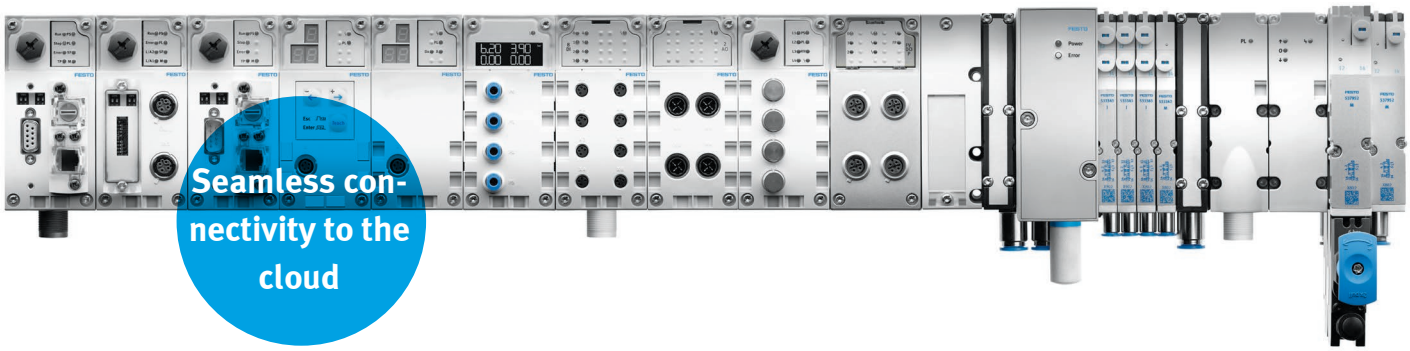
Maximum productivity – with the modular electrical terminal CPX



Automation platform 4.0!

Highlights

- Modular and flexible remote I/O to IP65 for I4.0
- IoT gateway and MQTT directly integrated for connectivity up to the cloud
- Decentralised and networked intelligence with embedded CODESYS controller
- Industry 4.0 thanks to OPC UA and MQTT as well as CODESYS control V3 (SP10)
- Modular and flexible IP65 remote I/O
- Optimised version for IP20 and Ex environments
- Maximum function integration for complete applications
- Falling installation costs and rising productivity

CPX is ideal as an automation platform, valve terminal partner or remote I/O – it is electric, open and direct. It is also the perfect platform for electrical peripherals. With CPX, you can integrate pneumatic and electrical control chains easily, quickly, flexibly and seamlessly into all automation concepts and company-specific standards – and into Industry 4.0 as well!

CPX – the new benchmark for perfect networking thanks to:

- Universal communication via fieldbus/Ethernet
- A choice of pneumatic platforms (valve terminals)
- Subordinate, decentralised installation systems IO-Link or I-Port
- Unrivalled module and application variety

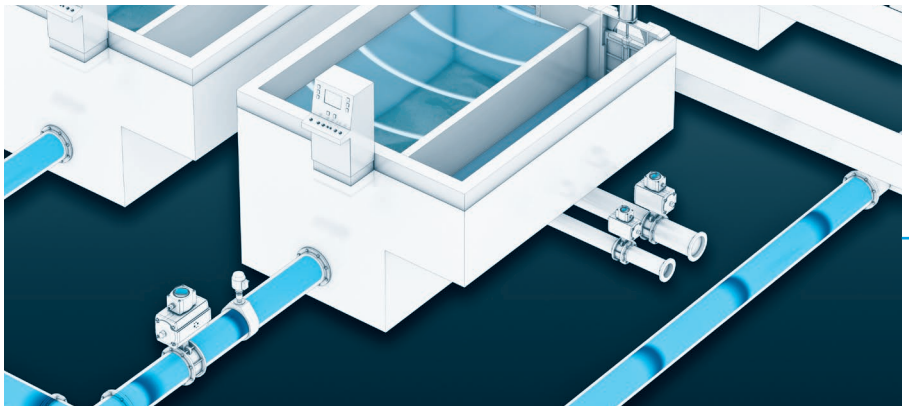
CPX – greater economy and operational reliability through function integration, such as:

- Front-end control
- A choice of scalable installation concepts
- Comprehensive diagnostics and condition monitoring
- Comprehensive diagnostics and condition monitoring, also via IoT gateway
- Motion control for
  - electric drives and
  - servo-pneumatic drives
- Measurement and control

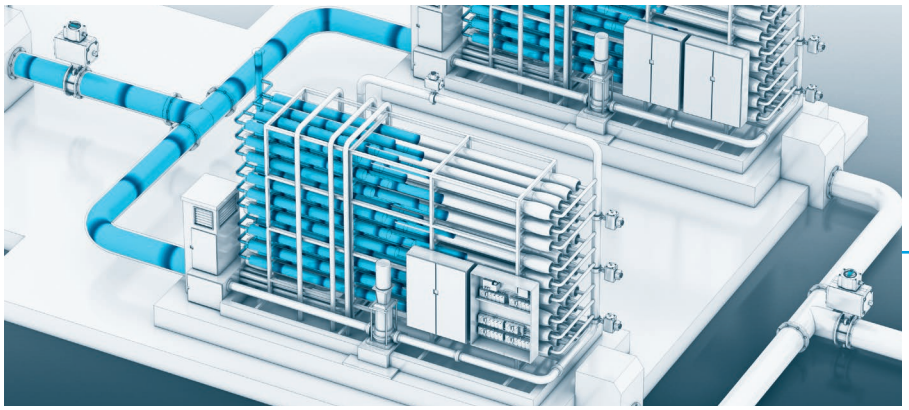
The terminal CPX contains everything that makes Festo stand out. Competency. Security. Efficiency. And simplicity. That is the basis on which we solve your automation tasks. And for working with you to achieve our shared goal: increasing your productivity.

Festo Terminal CPX. The platform for integrated automation. Highly competent in all standard functions.

Process automation

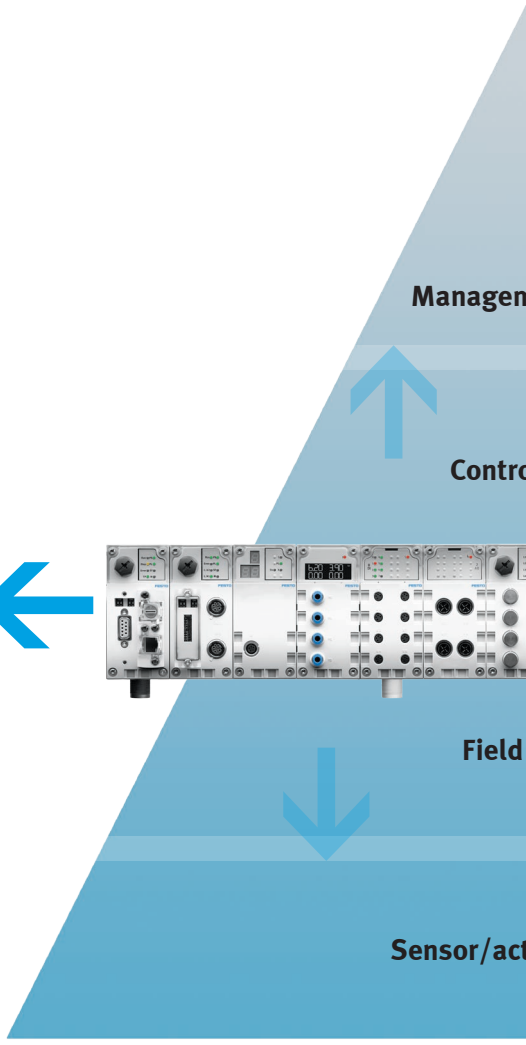


Sand filtration – CPX in a control cabinet for decentralised control of wastewater treatment processes.



