda is a medium-sized family business which exclusively processes waste paper. It has two sites which process over one million tonnes of raw paper for corrugated boards every year. During the paper manufacturing process, water is used to dissolve and clean the waste paper. It is also used as a transport medium for the pulp that is recuperated.

The mill has four groundwater wells at the Fulda site, which serve as the water source. Three observation wells are used to measure the groundwater level. To verify that the amount of water that is taken does not harm the balance of water in the region a report of the hourly water level in the wells has to be provided to the district president in Hessen every month. The hourly, daily, and yearly flow rates of the pumps in each of the wells also have to be recorded and monitored as the total of these flow rates is not allowed to exceed a certain limit value either. Furthermore, other than recording, monitoring, and evaluating the values in the wells, bidirectional communication to the superordinate control room was also to be integrated.

All measurement data is stored in a tamper-proof manner.

Trouble-free analysis and documentation

All these requirements were met with the JUMO mTRON T automation system, the JUMO dTRON 308H compact controller, and JUMO level and flow sensors. Each well was linked to its own interface in the JUMO mTRON T system. JUMO dTRON 308 controllers were built into the well systems themselves to measure the levels and flows as well as to determine the speed of the pumps.

The captured measurement data is saved and processed in the JUMO mTRON T multifunction panel. Daily, weekly, or monthly quantities can be very easily determined from a flow rate through provided integrator functions. Monitoring the limit value can also be carried out with very little effort using predefined functions.

Furthermore, all of the measurement data is saved in the mTRON T system in a tamper-proof manner. This data can be extracted automatically using the JUMO PCC communication software and saved in an archive on the network. Furthermore, automatic reports can be created individually according to customer requirements. These can be stored in such formats as PDF, XLS, or text files in a predefined folder structure on the network. Sending the documents directly by email is also possible.

When implementing the project the paper mill not only put their trust in JUMO products but also in the experience of the JUMO Engineering team. It developed the application right from the PLC programming – including the visualization – through to the creation of the automatic report. ■

What can you actually measure in water?

Examples:

Temperature

Water boils at 100 degrees Celsius – but only at sea level. On Mount Everest the boiling point is already reached at 70 degrees Celsius – in a pressure cooker only at 125 degrees Celsius.

Pressure

With a depth of 11 000 meters, the Mariana Trench in the western Pacific is the deepest point of the oceans. Here the water pressure is around 1 000 bar. This means that the surface of a stamp would bear the pressure of 1 000 kilograms.

Level

Not only baths, but also oceans have a different filling level – caused by ebb and flow. The greatest tidal range reaches up to 21 meters and is located in the Bay of Fundy in Canada.

Flow

The Amazon is not just the longest, but, with an annual average flow rate of 180 000 cubic meters, also the strongest current on Earth.

Oxygen content

When the outside temperature is 0 degrees Celsius, the saturation degree of oxygen in water is around 14 milligrams per liter. When it is less than 3 milligrams per liter it starts to get critical for the fish as the water is at risk of becoming toxic.

Conductivity

This measurand is important for determining water quality – it is measured in such places as swimming pools, sewage treatment plants, and breweries.

25 years of JUMO Campus

From the practitioner for the practitioner

Training and further education are becoming ever more important in the JUMO corporate group, both internally and externally.

All of the activities are housed in the JUMO Campus, which in 2019 can look back on its 25-year history. It started out as a rather modest initiative. The first customer seminar was offered in September 1994. *"Over the course of the years, our measurement and control technology has become more and more extensive. We became aware that a simple handbook was often no longer sufficient to convey the full range of functions and all of the possibilities,"* explains the former training manager and founder of the JUMO Campus, Frank Blasinger. The offered training course soon became very popular. As a result, in 1995 a training center with classrooms and a bistro area – which are still there today – had sprung up on the JUMO company grounds in Fulda.

Impressive numbers

In subsequent years, the need for training constantly increased so the team of staff members grew as well. The training formats were also constantly developed further. Soon after, in addition to exclusive training courses, traditional seminars, technical literature, e-learnings courses, and, since 2016, webinars were also held. In addition to JUMO customers, JUMO employees and school classes now also take advantage of the diverse training program.

Sabine Häcker, who has been managing the JUMO Campus since 2015, can show impressive figures: *"In 2018, we held a total of 177 training courses with around 1 500 participants. Our webinars, of which we offered 89 last year alone, are experiencing particularly high growth rates."*

In general, the greatest dynamic can currently be observed in the online sector. *We notice this trend, on the one hand, on our Campus portal, which has been available to our customers and employees as an online tool since 2017. On the other hand, we have seen a growing interest in self-regulated learning on demand,"* adds Sabine Häcker.

