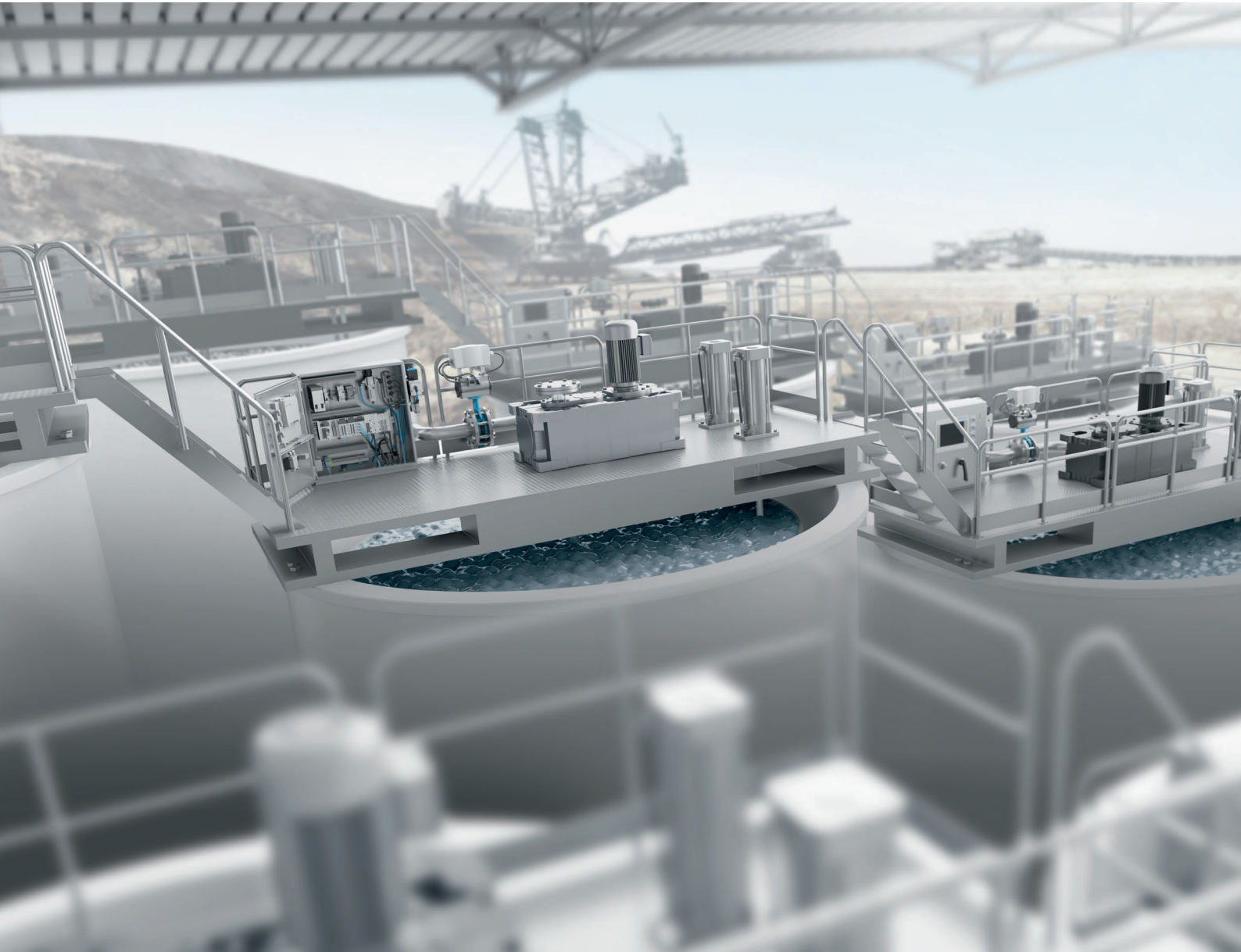


Automation solutions: mining and mineral processing

FESTO



By controlling froth levels in flotation cells, Festo boosts efficiency at a major mining company in South Africa



In order to boost productivity, the mining industry needs to continuously improve the systems for extracting and refining minerals. This requires cutting-edge modular solutions. The durable automation components from Festo have proven themselves in operation and are designed for the extreme requirements of the mining industry. Maximum plant availability and safety for people and the environment are also paramount.

One of the world's largest primary producers of platinum and other important raw materials from South Africa chose Festo to replace its obsolete actuators for dart valves with new ones. The dart valves need to be precisely and dynamically controlled to achieve optimum results and increase yield in the flotation process.

Festo supplied a turnkey complete solution that has been tried and tested in many countries around the world, consisting of linear actuators DFPI with positioners CMSX, a control cabinet for pneumatic control, including installation and commissioning. The mining company thus benefits from faster reaction times, increased productivity and higher yield thanks to the high precision with which the fill level can be controlled. Despite the corrosive environment and the vibrations, the flotation cells now have much fewer failures due to faults and need much less maintenance.

**You rely on high levels of productivity.
You need maximum system availability.
We are your automation partner in mining.**

**→ WE ARE THE ENGINEERS
OF PRODUCTIVITY.**

Your partner for each project phase

From initial planning to the modernisation of your plant, Festo always offers suitable services and software tools. Below are a number of examples that we have selected for you. You can find the full service and support offer at www.festo.com/support

Engineering – plan with us

When planning mining plants, planning and engineering offices work closely together on the details. Engineering tools and services from Festo simplify and speed up the selection of the components and help to ensure they are all correctly sized for your application – an important factor in reducing CO₂. If required, our engineers will work out the ideal automation concept with the planners. Festo speeds up and simplifies your engineering processes

- By providing industrial process know-how Festo supports you right from the concept phase
- For the detailed design, we work out the right solution together with you
- You get useful tools that significantly simplify your engineering, including configurators, CAD models, etc.