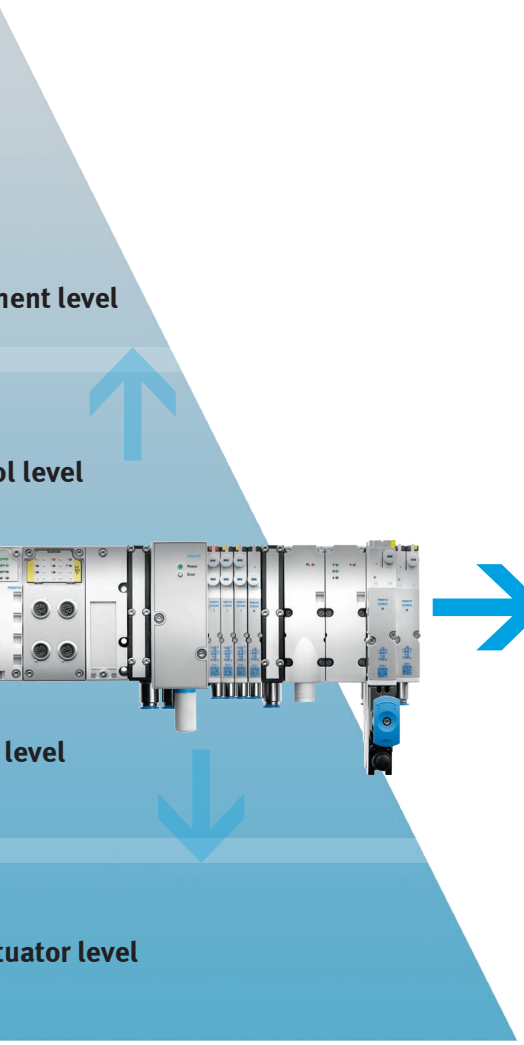
Reverse osmosis – CPX as a proven, complete solution for municipal or industrial water treatment.

Control combined processes with fluid and motion control – CPX controls media valves for biotech or pharmaceutical production processes, or the cooling/lubrication/washing processes in machine tools, or simultaneous transferring and multi-stage packaging. All this as a complete solution from a single source.



Festo CPX – the complete solution for groundbreaking automation.

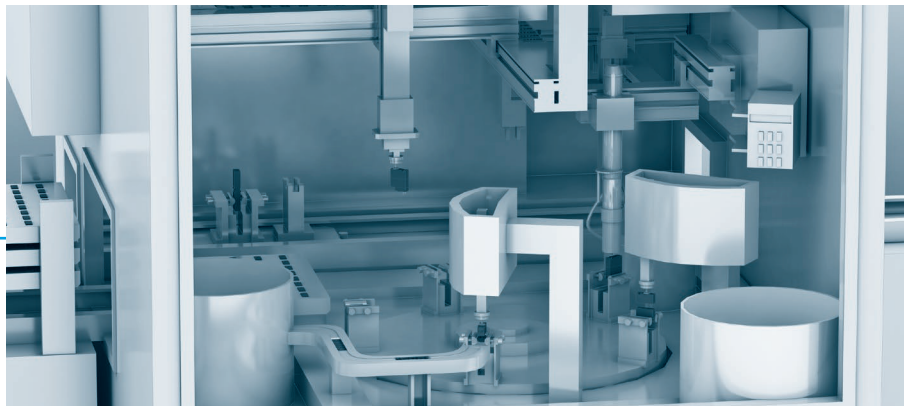
CPX as universal standard
If you expect the best from your automation solutions, then CPX is exactly right for you. It covers all standard process and factory automation functions. This means CPX can be used as the standard for all process steps with fluid and motion control.



