



KROHNE

▶ *achieve more*

The allure of water

Intelligent solutions for the water and wastewater industry



The allure of water – a KROHNE world



From space, our earth is a blue planet with seemingly vast water resources. However, only 2.5 % of this water is usable fresh water. At the same time, the increase in global population and rapid industrialization put enormous demands on the natural water resources.

Water is becoming rare in the future. Against this backdrop, it is clear how important it is to man and industry to have an efficient, high-capacity potable water supply and to have eco-friendly wastewater treatment for the planet as well as for the development of entire regions.

At the same time, the increasing competition in the field of supplying potable water forces the operators to not only consistently pursue the topics of process certainty and availability, but also to examine the topic of efficiency more closely than in the past.

As the worldwide leader in process measuring technology, KROHNE's contribution is considerable. Our product line covers the entire range of measuring and analyzing technology, from individual measuring stations to complete system solutions. In addition to the complete range of products for measuring level and flow, we also offer analyzing products for pH value, conductivity, ion concentration, redox and pressure. Servicing and calibration services round out the portfolio.

In 1961, KROHNE introduced the first electromagnetic flowmeter (EMF) for water, wastewater, additives and sludge. Since then, we have been able to win over those in the water management community time and again with the advantages of our innovations. Today, we produce more than 120,000 electromagnetic flowmeters annually in our plants in the Netherlands, Brazil, India and China.

Water is the most important future market worldwide. For this future market, we develop and produce meters that always set the example for the competition.

KROHNE – 90 years of experience and know-how in the water and wastewater industry

1921

Company founded as LUDWIG KROHNE & SOHN in Duisburg, Germany, production of variable area flowmeters for measuring the flow of air, gases and liquids

1955

The beginning of manufacturing mechanical level indicators for measuring liquids in tanks and containers

1961

The first electromagnetic flowmeter (EMF) for water, wastewater, sludge, etc.

1972

The first EMF with pulsed direct current field excitation/automatic zero point offset for the water and wastewater industry

1978

The first ultrasonic flowmeter for water, district heating, etc.

1979

The first non-analog, but frequency-based electronics for EMFs for improved flow measurement of wastewater and sludge

1981

The first EMF measuring tube made of Al_2O_3 and sintered platinum electrodes for measuring the flow of iron-chloride, etc.

1983

The first microprocessor-based electronics for cost-optimized manufacturing of EMFs for the water and wastewater industry

1986

The first EMF with capacitive pickup and without contacting the measuring electrodes with the medium for measuring such things as aliphatic sludges

1990

The first radar level meter (FMCW – microwaves) for process tanks and digestion towers

1994

The first straight tube Coriolis device for determining mass flow rate and density of polymers, methanol, activated carbon, sludge, etc.

1996

The first electromagnetic flowmeter with integrated capacitive level measurement for partially filled tubes

2000

Construction of the third and world's largest and most accurate certified volumetric calibration system with an uncertainty of under 0.013 % relative to the total volume of the calibration tower, with a height of 43 m, suitable for wet calibration of sensors to DN 3000

2004

The first electromagnetic flowmeter with automatic diagnostics/monitoring of the installation, of the operating status and of the medium, as well as meeting the requirements for the custody transfer applications (OIML R 49)

2005

A new clamp-on flowmeter for temporarily or continuously measuring the flow of existing water/wastewater pipelines or for checking the pumps, outputs, etc.

2006

First electromagnetic water meter with battery power for an operating time of 15 years with a cycle time of 1/15 Hz, MI-001/OIML R 49-approved

2010

Development of a multiparameter converter for liquid analytical measurement which present a unified converter platform for analysis, flow and level, a unified user interface as well as unified service philosophy

2012

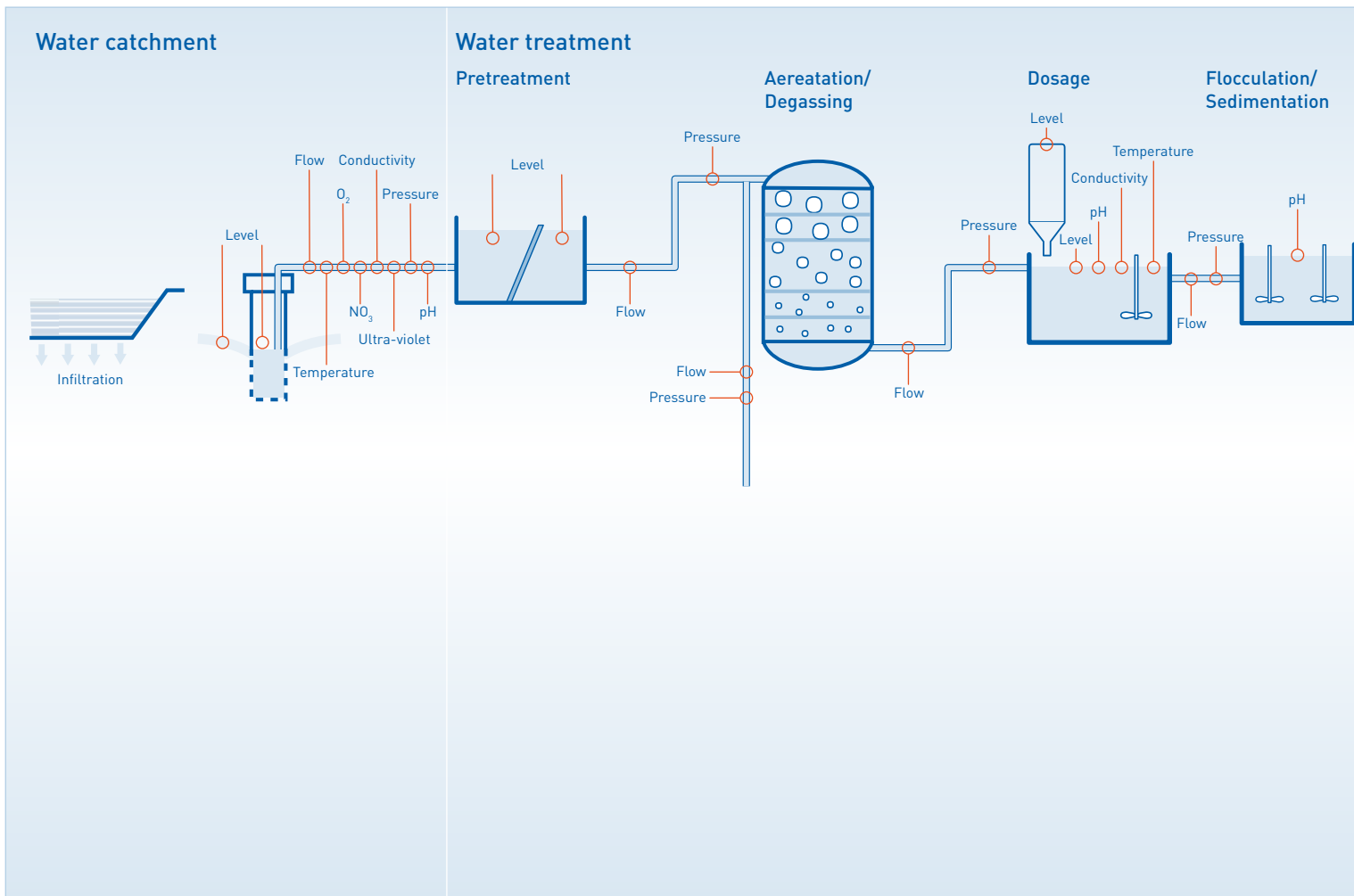
First battery powered water meter in an IP68 compact housing with an integrated GPRS module for remote transmission as well as integrated pressure/temperature sensor





