

Partner for water technology

FESTO





Automation concepts for optimum water treatment

Ensuring the ready availability of water of a specific quality is becoming a challenge for the entire human race. More frequent bottlenecks in energy supplies, sinking groundwater levels and increasing contamination of global water resources are causing this vital commodity to become even more scarce.

Whether for municipal or industrial water and wastewater treatment, Festo offers individual automation solutions that are powerful, economical and reliable. Festo can supply everything from actuator technology to the field level and deliver it as individual components or a pre-assembled system. Together with our customers we offer a more intelligent automation, from concept creation to smooth operation.



Content	Page
Why use pneumatics for water systems?	4
The advantages of pneumatics	5
Festo's automation concept	6
Greater transparency and clarity in operation	8
The actuators for process valves	10
References	14
Products and services: benefits for our partners	28
Festo Didactic	30
Product overview	31



Why use pneumatics for water systems?

Water is a precious commodity all over the world, one which humanity needs to be even more careful in using as consumption levels rise. Industrial automation of potable, and wastewater treatment plants ensures customers have access to this high quality resource when ever it is needed. Pneumatics presents a valuable and extremely reliable alternative to electrical automation systems, especially when it

comes to meeting the requirements of water and wastewater treatment. Pneumatics, one of the indispensable core technologies for automation, has the additional advantages of robustness and cost-effective system solutions. This brochure therefore not only tells you about the advantages of pneumatics, but also informs you about stimulating and economical applications in potable water treatment and wastewater treatment across Europe.

Festo is well placed to give you this information. A leading innovator in manufacturing and process automation, Festo has been active for many years in the area of water treatment, with complete, single-source automation solutions tailored to meet the needs of plant operators. Including intensive consultation and support through all the specific project steps of value creation.

56 national companies, 12,000 employees and a dense customer service network in more than 170 countries means that users all over the world can rely on us to supply them at very short notice with components, subsystems and systems for automation tasks. For more than 300,000 industrial customers, Festo is a valued business partner.





The advantages of pneumatics

Compressed air is the second most commonly used source of power in industry after electricity. Simple transporting and storage in reservoirs count among its advantages, so too its ease of control, which sets it apart from electrical power. Simply by increasing air pressure thrusting and tensile forces as well as torques can be enforced. Compressed air is rightly known as the “fast” control medium, but it is also ideal for less dynamic applications.

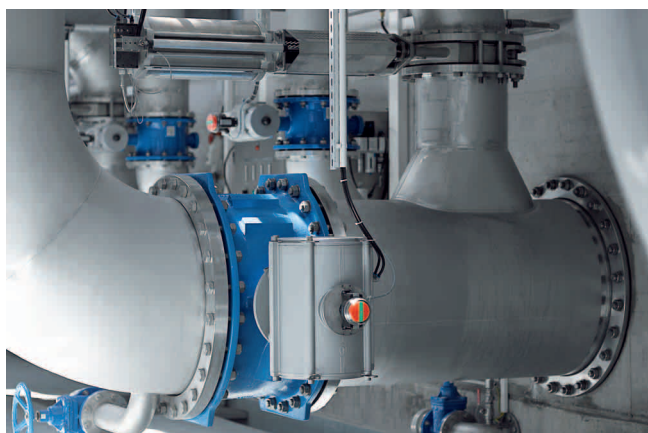
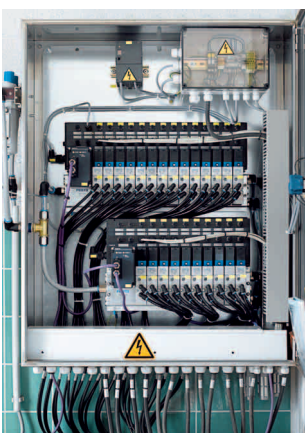
Obvious advantages in practice:

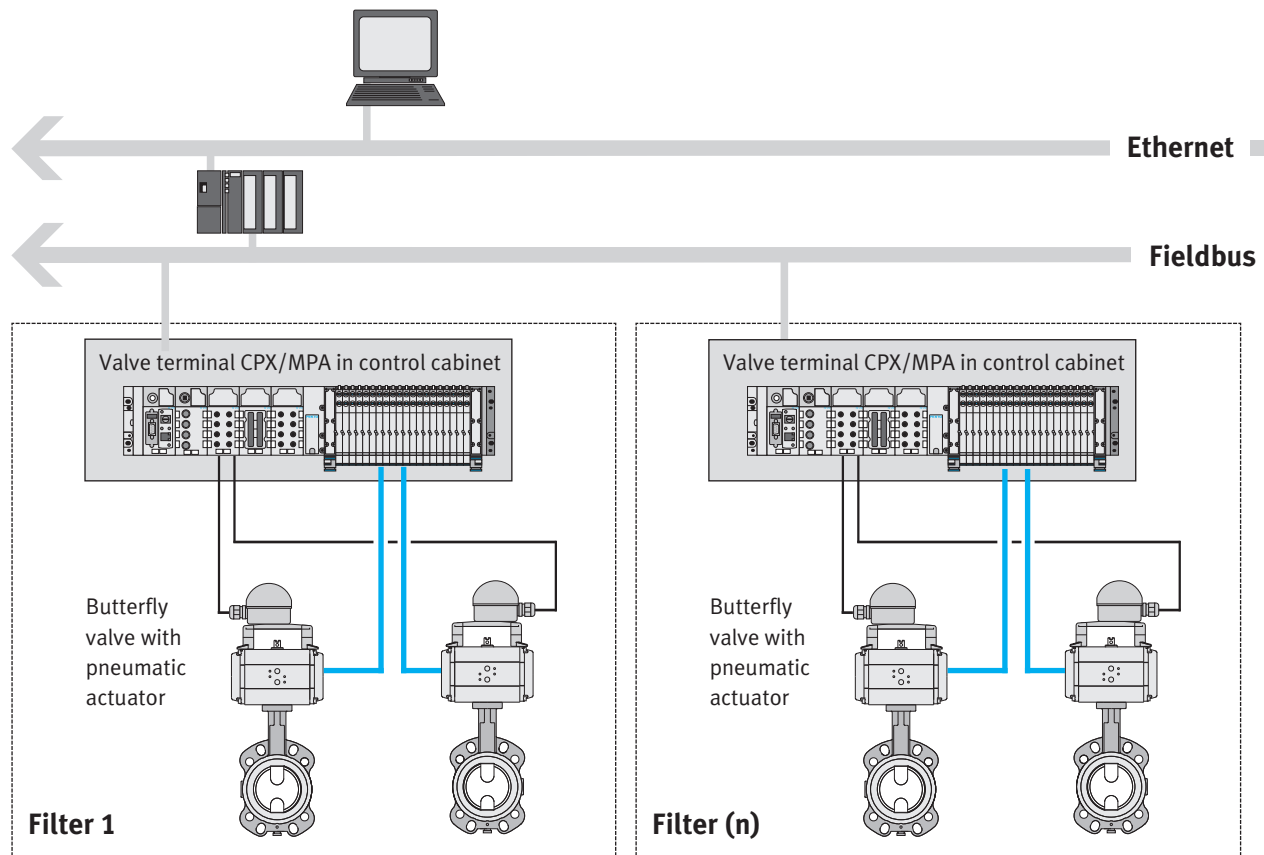
- Compact and robust generation of compressed air
- Simple distribution of pilot air in networks
- High power density
- Overload proof: withstands loads even at standstill without damage
- Cost-effective as the valves are rarely actuated
- Inherently safe technology, ideal for areas with explosive atmospheres