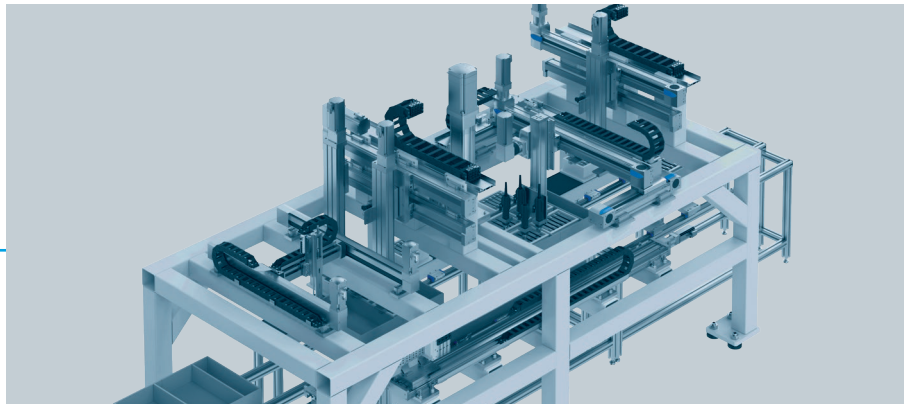
One platform across all levels in the control technology pyramid.

You can now get these automation solutions from a single source so you can benefit from reduced interfaces, considerably simplified engineering processes, convenient operation and reliability. A technology for the future: CPX can be connected to host environments for Industry 4.0 – and via the IoT gateway into the cloud.

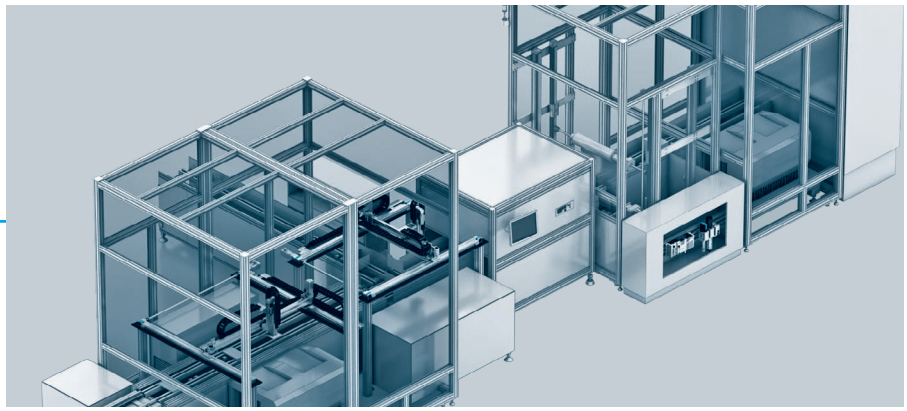
Factory automation



Small parts assembly – CPX controls a combination of electric and pneumatic drives and grippers, processes all sensor signals and provides comprehensive diagnostic services.



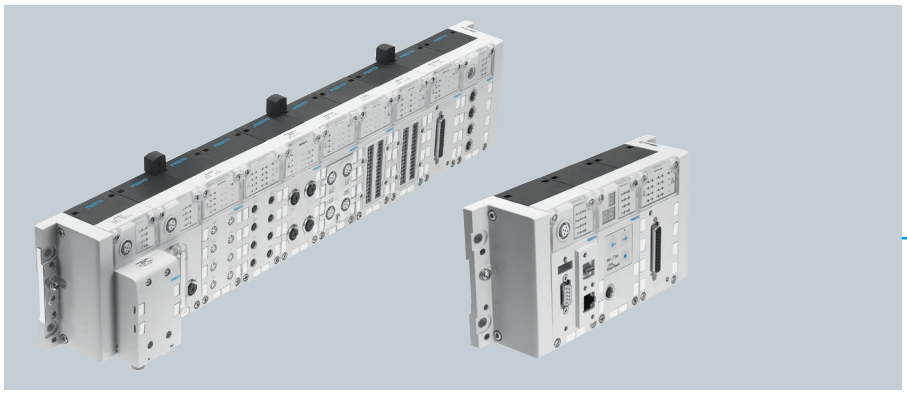
Assembly of battery modules for electric vehicles – CPX controls the entire system decentrally, including motion control and safety.