Waterworks

The Haltern waterworks – Responsible for the Rhine, Ruhr and Münsterland



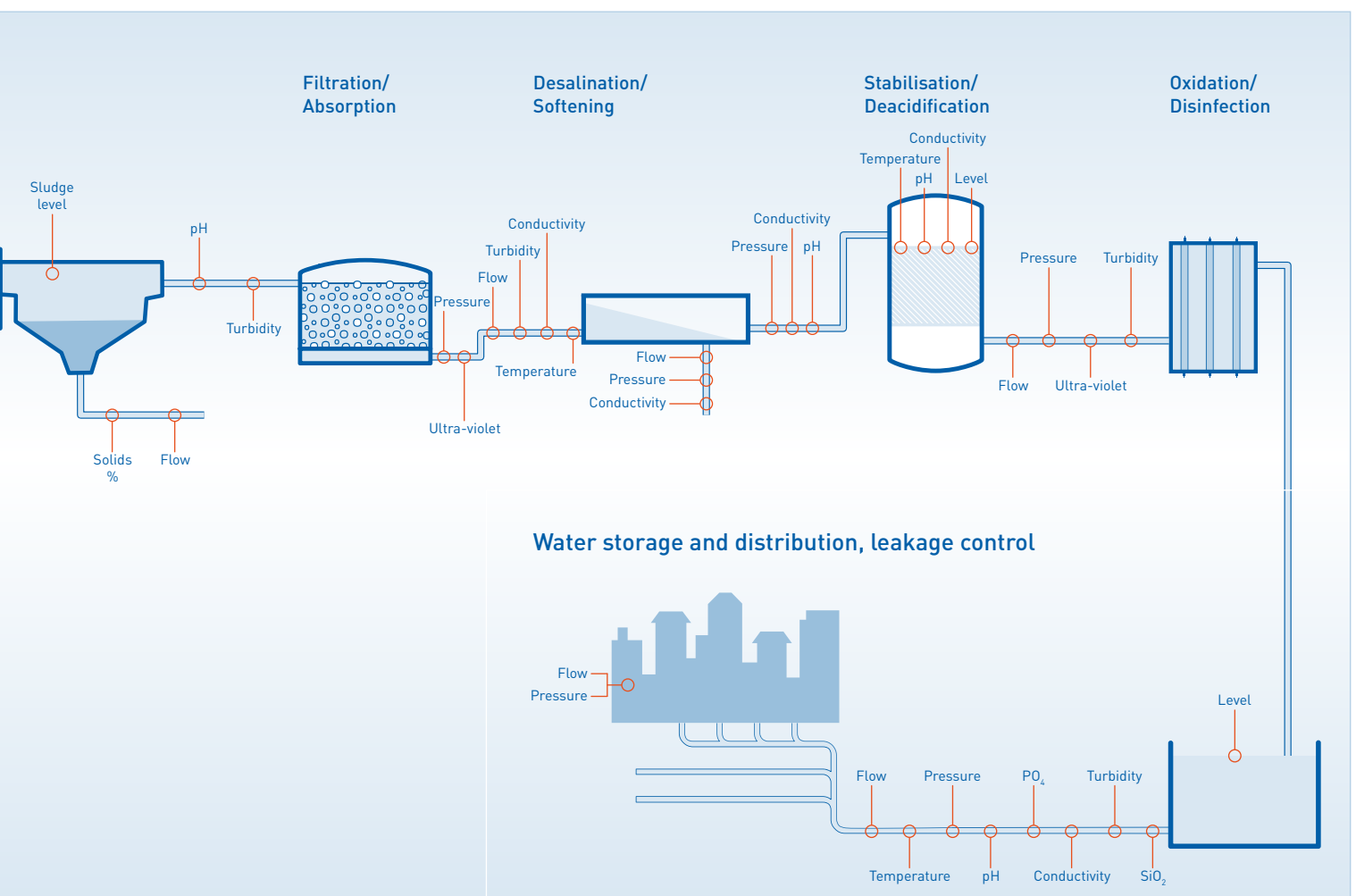
The waterworks in the Westphalian town of Haltern am See is one of a total of 13 waterworks run by Gelsenwasser AG, one of the largest providers of potable water in Germany. With an annual delivery of around 105 million m³ of water, it ranks among the largest of its kind in Europe. The service area includes more than 20 communities of the northern Ruhr district and Münsterland. A total of a million people, including commerce and industry are reliably supplied with potable water and service water by the waterworks. 24 hours a day, 365 days a year.

The Haltern waterworks is situated in a hydrogeologically favorable location, which owes its advantages to the 200 m high Halterner sand. This exposed location, in combination with responsible operation of the waterworks, is the guarantee that the natural environment in the popular local recreation area and around the waterworks and the

Stever and Mühlenbach rivers is sustainably used and thereby preserved.

The supply to the Haltern waterworks is ensured by a total of three sources: firstly, via ground water abstraction in the area around the waterworks and the adjacent Haard and Hohe Mark forests. Secondly, by ground water accumulation via the Haltern and Hullern dams. During this, the surface water stored in the dams is conducted into the deep bottom layers via seepage basins. And thirdly, by transferring water from the Dortmund-Ems canal into the dams during dry periods.

The Haltern am See waterworks has a transport capacity of 577,000 m³/day and 128 million m³ per year. The size of the water abstraction area (protection zone 1) is 200 ha.



The well house – 100 % certainty, thanks to 3x100%-diagnostics

The untreated water is abstracted in the waterworks via groundwater wells or bank filtration wells and from dams and other types of surface water.

A large number of waterworks have decided on the OPTIFLUX electro-magnetic flowmeter for monitoring the delivery rate into the well houses. And for good reason: because, compared to conventional mechanical Waltman meters, OPTIFLUX offers key advantages. There is the significantly lower pressure loss, for example, which has a positive effect on the power consumption of the pumps. Or the longer service life, due to the fact that the device does not have any mechanical parts in the measuring section, which ensures that no grains of sand or minerals can be deposited.

And another problem is almost completely eliminated by the OPTIFLUX: on the path that the untreated water takes from the lake to the waterworks in conveyor lines with up to DN 1200, heavy deposits can accumulate on the invert as a result of the slow rate of flow. But such deposits also accumulate inside the flowmeter – undetected by the operator. Experiences with an EMF DN 500 resulted in erroneous measurements of around 13,000 m³/h per year. At year's end, this water tore a big hole in the consolidated balance sheet.

OPTIFLUX meets this challenge impressively. Because the new generation of devices with the IFC 300 signal converter offers a 3x100%-diagnostics for the installation, application and measurement value and guarantees the operator maximum certainty on all levels.

Thus, the flow profile is permanently controlled within the measuring section. To this end, the magnetic field of the OPTIFLUX is briefly switched-over. In this way, two independent measuring fields result, one in the upper part and one in the lower part of the measuring section.

Because any turbulence as a result of an insufficiently straight feed or obstacles such as manhole covers in or upstream of the sensor also cause different types of turbulence. The same applies to invert deposits. In this case, a weak wanted signal is induced in the lower part of the sensor just as in the free or upper part. OPTIFLUX uses this difference and alerts the operator that there will be disturbances or measuring errors inside the pipe.

In addition, each OPTIFLUX is already completely parameterized at the factory – therefore, no readjustment is necessary when the device is installed.





The pressure filter system – The heart of water treatment

The quality of untreated water can vary widely in nature, depending on the extraction point. Therefore around one third of the entire amount of ground filtrate in the waterworks is conducted through a total of nine pressure filter tanks filled with quartz chips for the biological filtering out of manganese.

This is where the core process of water treatment takes place. Because, in addition to flocculation, this is where the decision is made as to which suspended particles and colloids are filtered out of the untreated water and in what amounts. And this answers the question as to what quality and composition of water can ultimately be provided to the consumer.

Gelsenwasser AG and other well-known waterworks have decided to use OPTIFLUX in this key area of water treatment. In many regards, the EMF specialist for water is predestined for this task: firstly, the device stands out due to its very high measuring performance while also boasting extremely rugged construction. The steel containment is fully welded and leak-tested at the factory.

Secondly, each OPTIFLUX is thoroughly tested over a time period of 20 hours at temperatures between -20 and $+60$ °C. These tests ensure a quality standard, which we call "KROHNE proved". These tests far exceed the legal requirements and therefore provide our customers with a high degree of investment security.

With so many outstanding properties, it is no wonder that the decision to use OPTIFLUX came easily to so many waterworks.

Booster pump works with collector well – Everything under control



Maximum system availability is indispensable for a waterworks – whether during water abstraction, water treatment or transport.

In the Haltern waterworks, a total of 16 rotary pumps with electric drives take on the task of supplying potable water to the public supply network. The largest pumps can transport 3,500 m³ of water per hour over an elevation of 110 meters.