Assembly and commissioning – shorten lead times

- Start processing the minerals and get a return on investment (ROI) as early as possible. This is where the Festo Easy Assembly Service helps, from delivery of the individual components, the PreAssembly Service to the ready-to-install pneumatic components. The installation service with experienced engineers from Festo ensures smooth commissioning.
- Pre-assembled, tested and ready for installation – simply Festo plug and work!
- Diagnostic function for fast fault detection
- Commissioning of modular plant sections is possible before the control system is installed

After-sales services for consistently high plant availability

- Maintenance contracts
- Energy Saving Services
- Monitoring compressed air consumption for immediate detection of leakages and failures
- Monitoring and ensuring the compressed air quality
- Components that can be diagnosed for predictive maintenance and reduced downtimes
- On-site consultation service
- Spare part and repair service
- Training and education for maintenance and operating staff

Procurement – at the right time, in the right place

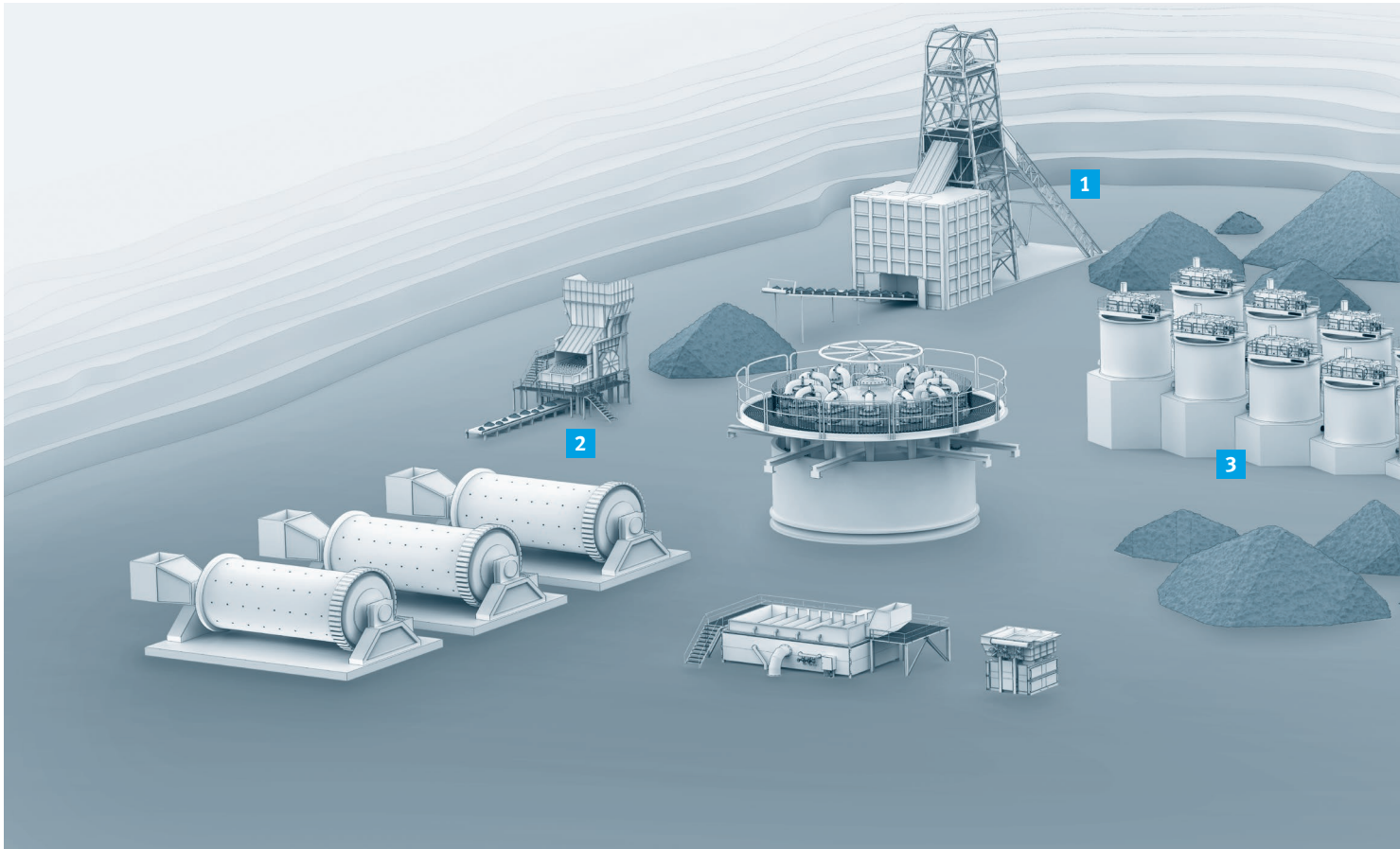
Centralised procurement – on-site delivery: fast delivery directly to the mines reduces costly downtimes and boosts productivity. Procurement and logistics services from Festo are perfectly tailored to this situation:

- 61 national companies with over 250 branch offices
- Festo Online Shop
- 24-hour delivery service
- Express service
- Customer-specific stocking
- On-site delivery on request
- Customer-specific packaging systems, contracts and part numbers



Rely on knowledge!

Together we make your processes more efficient and increase the productivity of your plants. You will find our automation solutions in all the different steps of the mining process. Follow us on a tour of the mining process.