- Insensitive to temperature variation between -20 °C and +80 °C
- High forces and torques: up to 50,000 N and torques up to 10,000 Nm

Safety first:

- Electricity supply for all system components: 24 V DC low voltage
- Secure storage of compressed air in air reservoirs which provide actuation in cases of power failure
- Low pressure values: maximum 10 bar
- No environmental contamination when using clean oil-free air





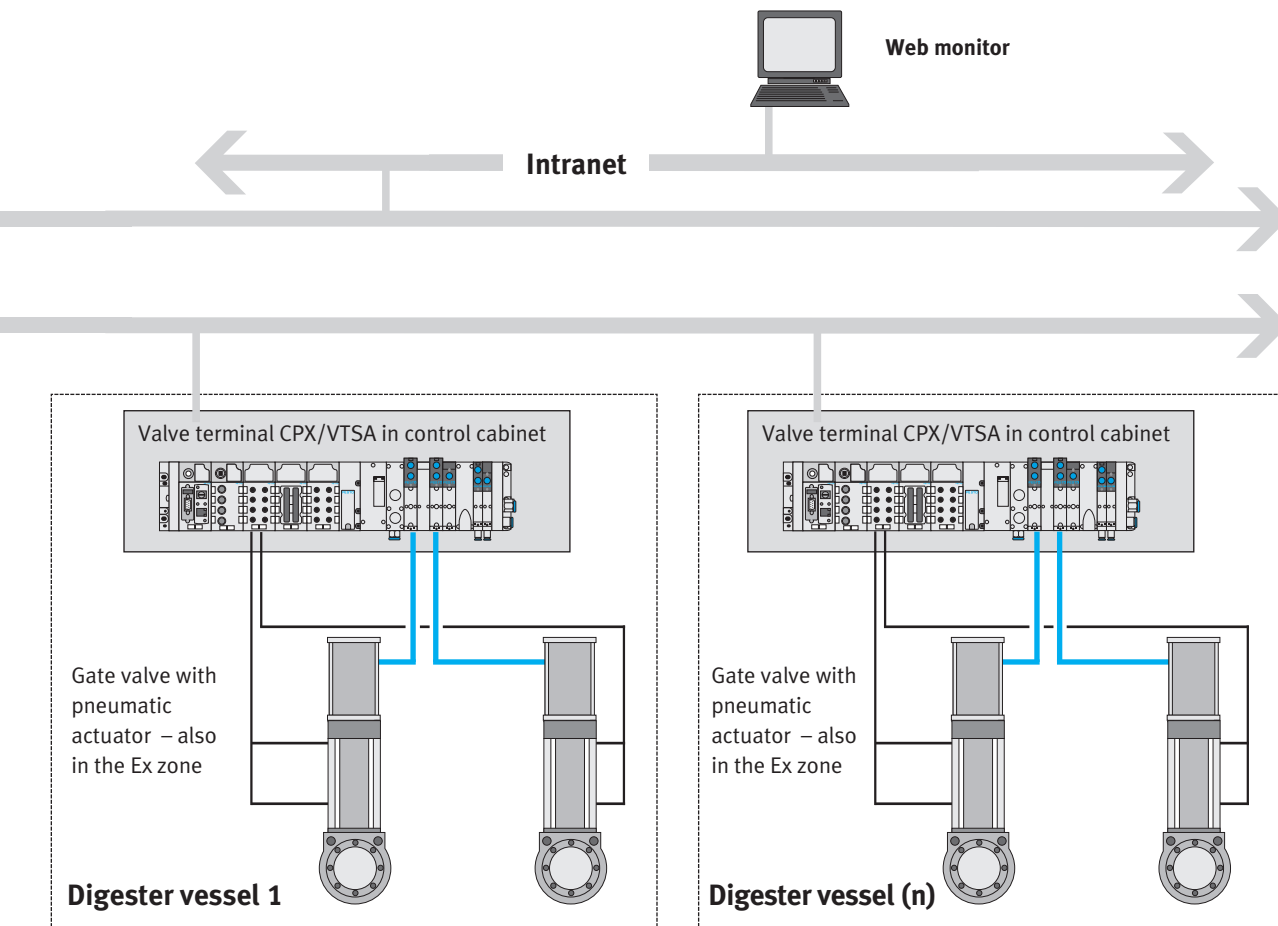
Example: Waterworks

Festo's automation concept – reliable and economical

As a general rule, automated processes are more stable to run, are more transparent and reproducible, can be documented and thus continuously ensure the desired result. Whether renovating, modernising, expanding and integrating in an existing plant, or new construction, reliable technology and economic efficiency are always bound to be at the fore-

front of decision making. Festo's automation concept takes both factors into account by reducing complexity and increasing operating reliability. This is supplemented by integrated diagnostics like Condition monitoring systems (CMS) which lead to more system availability and productivity.