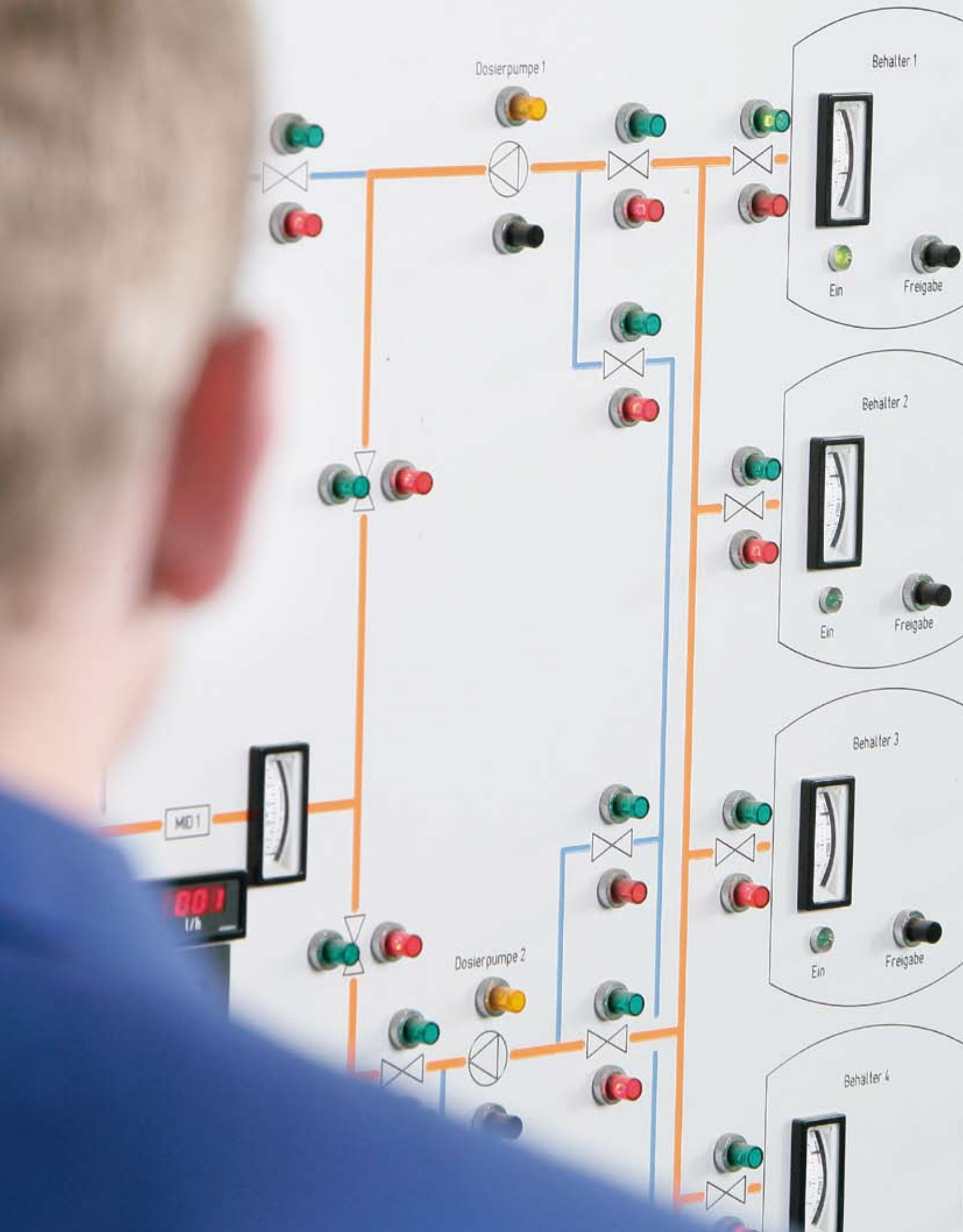
Do different water qualities and flocculating agents also mean different types of devices for measuring the flow? Not necessarily. Gelsenwasser AG, for example, has decided on only one device and only one technology – the OPTIFLUX. This holds true over the entire process chain of the plant.

The advantages for the operator are obvious: because OPTIFLUX covers every application with a single electronics unit. A number of potential savings for the waterworks result from this. Because the use of only one device for each flow measuring station not only creates planning and investment security, but also keeps the warehouse management streamlined.

In addition, there is the unique 3x100%-diagnostics of the OPTIFLUX – whether for device diagnostics, application diagnostics or out-of-spec testing: all of these functions are already standard on the OPTIFLUX. Periodic maintenance intervals and unexpected downtimes are therefore also a thing of the past.



Flockungsanlage



Corrosion protection and disinfection – Finding the right degree

In waterworks, the untreated water from all of the vertical wells is consolidated in deep containers. Here, natron base liquor for increasing the pH value and monophosphate are dosed for protecting the pipeline network and home installation from corrosion. Optionally, a chlorine bleaching system can be connected for dosing, to prevent microbiological effects.

These dosings require the use of a flowmeter, which stands out on the one hand due to its extraordinary measuring accuracy ($\pm 0.15\%$) and which is also chemically durable and compatible. The solution: OPTIFLUX.

During level measurement in the deep containers, type BM 26 level indicators with bypass flap indicators from KROHNE are used. As an alternative to this, the OPTISOUND ultrasonic level meter can be used. This measures the level in basins,

containers and tanks without contact. OPTISOUND also lends itself to being used in the inlet of the system. Here, the flow in open channels can be determined indirectly via the height.

To ensure that these measurements can be made independently of influences such as fog, snow, wind or foam formation, KROHNE developed the OPTIFLEX and OPTIWAVE level meters.

The OPTIWAVE works without contact, by means of radar, no approval is required for this device. The OPTIFLEX uses guided radar and is equipped with a stainless-steel probe for guiding micro pulses.



The run-out – Clean and neat

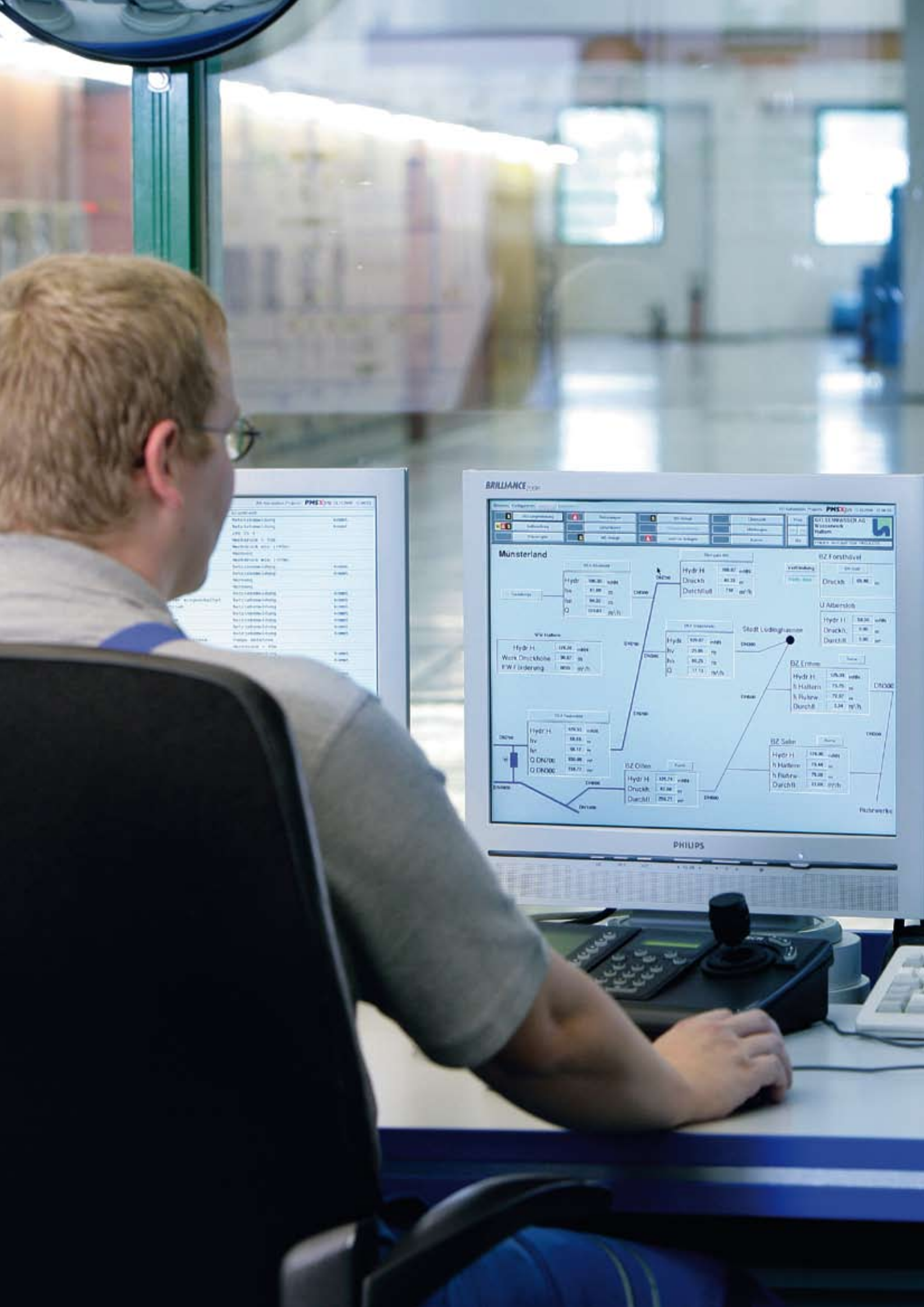
Flowmeters in the run-out of the waterworks and in the distribution network work in responsible positions. After all, they measure the potable water intended for the population and must precisely comply with the strict legal regulations.

