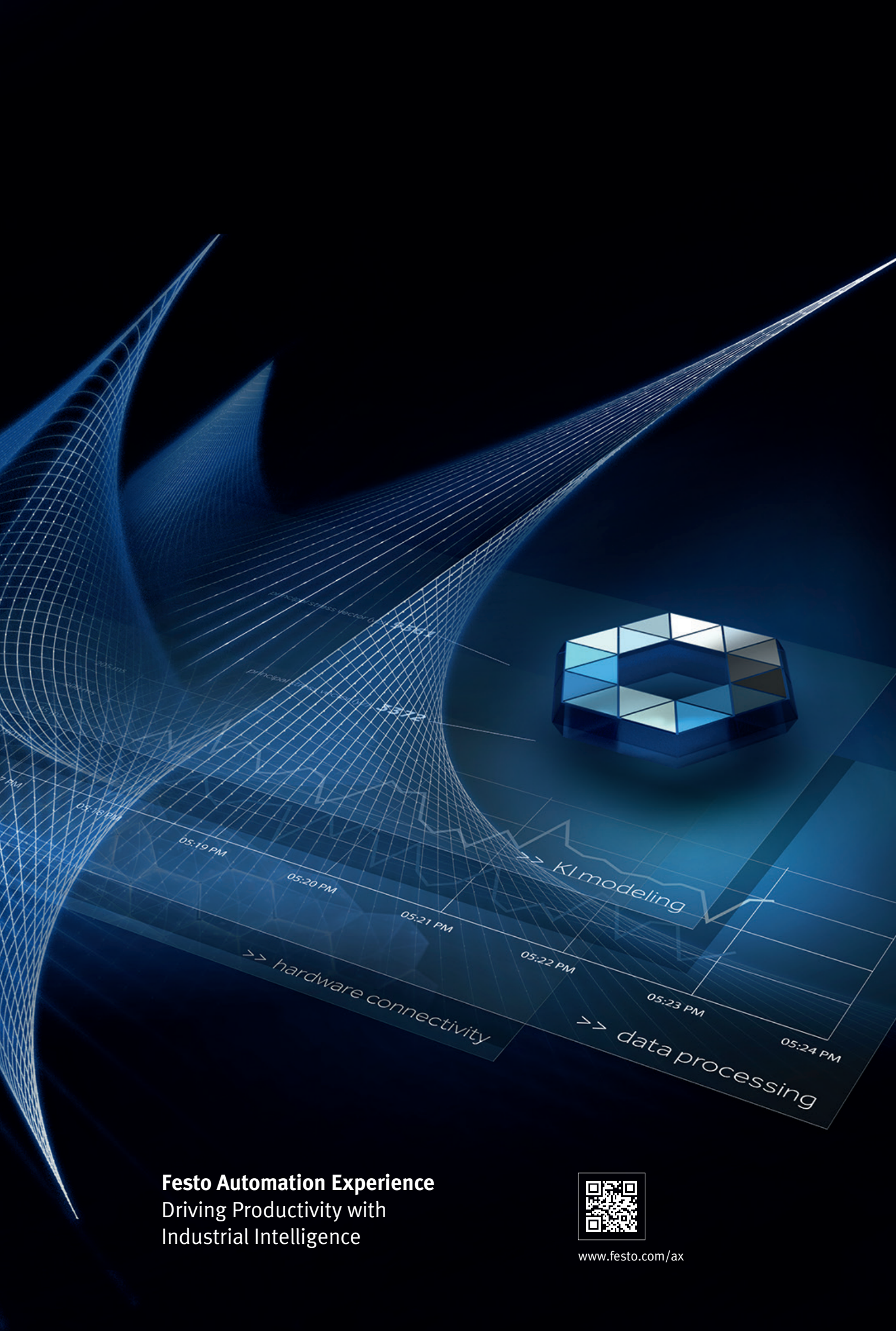
FESTO

Highlights

2023/24



Festo Automation Experience
Driving Productivity with
Industrial Intelligence

www.festo.com/ax

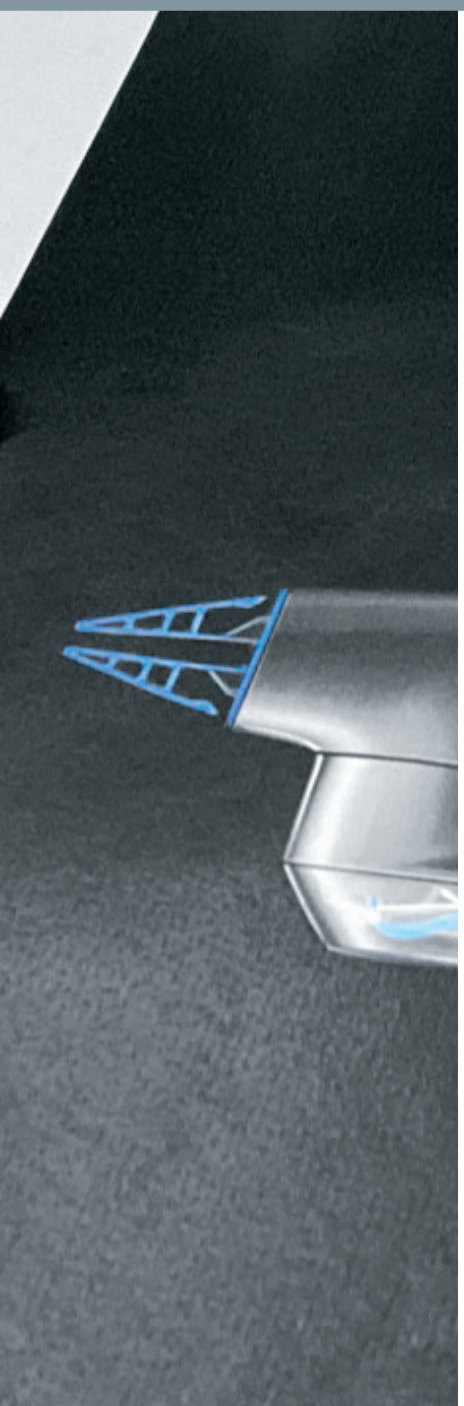
Contents

01 Future forward robotics

The world’s first pneumatic cobot

Hardly any industrial market segment will grow as rapidly over the next few years as robotics, particularly human-robot collaboration.

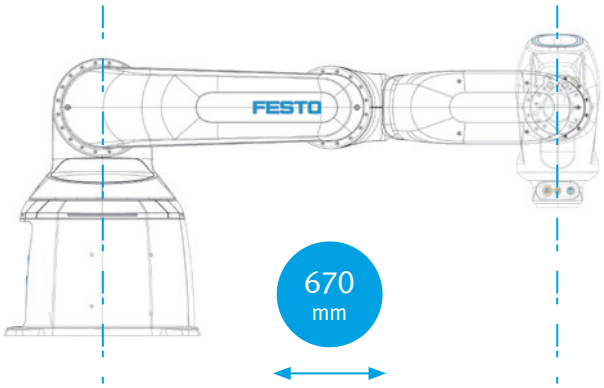
Cobots relieve employees of strenuous or monotonous tasks. Since pneumatics offers many advantages, it only makes sense that Festo is conducting research into pneumatic cobots.



Work in production is becoming more and more stressful for people. Small batch sizes have to be produced efficiently and economically. Productivity gains demand fast retooling in the production process. In order to adequately supply the growing world population, more goods have to be produced. Production runs day and night. Other challenges are the shortage and training of skilled workers. Cobots can be a valuable support for improving how we respond to these challenges.

The world’s first pneumatic cobot

The Festo Cobot is the result of many years of research and development, and the expertise that this has enabled Festo to build up in the area of Controlled Pneumatics. It owes its advantages, such as its sensitivity, weight and value for money, to the benefits of pneumatics. The direct drives in the articulated joints are very cost-effective and amazingly lightweight; unlike electric solutions, no heavy gear units or expensive force-torque sensors are required. This technological advance in robotics offers unique advantages for industrial automation.



Simply for everyone

Festo has set itself the goal of making robotics accessible to everyone. With its simple hand-guided teaching function and safe behaviour in the event of collisions, the Festo Cobot can also be used in production environments where no specific robotics expertise is available. The Festo Cobot thus becomes a real alternative, even for companies for which previous robotics solutions were too expensive or too complex to operate.

Find out more about **research into robotics** at Festo.

“No other technology has such a sensitive and flexible approach to human-robot collaboration as pneumatics.”

Christian Tarragona, Vice President Robotics, Festo

Creative minds from different fields and disciplines – engineers, designers, safety specialists, scientists, information scientists – are rising to the challenge of developing a cobot that is collaborative, sensitive, safe and intuitive.