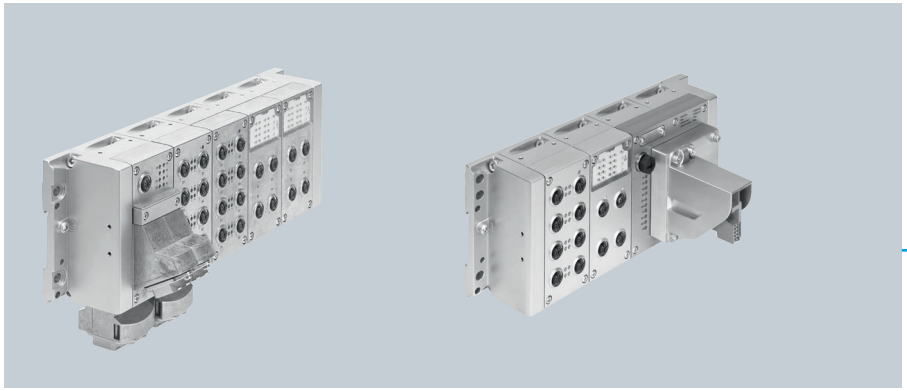
Battery production for electric vehicles – CPX controls independent, decentralised, interlinked machine modules.

Festo Terminal CPX. One platform for many applications. Makes your automation easier.

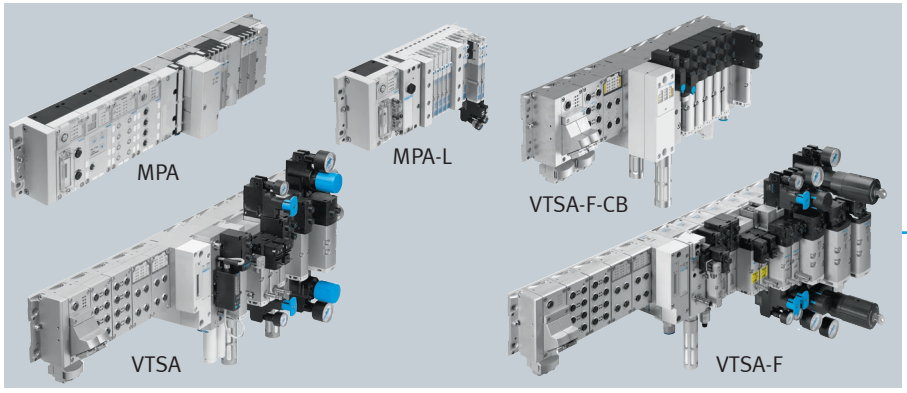
Automation in the field



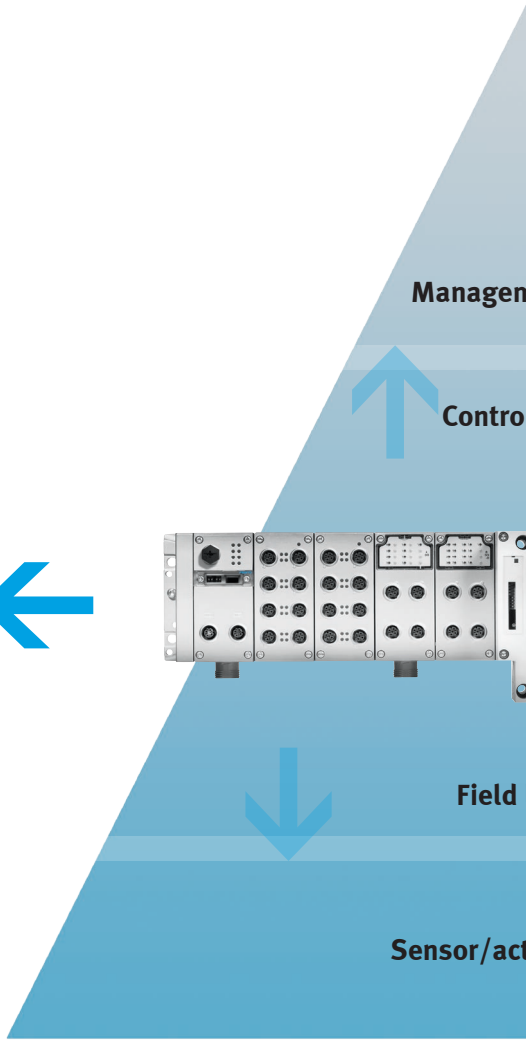
Universal and efficient for all applications – CPX as remote I/O with interlinking and connecting components in polymer. Perfect for centralised and decentralised installation concepts.
→ Pages 12/13