This also affects the selection of the flowmeter and its materials inside the measuring pipe. Thus, only sensors that have liners that are approved as per KTW and DVGW worksheet 270 as well as respective guidelines according to the UBA may be used in Germany. The OPTIFLUX from KROHNE meets these criteria and is the first choice for many operators due in part to this fact.

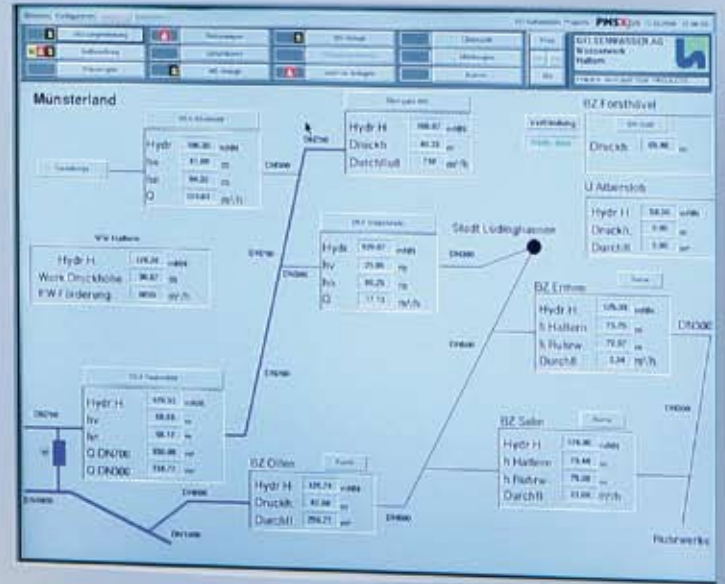
Another benefit: all OPTIFLUX meters are wet calibrated on a certified volumetric calibration station and are delivered with an official calibration certification. Regardless of whether it is a DN 2.5 or 3000 – each OPTIFLUX is also available for use in the business transfer upon request.



OPTIFLUX 4300



BRILLIANCE²⁰⁰⁰



PHS 2000

Item	Value
Hydr. H	100.00
Druckh.	100.00
Durchfl.	100.00

PHILIPS

Measuring the chlorine content in the emergency chlorination



Many municipal waterworks perform no permanent disinfection of drinking water. However, in many cases a process known as emergency chlorination takes place. The process is switched on in case of need, adding chlorine to the drinking water as a disinfectant.

Emergency chlorination is special in that it is only very rarely required, which means that non-chlorinated water usually flows through the measuring systems. Conventional measurement technology is now often faced with the problem of biological fouling covering the membrane, making the sensor inoperative over time. For this reason, some operators use extra doses of chlorine from time to time in order to keep the instrumentation clear of such biological fouling, even though it is not actually necessary from the standpoint of drinking water quality. If no extra chlorine is added the sensors in the system must be regularly checked and mechanically cleaned. In some cases, it may be necessary to replace the membrane and then recalibrate the system. A particularly critical situation arises if the gradual deterioration of the sensor goes unnoticed and the membrane is only replaced when the metering system does not start properly when needed for emergency chlorination.

As soon as chlorine is added to the water, the legal limits must be monitored in the effluent (e.g. in Germany 0.1 mg/l according to the Drinking Water Ordinance). In order to monitor these limits as well as to ensure accurate measurement of the chlorine, online measuring technology is used in many instances. Unlike conventional sampling and laboratory evaluation, this technology continuously monitors measurement values.



In addition, conductivity, pH value, turbidity and flow rate of the water are measured at the outlet of the waterworks along with the chlorine content.

The OPTISYS CL 1100 measuring system with automatic sensor cleaning system and a membrane-free potentiostatic sensor at the outlet of the waterworks was used to monitor the chlorine values in the process. The measurement was done as a bypass measurement with an open outlet.

Unlike comparable sensors, the potentiostatic sensor in the OPTISYS CL 1100 has no membrane and thus no pores to get clogged by biological fouling (naturally-occurring in non-chlorinated water). It features two gold electrodes on the outside, whose metallic surfaces are not affected by biological fouling. In addition, these electrodes are automatically cleaned on a daily basis, without the use of chemicals, thanks to automatic sensor cleaning.

The OPTISYS CL 1100 is thus always 100 % ready to measure, even if no chlorine has been added for a longer period of time. The measuring accuracy and suitability of the OPTISYS CL 1100 for measuring the chlorine content in drinking water has been certified by the IWW Rheinisch-Westfälisches Institut für Wasser (Institute for Water Resources Management) in Mühlheim, Germany.



OPTISYS CL 1100

Remote monitoring of groundwater abstraction points in the city of Jakarta



It is quite common in Jakarta, Indonesia, that major water consumers like residential parks, hospitals, hotels, industrial companies, golf clubs or shopping malls abstract their raw water directly from deep water wells. The water wells are up to 300 m deep and often located directly on the consumer's property. The groundwater is either used for utility purposes or it is treated and used as drinking water.

To charge the customers for the amount of abstracted water, dedicated water meters are needed. Up to now mechanical meters are used. As the abstracted water often contains a high percentage of minerals and solids, these meters are subject to serious wearing and clogging, leading to high maintenance expenses and a limited lifespan. Jakarta city government started a project for retrofitting of the operated abstraction points. Next to robust, non-wearing and low maintenance metering instruments, a remote data transmission of meter readings and alarms was asked for. In addition, the whole solution should be self-sufficient regarding power supply to keep on-site installation costs as low as possible. The water meters must fit into the existing pipeworks, no additional piping should be carried out. Although each measuring point is different with regards to flow conditions, pump capacities and installation restrictions (e. g. a 90° bow before/after the meter), the initial start-up, configuration and operating of the meters need to be easy and user-friendly.

As part of the project, a web-based solution for remote monitoring of the readings was also asked for. Emphasis was put on the security of remote transmission as well as a clear and user-friendly analysis and visualisation of values at customers' control room.

KROHNE was the only supplier to match the given requirements and delivered hundreds of battery powered electromagnetic water meters WATERFLUX 3070 with wireless data transmission together with remote monitoring system.

WATERFLUX water meters are not sensitive to flow conditions or installation restrictions on site. The rectangular cross section of the measuring tube allows for an accurate measurement of high and low flows. As it optimises the flow profile, there is no need for straight inlets and outlets or flow straighteners. The pressure loss resulting from necking is negligible, especially when compared to mechanical meters. There are no moving parts or obstructions in the measuring tube that are subject to wearing or maintenance. Two integrated batteries provide up to 15 years of operation (depending on ambient temperatures and frequency of measuring).

For remote transmission of the readings, the water meters were connected to a KGA 42 GSM antenna. Next to transmitting the readings, the KGA 42 can also store them for several weeks in case the network is down. The device also has programmable alarm functions: when pre-set thresholds are reached, the KGA 42 will send an alarm message to a given phone number, e. g. mobile phone of a service engineer.

For remote monitoring of readings, KROHNE offered WebKGA – a server-based solution. It is set up by KROHNE on a remote secure server infrastructure with direct connection to GSM network. WebKGA can be accessed via any standard internet browser. Requiring only a valid login/password, operation is very user-friendly and can be compared to an online e-mail account. No additional hardware or specific knowledge is needed. The WebKGA server can connect to an unlimited number of metering points/antennas.

At control room, personnel were able to operate remote monitoring systems after a short training. Next to the meter readings, also trend analysis, total consumption, average flow rate, night time flow rates or customised time periods, etc. can be displayed. WebKGA also provides additional information about the status of each metering point, e. g. power status and need for battery change is indicated for water meter and antenna.