1

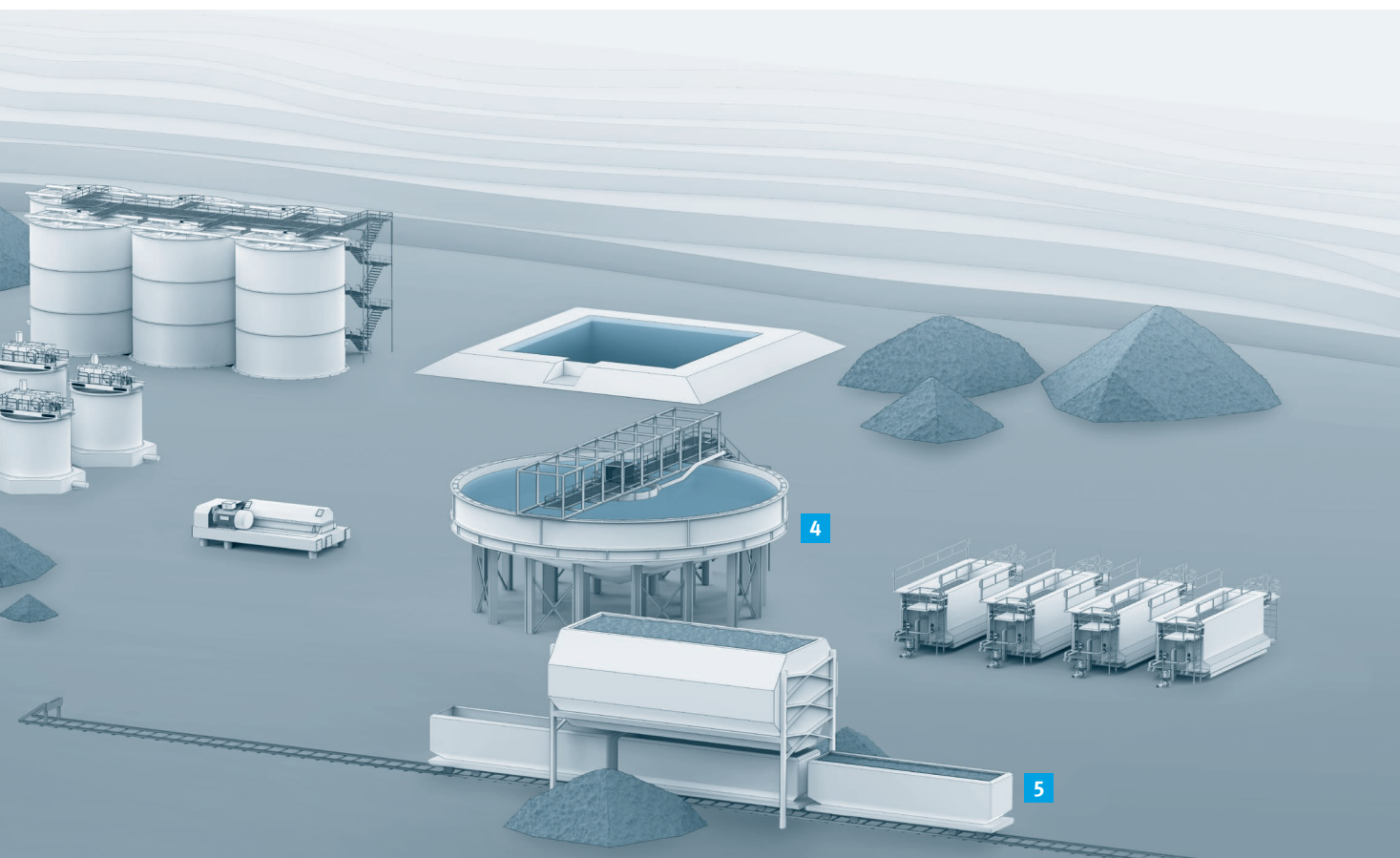
Mining

With deep mining or open-pit mining, the rock is drilled and blasted and then transported or conveyed to the surface.

2

Crushing

- Breaker
A breaker station crushes the rock, often to rock dust.
- Ball mills
The wet milling of minerals like copper ore crushes the material.
- Screening plant
Screening separates granulated ore material into different grades based on particle size.
- Jigger
The separating machine has a deep tank in which water is used to separate out the materials since they have a specific weight that is different to the gangue.
- Hydrocyclone
Cyclones are one of the most frequently used plant components for separating solid particles from the liquid flows.



3

Processing and extraction

- **Flotation**
Froth flotation selectively separates high-value, hydrophobic minerals from hydrophilic waste product. In its simplest form, the minerals are skimmed from the surface of a “slurry” of specific chemicals, water and air bubbles.
- **Leaching**
This is the process by which precious metals, copper and other compounds are extracted from ores. Because of the chemical reactions, certain materials are absorbed and then separated again from other earth materials.

4

Thickener and filtration

- **Thickener**
The froth concentrate from the flotation cells is pumped to the concentrate thickener. The gravitational force causes the particles to form a thick slurry, which contains most of the solids. The overflow consists of liquids and caustic solution.
- **Filtration**
Filter presses are used to dewater the concentrate and waste material. The minerals that are extracted from the sludge are processed further in follow-up processes and the water used is returned to the process.

5

Onward transport

The finished mineral concentrate is transported to primary production plants like smelting works or refineries. In fully integrated plants, the internal transport is handled by conveyors.

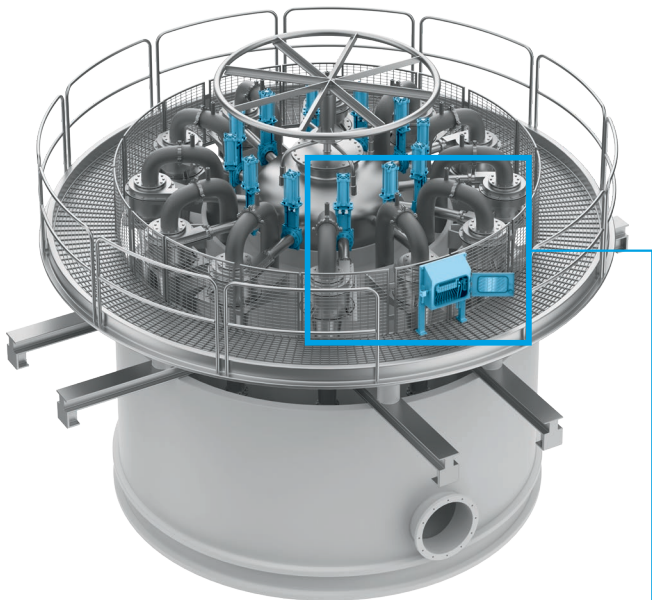
Higher availability, optimised yields – with a good partner

Efficiency at all levels

For automation solutions in the mining industry to be future-proof, they have to provide a reliable compressed air supply in the appropriate quality, ensure energy consumption can be controlled and reduced, and ensure optimum plant availability. These are all crucial in order to increase yields.

All this has to be done in the toughest ambient conditions, be that temperature, corrosion, dirt, dust, acids, altitude or UV radiation. Customer-specific automation solutions all the way up to comprehensive automation concepts are the key to meeting all these requirements.

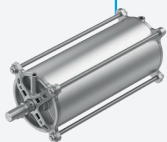
Hydrocyclone



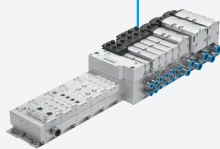
Valve terminals for higher plant availability

Valve terminals for controlling the automated knife gate valves provide a central point of access for your maintenance management at a site. Everything is easily accessible, which helps you to save a lot of time. Individual valve slices can even be exchanged during operation thanks to the hot-swap functionality. The automation platform CPX provides the basis for preventive maintenance and allows you to use common fieldbus protocols for control. A decentralised installation concept means the components can be placed in a protected location, in the control cabinet. This keeps them safe from vibration and mechanical influences – less downtime, increased productivity.

The complete package from Festo has everything you need, from the process valve and the actuator to the control components in the control cabinet.