Example: Treatment plant

One interface – from the command level to the field level

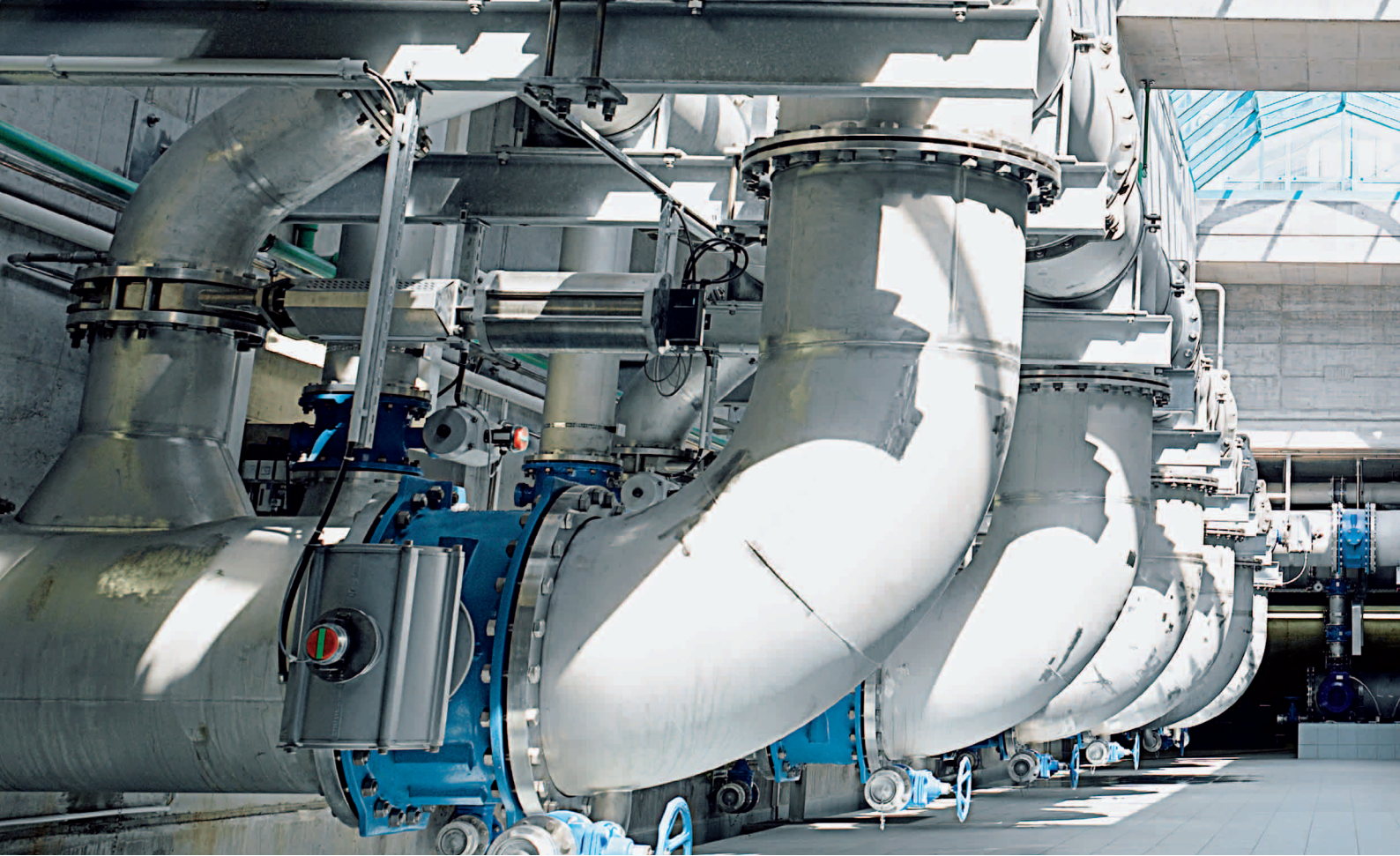
The valve terminal forms the central element of the decentralised system. In the vicinity of the process valves, it is ideal for quick and simple automation solutions in which valves, pneumatics and electronics coalesce. The valve terminals may be fitted in a modular structure, depending on the number of valves. This system solution has just one clearly

defined and standardised interface between the control system (PLC) and the valve terminal – the fieldbus. Further advantages of this universal solution – whether setting up a new automation system or integrating into an existing one – are the modular, easy-to-expand fieldbus design and the ease of connection to the bus for expansions, without making any modification to the installed hardware.