WATERFLUX 3070 C

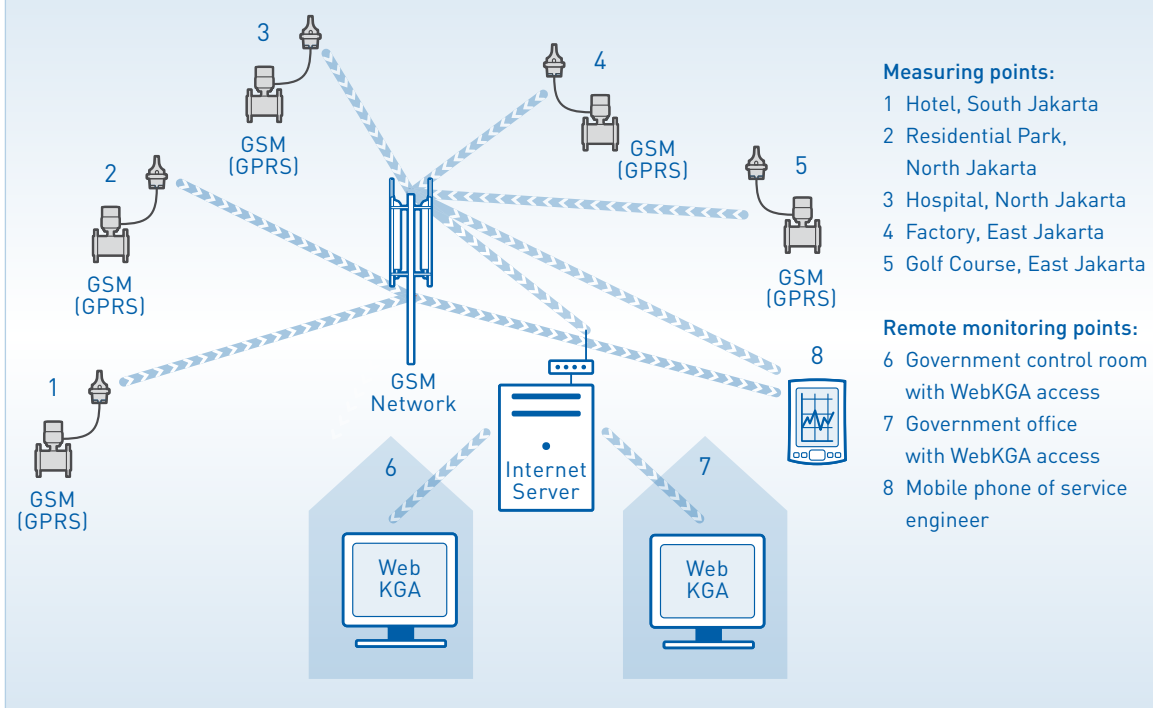


WATERFLUX 3070 IP68



WebKGA

Schematic diagram of the installation:

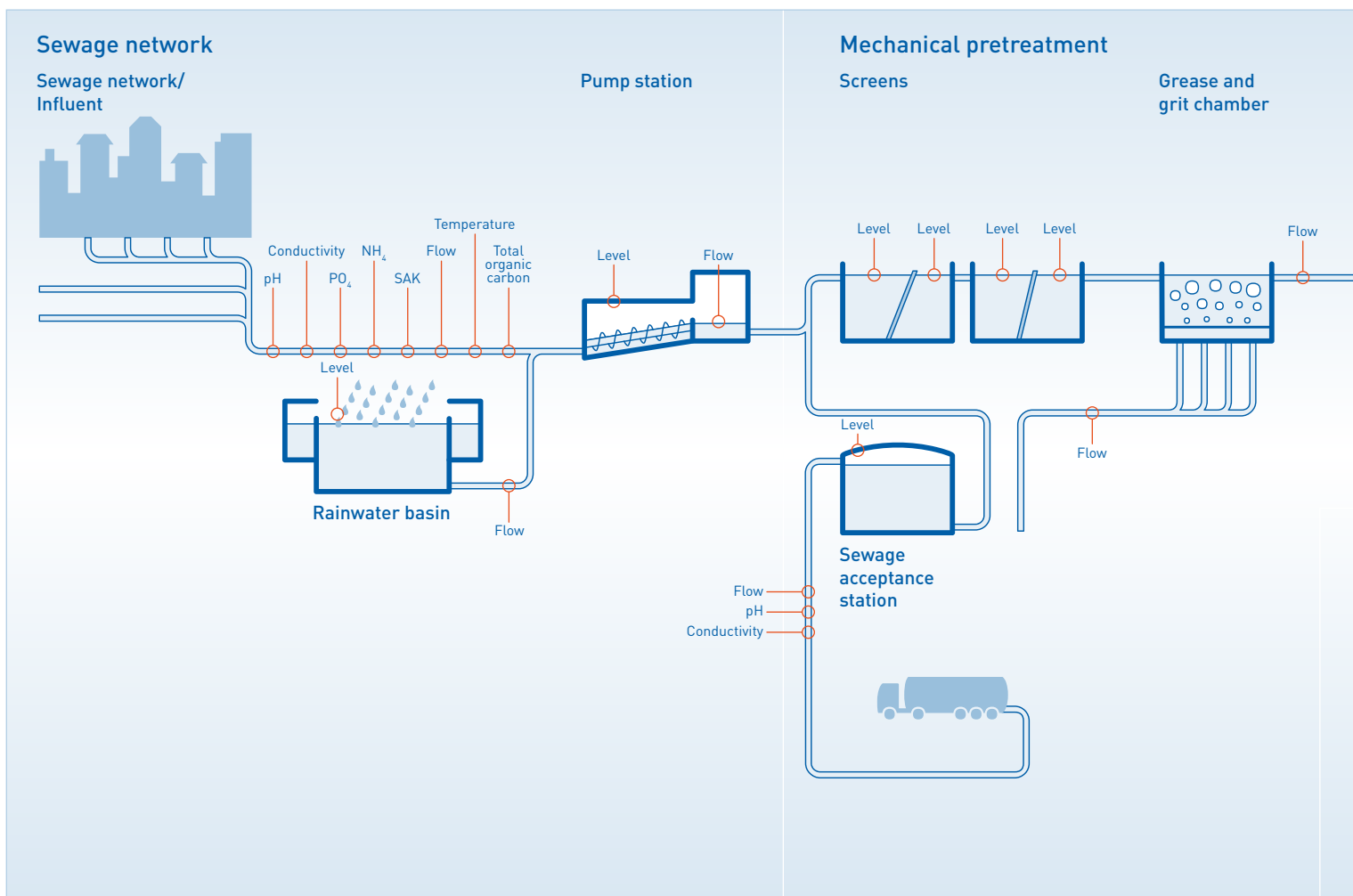






Purification plant

The Nuremberg purification plant – A matter of cleanliness for 500,000 people



All of the wastewater that accumulates in the large city of Nuremberg, Germany, is purified in two closely situated purification plants.