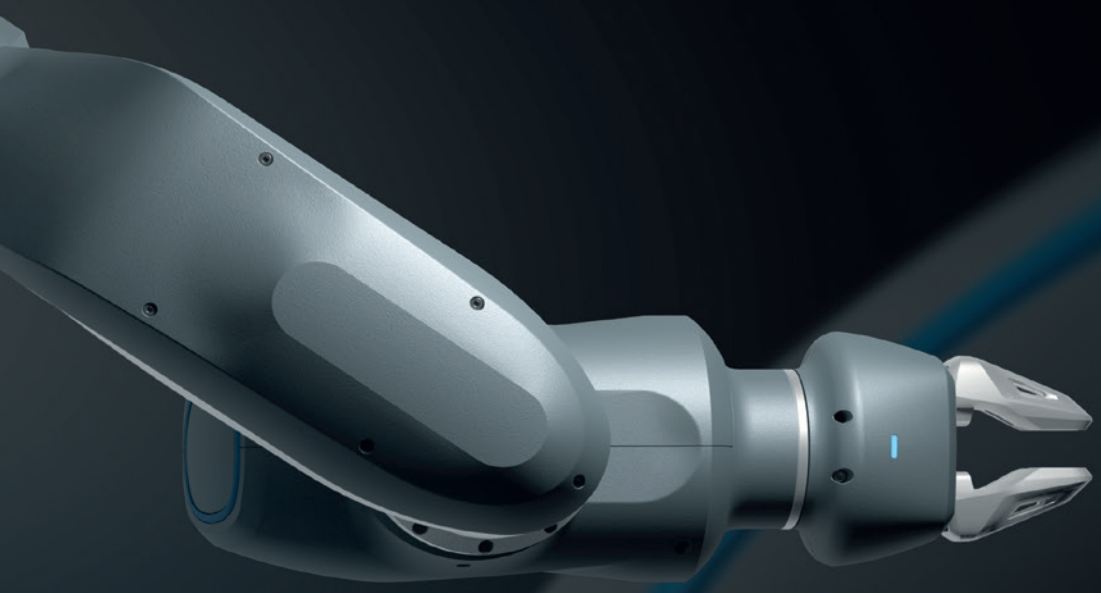
Click here to find out more:

> www.festo.com/cobot

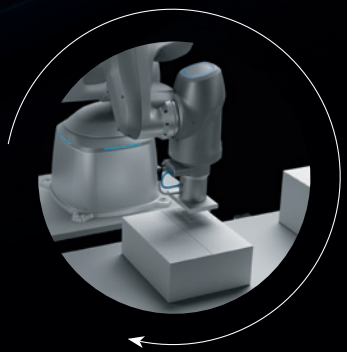
Festo Cobot

Developed for many different tasks and quick changes of location

The pneumatic cobot is suitable for numerous standard applications in which manual operations are carried out by a worker. The Festo Cobot can be used very flexibly, whether for loading and unloading machines or testers, for complex spraying or blowing-off processes or for applying shipping labels. At the same time, its low weight and ease of use mean it can be quickly ready for operation at another location.



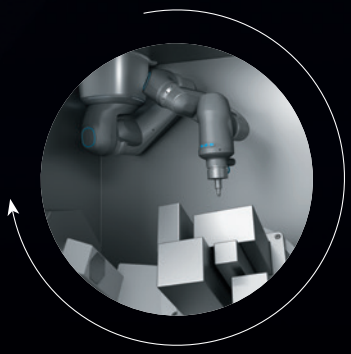
Labelling: applying labels to packages
The flexibility of pneumatic systems makes labelling processes such as applying labels to soft materials easier. When the labels are pressed on and applied gently, they don't cause any damage and don't leave any pressure marks or creases in the packaging.



Machine tending: loading and unloading CNC machines
When loading and unloading or when equipping machines such as cutting or milling machines, the Festo Cobot can act independently. This makes it particularly interesting for use inside a machine. Its reach of 670 mm can be extended in different directions by connecting electric linear drives from Festo.

Testing: checking circuit boards
The Festo Cobot loads and unloads the test equipment during the production of circuit boards, a task which is often still done manually. Once a workstation has been prepared, it is possible to switch between manual loading and robot loading, making temporary use of robots economical.

Federal Chancellor Scholz meets the Festo Cobot
The world premiere of the Festo Cobot at the Hannover Messe 2022 attracted great interest. Even Federal Chancellor Scholz got up close with it. He was able to witness the almost “human-colleague” like collaboration with the world’s first pneumatic Cobot at first hand, as it initiated a safe and at the same time uniquely soft stop within milliseconds on colliding with a person. And in the event it does collide with a person, the contact is extremely gentle thanks to the low system weight with ultraligh direct drives, the use of air as the operating medium in the articulated joints and the decoupled robot segments.



Depowdering: blowing residues off 3D-printed workpieces
Blowing off residual material often involves complex motion sequences. The simple hand-guided teaching function of the Festo Cobot eliminates the need for individual and laborious programming of the many waypoints. They are taught in once using a manual process, and then repeated later by the robot. The uncomplicated teach-in method make even processing small batch sizes cost-effective.

Do you want to find out more about the Festo Cobot? Subscribe to our **Cobot Newsletter!** This is the best way to receive exclusive insights and stay up to date at all times.

02 Sustainable automation

Reducing CO_2 emissions to combat climate change

The world's largest photovoltaic system at the Festo plant in Jinan, China. With an expected electricity output of 4,500,000 kilowatt hours, 4,200 tons of CO_2 could be saved.

Combating climate change begins within our own four walls. That is why Festo pursues a sustainability strategy that is aligned with the development goals (SDGs) of the United Nations. From 2023, all Festo buildings in Germany and the global production and logistics locations will be CO_2 neutral with regard to Scope 1 and 2. From 2026, the entire Festo Group will be CO_2 neutral. And even after that, Festo will continue to work on energy-saving measures to reduce non-avoidable offsetting.

With the decision to be CO_2 neutral, Festo is taking responsibility as a family-owned company. In addition to Scope 1 and 2 emissions, Scope 3 emissions also play an important role. This takes into account emissions from purchasing and logistics, product design and the use of the products by our customers.

The Festo Sustainability Report provides yearly information on sustainable corporate development. Read the latest edition.

"Sustainability is an integral part of the corporate strategy at Festo. We have a clear focus on combatting climate change, since sustainable management is the foundation for competitiveness and long-term growth."

Christian Österle,
Vice President Sustainability, Festo

Here you will find the full **video statement** from Christian Österle and other Festo employees.

The blue path to higher efficiency

Your way to zero emissions

It is the design of a machine or system that lays the foundation for the smallest possible CO_2 footprint. Festo supports the selection of the right components in the right size by offering free **engineering tools.**

It is also part of the Festo strategy to make product-specific assessments available that evaluate the CO_2 emissions produced by the products. The consistent further development of **products** with innovative solutions is seen by Festo as the key to a CO_2-neutral future.

In the use phase of the products it is all about keeping energy consumption at an optimum level in the long term and identifying deviations in good time. The **Festo Energy Saving Services** as well as the digital solutions for energy monitoring help the manufacturing industry to do this.

Festo Didactic, a leading global specialist in **technical training,** provides the experts of today and tomorrow with the knowledge and skills they need to identify potential savings in their work and implement them systematically.

Energy efficiency module

MSE6-C2M

The **energy efficiency module C2M** can save up to 60% in energy consumption and CO_2 emissions. A new feature is advanced fieldbus technologies for smooth integration into the system environment and software libraries for simplified parameterisation.

The measured values provided by the C2M, such as pressure and flow rate, can be used in combination with **Festo AX** for predictive energy management. The benefit: up to 70% fewer leakages thanks to automatic leak detection.

By using “Specific catalogues > Sustainability” in the **Festo Online Shop,** you can find more products to help reduce energy consumption and CO_2 emissions.

The compact cylinder ADN-S, for example, is half the weight of the ISO standard cylinder and already reduces CO_2 emissions during production.

Compact cylinder
ADN-S

You can find more information at:

- **> www.festo.com/sustainableautomation**
- > www.festo.com/ax
- > www.festo.com/mse6-c2m
- > www.festo.com/adn-s

Sustainable automation

Saving energy with Energy Saving Services

Catheter production at Wellspect: by 2025, the company plans to reduce the energy consumption for each catheter manufactured by 12% compared to 2020. (photos: Wellspect)

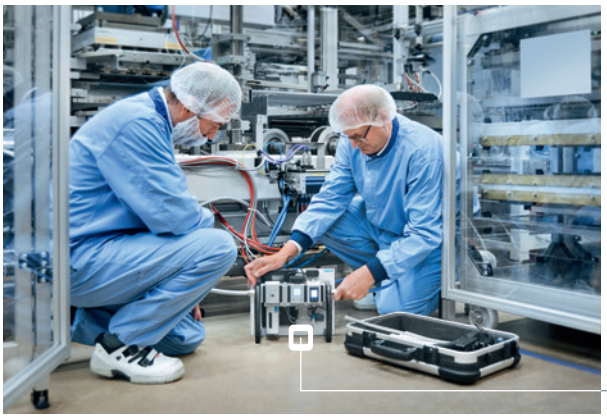
The Swedish company Wellspect, a leading global manufacturer of solutions for medical continence care, has integrated sustainability in its corporate strategy and is committed to implementing it. The company's production facilities are already powered exclusively by electricity from renewable energy sources. Carrying out the Festo compressed air energy efficiency audit GFAA is part of Wellspect's sustainability strategy.

Energy savings that pay off

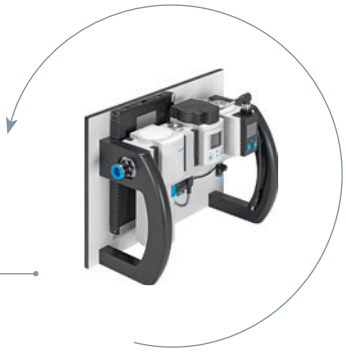
Using compressed air more efficiently and reducing CO_2 emissions in production are becoming increasingly important. It is often not clear where the weak points in a compressed air system are. In the Wellspect plant on the outskirts of Gothenburg, that is no longer the case. Here, the energy efficiency expert from Festo Sweden used the compressed air energy efficiency audit to uncover those weak points and show Wellspect which measures would be most likely to pay off in the compressed air system. And successfully so, as Wellspect was able to reduce its annual energy bill by €37,000. These energy savings correspond to 24 tons fewer CO_2 emissions per year. A pleasant side effect of the lower energy consumption is that machine availability on one of the catheter packaging lines has increased by 10% thanks to reduced component wear.