Especially robust, with individual linking – CPX as remote I/O with interlinking and connecting components in metal. AIDA connection technology available on request.



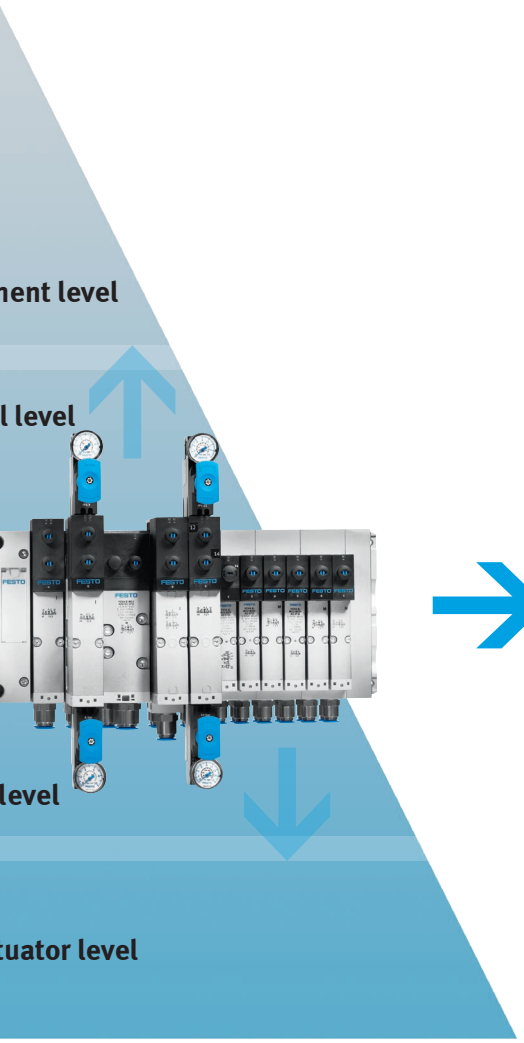
CPX combined with powerful valve terminal platforms
- MPA with serial interlinking and pressure control/proportional pneumatics
- MPA-L with individual expansion in affordable polymer
- VTSA – standard valves to ISO 15407 and 5599 in 5 sizes, with integrated safety functions
- VTSA-F – optimised for up to 30% more flow
- VTSA-F-CB – optimised with serial linking and optional safe internal shutoff



Festo CPX – the complete solution for groundbreaking automation. One platform

We want to make things easy for you.
The CPX portfolio provides you with one technology, one platform, one structure. And just one specification, one supplier, one responsibility. But in 5 specific variants so that CPX becomes the perfect fit for your application, sector, and environment.