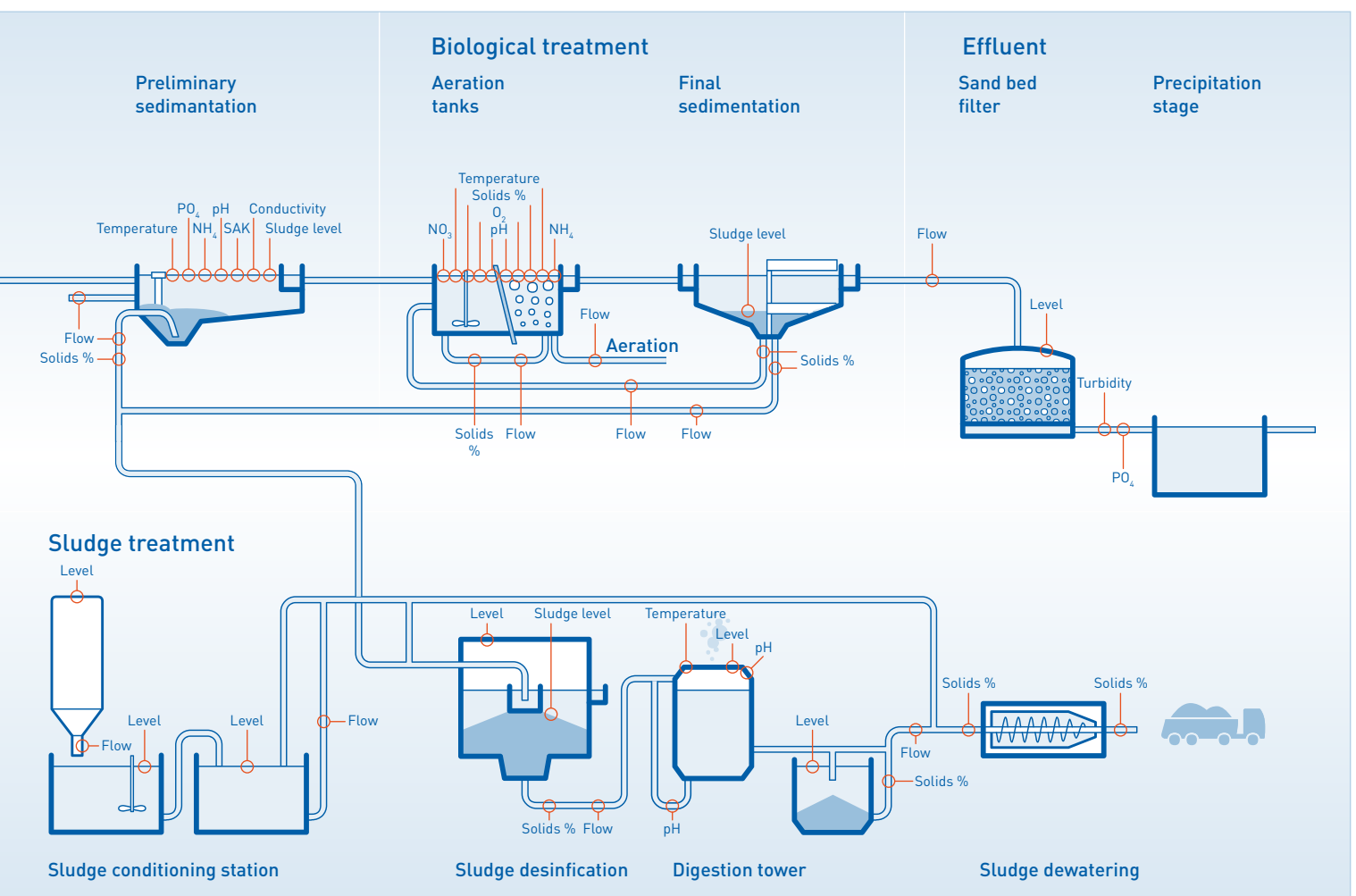
Purification plant 1 is by far the larger of the two purification plants and has a capacity sufficient for 1,400,000 inhabitants (EEC). The plant in West Nuremberg was commissioned in 1931. Since 1956, ongoing expansions and adjustments have been undertaken in the plant in order to increase the purification performance and to ensure that the plant is now up-to-date with the latest technology.

Purification plant 2 is the smaller of the two large purification plants in Nuremberg and is designed to

serve 230,000 inhabitants. It was put into operation in 1913 as the "Nuremberg South purification plant" and became the first large purification plant in Bavaria. Since 1984, the system has been completely reconstructed.

Both purification plants are now two-stage biological purification plants (aeration/aeration) with a downstream sewage filter.

When it rains, up to four cubic meters of wastewater per second can be piped through the plant. The purified water then flows into the Pegnitz river. A total of around 130 employees ensure the smooth and safe operation of the Nuremberg purification plant.



Flow measurement for partially filled pipelines using TIDALFLUX



The Nuremberg 1 purification plant is a mechanical-biological purification plant, which has two-stage biological purification with nitrogen and phosphate elimination and a downstream wastewater filter. There are also sludge digestion and sludge treatment systems on the site with drainage and drying.

In the mechanical purification stage, the wastewater, which flows in from the northern main collector, the old town of Nuremberg and the Pegnitz valley collector, is raised to the height of the purification plant's inlet. This takes place in purification plant 1 via a raising works that consists of three raising screw pumps. In contrast, the wastewater from the southern districts of the city (the southern relief collector and southwestern main collector) flow to the purification plant following the natural gradient.

The measurement of this flow in partially filled pipelines (DN 200 to DN 1600) is a genuine showcase field for the TIDALFLUX from KROHNE. The tried and tested electromagnetic meter, with its patented level measuring system, ensures accurate and reliable flow measurement in partially filled pipelines.

TIDALFLUX combines two measuring principles in one device. Firstly, the average flow rate in the partially filled cross-section is determined electromagnetically. During this, the device makes the measurements via two measuring electrodes, which are always under the surface of the water and therefore cannot be obscured, even at levels of only 10 % of the inside diameter.

The level is determined using a capacitive contactless level meter integrated in the pipe wall. The measurement takes place independently of deposits and dirt on the pipe walls and is unaffected by wave formation. Another benefit of the device is the abrasion-resistant polyurethane lining, which remains resistant even to sand and stones.

In addition to flow, total volume and level, the TIDALFLUX reliably reports when limit values are undershot or exceeded.



TIDALFLUX 4300



KROHNE

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Measurement of untreated water using electromagnetic flowmeters

The wastewater which is crudely cleaned by raking then flows through a sand filtering system with an automatic sand screener. The aired sand filter ensures that sand and other mineral solids settle on the bottom of the sand filter basin. At the same time, the fat in the wastewater floats to the surface.

The wastewater now flows into the pre-purification. In purification plant 1, this consists of four rectangular settling basins in which all undissolved pollutants that are heavier than water settle as pre-purification sludge at the invert of the basin. Fats, oils and light plastics that were not completely removed in the aired sand filter float to the surface of the water and are skimmed off.

Several electromagnetic flowmeters from KROHNE are installed in the untreated water inlet of the pre-purification system. As a rule, they have linings made of polypropylene or ebonite in order to guarantee a high degree of resistance to solids and abrasive media.

Measuring return sludge with OPTIFLUX

As the first biological purification stage, a heavy-duty aeration system is used with oxygen gas.

Here, carbon compounds are removed from the wastewater in a total of four aeration basins operating in parallel. The heavy-duty aeration system replaces the trickling filters in Nuremberg, which previously served as the first biological purification stage.

The city of Nuremberg has decided to use the OPTIFLUX for measuring the return sludge in the heavy-duty aeration system. And for good reason. Because the reliable detection and measurement of thick sludge using electromagnetic flowmeters was anything but easy for the operators of purification plants until now: large proportions of solid bodies and gas bubbles frequently caused a noisy measuring signal. Another problem with conventional devices with a pulsed direct current field is that sludge particles and grains of sand broke the electrochemical boundary layer with disturbing regularity. The result of this: Voltage jumps. Even gas or micro-bubbles caused a similar effect and considerably affected the quality of the induced measuring signal.

OPTIFLUX is different. Because, with the IFC 300, the latest generation of electromagnetic flowmeters offers a measured value converter for all applications: for media with a high proportion of solids (40 % and more). For media with the lowest conductivity ($>1 \mu\text{S}/\text{cm}$). For a rapid media change. For stroke piston applications with pulsing flows and for turbulent flow.

There is already the revolutionary A/D converter electronics from the factory, which has a signal-to-noise ratio that is 40 times better than before. The result: even disturbed and noisy signals can be controlled using the OPTIFLUX.

Maximum certainty is also offered by our unique 3x100%-diagnostics even for critical applications. In doing this, KROHNE is the first and only supplier to date that has supplemented the usual device diagnostics by a complete application, accuracy and linearity test (out-of-spec diagnostics). This provides the user with reliable information about instrument condition, measurement quality and possible operating faults. In this way, for example, gas bubbles are safely and reliably detected.





OPTIMASS 7300



Methanol measurement with Coriolis flowmeters

Light-duty aeration is the second biological purification stage. After the primarily organic carbon compounds are broken down in the heavy-duty aeration, reduced nitrogen compounds remain in the wastewater. For the most part, these are present in the form of ammonium.

The problem: in nature, ammonium becomes nitrite and nitrate. Nitrite is poisonous, while nitrate in the waterways causes over-fertilization and consumes large amounts of oxygen as it forms. What this means: a high ammonium load can cause a die-off of fish in waterways and also allows algae to bloom.

To prevent this, this process is accelerated in the purification plant. In this way, each of the four aeration basins in the Nuremberg purification plant 1 are divided into oxygen-rich and oxygen-free zones. Ammonium is converted into nitrate (nitrification) in the oxygen-rich zones. Subsequently, the nitrate is converted to nitrogen in the unaired, oxygen-free sections of the aeration basin ("denitrification").

