

Automation in one of the most modern water treatment plants in Europe

Water's long journey

Fresh, clean drinking water straight from the tap is something that many people in industrial nations take for granted. However, water often has to travel a considerable distance to get there. The pioneering water treatment plant of the Landeswasserversorgung (state water supply company) in Langenau is one of the most modern in Europe. Actuators from Festo contribute to stable processes in its systems, which are designed to run for several decades.





“We expect our plants to run for decades,
so reliability plays a crucial role.”

Bernhard Röhrle, spokesperson for the Landeswasserversorgung

Weadows, forests, farmland – fertile land as far as the eye can see. At first glance, Baden-Württemberg looks like a region that has been blessed by nature, were it not for the lack of water. There is plenty of water, but not always where it is needed. Large areas of land, including the Swabian Jura, do not have enough ground water. The reason for this is the limestone landscape. It covers an area of around 40 by 200 kilometres, making it the largest continuous limestone region in Germany. Formed on the bed of the Jurassic Sea up to 200 million years ago, the current bedrock is a gigantic limestone block. For millennia, acid water flushed through the limestone rock, forming countless cracks, crevices and caves in which rainwater today quickly seeps away, flows underground and is no longer available as ground water. However, there are places where it gathers and forms large ground water basins. One of the biggest of these is the Donauried near Langenau.

Up to 4,500 litres of water per second

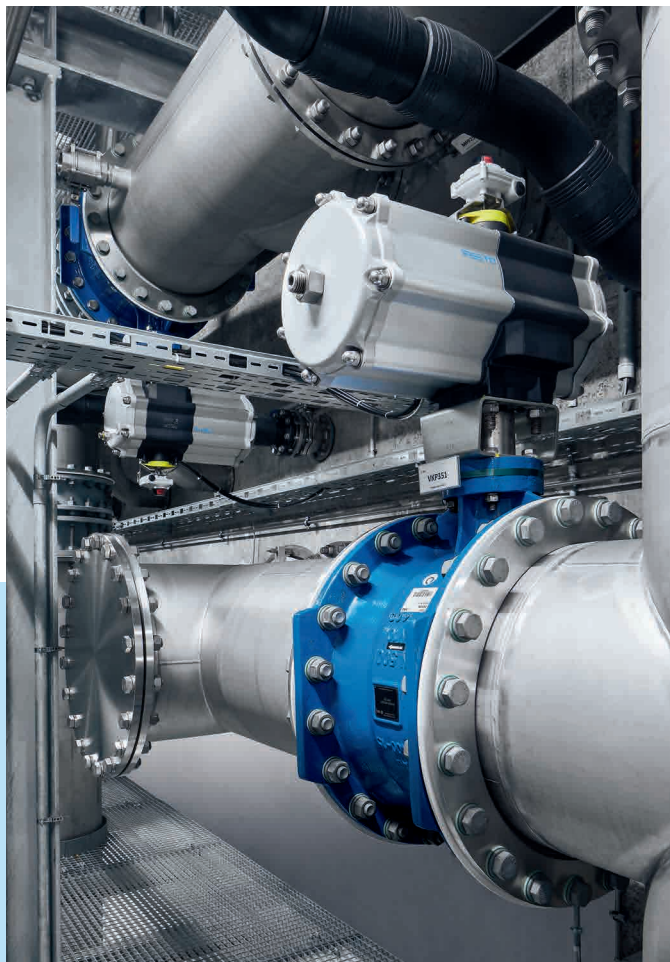
The water catchment area for the Donauried, southern Germany, covers an area of 315 square kilometres and holds around a billion cubic metres of ground water. Ground water can be drawn relatively easily from an average depth of around eight metres from one of the 204 springs in the Donauried region in Württemberg. This water is then treated at the water treatment plant in Langenau, the centre of the Landeswasserversorgung network. It is one of the biggest and most modern water treatment plants in Europe, supplying three million people. Created in 1912, the organisation is the first long-distance water supply company in Germany. It serves 250 cities and municipalities with a 775-kilometre long pipe network, providing an

annual supply of around 95 million cubic metres of drinking water. This corresponds to around 250,000 cubic metres per day and up to 4,500 litres per second at peak times. River water is also taken from the Danube and treated.

In the widely branched long-distance water supply network with pipe diameters of up to 1.5 metres, drinking water flows at a pressure of up to 12 bar. The underground network has made a significant contribution to large-scale industrialisation in Baden-Württemberg. Just about every community in the region has at least one small to medium-sized company – and water represents a sustainable success factor.