Markedly more efficient: systems with pneumatics

- Save more than 50% in your budgeting – with fieldbus, valve terminals and pneumatic actuators
- Faster startup and fault elimination
- Considerably simpler installation
- Fewer interfaces due to harmonised components and modules
- Competent and expert advice





Greater transparency and clarity in operation

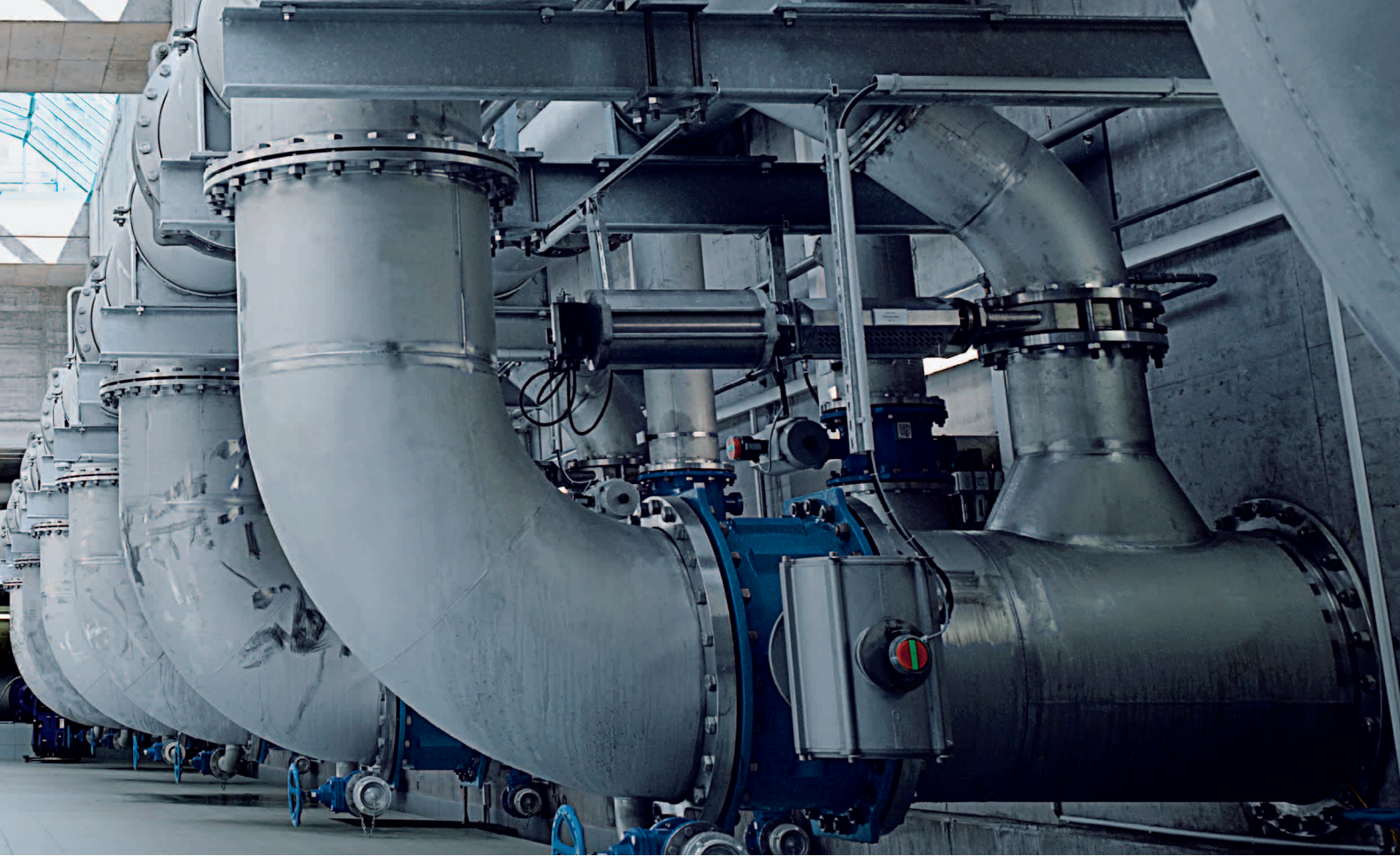
Reliability at startup and during operation

Valves and their actuators are usually distributed throughout the plant and are therefore hard to access. Once the plant is entirely connected with wiring and piping, each valve can be tested very simply at dry startup one by one from the control cabinet. The valves are operated with manual override and applied pilot pressure.

The positions of the valves are reported by the limit switch modules. The LEDs on the input modules of the valve terminals show the current valve position. The same procedure applies in the case of inspections.

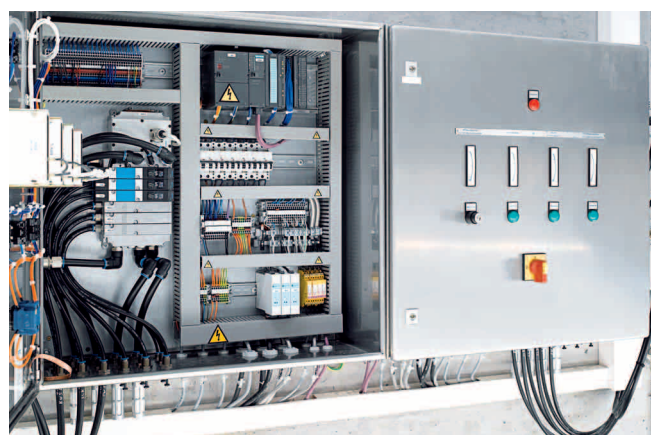
Furthermore, functional blocks or system components can be grouped together and these groupings applied to the configuration of the valve terminals. This helps to automate complex plants in a clear, modular, integrated system, where everything falls into place. The operator benefits from greater transparency.





The advantages at a glance

- Valve terminal in the control cabinet wired ready for connection
- Control cabinets structured in consultation with the operator and plant engineer
- Valve terminal takes on the role of local controller
- Dry startup to test functioning
- Automatic/manual modes, selectable for clear and definite operating status
- Manual operation also for inspections or elimination of malfunctions
- Signalling by LED for local transparency





Simple and maintenance-free: the actuators for process valves

Pneumatic actuators provide considerable advantages over electric actuators when it comes to automated processes, thanks to their simpler and more direct setup.

Very direct for greater reliability

The pneumatic actuator is directly flange-mounted to the valve, without any further gearing. The “Open/Close” function action also triggers the limit switches at the same time. The result: fewer moving parts and greater reliability in functioning.