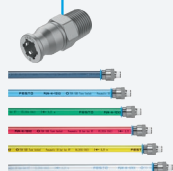
Linear actuator DFPC



Valve terminal CPX-VTSA

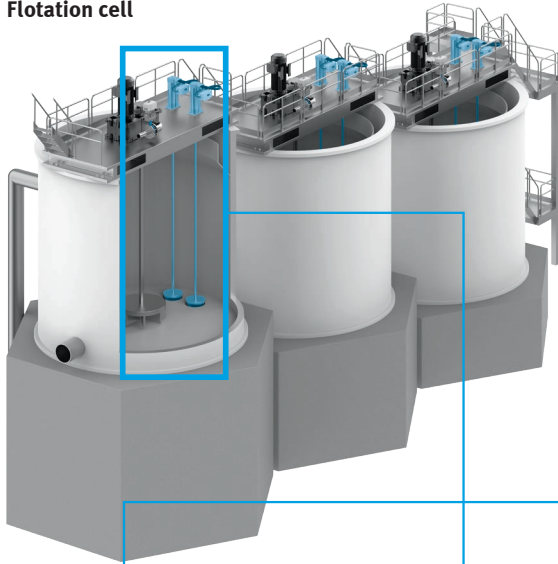


Service unit combination MS6



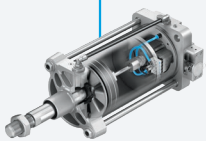
Connection technology

Flotation cell

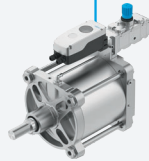


Higher yield – less effort

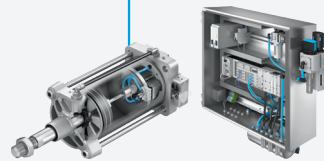
The more constant the froth level, the higher the yield. With closed-loop controlled linear actuators from Festo, you achieve a very high control accuracy and can thus optimally separate the fine-grained ores and high-quality sulphide from the gangue – all without external attachments like displacement encoders, connectors and converters. This solution is both insensitive to corrosive environments and to vibrations. This significantly reduces the need for calibration and maintenance. The relevant safety functions are already integrated too.



Closed-loop controlled linear actuator DFPI with integrated displacement encoder and positioner

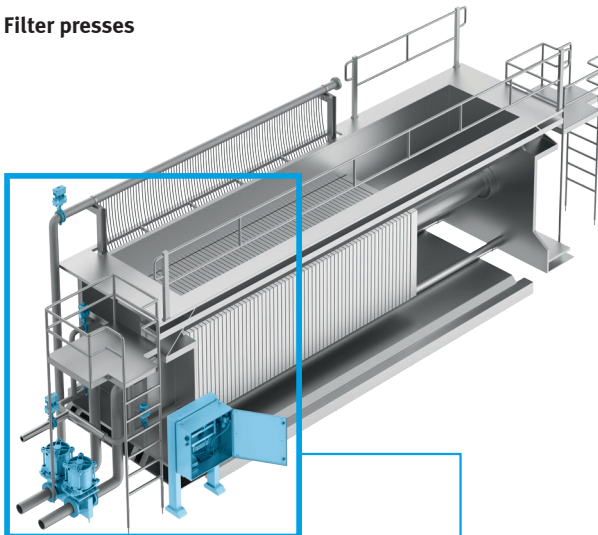


Closed-loop controlled actuator DFPI with integrated displacement encoder and externally attached positioner (VTOP and CMSH)



Closed-loop controlled linear actuator DFPI with modular automation platform CPX and positioning software

Filter presses



Maximum performance in dewatering

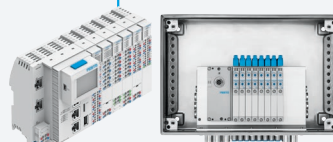
Use optimisation potential when operating your filter presses. Control your process valves from a control cabinet with remote I/O valve terminal combinations and reduce the costs for installation and commissioning, since the decentralised pilot valves no longer need to be individually wired. At the same time, the feedback from the process valves and the data from the process sensors provide valuable insights into optimisation options, directly on site or centrally via Ethernet. Predictive maintenance and fault localisation are now possible.



Butterfly valve unit KVZA



Automated pinch valves



Valve terminal VTUG and modular control system CPX-E

Components and solutions that suit your application

Controlling process valves and actuators



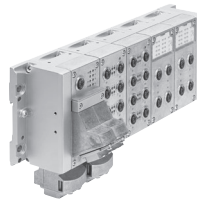
Modular electrical terminal CPX-E

Automation system to IP20 with high component density, as remote I/O with bus module or as a control system with a control unit.



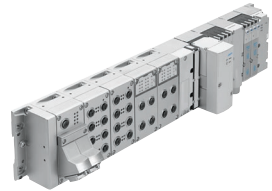
Decentralised remote I/O system CPX-AP-I

Up to 500 modules can be connected to common bus systems, including for existing valve terminals. IO-Link® devices can be integrated and parameterised. Cable lengths up to 50 m between stations, IP65/IP67.



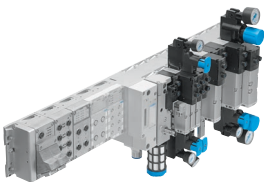
Modular electrical terminal CPX

Open to all common fieldbus standards and all electrical installation standards. Control of the complete pneumatic control chain via a fieldbus connection. PROFINET (incl. S2 redundancy), Ethernet IP, EtherCAT®, PROFIBUS. Degree of protection: up to IP 67. Plastic or metal interlinking blocks. The terminal can be separated into two rows. Can be combined with valve terminals VTSA and MPA to form a complete terminal.



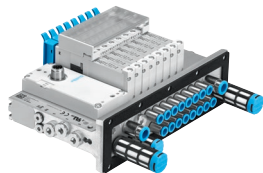
Valve terminal MPA

Fieldbus terminal, multipin terminal or individual valve – all metal valve body and sub-base. Wide range of functions (incl. proportional pressure regulator). Up to 128 solenoid coils. High flow rate of up to 700 l/min. Degree of protection: IP65. Flexible compressed air supply, variable pressure and voltage zones, additional supply at any location.



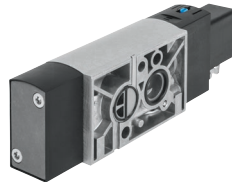
Valve terminal VTSA

When combined with the CPX terminal in metal design, this opens up new perspectives for tough areas of application and for maximum function and system integration. Up to 96 solenoid coils 5 valve sizes integrated on one valve terminal. Very high flow rate of up to 4000 l/min. Complete vertical stacking range. Valve replacement during operation (hot swap). Degree of protection: IP65/NEMA4. Flexible compressed air supply, variable pressure and voltage zones, additional supply at any location.



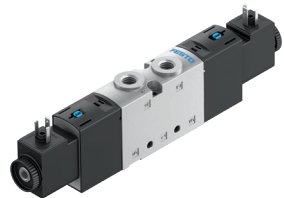
Valve terminal VTUG

Optimised for control cabinet installation (horizontal/vertical). IP67, in the control cabinet IP69K/NEMA 4X. How-swap function, connection for all common fieldbuses and IO-Link®.