That is why over the next few years the focus will be on expanding the e-learning courses even further. The seminar printouts will also be replaced with electronic-based documents on tablets.

> *"The idea is to evolve the campus portal into a personalized learning portal."*
>
> *Sabine Häcker, Head of JUMO Campus*

However, when it comes to the Campus motto "from the practitioner for the practitioner" nothing has changed over the last 25 years. All of the tutors are proven specialists in the field of measurement and control technology who are capable of relaying even technically complex material in a comprehensible and didactically appropriate manner. ■

JUMO news:

Of course, JUMO Campus also offers comprehensive training courses on the topic of "liquid analysis": http://campus.jumo-en.info

Frank Blasinger and Sabine Häcker

Is water the "gold" of the 21st century?

A mineral water from the Japanese Rokkō mountains is sold for 120 euro per liter. In Germany, a liter of drinking water costs around 0.2 cent. So, is this clear liquid actually a luxury commodity or a very ordinary raw material? Answers to these questions have been provided by Matthias Kremer, Market Segment Manager for Water and Wastewater at JUMO.

Mr. Kremer, is water the gold of the 21st century?

Water has always been a valuable commodity that has been at the center of countless wars and conflicts throughout human history. However, between 1940 and 1990 alone the global consumption of water quadrupled. As a result of demographic developments and the way in which we consume water the situation has become even more extreme in recent years.

Are there examples of this?

Here are a few basic statistics: more than 600 million people in India are already suffering from acute water shortages. Yet at the same time, the population in this country is expected to rise by another 300 million people by 2050. 1.8 billion people around the world do not even have access to clean drinking water. Drinking water is increasingly becoming a reason for migration.

To put this into perspective, every person in Germany consumes 130 liters of water daily and every flush of a toilet drains away up to 9 liters of valuable drinking water. This discrepancy will increasingly cause problems.

So the lack of water is the real problem?

Paradoxically, too much water is also causing more and more problems – in short: climate change. In Germany, so-called "severe precipitation events" are increasing spectacularly. The storms in the summer of 2017 caused damage amounting to 300 million euro. But that is just a minute part of the problem. Rising sea levels threaten half a billion people worldwide. In the Netherlands around 44 percent of the population would be affected.

These are gloomy prospects ...

True, but on the other hand, a lot of very positive things are also happening. As one of 17 global Sustainable Development Goals, the UN has specified that "universal and equitable access to safe and affordable drinking water for all" should be available by 2030. All of the members of the UN have pledged to meet this target. Many projects and initiatives have been launched to address this issue. I would say that the danger is far from being averted, but at least it has been firmly acknowledged.

And what is JUMO doing?

Firstly, we produce high-quality sensors as well as measurement and control technology for the water and wastewater sector, which are used all around the world. Our Engineering team is always mindful of using resources sparingly in all of the projects that involve water. An important application area includes, for example, reverse osmosis systems which are used for desalinating seawater.

Reliable sensors and measurement technology are also needed for ZLD (Zero Liquid Discharge), whereby water used for industrial purposes is recirculated in the factory. Through purification stages in the process sequence the water is repeatedly returned to its original clean state and the water is reused. This means less fresh water is needed and that practically no wastewater is produced. Digital analysis sensors, such as JUMO digiLine, are excellent devices for monitoring this closed-loop water circulation.

But are products and services enough to change the situation?

Of course not! That's why JUMO has been involved with the GWP e.V. (German Water Partnership) since 2016. It is a network of around 350 private and public German companies from the water sector as well as professional associations and institutions from the fields of economics, science, and research – united in a common cause. At the moment we are planning a pilot project for the construction of a modern wastewater plant in India. Conferences will soon be held in three Indian regions to discuss this topic.

Member of German Water Partnership

What contribution can each individual make?

Very simple: save water wherever possible. A dripping tap uses more than 5 000 liters of water per year and those who leave the water running while brushing their teeth waste 15 liters of water each time. Eat less meat: producing 1 kilogram of beef requires 15 000 liters. And please do not buy mineral water for 120 euro per liter. In Germany, tap water has mineral water quality and is even subject to better control. ■

Michael Brosig (left), JUMO Press Speaker talking to Dipl.-Ing. Matthias Kremer (right), JUMO Market Segment Manager for Water and Wastewater