It has to be clean and soft

The ground water takes around 12 years to complete its long journey from the Swabian Jura to the Donauried, and even though it is very pure, the water treatment process by the Landeswasserversorgung is extremely thorough. Ground water filtration and a decarbonisation plant ensure consistently high water quality. Organic substances are removed and excess lime content is reduced. On its long travels through the limestone landscape, the ground water is enriched with lime and has an average degree of German hardness of 22 when abstracted. In order to prevent too high a lime content from creating unwanted deposits in water pipes, household appliances and industrial plants when the water is heated, decarbonisation reactors reduce the water hardness to 12 degrees of German hardness.



Fast, clean, safe – quarter turn actuators DAPS with de-energised normal position return to their initial state automatically in the event of a malfunction.

A wide variety of quarter turn and linear actuators from Festo are used to ensure maximum reliability during the decarbonisation and ground water filtration processes. Reliability is very important to the Landeswasserversorgung as the systems in Langenau are designed to run for several decades. Water treatment requires process automation systems that are built to last. Pneumatic products from a single source – such as control cabinets, tubing and actuators with accessories – provide the lasting advantages of short response times and simplified ordering processes. These same advantages also apply to future maintenance work.

Lime pellets as an industrial by-product

Until 2016, the degree of hardness of the ground water was reduced through slow decarbonisation (SDC). This process has now been accelerated thanks to a new rapid decarbonisation plant (RDC). This new plant uses automation technology from Festo. Apart from its speed, RDC offers another advantage. With SDC, the lime sludge produced had a residual water content of around 50 per cent, whereas modern RDC produces lime pellets with a residual water content of just 2 per cent. In addition to increased system efficiency, the changeover has also influenced the changing market situation in the lime-consuming industry. Lime sludge was once used in large quantities in paper production, but the decline of this industry in Germany led to a slump in demand for this natural product. Lime pellets, on the other hand, are currently widely used in the glass, animal feed and plastics industries, among others. When all seven reactors are running at full capacity, they produce more than 10,000 tonnes of lime pellets every year, making them a valuable by-product. In the reactors,

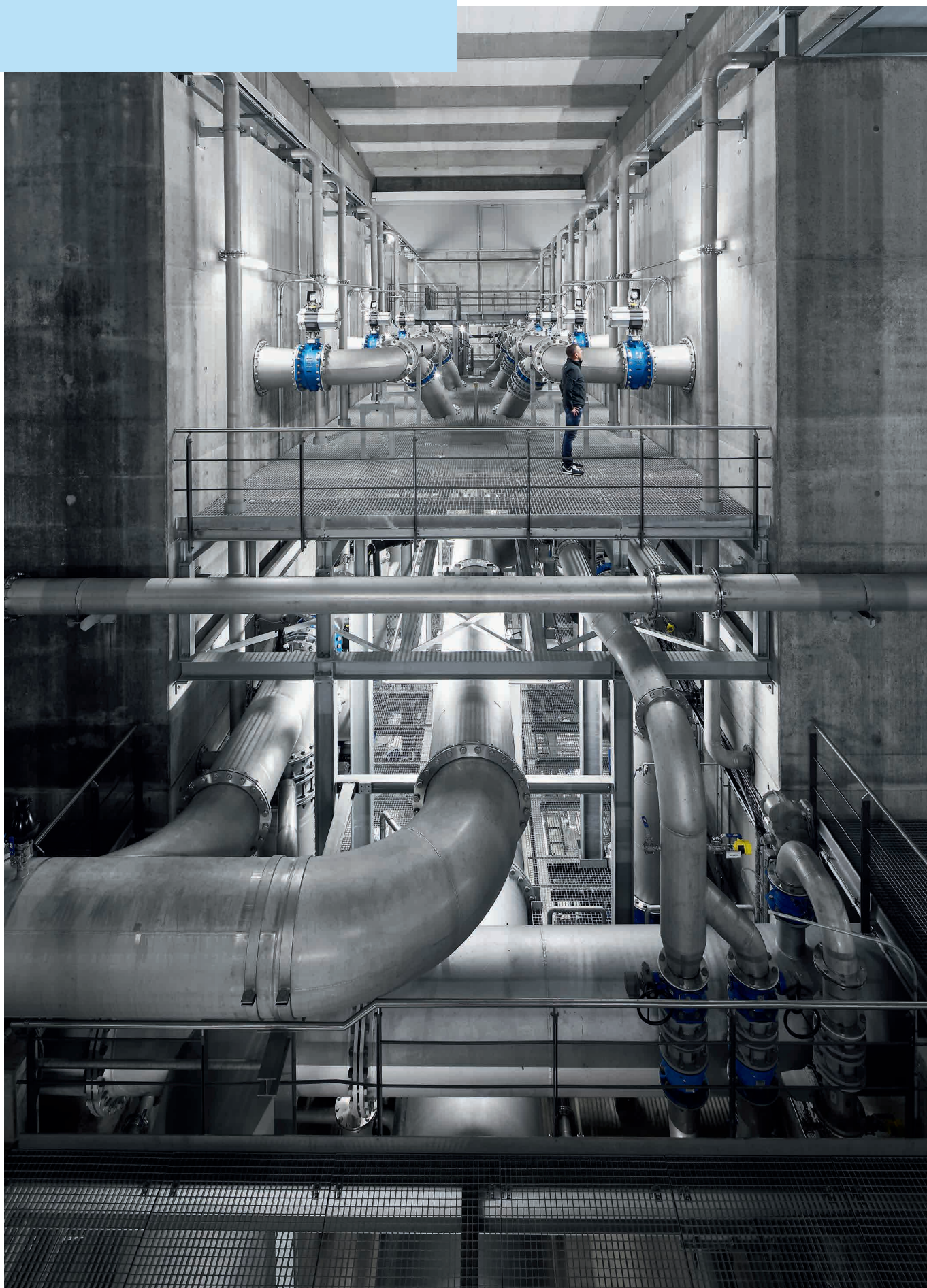
which are 10 metres high and have a diameter of 4 metres, the hard ground water travels upwards, is mixed with a base of lime water and enriched with lime grains. The precipitated lime from the ground water is deposited on these grains. When they have grown to pellet size, they drop because of their weight and can be removed. The soft water travels upwards and flows out. Butterfly valves equipped with pneumatic quarter turn actuators DAPS from Festo control the inflow and outflow. The state-of-the-art RDC technology also contributes to reliability.