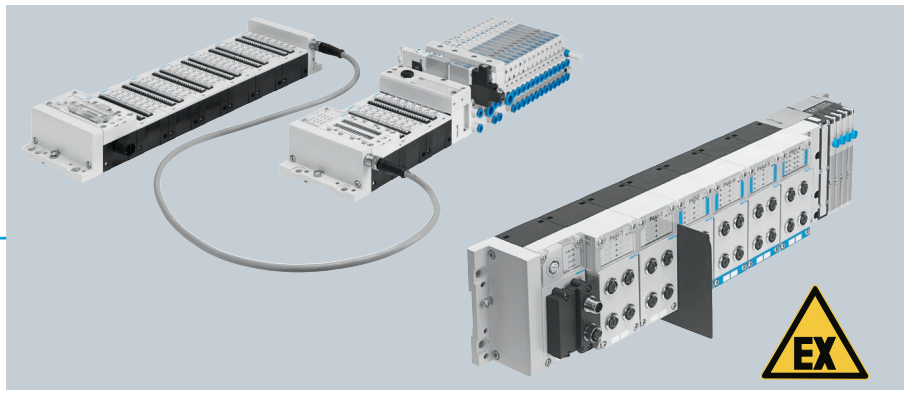
Core competency in automation



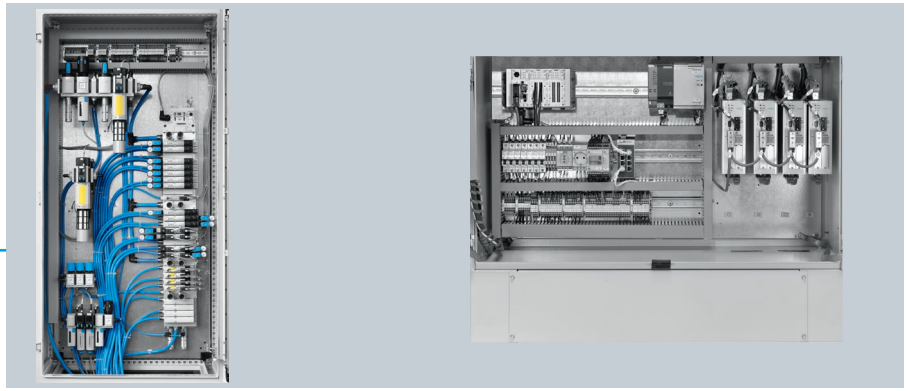
across all levels in the control technology pyramid.

But still have all your needs met.
CPX can give you what you want: modifications, installation-specific adaptations and pre-assembled solutions are possible at all times and with little effort.
Easy to achieve: decentralised CODESYS control and IoT gateway with OPC-UA or MQTT integrated in PROFINET for communication directly with the cloud.

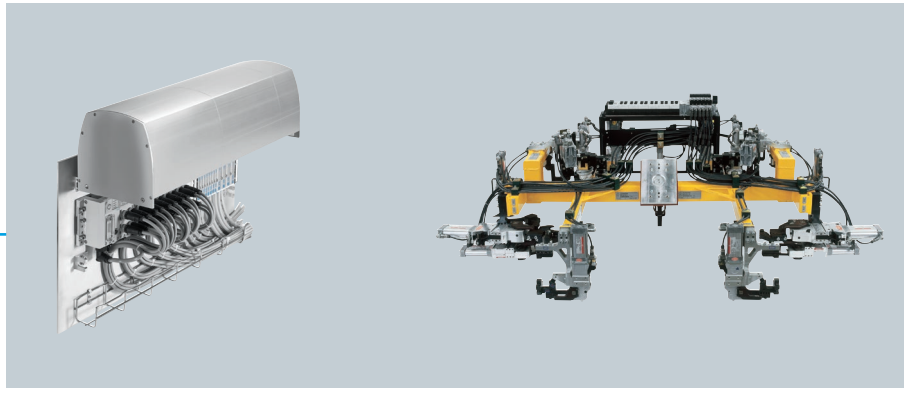
Automation in special environments



CPX-L as cost- and space-optimised IP20 solution for the control cabinet and with second-row expansion options. CPX-P with NAMUR inputs for sensors in Ex zones 0 or 1, can be combined with all CPX standard functions.



Control cabinet construction as a complete solution for fluid and motion control applications. A service from Festo.