The quarter-turn actuator principle

The actuator's shaft acts directly on the stem of the valve, moving it from 0° to 90°. The flow of escaping air can be restricted, allowing adjustable actuation speeds. The limit switch module indicates the valve position visually. At the same time, the integrated limit switches are triggered. Watchdog timing in the control system allows monitoring of the opening and closing operations.



**The linear actuator principle**

In linear actuators, the piston rod acts directly on the gate of the gate valve. In contrast to electric actuators, this action produces no wear, which is particularly important when the valve is used as a “dosing valve”, for example, and is therefore actuated frequently.

Overall, linear actuators are fast and durable: very short time intervals when controlling flow and more than one million strokes in continuous operation make them ideal for reliable and heavy-duty solutions.





Versatile in application: the actuators for process valves

First-class technology ensures versatile application options for Festo's quarter-turn and linear actuators:

- Configured as standard for explosive atmospheres up to Zone 1
- High corrosion protection for exposed outdoor use
- Optional: complete stainless steel versions
- Special version available for up to 20 meters head of fluid pressure, e.g. in drinking water fountains
- Temperature range -20 °C to +80 °C, as standard
- High-temperature versions to +120 °C
- Low-temperature versions to -40 °C

ISO and NAMUR standards

- Actuator flange mounting: EN ISO 5210/5211, DIN 3350
- Installation of limit switch modules and solenoid valves: NAMUR, VDI/VDE 3845





The advantages at a glance:

- Reduced size due to greater power density
- Reduced weight with smaller nominal diameters
- Simple setup and few attached parts
- High switching cycle rate, easy-to-adjust opening and closing times
- Overload proof and 100% duty cycle, superbly suited to variable-speed actuation
- Simple connection technology for fast installation
- Maximum of just 2 I/2 O from the point of view of the PLC
- Low current consumption, usually less than 2 A at 24 V DC
- Emergency functions in the event of voltage drop
- Actuation functions: open/close operation, stopping in intermediate positions, positionable across the entire stroke





Ultrafiltration plant in Roetgen waterworks

Germany's biggest ultrafiltration plant is operated by WAG Nordeifel in Roetgen. Following extensive testing, the company decided to construct a new UF plant as a prefiltering stage. The reservoir water is now treated in two stages.

The first stage separates out bacteria, viruses and micro-organisms. The filtered water

then passes through the second stage for deacidifying, hardening and reduction of manganese. A further UF membrane stage is used to treat the backwash water. There is regular backwashing with chemical-free filtrate or with caustic soda and sulphuric acid. The main membrane plant consists of 12 hydraulically optimised skids.

More than 25,000 cycles p.a. – thanks to pneumatics

The ultimate high performance plant, with up to 144,000 m³ of treated potable water per day, using a filter surface area of approximately 70,000 m²: only with pneumatics is this technically and economically feasible. One treatment cycle, consisting of filtering and backwashing, takes about 30 minutes. That makes more than 25,000 cycles per year.





Festo as a partner for operators, planners and plant engineers

- Very close collaboration with the plant operator and the planning company in the initial design phase
- Consultation and presentation of the automation solution
- Support in designing the layout of the compressed air network and in estimating consumption levels

- Definition of the plant standards for the pneumatic valve and actuation technology
- Calculating the actuation characteristics for valves

Pneumatic systems rise to the challenge in areas of:

- High switching frequency about 25,000 open/close actuations annually
- Short response times between 2–3 seconds to reduce back-wash times

The technical solution

- Valve terminals with Profibus DP communicating with the PCS7-400 from Siemens
- 27 valve terminals CPX/MPA1+2, double pilot valves, configuration with 5 to 24 solenoid valves
- 27 fully assembled and tested filter-regulator service units
- Accessories such as QS fittings, pressure switches, on-off valves





Pressure filter plant at Kleine Kinzig waterworks in the Black Forest

As well as being a source of drinking water, the Kinzig dam is also used for flood prevention, increasing low-water levels and renewable energy generation. Towards the end of 2004, a new treatment plant began operating as a preliminary purification stage. It is designed to maintain the high quality of the drinking water, even when the untreated water is heavily clouded.

The untreated water from the dam flows at a full input pressure of about 6 bar from the dam through the preliminary purification stage. A total of eight pressure filters are used. After the prefilter stage, it is conveyed through a generator to a discharge basin and from there into the second filter stage. The maximum daily throughput is around 67,000 m³.

Tried and proven: Pneumatics

The actuation systems were initially planned to be fully electrical, because of prior experience with this technology. After intensive investigation, including study of other plant operations, the decision was made in favour of pneumatics.





Decisive factors in favour of pneumatics

- Reliable technology due to the simple structure of all the pneumatic components
- Reductions in cost of capital assets and installation
- Robust and maintenance-free together with long service life
- Easy-to-operate pneumatic automation

- Expert advice during the planning phase, also with regard to automated processes
- Training of operating personnel after startup
- Close collaboration with the valve supplier VAG
- Long switching times for the actuators of up to 30 sec

What components and systems are used?

- Communication between PLC and valve terminal CPX/Typ03 via Profibus DP
- 2 valve terminals per control cabinet, tested and delivered ready for installation
- A total of 4 control cabinets for the 8 double-row filters

- More than 70 quarter-turn actuators for wafer-type and double-flanged butterfly valves, DN 100 to DN 250
- Filter-regulator service units with pressure switches
- Tubing and accessories





Waterworks in Briosco for CAP Gestione

CAP supplies 196 cities and districts in the Italian regions of Milan, Lodi and Pavia with drinking water. For a number of years now, CAP has been committed to Festo pneumatics as the standard for automation in their waterworks.

Another, new project in Briosco was now again realised using system solutions from Festo. Manganese is eliminated by oxidation with subsequent filtration in the waterworks.