Compressed air energy efficiency audit GFAA

The compressed air energy efficiency audit consists of five steps. In the first three steps, the energy efficiency expert analysed the compressed air generation, preparation and distribution of the entire system. He then turned his attention to the pneumatic applications, i.e. the machines and systems themselves.



Part of the sustainability strategy: Bo Lilja (right), energy efficiency expert from Festo Sweden, conducts the energy efficiency audit in the presence of Erik Blomholt, Maintenance Manager at Wellspect.



Efficient measurement and analysis: the air-flow analyser SGFA.

"The goal is to optimise energy use in all our production plants. That is why we intend to gradually expand the energy efficiency audits to all plants." Eric Blomholt, Maintenance Manager, Wellspect

He analysed the energy efficiency of these machines and systems, from the optimum sizing of the drives, valves and tubing, to the efficient design of the blowing and vacuum applications, to ways of optimising the control concepts. In the final step, the specialist developed a concept for a compressed air monitoring system that could be used to continuously monitor the energy status.

Comprehensive analysis

At the end of the analysis, Wellspect received a detailed report that precisely documented the data and provided recommended actions in order of priority. The documentation shows, among other things, energy consumption and costs, energy reserves and CO_2 emission values, which Wellspect needs to include in its own sustainability report in accordance with GRI (Global Reporting Initiative) or GHG (Greenhouse Gas). The measures themselves were made available to the Wellspect maintenance team online on the Festo Energy Saving Services Portal. This allowed them to monitor the elimination of defects such as leakages at all times and in a simple and structured way.

But Wellspect is planning to do even more. Its goal is to optimise energy use in all of its production plants. That is why it intends to gradually expand the energy efficiency audits to all systems. This will enable them to continuously reduce the kilowatt hours consumed annually for each catheter produced. This is how, by 2025, Wellspect hopes to reduce the energy consumption for each catheter manufactured by 12% compared to 2020.

You can find more information at:

> www.festo.com/gfaa

> www.festo.com/sfga

03 Controlled Pneumatics

The new technology is pushing the boundaries of pneumatics

Simple and efficient control
In Controlled Pneumatics, Festo combines proportional technology, sensors and control algorithms to form a control loop. This technology opens up completely new application areas for pneumatics and also makes conventional production more efficient in many places. Not least because it reduces the compressed air consumption by up to 50% by accurately metering the required energy.

What used to involve complicated configurations and tricky programming is now quite simple. The closed-loop controller with sophisticated algorithms from Festo needs just a few parameter inputs. The most modern communication technology is used here. Another process that paved the way for Controlled Pneumatics is piezo technology, with which compressed air can be controlled very precisely.

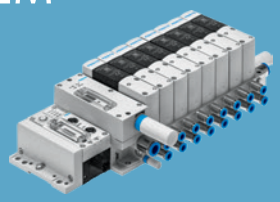
The benefits of Controlled Pneumatics

Increased competitiveness thanks to maximum process reliability
Controlled Pneumatics enables you to control production processes, whether existing or new, with the utmost precision and absolute reproducibility, and this is further enhanced by being able to trace the data. Fast and flexible control is combined with perfect, position-dependent force and motion characteristics. The result is increased process reliability and quality in the machining of workpieces.

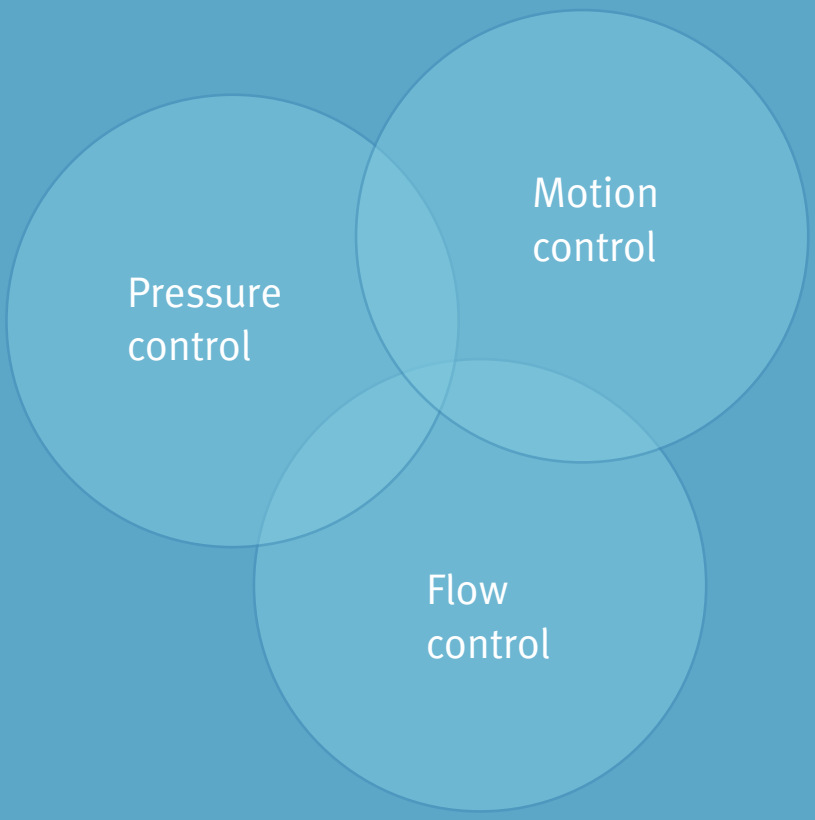
Easy commissioning and operation
Controlled Pneumatics makes complicated things very easy. For example, with the apps for the Motion Terminal VTEM multiple channels can be controlled by one piece of hardware. Thanks to the closed-loop control it is surprisingly easy to get the best results during commissioning and operation couldn't be easier.

Economical and sustainable production
Through the targeted metering of compressed air right from the beginning, enormous potential for energy savings can be unlocked. Analysing the components' condition and detecting leaks at an early stage are further factors for a positive energy footprint.

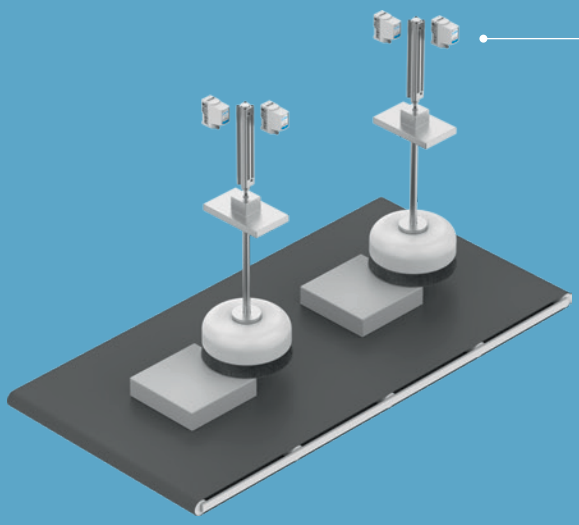
Motion Terminal
VTEM



- Individual control of motion, pressure and flow rate
- Maximum repetition accuracy
- Easy traceability



Individually or in combination:
The strengths of Controlled Pneumatics are the control of motion, pressure and flow rate.



Proportional pressure regulator

VPPI

- Controller presets and pressure curves are individually adjustable
- Low-noise, flexible and highly dynamic
- With or without display

Some typical application areas

Controlled Pneumatics opens up a wide range of applications in pressure and flow control, where both standard pneumatics and electric automation fall short.

Highly precise, force-controlled polishing
The variable contact pressure of the individual polishing chambers on the polisher is controlled highly precisely using Controlled Pneumatics and ensures excellent polishing results, even when polishing wafers.

Best control for dancer rollers
Perfect timing in the event of unexpected forces improves process reliability in small and very large web control processes, for example in paper production.

Pressure-controlled dispensing or pumping
Whether ink, adhesives or liquids for testing and analysis, with Controlled Pneumatics, liquids can be metered extremely precisely and according to an individual recipe. This is not possible with either electric automation or standard pneumatics.

Gripping and vacuum
With Controlled Pneumatics, gripping and joining processes can be carried out using a valve, for example in end-of-arm solutions for robots, even for different workpieces.

The algorithm is the key
In order to get the best possible system, Festo brings together the exceptional knowledge of experts from a number of disciplines for Controlled Pneumatics: mechanics, electrical engineering, control technology and software. The vast expertise of both Festo and the customers makes it easy to tailor the algorithm to the application.

The result is high control accuracy with an optimum characteristic curve in relation to the setpoint value at the highest speed. At the same time, the algorithm avoids unwanted vibrations, disturbance variables and control deviations, or corrects them almost in real time.

Controlled Pneumatics in practice:
On the next page, you can read how the proportional pressure regulator VEAB comes into its own in the winding of high-performance yarns. →

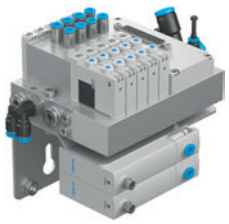
You can find more information at:

> www.festo.com/controlledpneumatics
> www.festo.com/motionterminal
> www.festo.com/catalogue/vppi

Controlled Pneumatics

Perfect web tension: high control accuracy for an optimum result

High precision: Innovations from SAHM and Festo ensure an optimum result when winding high-performance fibres and technical yarns.