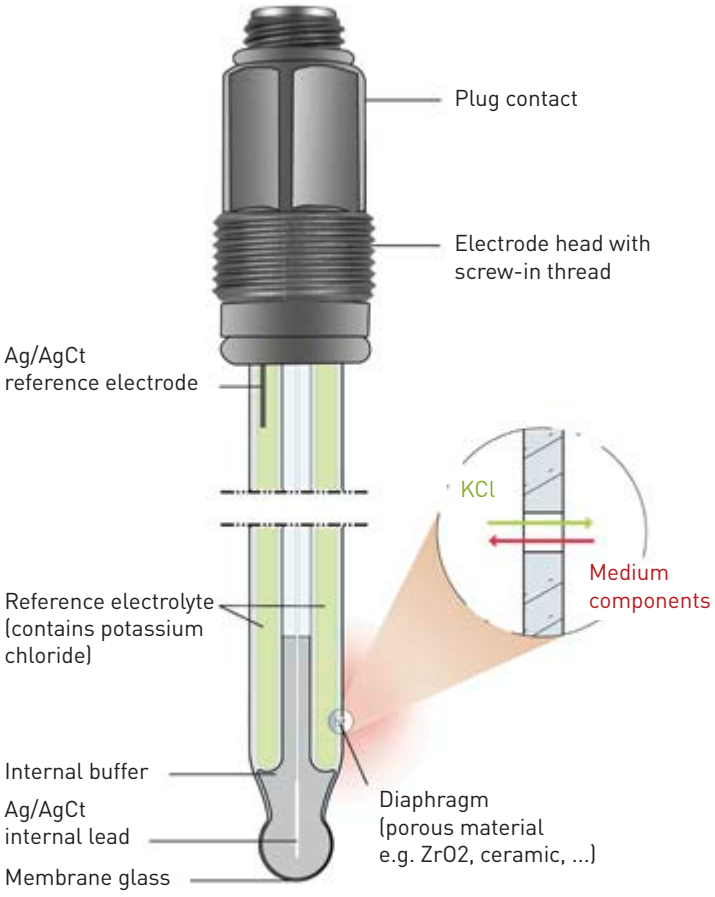
10 Facts for perfect pH measurement

with combination electrodes made out of glass

Online measurement of pH levels in industrial as well as communal water and wastewater plants is usually carried out using combination electrodes. In this article we have collated ten tips for using this sensor technology.

Trainer for sensor and automation technology
Dipl.-Ing. (FH) Manfred Schleicher
manfred.schleicher@jumo.net

Structure of a combination electrode



One:

For the measurement to take place both the glass membrane and the diaphragm have to be inside the measurement solution. It has to be mounted with a minimum angle of 10 degrees from the horizontal.

Two:

When wiring, the penetration of moisture into the connectors must be avoided at all costs as otherwise measurement will not be possible.

Three:

The reference electrolyte forms a salt through the diaphragm – this is also why combination electrodes should be seen as consumables. Different diaphragms must be selected depending on the pollution degree.

Electrodes for measured media with different levels of pollution

JUMO webinar
Setting up JUMO digiLine sensors for pH value and electrolytic conductivity

Four:

To keep the reference electrolyte saturated for as long as possible many electrodes have salt rings. If the electrolyte is no longer saturated more salt from this salt reserve is added to the solution. In the event of temperature fluctuations, crystals can form in the reference system. In principle this does not influence the functionality of the sensor technology.

Five:

The glass membrane of the pH combination electrode is particularly sensitive. It has to be protected from becoming scratched or even broken. The standardized design of the electrodes enables many different fittings to be available for adaptation by the customer.

Six:

The transmitter always requires the temperature of the measurement solution to carry out temperature compensation. In the case of large temperature fluctuations and measurements that are a long way off pH 7 the temperature is measured with an RTD temperature probe. In other cases the specification of a fixed value is sufficient.

Seven:

The zero point of combination electrodes is the pH value at which the sensor displays 0 mV. The parameter should be between pH 6 to 8. Ideally, the output voltage of the measuring chains falls with a value of -59 mV/pH at 25 degrees Celsius. This equates to a slope of 100 percent. The slope should be at least 90 percent. The parameters are displayed after each calibration.

Eight:

The zero point and slope of the combination electrodes vary over the service life of the device. The measuring chains are calibrated both during startup and on a regular basis throughout their service life. For the calibration, buffer solutions have to be provided in suitable containers. The solutions have to discarded after the calibration.

Nine:

Combination electrodes can only be stored for a limited amount of time – in a cap filled with potassium chloride to keep them wet.

Ten:

The electrodes have to be kept clean throughout their service life. They can be cleaned with water. Glass or laboratory cleaning solutions (such as alcohol or acetone) can be used as cleaning agents. Cleaning the diaphragm improves the response behavior of the measuring chain. It can be cleaned using a pepsin or hydrochloric acid solution, which prevents both protein and lime deposits. Once the electrodes have been cleaned they have to be rinsed and their functions tested using buffer solutions. In the event of noticeable deviations the measuring circuits have to be calibrated. ■

JUMO news:

A new training video on pH measurement is available.
This e-learning course can be found at:
http://elearning.jumo-en.info

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