Reliability matters

Good experiences from previous projects realised using pneumatics led once again to an economical solution. The valves in this plant are equipped with manual operation and spring-force closing pneumatic actuators. Limit switch modules are mounted on the actuators for position sensing.





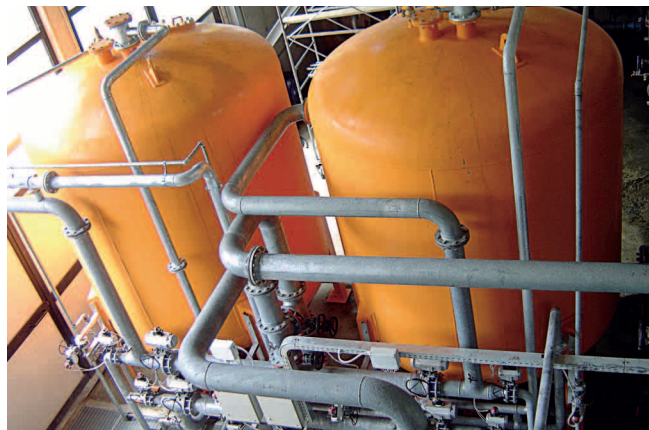
Decisive factors in favour of pneumatics

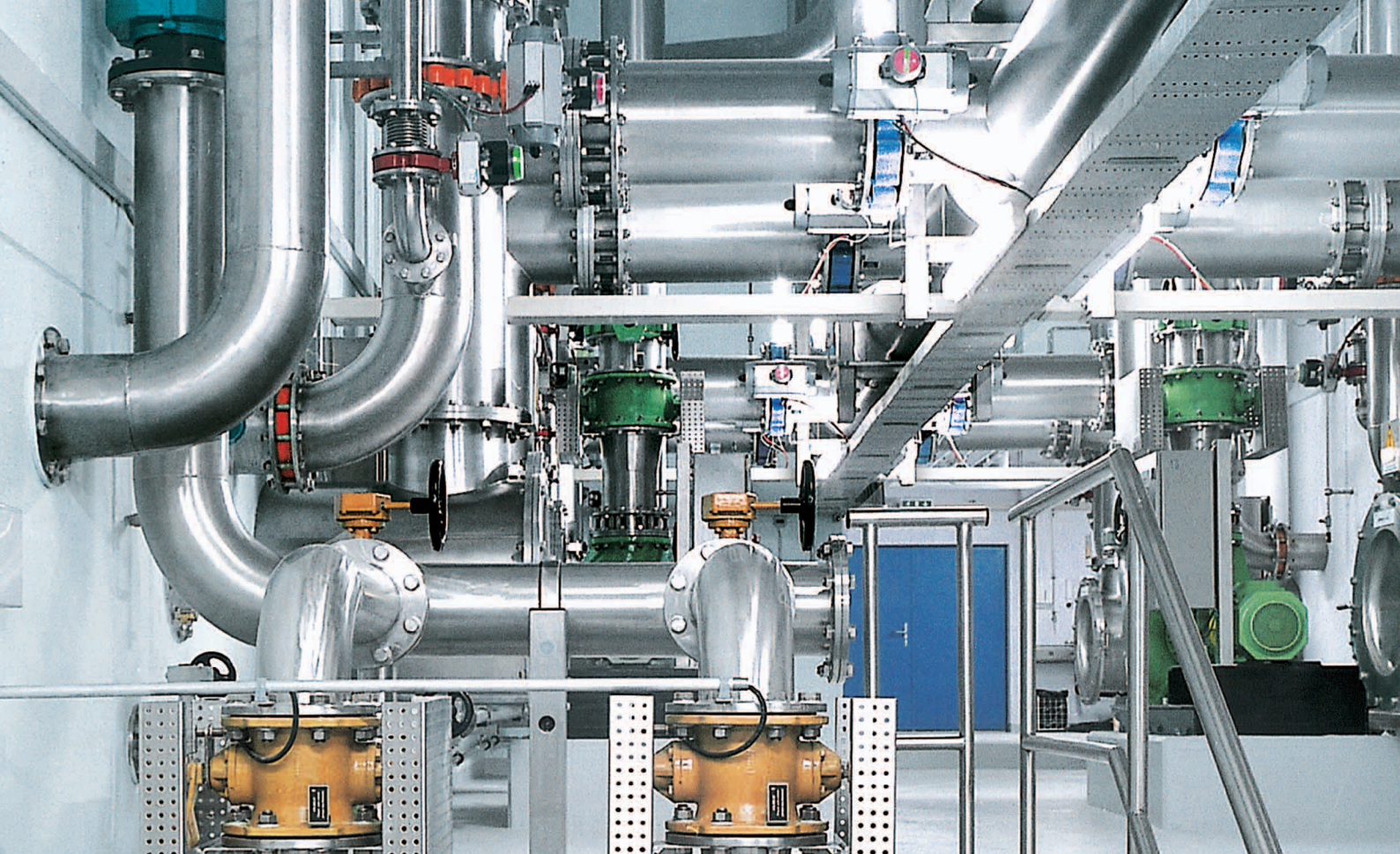
- Quick and simple project realisation, because everything was from a single source
- Reliable technology due to the simple structure of all the pneumatic components
- Reductions in cost of capital assets and installation
- Robust and maintenance-free together with long service life

- Easy-to-operate pneumatic automation
- Expert advice during the planning phase, also with regard to automated processes

Festo's services and systems

- Modular assembly of 14 valves with manual operation and single-acting actuators
- Design and installation of 2 control cabinets with separately structured valve terminals, each configured with 7 solenoid valves
- Supply of all pneumatic component accessories





Central wastewater treatment plant Grésillions, Paris

The SIAAP, an association integrating all the municipal authorities responsible for sewage disposal in the greater urban area of Paris, operates a central treatment plant in Grésillions near Paris. In the plant, up to 100,000 m³ of wastewater is purified daily, using a special filtering technology in the biological stage

of the plant rather than the conventional activated-sludge tanks. Initially, the influent is cleaned mechanically with the aid of screening fixtures and sand traps. This is followed by the biological purification phase, in which the pretreated sewage is conveyed through three different filters. In this phase, the special “Biolest” procedure comes into operation, during which denitrification takes place.