Standard NAMUR valve VSNC

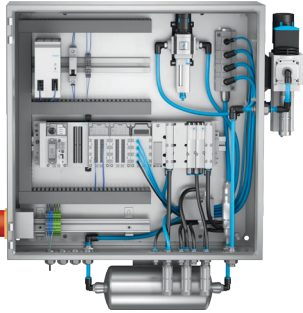
The seal can be turned for 3/2-way or 5/2-way function, 5/2-way double solenoid, and 5/3-way design. Wide range of Ex solenoid systems, CNOMO interface to ISO 15218, extended temperature range, piston slide and poppet valve principle.



Individual valve VUVS

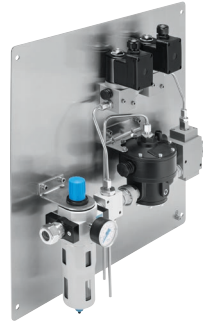
High flow rate and sturdy, can be extended to create valve manifold assemblies, easy to use, electric or pneumatic actuation.

Ready-to-install solutions



Industry-specific control cabinet solutions

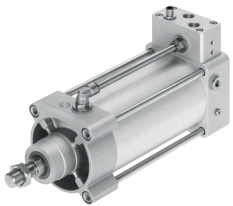
Completely pre-assembled and tested according to your requirements, design to IP65.



Pneumatic operating panels

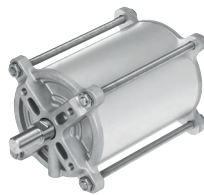
Fail-safe solutions for safe switching on and off and/or achieving a predefined plant state in the event of a fault. Combines pneumatics with electronics.

Automation of process valves



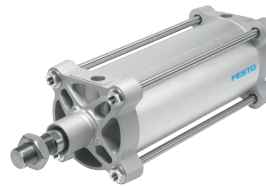
Closed-loop controlled linear actuator with integrated displacement encoder DFPI

Design to ISO 15552. An optimised piston rod guide provides compensation for lateral forces. The product is available either with an integrated displacement encoder or fully integrated positioner.



Linear actuator DFPC

Sturdy, optimised for process valves. Interfaces to ISO 5210 and ISO 15552 with protruding threaded rods: for many configurations and low-cost, predefined standard variants.



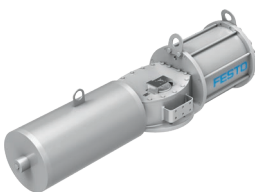
Linear actuator DSBG

Powerful, economical, durable, technically sophisticated. With P or PPV cushioning as standard and many optional features. Temperature resistance up to 150 °C as well as stud bolts for easier vertical or horizontal mounting are also available.



Quarter turn actuator DFPD

With rack and pinion principle for constant torque characteristics of up to 2300 Nm. Single-acting or double-acting, configurable spring forces and end-position adjustment at both ends. Optional epoxy coating. Connection pattern to NAMUR VDI/VDE 3845.



Heavy-duty quarter turn actuator DFPD-HD

Scotch-yoke actuator up to 32,000 Nm. Interfaces to NAMUR VDI/VDE 3845 and ISO 5211. Single-acting or double-acting, configurable spring forces, a choice between right or left direction of rotation, and mechanical or hydraulic actuation.

Positioners and sensors



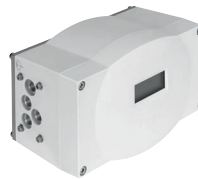
Limit switch attachments SRBC, SRBE, SRBG

Position indicator for quarter turn actuators with interface to NAMUR VDI/VDE 3845.



Smart positioner CMSH with HART communication

2-wire technology, high air flow, low internal air consumption, ambient temperature $-40...+80\text{ }^{\circ}\text{C}$. Fail safe or fail freeze. Integrated self-monitoring and diagnostics. Classic installation or with integrated air duct – perfect in combination with pneumatic extension modules VTOP.



Positioner CMSX

For swivel and linear actuators. Energy-efficient, highly reliable thanks to analogue and digital feedback signals and definable safety position.

Compressed air preparation and supply



Service units MS series

Increase the service life of your components and systems by using the correct air preparation, and thus reduce machine failure times and unscheduled down-times.



Filter regulator LFR- ... -EX4

For harsh ambient conditions. UV-resistant. Ambient temperature $-40\text{ }^{\circ}\text{C}$... $+80\text{ }^{\circ}\text{C}$.



Stainless steel filter regulator PCR-P

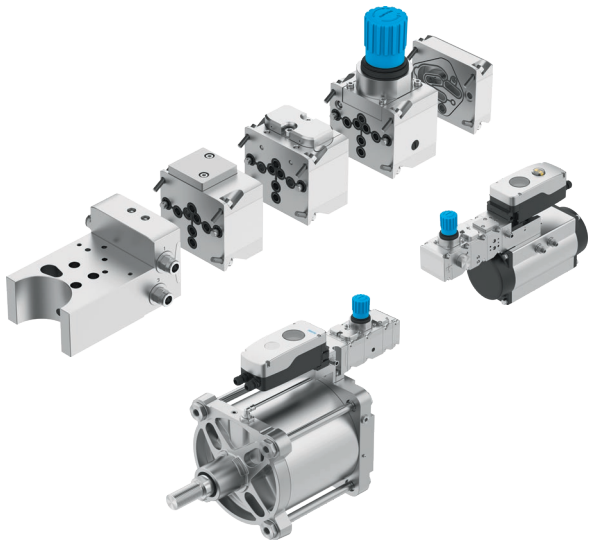
The sturdy filter regulator PCR-P with its high flow rates and reliable pressure control performs well even in very harsh environments, whether corrosive atmospheres or extreme temperatures from $-60\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$.



Connection technology and tubing

Always the right tubing/fitting combination, whether for standard requirements or for harsh ambient conditions.

Automated units



Pneumatic extension module VTOP...

in combination with automated actuator packages DFPI/DFPD and CMSH. Modular, innovative installation concept. Extends the functions of quarter turn and linear actuators without any external tubing/piping.

Patented integrated air duct for individual assembly of the modules – ideal as a complete solution with actuator packages. Available: pneumatic bridge with interface to VDE/VDI 3847-2 for CMSH, fail safe, booster, filter regulator.



Butterfly valve unit KVZA/ ball valve unit KVZB

Consisting of matching components, assembled ready to install and tailored to your requirements. Butterfly valves with hand lever, manually actuated or automatically actuated with optional end-position detection and pilot valve. Controlled via a positioner.

Pinch valve and linear actuator DFPI for heavy-duty applications

Heavy-duty pinch valve for abrasive or corrosive fluids, pastes, sludges, powders, or media with a high solids content. Full flow rate, bidirectional. Automated via double-acting linear actuators DFPI with integrated positioner for proportional closed-loop control or DSBG for opening/closing.