Perfect solution: Controlled Pneumatics (VEAB) in combination with standard pneumatics (VTUG).

"Controlled Pneumatics sets new standards that will significantly strengthen our market position in the medium and long term."

Martin Schmidt, Head of Purchasing, SAHM

Georg Sahm GmbH & Co. KG, based in the German town of Eschwege, is a technology leader in the automatic winding of all kinds of technical yarns. Its portfolio includes automatic and manual precision winding machines, automatic bobbin removal devices and transport systems. For extremely precise winding of the high-performance fibres and technical yarns, SAHM uses the TWINSTAR II automatic precision cross winder. The stringent quality requirements of its customers demand premium technologies such as Controlled Pneumatics and standard pneumatics from Festo.

Quality requires precision
When winding yarns, such as high-performance fibres, multifilaments, coated and twined yarns, they need to have uniform, continuous lengths and higher spool weights so they can be economically further processed, but the spools then become too heavy for the operator to remove. Parameters such as tensile force, winding speed or winding precision decide whether a technical yarn can be turned into a flawless high-tech product. What was needed, therefore, was a solution that combines high control accuracy during winding with a flexible and really reliable solution for changing the bobbins. The high-performance yarns are then used to make high-quality products for safety-related areas, such as firefighting and safety clothing, helmets or automotive applications.

Perfectly wound with Controlled Pneumatics
The TWINSTAR II winder meets the requirements very reliably, thanks in part to Controlled Pneumatics from Festo. The proportional pressure regulator VEAB controls the yarn tension very precisely and dynamically. When controlling the contact pressure on the bobbin, high accuracy and linearity are key factors. Both ensure the bobbin winding result is more precise, even at a maximum winding speed of up to 2,500 metres per minute.

Economical piezo technology
The piezo technology used in the proportional pressure regulator VEAB requires very little electricity to operate compared to conventional solenoid valves. The piezo elements maintain their state without generating any heat. The VEAB, together with the precisely configured control algorithm, responds quickly and highly accurately, using the exact amount of compressed air required to control the process.

Standard pneumatics – a good addition
The fully pre-assembled and tested module also uses standard pneumatics in the form of valves VTUG. As part of the compact and powerful unit, they ensure that the automated bobbin change is fast and reliable, without wasting any material and without any downtimes. By standardising these systems, they can be scaled to multiple TWINSTAR II variants.

Partnership in practice
Innovations are part of the DNA of SAHM. That is why the company is always on the lookout for partners that are also drivers of innovation, explains Martin Schmidt, Head of Purchasing: “Festo supported us very well with its portfolio, but also with its process knowledge, and helped us solve the problem very quickly and efficiently. Controlled Pneumatics sets new standards that will enable us to significantly strengthen our market position in the medium and long term. That’s why we use this technology.”

Proportional pressure regulator

VEAB

For pressure ranges up to 6 bar, piezo technology makes the VEAB extremely precise and gives it a very long service life.

- Quiet operation
- Low energy consumption
- Very short switching times

You can find more information at:

> www.festo.com/controlledpneumatics
> www.festo.com/catalogue/veab

04 LifeTech

New products and product features

Automation components and solutions in the LifeTech sector generally need to meet demanding requirements. They have to be precise and compact, work well in a confined space and avoid heat and noise generation, and be available at an economical price too. The portfolio from Festo is designed precisely for these requirements – to ensure that the automation of your processes is a complete success.

Problem-solving expertise in laboratory analysis and medical technology: prepare to be inspired!

www.festo.com/highlights/lifetech

Mass flow controller

VEMD

In lots of applications, whether life sciences, food or biotech, the flow rate of air or other gases, such as oxygen, needs to be regulated. Precise dosing is also required for regulating shielding gases in production or for respiratory air in medical devices. Reliability and performance are as important here as cost efficiency. The new VEMD offers both: a high dynamic response at an extremely affordable price.

Optional display

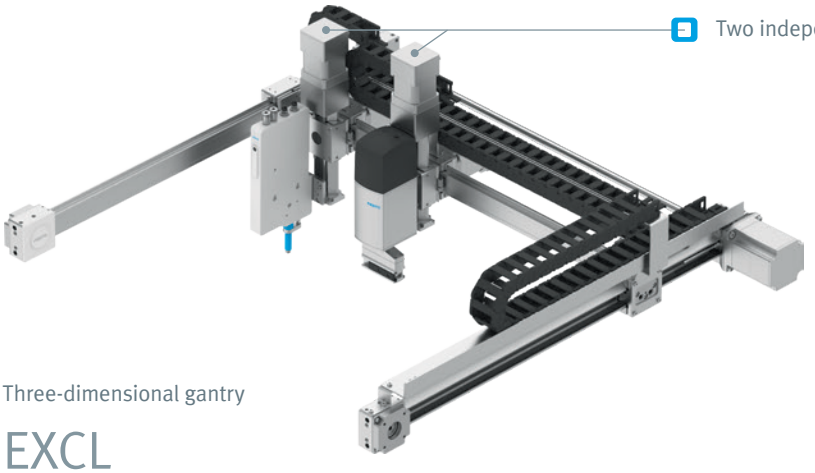
- Many flow rate ranges: 10, 20, 50, 100 and 200 l/min
- Analogue and digital interfaces built in
- Linear control response
- Sturdy and durable

Rotary gripper module

EHMD

- Either fully electric or with pneumatic gripper
- Optional module to compensate for the cap thread pitch
- Easy configuration of the Festo motor controller CMMO-ST or CMMT-ST

New size for opening large vials



Three-dimensional gantry

EXCL

The multi-axis gantry EXCL has a small footprint and PCB-based motion controls, saving valuable space when designing systems and devices. The functionality of the system can be further extended with two independently moving Z-axes.

- Max. stroke:
  X/Y-axis: 1,000 x 700 mm
  Z-axis: 50, 100, 150 or 200 mm
  with 1 or 2 Z-axes
- Max. payload: 1.5 kg
  (with 2 Z-axes together max. 2 kg)
- Optional 6-axis motion controller
- Programmable via G-code

Media-separated valve

VYKA

- Dosing, aspirating and continuous flow
- Media separation
- Kv value: 0.35 l/min
- Nominal width: 1.2 mm
- Very compact
- High-performance polymers: EPDM, FKM and FFKM

Vacuum function for a wider range of applications

Media-separated valve

VYKC

- Dosing, aspirating and continuous flow
- Nominal width: 1.2, 1.6 and 2.0 mm
- Reduces heat transfer to media with holding current reduction
- Very cost-efficient

High-performance polymers: EPDM, FKM and FFKM

Liquid handling: a real-life example →

You can find more information at:

- **> www.festo.com/lab**
- **> www.festo.com/liquidhandling**
- > www.festo.com/mfc-vemd
- > www.festo.com/ehmd-50
- > www.festo.com/excl
- > www.festo.com/vyka
- > www.festo.com/vykc

LifeTech

Automated liquid handling for precision, speed and reliability

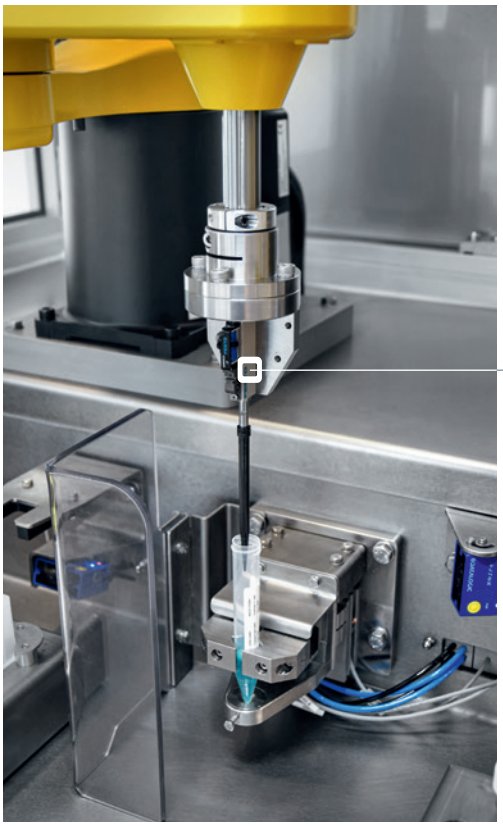
High throughput: the PurePrep TTR system fully automatically prepares 320 patient samples per hour for PCR testing.

Demand from laboratories for a high throughput of samples is constantly growing. The new handling device PurePrep TTR from the Dutch company MolGen prepares 320 patient samples per hour for molecular processing – at a speed that cannot be matched by a single individual person.

Sample handling with precise fill level detection

The first robot arm of two SCARA robots on the PurePrep TTR uses an electric gripper to pick up a sample vial by the cap and places it in a position where the cap can be removed. Once it's been opened, the second robot arm uses pipette head DHOE to transport the liquid from the sample vial to the microwell plate.

One of the highlights is that the pipetting system is even capable of precisely determining the liquid level in a sample vial by using high-precision pressure and vacuum adjustment. At the same time as liquid handling, the first robot arm closes the open sample vial and returns it to the rack. Then it continues with the next sample vial.