Fully functional: from mechanisms to data control

The main automation task for Festo was the automation of the twenty-eight biological filters. This also involved data collection and control for all filter tank data.





Economical, reliable and innovative: the solution

- Significantly faster implementation thanks to coordination and intensive consultation at the start of the project
- Close collaboration with plant engineers and the valve supplier Fontaine
- Installation of 28 decentralised electric CPX terminals and MPA valve terminals, each with six valves
- Fieldbus connection between the valve terminals and the central Allen Bradley control system, via DeviceNet.
- Integrated intelligent functions (FEC) for local valve control
- IP67 for an open installation without safety enclosures, making the solution simpler and cheaper
- Compressed air preparation units for all systems
- Specialised actuators, 28 x DLP-250-800-S2, to control the gate valves at influx
- Comparative measurements of air consumption to detect any leaks





Wiesbaden main wastewater treatment plant and Wiesbaden-Biebrich wastewater treatment plant

Since the end of 2006, Wiesbaden's wastewater has been treated in just two large plants: the main wastewater treatment plant and the Biebrich wastewater treatment plant.

The main wastewater treatment plant is one of the most modern in Europe. Between 45,000 and 75,000 m³ of sewage is purified there daily. Phosphorous and nitrogen is extracted in a special "three stage solution":

1. Biological phosphorus removal (BPR)
2. Denitrification stage
3. Nitrification stage with internal recirculation

The Biebrich wastewater treatment plant is situated in the middle of a residential and commercial area. The complete purification of about 19,000 m³ of sewage daily using fixed bed technology therefore takes place inside the building,

so that nuisance odours are virtually eliminated. At the end of 2006, construction began on the two new digesters, the thickener and the powerhouse.

Pneumatics preferred

Before starting work on the two treatment plants, the operator made a clear decision to use pneumatic actuation and automation technology – with the categorical choice of Festo as preferred supplier.





**A winning combination:
pneumatics and Festo**

- Long service life
- Maintenance-free thanks to lifetime lubrication
- Sturdy construction and high corrosion resistance
- Use in explosive atmospheres without additional costs
- High reliability of all components used due to Festo's industry standard

- Close co-operation with the valve suppliers for gate and butterfly valves
- Expert advice in the area of actuation and automation technology
- Long-term availability of products
- Same control cabinet structure for both wastewater treatment plants
- Components easily interchangeable
- Simple handling for manual operation

Festo pneumatics as standard

- More than 700 actuators for gate and butterfly valves
- Over 70 type O2 valve terminals built into the control cabinet
- Connection via fieldbus, Profibus DP
- Filter-regulator service units with pressure switch for monitoring of availability
- Push-in fittings and tubes





Central wastewater treatment plant Athens

Psytalia Wastewater Treatment Plant is the name of an ambitious project on the island of Psytalia in the Saronic Gulf, the bay in front of Athens and the port city of Piraeus. The wastewater is pumped through a 1.5 km long pipeline from the mainland to the wastewater treatment plant on rocky Psytalia island. The technical specifications take on gigantic proportions: the biological treatment stage comprises

12 activated-sludge beds with a volume of nearly 300,000 m³ and a flow rate of 1,000,000 m³ per day.

Gigantic dimensions: mastered with pneumatics

The flow of the sludge into the digester vessels is controlled by pneumatic linear actuators of the DLP type. These act directly on the gate of the valve, enabling variable opening and closing.

To control the flow of the biogas generated in the digester, quarter-turn actuators were used. The biogas generated by the fermentation process in the digesters is utilised to meet the energy requirements of the wastewater treatment plant. The actuators also regulate the distribution of hot water for the heat exchangers, which maintain a constant temperature of 36 °C in the digester vessels.





Founded on trust: decision in favour of Festo systems

- Established expertise and trust built up through long-standing collaboration with the responsible plant engineers
- Constant support through the planning and implementation phase
- Long service life of components

- Maintenance-free thanks to lifetime lubrication
- Sturdy construction and high corrosion resistance, even in outdoor areas
- Use in explosive atmospheres without additional costs
- High reliability of all components used due to Festo's industry standard

Festo pneumatics proves its worth – in the Aegean as well

- 50 actuators for gate valves in the area of sludge handling
- 40 quarter-turn actuators for butterfly valves in the area of biogas and digester heating
- Multiple type O3 valve terminals built into the control cabinet
- Connection via fieldbus
- Service units with pressure regulation and filtering





A good track record is the best recommendation

The examples described previously are just a few representative projects automated in recent years by Festo pneumatics. There are without a doubt many arguments which speak in favour of Festo's ingenious pneumatic solutions. A summary of the most important points:

- Constant advice and support throughout the phases of the project
- Winning pneumatics solutions based on reliable and innovative technology
- Explosion protection, corrosion resistance and over load protection all included
- High feasibility and high transparency from the field level to the command level
- High reliability in operation
- Overall more than 50% lower costs when compared with purely electrical automation solutions





That's why Festo pneumatics continues to prove its worth today, working hard in more than 100 waterworks and more than 200 wastewater treatment plants every day. The following is a small selection of locations across Europe:

Waterworks

Croatia	Butoniga
Germany	Berlin Bischofswerda Dresden Roetgen
Hungary	Tatabanya
Poland	Poznan

Wastewater treatment plants

Austria	Graz Telfs
Denmark	Korsoer

Germany	Augsburg Darmstadt Marburg Mönchengladbach München, Großlappen Neckarsulm Sindelfingen Stuttgart-Mühlhausen Wiesbaden
Hungary	Budapest Pecs
Poland	Bedzin Rypin Nieszawa