Methanol is dosed in during this light duty aeration phase. It serves as a source of carbon and is measured in a separate system (explosion hazard area) with a mass flowmeter from KROHNE.

The OPTIMASS 7300 is practically made for this application. This high-end device from the OPTIMASS Coriolis family is a truly multitalented device. It reliably determines mass flow rate, density, volume, temperature, mass or volume concentration and the proportion of solids with the utmost precision. The OPTIMASS 7300 masters inhomogeneous mixtures with its unique straight pipe design just as competently as nominal flows of 15 to 430,000 kg/h. This guarantees the highest degree of accuracy and reliability in the typical applications of the wastewater industry – and it does this completely independently of the respective installation situation on site.

Dosing of coagulant and flocculating agent with electromagnetic flowmeters

Subsequently, the wastewater from the aeration basins of the light load aeration system makes its way to nitrification and denitrification in the secondary sedimentation. Here, the activated sludge is separated from the wastewater. In the inlet of the secondary sedimentation, iron chloride or an equivalent substance is added for elimination the phosphates – just as with the sand filter.

For dosing the iron chloride, more and more purification plant operators put their faith in the OPTIFLUX with PTFE special lining. The easiest commissioning, highest degree of measuring precision and maximum application certainty thanks to the unique 3x100%-diagnostic packages make the OPTIFLUX a safe investment at the lowest possible life cycle costs.

The comprehensive OPTIFLUX vitality check is carried out by default for each device. It meets and exceeds even the VDI/VDE/NAMUR directive 2650. It includes an accuracy test, a check of the electrodes for corrosion, a check of the lining for damage and the conductivity check, to name only a few points.

It is no wonder that the OPTIFLUX, with so many outstanding properties, is the first choice even for dosing flocculating agents. The highest level of precision is the top priority. After all, the dosing of flocculating agents must always be adjusted to the amount of wastewater and the degree of turbidity.

With a measuring accuracy of 0.15 % of the measuring value and a reproducibility of 0.06 %, OPTIFLUX sets the standard for the competition in this showcase field. And it does this completely unperturbed by sticky gas bubbles (vitality check). It even exceeds the accuracy of field units with a SIL-2 certificate.

Optionally, in addition to the PTFE special lining, high-value ceramics are also available for the OPTIFLUX. In this area, KROHNE can fall back on the knowledge and experience of more than two decades, thanks to its close and trusting cooperation with the Mannheim-based material and ceramics specialists at Friatec AG – an edge that we gladly pass on to our customers.





Flow measurement of sludge in the pre-thickener and in the main sludge thickener with electromagnetic flowmeters

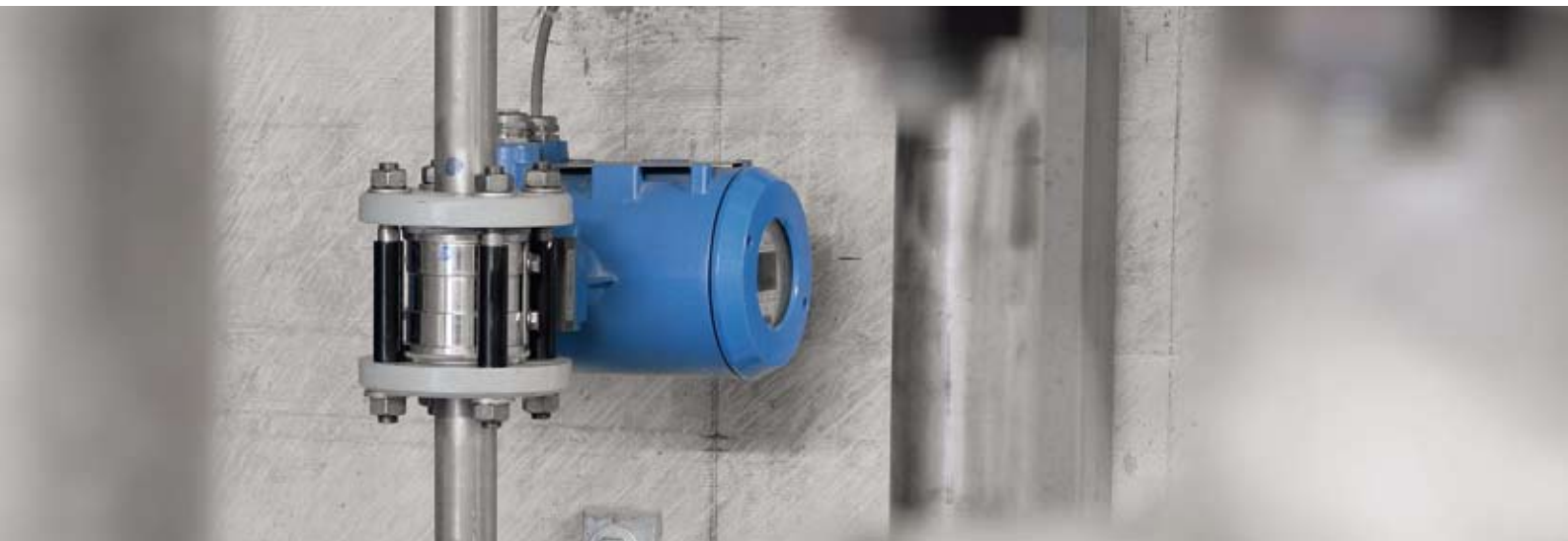
The sludge treatment allows biological stabilization of the sewage sludge. The central goal here is to induce controlled digestion, thereby keeping the resultant smells to an absolute minimum.

To reach this goal, the main sludge from the biological purification stages undergoes thickening in the so-called main sludge thickener and is temporarily stored in sludge storage containers before digestion.

Both in the pre-thickener and in the main sludge thickener, more and more purification plant operators put their faith in the latest generation of OPTIFLUX electromagnetic flowmeters that were introduced with great success in 2004.

Thanks to the unique diagnostics package of the OPTIFLUX, the installation and operating status of the device are just as permanently monitored as are the critical functions and components. A real source of potential savings for the city of Nuremberg: finally, with such a high degree of certainty, not only is periodic maintenance no longer necessary, but unexpected repairs do not even occur.





Gas metering in the gas compressor with vortex flowmeters

Under anaerobic conditions in the digestion containers of the Nuremberg purification plant, approximately half of the organic substances in the sludge is converted to sewage gas. This corresponds to approximately one third of the solid content.

During this, the sludge is continuously circulated in the oval digestion towers at an operating temperature of approx. 37 °C. This ensures optimum temperature distribution and, at the same time, prevents sedimentation.

In the gas compressor of the Nuremberg 1 purification plant, the flow measurement is done using a vortex flowmeter from KROHNE.

With the OPTISWIRL 4070 C, KROHNE offers the only vortex flowmeter with integrated pressure and temperature compensation in the 2-wire design. The device reliably determines operating flow, flow volume at normal conditions and mass flow of gases and vapors. Even when pressures and temperatures are fluctuating, the compact unit provides stable and reliable measurement results (thanks to ISP – Intelligent Signal Processing). The temperature compensation for saturated steam is already standard on the OPTISWIRL 4070 C.

The following steps serve to separate the water from the sewage sludge. First, the excess sludge is thickened. The sewage sludge is processed further in a centrifuge and in two other drying steps (thin layer dryer and sheet dryer). This allows a dry substance content of approx. 90 % to be achieved. For safety reasons (risk of spontaneous combustion), the dried sewage sludge undergoes a pelleting process before it is put into interim storage in dry sludge silos until it is transport out.

Simultaneous measurement of flow and electrical conductivity



Electrical conductivity is one of the indicators that provides information about the quality of wastewater. As a rule, the wastewater from an indirect discharger or a communal inlet area has a known average electrical conductivity. If the measured electrical conductivity differs greatly from the average value, there is reason to assume an unauthorised discharge. This then leads to further tests.

Electrical conductivity is generally measured at pumping stations, gauge wells and sewage treatment plant intakes by usage of inductive sensors. Flowmeters are also usually installed at these locations to perform this task. This comes at considerable expense. In addition to the investment costs, there are installation, wiring and maintenance costs to consider.

The OPTIFLUX 2300 C electromagnetic flowmeter simultaneously measures volume flow and electrical conductivity.

In terms of accuracy, the flowmeter did not come close to the precision of the conductivity meter. However, this is also not necessary because operators do not use conductivity measurement as a controlled process variable. The response time of the measurement is comparable to the reference and operators deemed the repeatability of the measuring results to be sufficient. As an indication measurement it is completely adequate in practice. With an optional additional current output on the OPTIFLUX, the conductivity value can be continuously monitored in the control room.