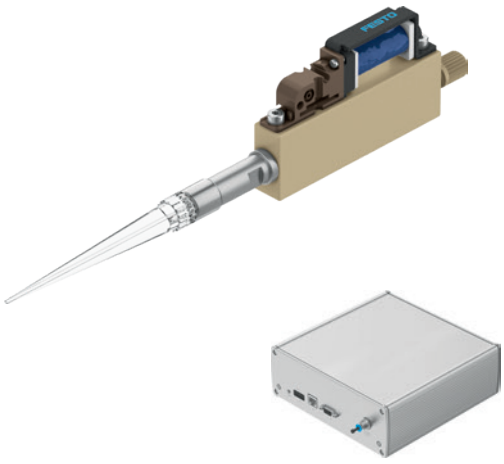
Extremely small pipetting volumes: the second robot arm with the pipette head distributes liquids onto a microwell plate.

Pipetting system with pipette head

DHOE

For the easy transport of liquids: with the flexible pipetting system, the most important pipetting functions can be configured and flexibly extended in line with needs, even with the largest pipette tips. Thanks to its outstanding chemical resistance, the DHOE can be used for a wide range of liquids with different viscosities. The DHOE pipettes even minute volumes as small as 1 µl with the greatest precision.

- Media-resistant pipette head
- Easy to integrate
- Complete solution from a single source
- Perfect additions: pipette tips DHAP and pressure/vacuum generator PGVA



Perfect additions:
pressure/vacuum generator PGVA

Decentralised sample preparation and pressure-controlled pipetting

Key components here are the decentralised pressure and vacuum generator PGVA and the pipette head DHOE. To enable samples to be analysed in any location, the PGVA has an integrated compressor, air preparation including filter system, reservoir and electronic pressure and vacuum control in the smallest of spaces.

The pipette head DHOE can transport extremely small pipetting volumes of as little as 1 µl with high pipetting precision, and can be configured and flexibly extended with the most important pipetting functions in line with needs. Its outstanding chemical resistance enables it to be used for a wide range of liquids with different viscosities.

You can find more information at:

> **www.festo.com/liquidhandling**
> www.festo.com/dhoe
> www.festo.com/pgva

05 Electric automation

Seamless connectivity – from the workpiece to the cloud

Free and seamless connectivity, embedded in future-proof and compatible concepts, with open platforms, including for Industry 4.0: on the way to the seamless automation of machines and systems, Festo offers precisely matching mechanical, electric and intelligent automation modules that impose no technical constraints.

Everything from a single source

The comprehensive solution portfolio from Festo ranges from mechanics, complete servo drive systems, state-of-the-art communication and control concepts to digitalisation with the right cloud solutions. It is complemented by innovative engineering tools for engineering, configuration and commissioning.

Electric connectivity

Mechanical systems and control technology are easy to combine with servo drives such as the CMMT-AS and servo motors EMMT-AS from Festo. They offer easy engineering, perfectly coordinated hardware and are completely flexible as they can be directly integrated into just about every automation environment. Commissioning takes just a few steps with the Festo Automation Suite software.

Servo drives CMMT
The compact, multi-protocol-capable CMMT-AS and the CMMT-ST are suitable for different Ethernet-based networks and can be integrated directly into the system environments of various controller manufacturers. The protocol can be selected in the Festo Automation Suite or directly on the servo drive.

Servo and stepper motors
Powerful servo motors EMMT-AS with single-cable technology for quick and easy connection to the servo drive.

> New cost-effective and efficient stepper motors will be added to the existing portfolio of stepper motors EMMS-ST at the end of 2023.

Mechanical connectivity

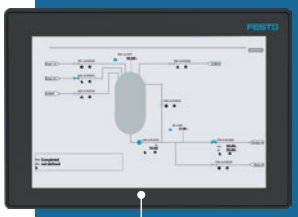
The electromechanical axes and modules from Festo can be used for linear motion, swivelling, gripping or stopping tasks in the majority of standard automation applications in machines and systems, and are compatible with the servo motors or any in-house devices.

Spindle and toothed belt axes ELGD
Since it's more powerful, even lighter and smaller, the next generation of the ELGD will become the future standard for axes at Festo.

- Suitable for battery assembly, cleanroom and packaging applications
- Innovative guide technology and stainless steel cover strip
- Even greater rigidity with reduced dimensions

Intelligent connectivity

Intelligent connectivity is based on free, flexible communication and direct, complete integration into higher-level control concepts. It enables automation tasks and machine architectures to be made more flexible and modular with integrated, decentralised motion control and remote I/O solutions, supported by innovative software solutions.



Operator units CDPX
As the human-machine interface, the new generation of operator units CDPX delivers enhanced performance, offers more functions and comes in three higher-resolution versions:

- Cost-optimised for simple visualisation tasks, e.g. of process data
- With high computing performance and multi-touch display, CODESYS, EtherCAT and Profinet master
- Explosion-proof and rated to IP65 for the requirements of process automation

With wide-screen technology

Remote I/O system CPX-AP-A and CPX-AP-I
On the basis of the Festo Automation Platform, the modular CPX-AP-A and the decentralised CPX-AP-I offer unique flexibility and performance:

- Real-time capability and extensive fieldbus communication
- IO-Link® for simple point-to-point communication
- Combination of modular and decentralised CPX-AP modules

Read more about the **flexible and technology-neutral automation platform** for integrated automation concepts and architectures on the next page. →

Competence in motion

Watch this video series and discover how experienced experts at Festo manage all the steps, from development and testing to in-house production, that are needed for high-quality, high-performance products and engineering tools.

Video series "Expertise in modern, electric automation"

In this **video**, find out how seamless connectivity can help make standardisation really easy, regardless of the network used.

You can find more information at:

> www.festo.com/ea

Electric automation

Remote I/O system CPX-AP-A

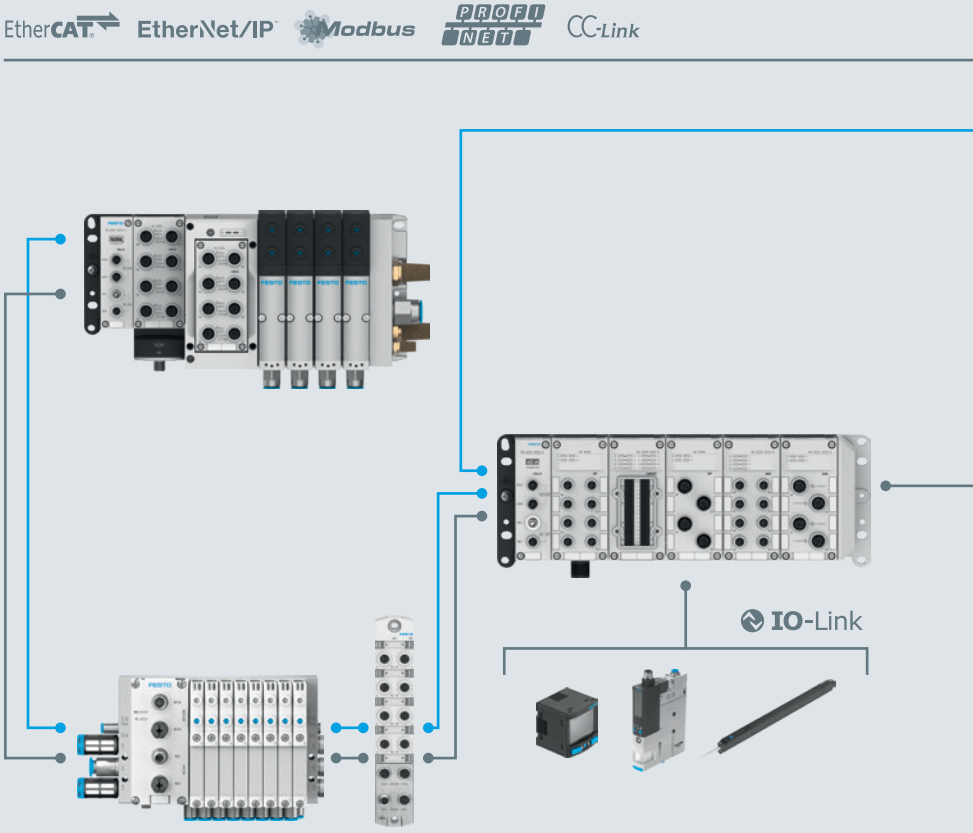
Combined on the Automation Platform

The new-generation CPX enables a freely scalable, flexible and powerful system architecture on the basis of the Festo Automation Platform (AP). AP uses a hybrid approach to combine modular and decentralised structures and brings together remote I/O and control technology with electric and pneumatic automation technology.

Combined with pneumatics

Valve terminals such as the VTSA and MPA-S can be connected to the CPX-AP-A right now. The valve terminals VTUG and MPA-L will be added later this year. Other connection options for valve terminals or proportional valves are available via IO-Link®.

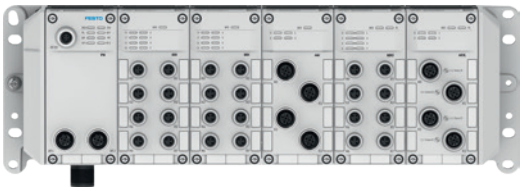
CPX-AP-A permits a completely free, decentralised integration of valve terminals via AP communication



Electric or pneumatic: CPX-AP-A enables a freely scalable, flexible and powerful system architecture.