Products and services: benefits for our partners

Choosing the right partner from the start is a vital factor in the successful realisation of complex ventures. Festo provides timely guidance every single step of the way through projects for water treatment or sewage disposal. With fast and expert advice during planning, and afterwards as well:

- Consultation and project engineering
- Intensive collaboration and development of the automation strategy
- Compiling corresponding specifications for the project
- CACOS: tool for calculating the switching time of process valves
- AirCon: tool for calculating compressed air requirements
- Water/Wastewater planning manual

Close at hand and quick to respond

- Planning engineers in the region
- Replacement parts supply in the region
- 24-hour-replacement parts service





**Tailored and targeted:
support services**

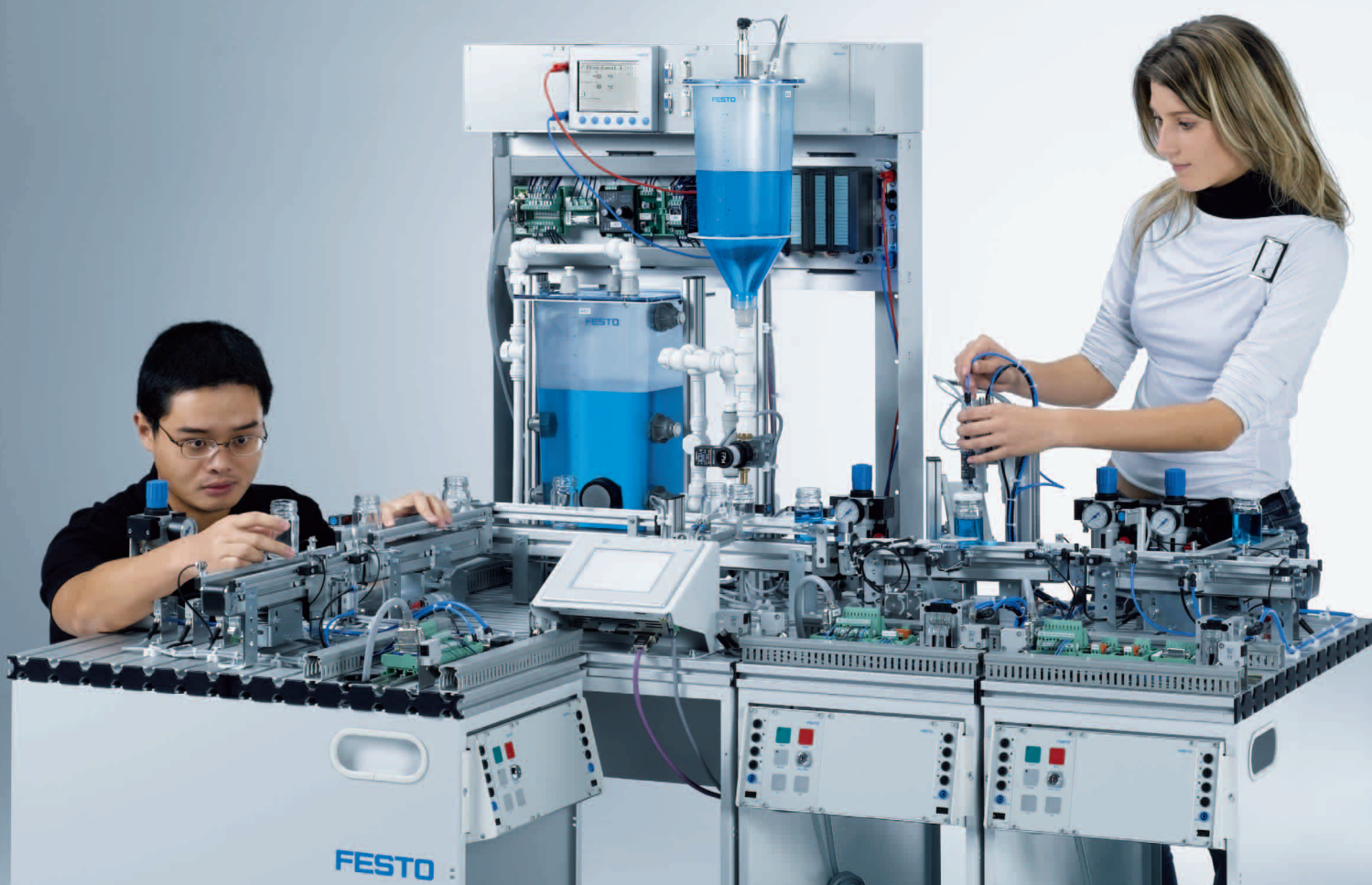
Concrete support across the entire value chain is guaranteed with our numerous support services. Profit from the excellent automation know-how of Festo's specialists. Overall, you increase your plant availability and reduce your procurement costs: it all means added value.

Exactly what you need to help you conclude the engineering phase faster, for example.

To give you reliability in ordering and supply. To simplify installation and startup.

Or to keep operations running securely and smoothly.





Festo Didactic

As for any industry, well-grounded training in water management systems requires modelling and learning facilities that reflect real-world conditions. “Learning by doing” and “process orientation” are two principles that are central to the successful achievement of these training aims. Modelling of a process engineering plant on a PC provides one opportunity, alternatively to hands-on-training on a scaled-

down training system. The process control system for developing the skills and knowledge required for process engineering is based on the same successful concept:

- Modular station structure
- With industrial components and standards
- With open interfaces for various automation devices
- Individually configurable and extendable

- Can be used at all qualification levels
- With attractive product ranges for project and team work

A glance through the contents of the teaching and training courses quickly reveals that this system provides an effective learning environment for technicians working in the areas of water supply, sanitation, sewerage systems and related industrial services.



Partner for water technology

FESTO



A complete range for efficient solutions

Designed on the basis of experience, to meet any requirements: Festo's product range for water and waste-water treatment.

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