Thanks to the use of OPTIFLUX with standard integrated inductive conductivity measurement, operators have other conductivity measuring stations at their disposal with no additional expense. When minimum and maximum limit values are set, deviations are automatically detected and countermeasures can be immediately implemented.

Energy saving through sludge blanket measurement in thickeners



OPTISYS SLM 2080

A large portion of the cost sewage treatment plants involved is used to heat the digestion towers. By increasing the suspended solids content of the sludge fed to the digestion tower, these costs can be lowered. A higher suspended solids content in the sludge concentrator means less water in the sludge to be heated in the digestion towers. Optimised prethickening of the sludge contributes directly to energy savings. This requires precise control when filling the thickener. Filling the thickener to higher level results in the bottom sludge layers in the settling cone being more strongly compressed, thus increasing the suspended solids content at the outlet.

To avoid overfilling the thickener, it is necessary to measure the sludge blanket. The difficulty here is in reliably measuring the different layers of sludge and swirled solids (fluff zone). Daily visual checks are not sufficient and the fluff zone cannot be measured using level measurement methods either. That is why special ultrasonic measuring systems are mainly used for this task.

The sludge blanket measuring system OPTISYS SLM 2080 from KROHNE uses the optical method that is more reliably than the indirect measurement offered by ultrasound.

OPTISYS SLM 2080 features a suspended solids sensor which is submerged in the medium and travels through all of layers or phases in the tank. The level and the suspended solids content are continuously measured and evaluated. The operator can determine certain concentrations which then characterise the different phases, e. g. 0.5 % suspended solids content for the fluff zone and 5 % for the settled sludge. In addition to the notification of the level in the concentrator, this makes the precise recording of the sludge profile of the various layers possible. The maintenance is very minimal as both the sensor and the cable are cleaned via integrated spray cleaning, which automatically eliminates contamination following a measurement.





Planning tool – Three steps to a customized tender document

When planning new systems, fast and precise compilation of lists of products and services in the field of measurement technology always requires information that is up-to-date and complete. All too often, imprecise and outdated information wastes a lot of time and in some cases even leads to planning errors with critical consequences.

The planning tool is tailored to the needs of plant planners in engineering offices who are responsible for creating complete contract specifications in the water and wastewater industry. When the work is finished, all it takes is a few clicks of the mouse and the planner holds the completed tender documents in his hand. The documents are precisely formulated, containing all of the technical details.



For more information go to: www.krohne-water.com

It is extremely easy for the planning engineer to access and start using this tool as nothing needs to be installed on the computer. Once the program has been started, the classical flow diagram of a sewage treatment plant appears on the monitor. To access the individual measuring points, the user can now just click directly on the image field.

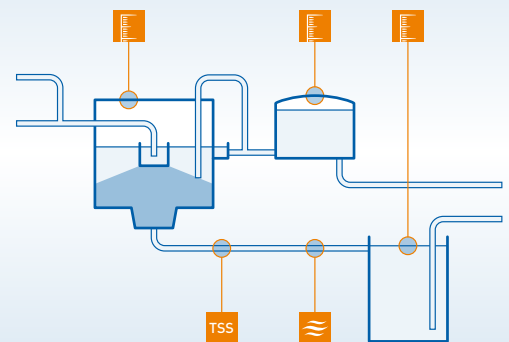
When the user clicks on a measuring point, appropriate devices are recommended. The list of devices also contains additional information. Each option features a button which, when pressed, can call up detailed information about the relevant KROHNE product. This information includes a brief description of the device, the relevant data sheet with optional nominal widths, the operating instructions, installation and assembly information, price lists, calculation programs for device design or an error curve analysis as well as approvals and certificates.

One particular highlight is the CAD drawings of the measuring devices in 2D and 3D in the manufacturer-independent DWG or IGES formats, which the planner can put into his planning system.

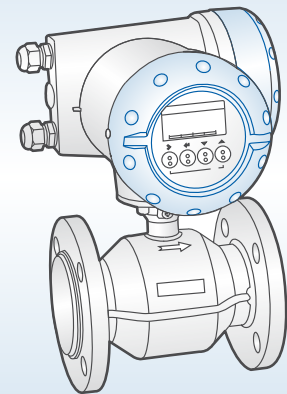
The user then receives completely formulated, supplier-neutral tender documents for the selected measuring point. They are initially completed using standard technical values. The device is configured in the left-hand dialog area. This is where all of the relevant specifications of the device version, from the nominal size to the power supply, are selected. The selected values are automatically transferred to the tender document. Once all of the variables have been selected, a precise tender document is created. It can be conveniently saved as a Word or Excel file or in the GAEB format typically used for contract specifications.

This ensures that the device described with these specifications is actually offered on the market. This means that not only can the planning engineer put his tender together very quickly and conveniently using the planning tool but he can also count on 100 % planning reliability. When all is said and done, the plant can become a reality with all of the planned devices, without exception. Time-consuming planning improvements are a thing of the past – at least when it comes to the measuring points.

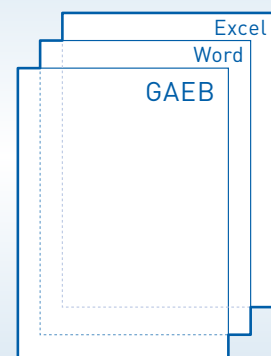
Step 1 Select the area to be planned and the measurement points



Step 2 Select the desired measurement device



Step 3 Configure the device/create the tender document



Communication at KROHNE – Open for the future



The industrial automation in the maximum system availability is indispensable for the water industry and its private and commercial customers. In order to be able to meet this key criterion 365 days a year, 24-hours a day, KROHNE invested its knowledge and decades of experience, not only in innovative products like the OPTIFLUX with its unique 3x100%-diagnostics, but also in positioning itself as a visionary in important communication and integration technology.

Thus, system concepts in which the products of the most diverse manufacturers harmonious work together are becoming a reality via open, standard interfaces such as HART®, PROFIBUS® and FOUNDATION™ fieldbus.

KROHNE has been actively following this development for years. Whether you are talking about electromagnetic, ultrasonic, variable area flowmeters, mass, vortex or level: KROHNE field units are open for the future. They communicate reliably with controllers, control systems and PCs and can also be used for the most diverse control and regulating tasks.

Integration is a top priority at KROHNE

KROHNE field units are capable of much more however. They meet all of the prerequisites for being integrated in plant asset management systems. And they allow the supplying of serious integration technologies such as FDT/DTM.

What is special about FDT/DTM: for the first time, bus-independent integration of the field technology into the plant asset management system is possible – no doubt a milestone for industrial communication, of which KROHNE had and has a considerable share, as a long-standing member of PACTware™ and the FDT Group®.

So it is no wonder that, since the beginning of 2003, we have made DTMs available in the FDT 1.2 versions for a number of field units with HART® and/or PROFIBUS® interfaces: OPTIMASS, electromagnetic flowmeters (two and four wire), level radar and reflex radar devices as well as H250 ESK and M10 variable area flowmeters.

[PACTware™ and all KROHNE DTMs are available free of charge and fully functional without a license. They are included on a CD in each delivery of the device and are available in the KROHNE download center.](#)

Calibration from KROHNE – Certainty that you can count on

The true quality of a flowmeter can be seen under adverse conditions: for example, when pressures and vacuums are fluctuating heavily during the measurement of inhomogeneous measured substances or media with a high proportion of solids.

Therefore, starting with the calibration, we at KROHNE do everything to ensure that our flowmeters perform impressively, with the highest degree of accuracy, reliability and reproducibility, even under such conditions.

Thus, for example, each KROHNE flowmeter is wet-calibrated in a direct comparison of volumes, which is by far the most accurate calibration method. The calibration is carried out both for electromagnetic and ultrasonic flowmeters on the world's largest calibration system at KROHNE Altometer in Dordrecht, in the Netherlands.



It is no wonder that the accuracy of the KROHNE calibration stations is generally 5x better than that of the flowmeters to be tested. For our customers, this not only means a maximum degree of certainty, but also guarantees the accuracy information of all flowmeters under reference conditions.

Another benefit for our customers: KROHNE supplies the largest NKO-certified flowmeters worldwide. This guarantees the highest degree of measuring accuracy – even under difficult operating conditions.



KROHNE

product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry



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