Quarter turn actuator unit KDFP-DFPD

Actuator units without process valve for automating existing process valves. Optionally with limit switch box, pilot valve and positioner. Quick and easy to put together in our online configurator.

Increasing productivity through digitalisation – with the right automation solutions

Choose our automation platform and take advantage of the numerous benefits it offers. The modular terminal CPX with directly connected valve terminal, as a remote I/O or with integrated CODESYS controller as an autonomous automation platform – and all to IP65/67.



Condition monitoring

- The integrated diagnostic functions allow you to always keep an eye on the most important process parameters as well as the actual states of connected components.



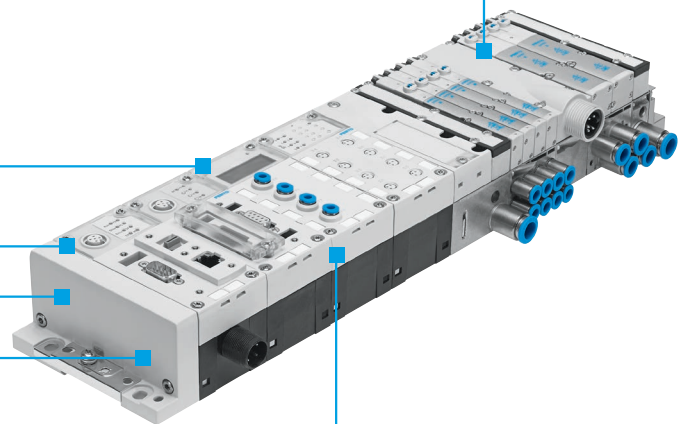
Control without an additional positioner

- Use CPX as a valve terminal partner, e.g. with CPX-MPA, and/or integrated PLC like the control block CPX-CEC. You can then also integrate the positioning of the connected process valve units – without a positioner.



Predictive/preventive Maintenance

- By receiving warnings early on of any changes in the process, you can take coordinated steps to carry out preventive maintenance tasks. This helps you to avoid unscheduled downtimes.



Cloud connection

- With CPX, you can process data in the cloud and evaluate it whenever you need to. The data obtained can be visualised on individual dashboards. The best thing about it? You do not need to be on site to retrieve the data; instead, you can do this via a web browser from anywhere in the world.



Automating modular plants

- The integrated controller helps you to effortlessly automate even modular plants. With CPX, each plant module gets its own decentralised intelligence and can thus act autonomously. The modules can be easily integrated into the higher-level system and can be enlarged or reduced if needed. All in all, you can modify your plant without much programming effort.



Easy programming with the PA Toolkit

Forget complex, time-intensive and above all error-prone programming processes. The CODESYS library greatly simplifies the programming of the automation logic, leaving you free to fully concentrate on your process sequences. The predefined function blocks and visualisation elements of the PA Toolkit enable you to program the CODESYS controller, even

without in-depth programming knowledge. With a few simple steps, you can record and parameterise different field components during programming and bring them together into a logical relationship. The programming is MTP-compliant (Module Type Package) for even easier integration of the controller into higher-level (control) systems.

More information can be found at
→ www.festo.com/pa-toolkit

Essential for stable processes – the right compressed air quality

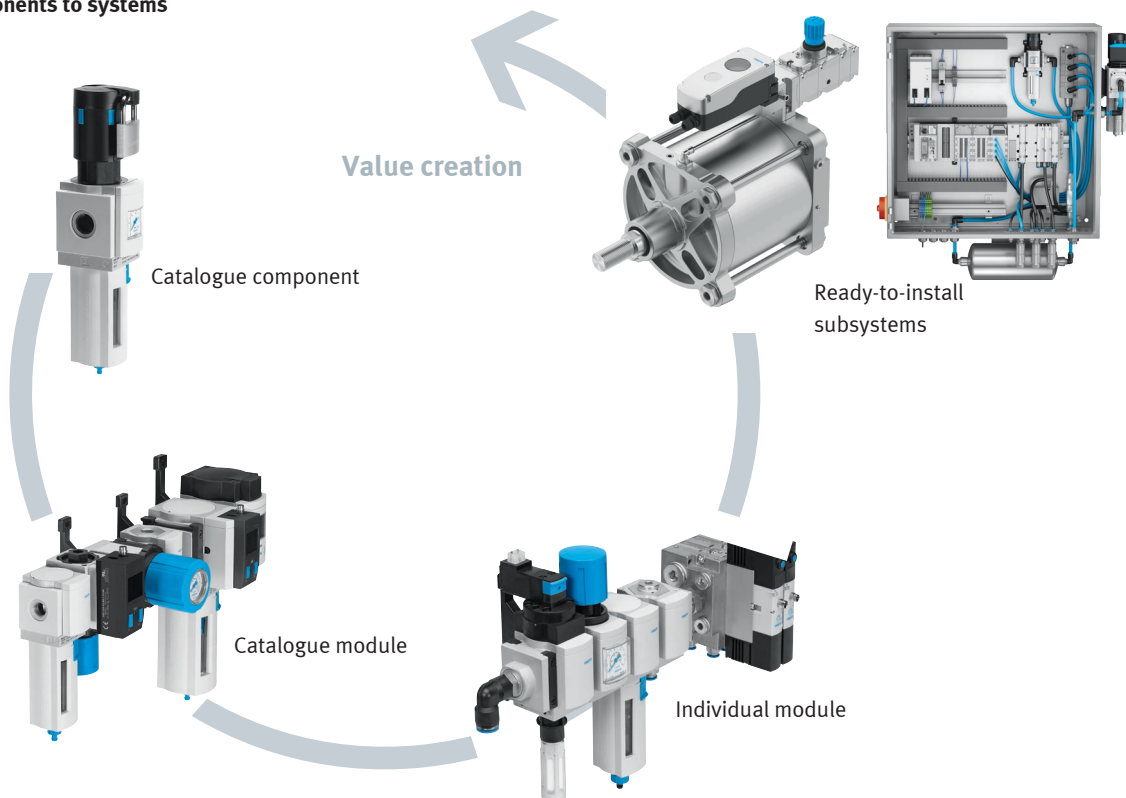
Integrated concepts for compressed air preparation

The importance of compressed air supply in mining plants and mines is often not recognised until poor design results in problems. Dirt particles in valves or positioners due to a lack of filters or rusty water in actuators as a result of inadequately dried compressed air can easily bring production to a halt and leads to high failure and replacement costs. The solution: you look after your core processes and let Festo help you with your compressed air supply.