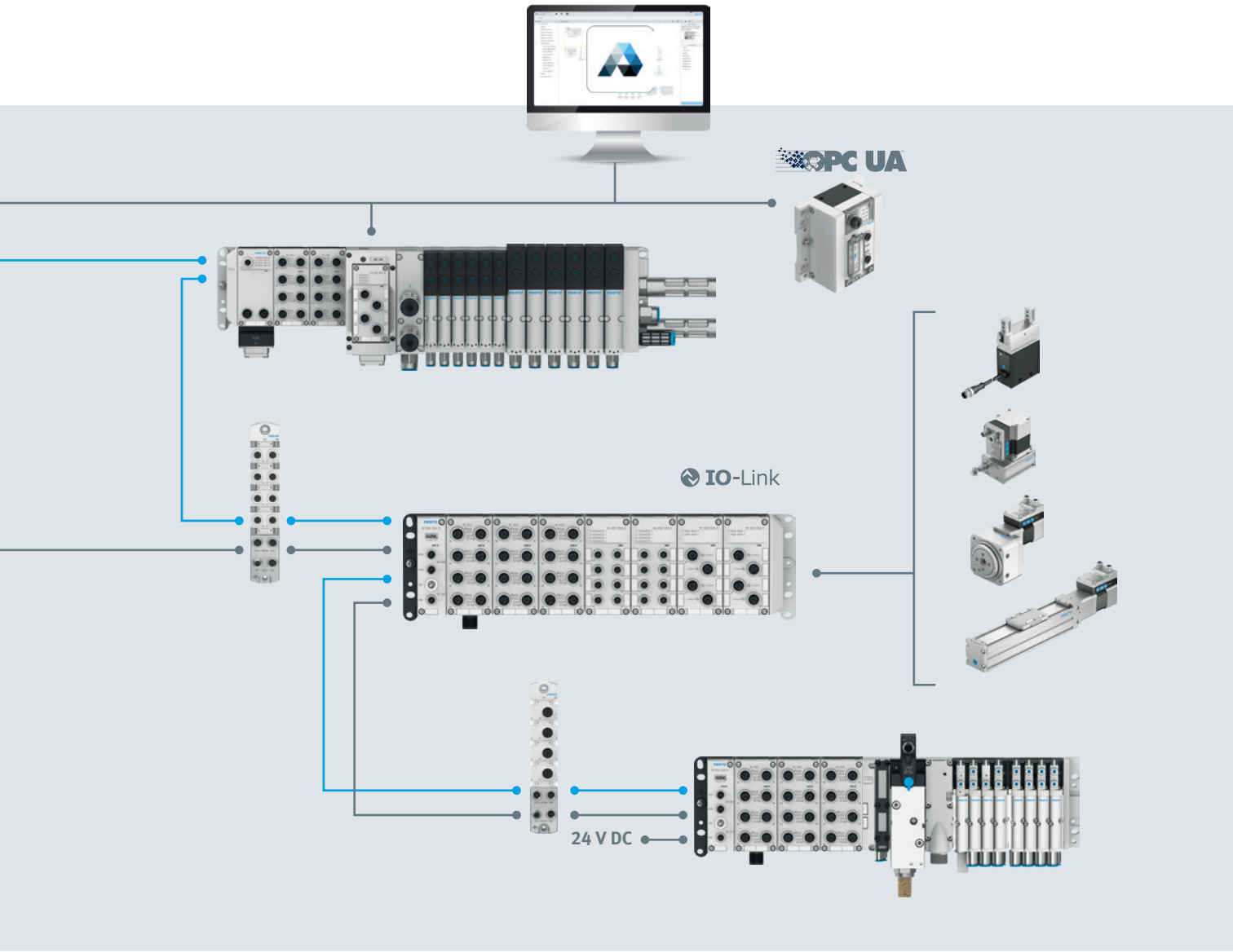
Performance in real time: modular remote I/O system CPX-AP-A

The system architecture in line, tree or star topology combines a modular remote I/O system with valve terminals, and communicates with many other products via an IO-Link® master.



Some technical features:

- Real-time communication with a data rate of 200 MBaud and a cycle time of up to 15 µs
- Decentralised architecture with a cable length of up to 50 m between stations
- IP65/67 degree of protection for direct installation in the machine
- Wide variety of modules with digital I/O and IO-Link® master.



Built-in performance: decentralised remote I/O system CPX-AP-I

Individual, powerful I/O modules are integrated into the network using a fieldbus module, or they are connected directly to CPX-AP-A via the AP communication system. This offers greater choice in machine concepts when connecting valve terminals or electric drives, and results in increased cost efficiency.

- Very sturdy line topology with up to 80 ultralight and compact modules in one or two lines
- Best price/performance ratio by combining valve terminals and decentralised I/Os

06 Electromobility

Safe battery production with reliable automation

Batteries are the powerhouses of electromobility. Gigafactories are being built around the world to meet the huge demand for batteries.

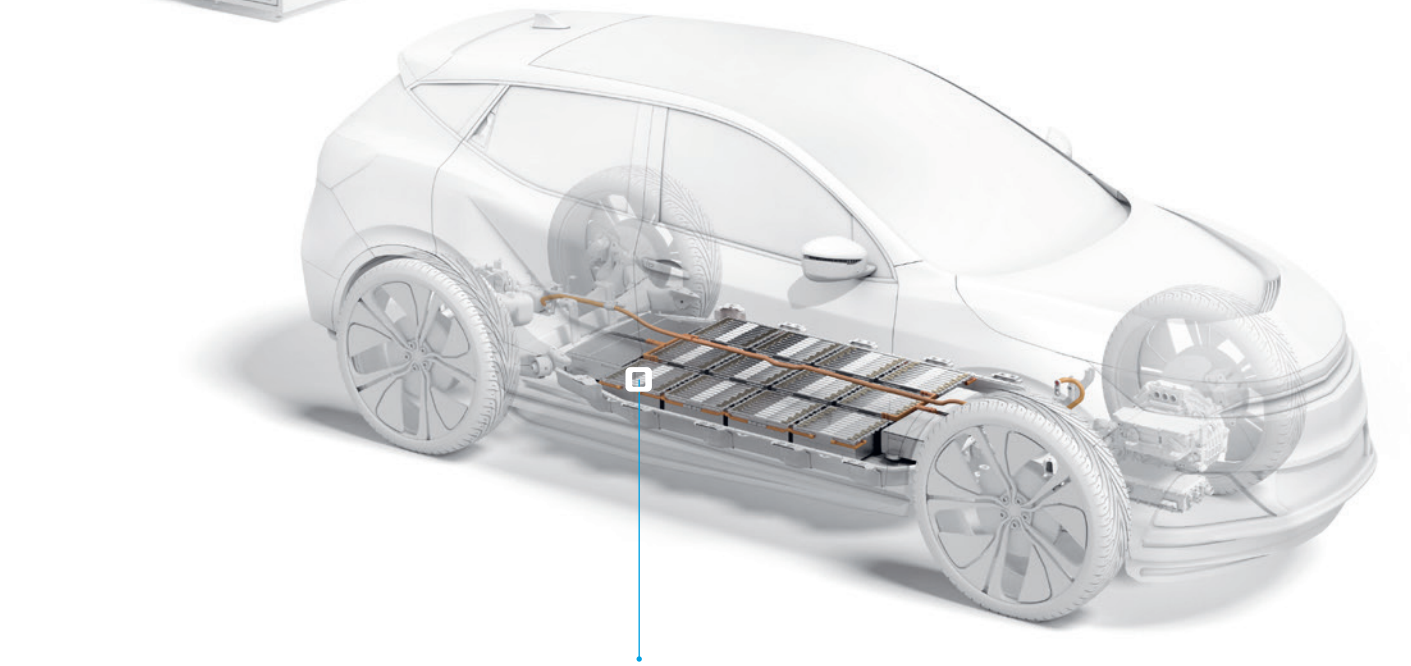
With a cross-technology automation portfolio, Festo ensures reliable and profitable battery production. Whether for degassing and sealing in cell production, module and pack assembly, or motor assembly and platform integration, Festo has suitable handling solutions.

A factory with an annual capacity of 24 gigawatt hours processes up to 400 tons of material per day, equivalent to the payload of more than ten articulated lorries. Day after day, around 500,000 batteries leave a gigafactory.

The challenge is to produce these quantities without losing sight of quality and profitability. Efficiency is the main focus here. Because the only way to achieve this goal is by ensuring that the plants are working productively and reliably, in other words with great speed, maximum throughput and the highest repetition accuracy.

Required: quality, reliability and profitability

A key to achieving this goal is by automating production. To be able to produce high-quality batteries reliably and cost-effectively, the processes should be automated from the outset. Festo offers suitable automation solutions, from processing the raw materials right up to the subsequent processes, for example the fully automated production of the battery cells or the precise assembly of the battery parts with transport and assembly systems.

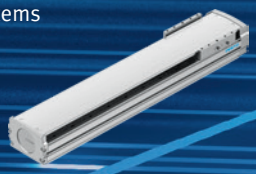


Find out more about precise and reliable automation solutions for battery and electric motor assembly.

Product highlights for battery production*

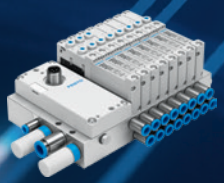
Compact cylinder
ADN

Spindle axis for cantilever systems
ELGT



Gripper
DHPC

Valve terminal
VTUG



* More information on these and all other products listed can be found in the product overview starting on page 30 ff.