Filter cleaning for clean drinking water

Ground water filtration with modern multi-media filters represents an investment in the future water supply. Sand and activated carbon filters in operation since 2014 remove organic substances. Seven filter basins with a two-metre thick filter substrate, each covering an area of 50 square metres, provide clean drinking water free from turbidity and suspended particles. The filter basins occasionally have to be cleared of dirt particles. This is done by backwashing with fresh water and air. A total of ten pneumatic shut-off valves stop the water inflow quickly and reliably using quarter turn actuators DAPS with positioners from Festo. The rinsed sediment is removed using a sludge water separator. The sludge water valve is controlled by a linear actuator DFPI from Festo.

A total of 77 Festo quarter turn and closed-loop controlled linear actuators ensure reliable processes. One of the benefits of pneumatics is that in the event of a malfunction, such as a power failure, the valves with DAPS and DFPI return to their initial state automatically

Reliability right down the line – quarter turn actuators
DAPS at the ground water inflow of the multi-layer filters.



thanks to their de-energised normal position. The filtration process can be resumed and the water that enters the inflow system is free of sediment. The Festo control cabinets with valve terminals CPX/VTSA are installed decentrally at the multi-layer filter basins and guarantee a high level of safety. The control cabinets control all pneumatic process valves and include additional sensors for measurement signals as well as limit switches. Tailored specifically to the functions of filters and reactors, the valve terminal concept is a flexible, reliable solution designed to meet the high technical requirements of the water treatment plant in Langenau.

- www.festo.com/water
- www.festo.com/catalogue/daps
- www.festo.com/catalogue/dfpi
- www.festo.com/catalogue/cpx

State-of-the-art automation

The entire system topography of the water treatment plant in Langenau is characterised by a high degree of automation. All systems – from water catchment to the 400,000-cubic metre water tanks – can be monitored and controlled by just two employees in the control station. Up to 5,000 pumps, shut-off devices and fittings across the entire drinking water abstraction, treatment and distribution plant supply around 3,500 measured values. With around 300 automation devices, the control system is one of the biggest and most modern operated by a German water supply company.

Underground treasure chambers:
the drinking water is collected in large reservoirs.



**About Festo:**

Festo is a global player and an independent family-owned company with its headquarters in Esslingen am Neckar, Germany. The company has become the global market leader in its sector over the past 60 years thanks to its innovations and problem-solving competency, as well as a unique range of industrial training and vocational education programmes. Festo supplies pneumatic and electric automation technology to 300,000 customers in the field of factory and process automation in over 40 industries.

Products and services are available in 176 countries around the world. In 2017, the company employed 20,100 staff in 61 countries in over 250 subsidiaries. Its turnover in 2017 was EUR 3.1 billion. Each year, the company invests about 8% of this turnover in research and development. 1.5% of this learning company's turnover is invested in basic and further training. However, training services are not only provided for Festo's own staff – Festo Didactic SE also supplies basic and further training programmes in the field of automation technology for customers, students and trainees.