Service right from the beginning

As a strong partner with wide-ranging expertise for everything related to decentralised compressed air supply, we make sure that all consumers in your plant are provided with the correct amount and the right quality of compressed air and with the optimal operating pressure. Festo Energy Saving Services offer a customised range of services for identifying and optimally exploiting potential compressed air savings – systematically and sustainably. Take advantage of our expertise, from individual devices to preconfigured modules – with innovative features like the energy efficiency module.

From components to systems



Extreme ambient conditions? Then we have something for you!



Stainless steel filter regulator PCR-P

Whether corrosive atmosphere or extreme temperatures from -60°C to $+80^{\circ}\text{C}$, the extremely robust filter regulator PCR-P performs well in even the harshest of environments with high flow rates and reliable pressure control.



Individually tailored to your needs: ready-to-install modules

As an example, filter regulator modules with modified, manually lockable 3-way ball valve for shutting off the supply air and for exhausting the downstream consumers.

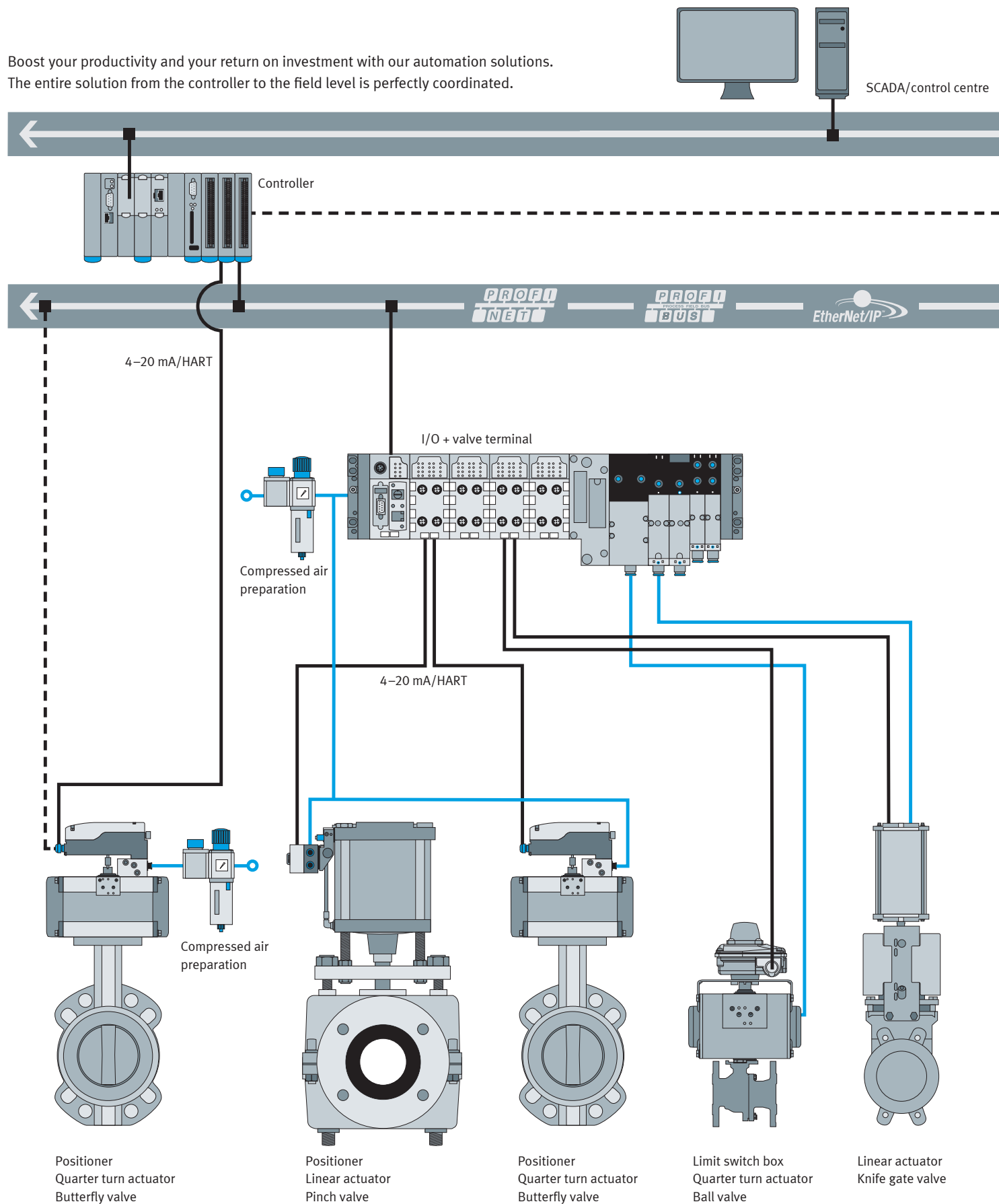
Fittings and tubing

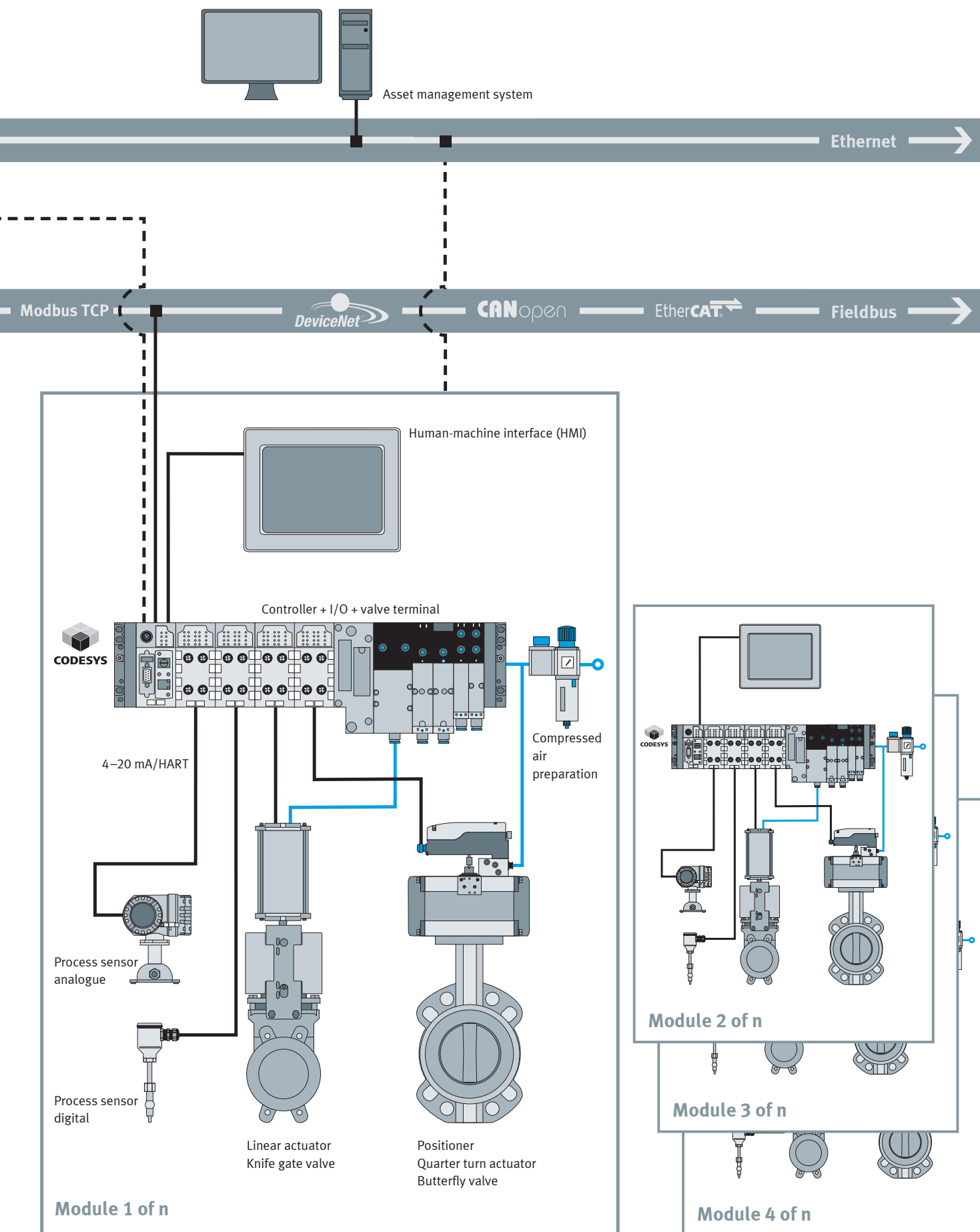
In order to make sure that compressed air gets to the consumers in the field, Festo offers you suitable components such as push-in fittings in polymer, nickel-plated brass or stainless steel for outdoor use. They are perfect in combination with standard O.D. tubing in a wide selection of materials that are resistant to chemicals, temperature, UV or all of the above in one tube.

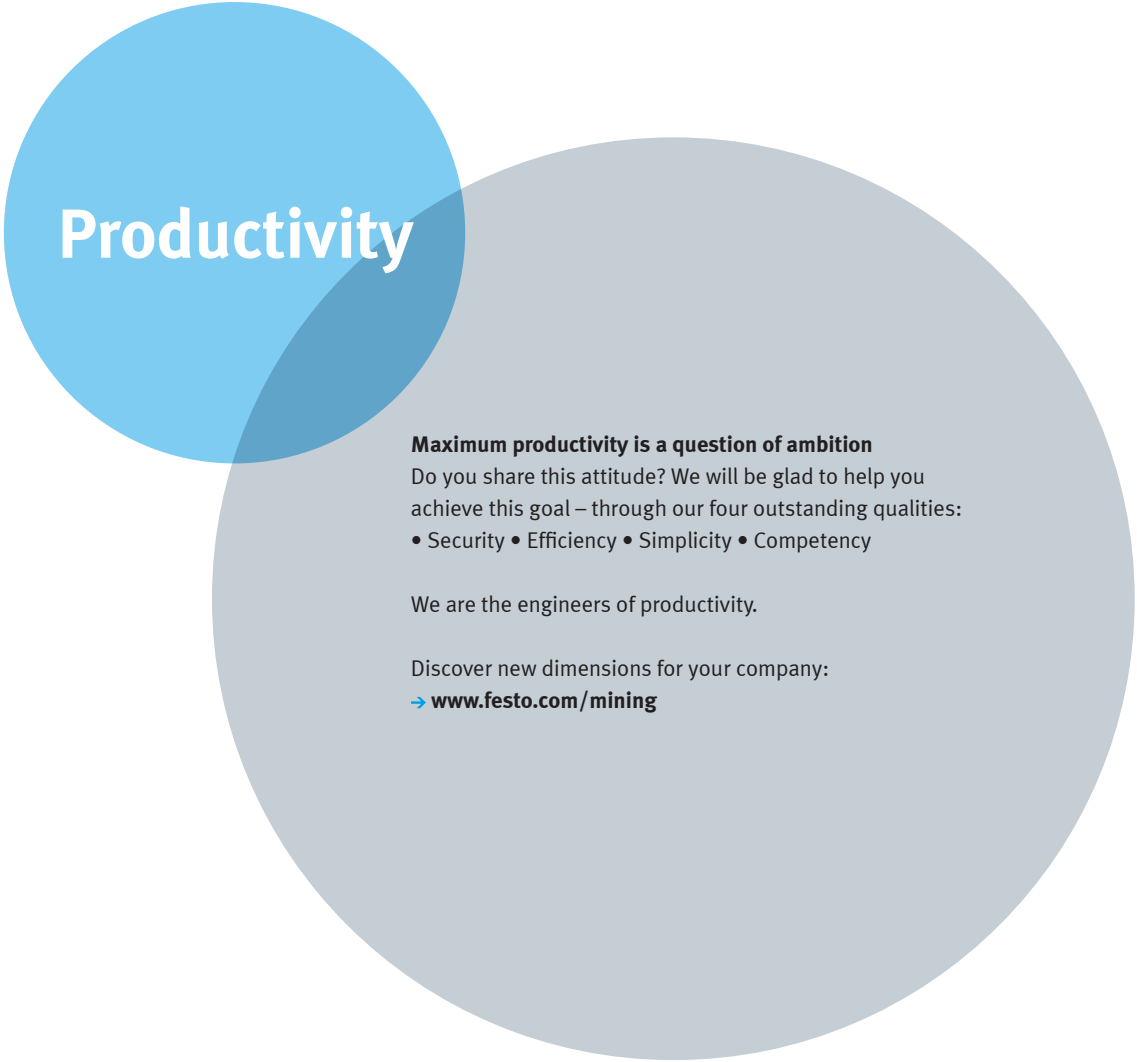


Your competitive edge: automation solutions from a single source

Boost your productivity and your return on investment with our automation solutions.
The entire solution from the controller to the field level is perfectly coordinated.







Productivity

Maximum productivity is a question of ambition

Do you share this attitude? We will be glad to help you achieve this goal – through our four outstanding qualities:

• Security • Efficiency • Simplicity • Competency

We are the engineers of productivity.

Discover new dimensions for your company:

→ www.festo.com/mining