Complex requirements need reliable solutions

Producing battery cells is an extremely sensitive process. On the one hand, the automation components are exposed to challenging ambient conditions such as drying rooms. On the other hand, they have a direct influence on the quality of the produced battery cells through the emission of particles. Depending on the application, products in battery cell production must not emit any copper, zinc or nickel particles. Otherwise there is a risk that the quality of the batteries will be reduced or even that they will be unusable. Festo offers an extensive product range for battery cell production that takes these requirements into account.

See for yourself how efficient and reliable battery production automation can be.

Gaining expertise

Efficient battery production requires extensive expertise. **The Didactic division of Festo** teaches the skills that are needed in highly automated production environments. It offers, among other things, practical training solutions supported by digital training content for factory and process automation, electrical engineering, industrial maintenance and more.

You can find more information at:

> www.festo.com/battery
> www.festo.com/electromobility
> www.festo.com/didactic

Electromobility

Battery recycling: recovering and reusing raw materials

After around 1,500 charging and discharging cycles, which is some 160,000 kilometres over 8 to 10 years, it is highly likely that the batteries of electric cars will no longer be cost-effective to use in the vehicle. The reason for this is that the reduced charging capacity of the batteries greatly reduces the range compared to that of a new system. However, a residual capacity of about 80% gives grants the batteries a second life.

As the disassembly process is increasingly automated, the recycling process is becoming more flexible and dynamic, making recycled materials available more quickly. Festo is a key driving force behind this development, since it fits in with its vision of a sustainable circular economy.

5

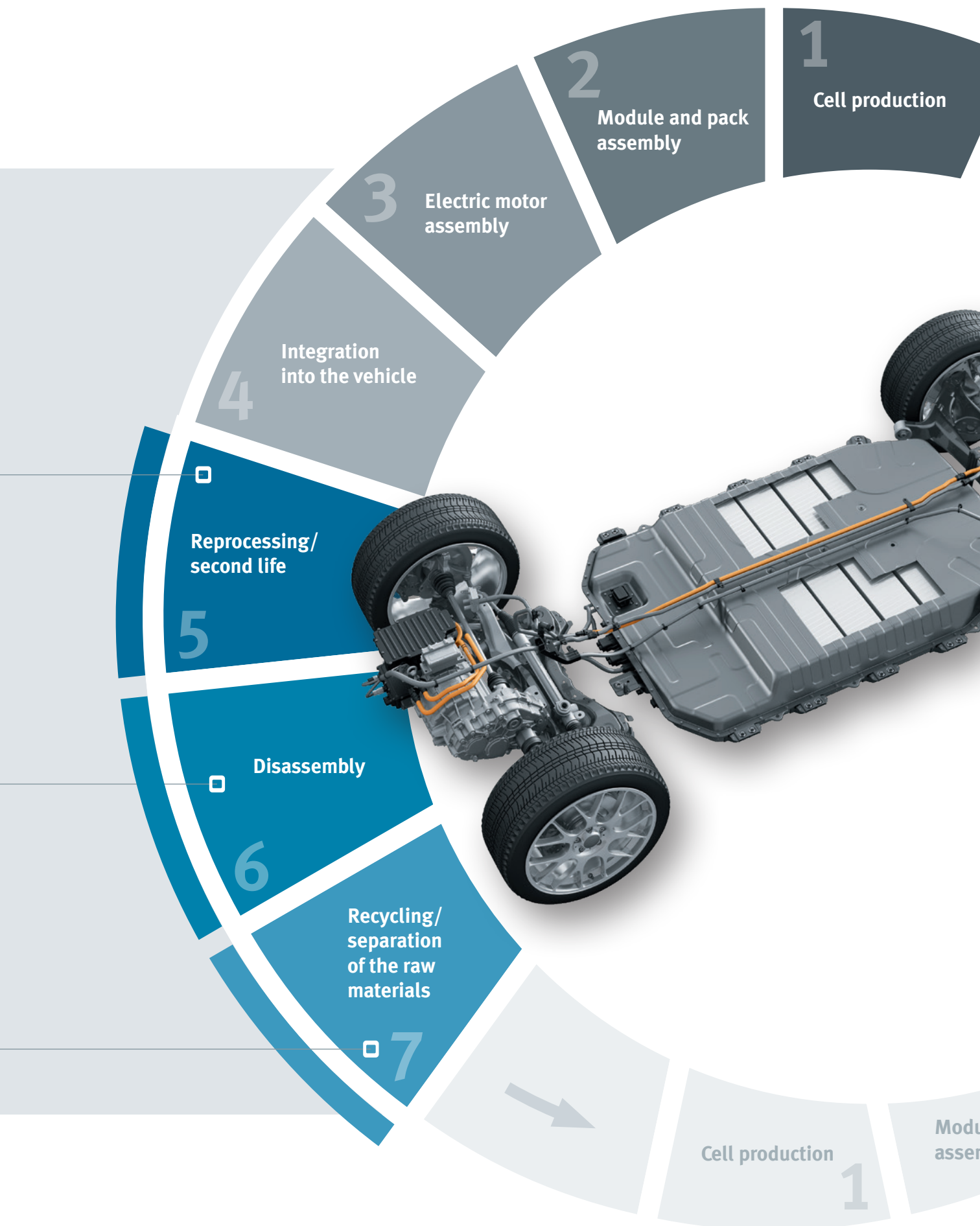
According to estimates, by 2025 some 600,000 tons of used batteries will need to be recycled. However, after the batteries have been removed from the vehicle and before they reach the recycling stage, they can be used in **so-called farms or stationary storage systems**.

6

The final stage in the life of a battery is proper recycling. First, the packs are **mechanically disassembled** into modules, battery cells and other components. At the moment, this is a difficult and laborious activity which is mostly done manually. Festo already offers modular automation concepts that speed up and simplify this process. The complete factory automation portfolio from Festo is in demand for this process, since position detection, position corrections and a wide range of different handling technologies are involved.

7

The next step is to **separate the materials** such as metal, plastics and other materials. However, the focus here is not exclusively on the automation solution. Festo offers suitable process automation products for this step, especially for hydrometallurgical recycling methods. A wide range of process valves are used for gaseous, solid or liquid substances.


1
Cell production
2
Module and pack assembly
3
Electric motor assembly
4
Integration into the vehicle
5
Reprocessing/ second life
6
Disassembly
7
Recycling/ separation of the raw materials
Cell production
1

07 Artificial intelligence

Festo AX improves maintenance, engineering and productivity

Pigment production: Heubach produces pigments in huge plants. Festo AX helps to optimise the PID control.

The Heubach Group, a leading global provider of comprehensive pigment solutions, chose Festo AX as the first step in establishing a centralised monitoring system for all controllers. The controllers are to be specifically analysed and optimised on the basis of the evaluation by Festo AX and experts on site.

Evaluating initial data with artificial intelligence

How can centralised PID data be leveraged for maintenance, engineering and productivity? This is the question the experts from the Heubach Group asked themselves when looking at the data collected by PID controllers in a centralised PIMS (production information management system) database. The databases in the production information management system contain the data of all controllers from different systems, from different manufacturers and from all connected production locations. The data can only be evaluated using this system.

First, the AI experts evaluated several months of historical offline data. In the second step, the specialist departments reported on the factors that are critical for improving the variable batch processes and how to prioritise the error deviations, for example for temperature, flow rate or pressure. An additional trend line for the anomaly scores should also help the specialist departments to accurately and above all easily recognise the deviations per batch at an early stage. Other requirements for the project were the portability (on premise) of the project and being able to easily visualise the results for the aggregated dashboards.

Optimum adjustment of the algorithm
Even after the first step of the AI analysis, the results were astonishingly insightful. The AI found many well configured and properly functioning controllers, but it also detected controllers that continuously failed to achieve the setpoint values or significantly overshot them, oscillated or required manual intervention. The controller and data science experts worked closely together to adapt the AI algorithm to other specific features of the (batch) production. The information was exchanged offline using classic Microsoft Office tools.

One tool for all systems and controllers
Up until now the different process control systems only made it possible to analyse the controllers at Heubach at company level and with different tools. The solution with Festo AX is now manufacturer-neutral and can be used globally on a centralised system, which means that the algorithm can be used for all systems and controllers. And it is so flexible in terms of the IT that, as it is used and enhanced, it can grow into a cloud-based implementation. Production processes can thus be optimised as effectively as possible in terms of energy consumption, output and quality, and monitored in the long term.

Festo Automation Experience AX

With Festo AX, decisions can be made on the basis of facts. The Festo Automation Experience (Festo AX) is an easy-to-use solution that uses artificial intelligence (AI) and machine learning to help achieve high added value from the data produced by assets. For example, with predictive maintenance, predictive energy and predictive quality – analysing the data with Festo AX increases productivity and reduces energy costs. Quality losses are avoided. Downtimes are reduced. Even optimising the shop floor and creating new business models are possible.

You can find more information at:
www.festo.com/ax

At a glance: is the PID controller working as it should? This quickly becomes apparent on the dashboards.

Product highlights at a glance

The fast way to find more information

Festo Cobot

Page 4–7

Energy efficiency module
MSE6-C2M

Page 9

Compact cylinder
ADN-S

Page 9

Compressed air
energy efficiency audit
GFAA

Page 10

Air-flow analyser
SFGA

Page 11

Motion Terminal
VTEM

Page 12

Proportional pressure regulator
VPPI

Page 13

Proportional pressure regulator
VEAB

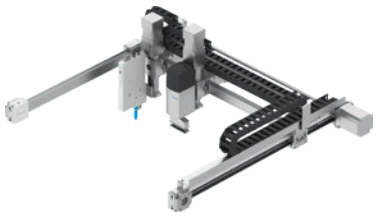
Page 15

Mass flow controller
VEMD

Page 16

Rotary gripper module
EHMD

Page 16



Three-dimensional gantry
EXCL

Page 17

Media separated solenoid valve
VYKA

Page 17

Media separated solenoid valve
VYKC

Page 17

Pipetting system with pipette head
DHOE

Page 19

Pressure/vacuum generator
PGVA

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Servo motor
EMMT-AS

Page 20

Product highlights at a glance

The fast way to find more information

Servo drive
CMMT-AS

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Servo drive
CMMT-ST

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Operator units
CDPX

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Remote I/O system
CPX-AP-A

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Remote I/O system
CPX-AP-I

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Gripper
DHPC

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Compact cylinder
ADN

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Spindle axis for cantilever systems
ELGT

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Valve terminal
VTUG

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Round cylinder
DSNU

Mini slide
DGSS

Standards-based cylinder
DSBC

Pinch valve
VZQA

Connecting cables
NEBA

Customisable plug connector
NECB

Position transmitter
SDAC

Plastic tubing
PUN

New: You can now also find more information about all **Highlights topics** online!

www.festo.com/highlights

Notes

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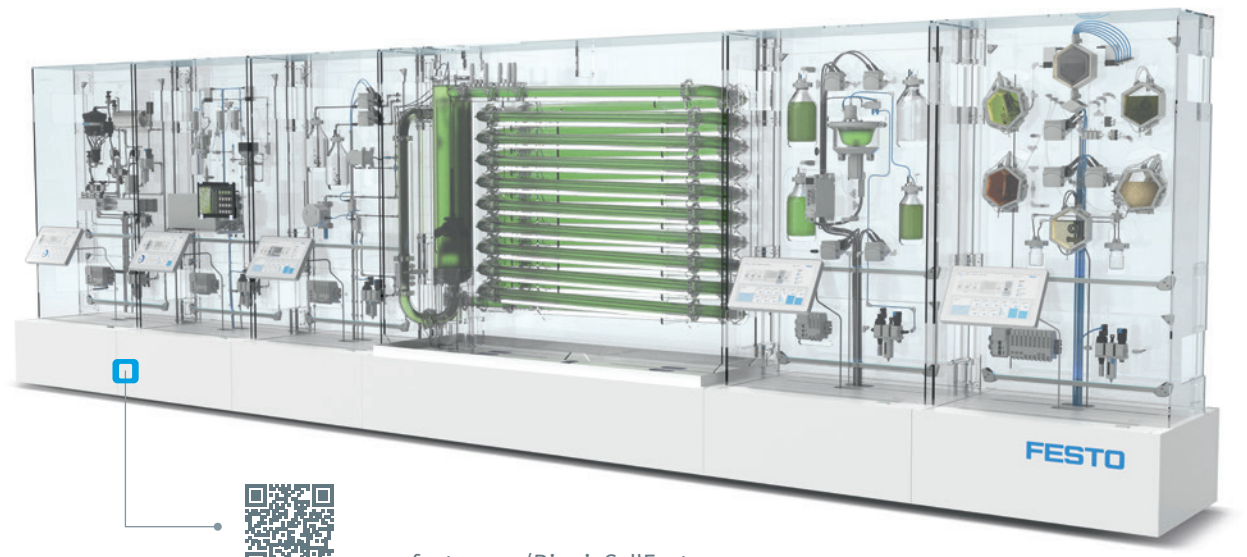
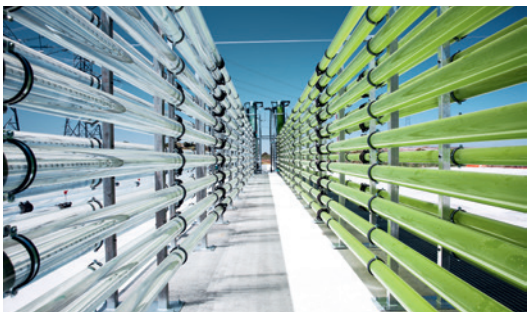


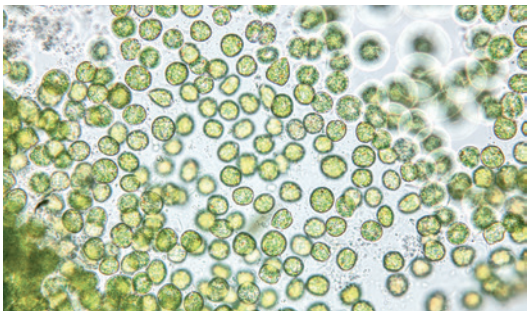
www.festo.com/BionicCellFactory

Festo BionicCellFactory

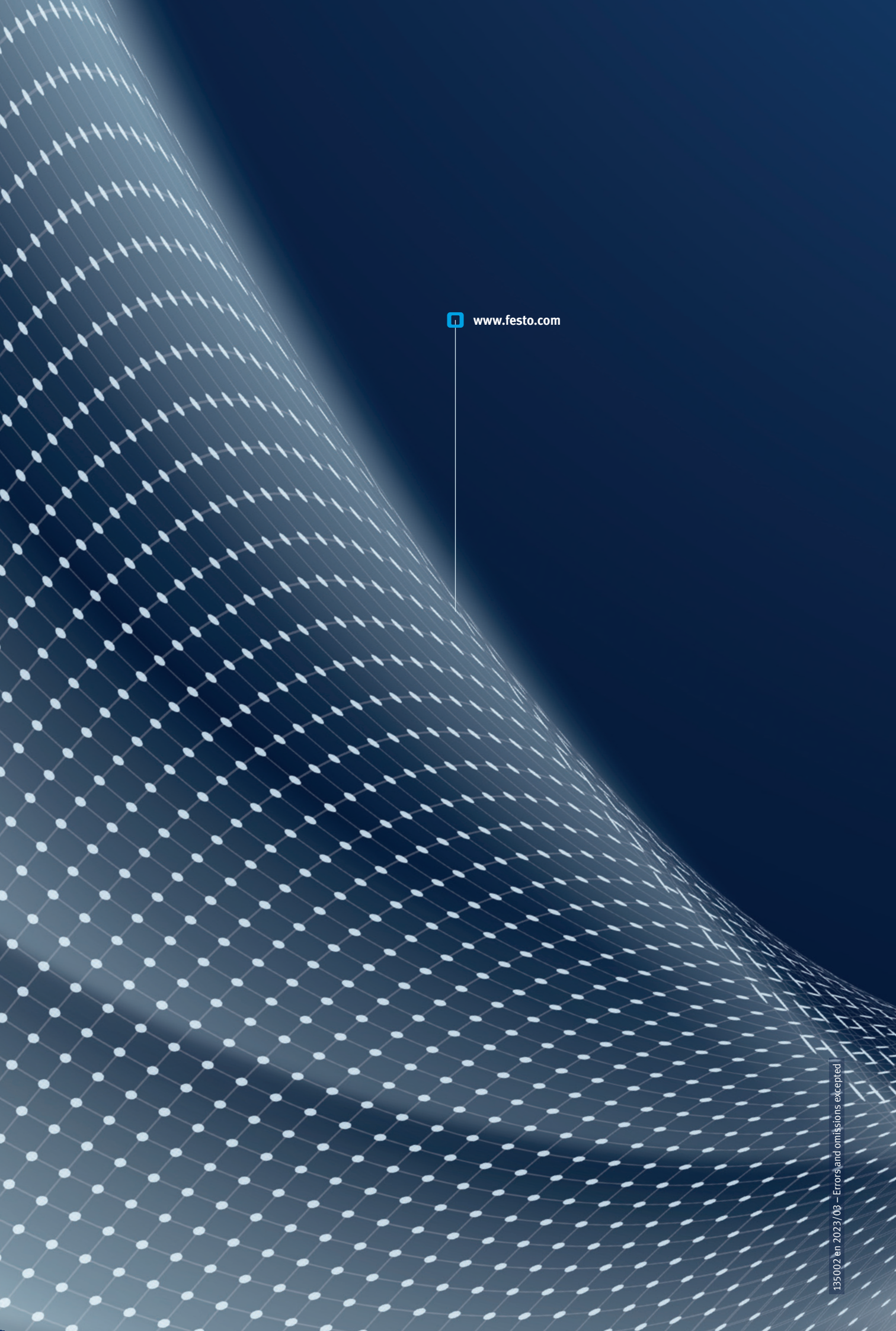
The PhotoBionicCell, presented in 2022 by Festo, was the first bioreactor for the automated cultivation of algae with a capacity of 10 litres. This year, the company is taking a significant step forward: with the BionicCellFactory it is showing an integrated bioprocess scaled up to 100 litres.

The BionicCellFactory is a universal model factory. It demonstrates the automation of the biological transformation towards a circular economy. The combination of expertise from life sciences, sensor technology and innovative automation technology offers new growth opportunities for the pioneering biotechnology, which at the same time reduces the burden on our natural environment. Biomass can be produced on a large scale for the chemical, food or pharmaceutical industry, depending on the application requirements. This systems extends to five modules, from the optimised cultivation of the algae cells with continuous monitoring and analysis of the harvest to the further processing and finishing of various constituents.





Small climate savers: Even in their natural state, algae absorb ten times more CO_2 than land plants. Their efficiency can be increased a hundredfold with the right technology.



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