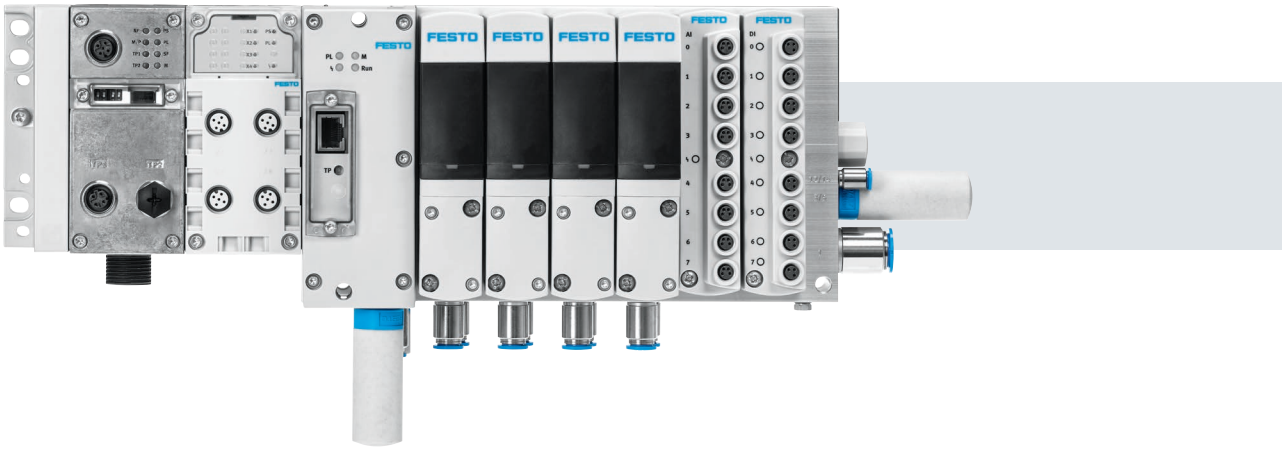


CPX can also master special requirements, such as quick tool changeovers thanks to fast startup/quick connect functions. And it can be easily adapted to special environments or requirements.

Pneumatics 4.0 with CPX – the matchless Festo Motion Terminal VTEM

The Motion Terminal VTEM uses the world's first valve that has its functions controlled by apps. The intelligent technology consisting of pneumatics, sensors, electronics and software enables many motion and monitoring tasks. The first product to truly earn the label "digital pneumatics".

The terminal CPX is an integral part of the Motion Terminal and opens the door to industrial digital transformation. With VTEM, you get your system ready for Industry 4.0.



Modular electrical terminal CPX
– electrical systems at their most flexible
With CPX, you have the option of using many different control systems and end user specifications, as well as all the usual digital and analogue I/O modules or decentralised classic valve terminals.

With CPX, you can integrate the fieldbus or Industrial Ethernet node you need, subordinate installation systems such as CTEL and IO-Link®, or the CODESYS controller with OPC-UA interface.
VTEM and CPX are ideal partners for your state-of-the-art automation solution.

Find out more at
→ **www.festo.com/motionterminal**

Controller with motion app
– software at its most flexible
The core of your Motion Terminal with decentralised intelligence and rapid control It enables you to conveniently control numerous functions and to assign them to the individual valves via the Ethernet Web-Config interface.

With the "Internet of Things", you can adjust parameters efficiently through the intuitive WebConfig user interface, which you access via a web browser on a computer – no additional configuration software is required. Or you can set parameters in the usual way, easily and directly via the PLC machine controller.

Motion Terminal VTEM
– pneumatics at its most flexible
The individual control and freely programmable functions of the individual valves on VTEM offer a high degree of flexibility.

The integrated stroke and pressure sensors provide optimal control and transparent condition monitoring.

Each valve on VTEM contains:
- Valve electronics for precise actuation
- 4 innovative piezo pilot valves for minimum energy consumption and maximum service life
- 4 proportional diaphragm poppet valves for extensive functionality

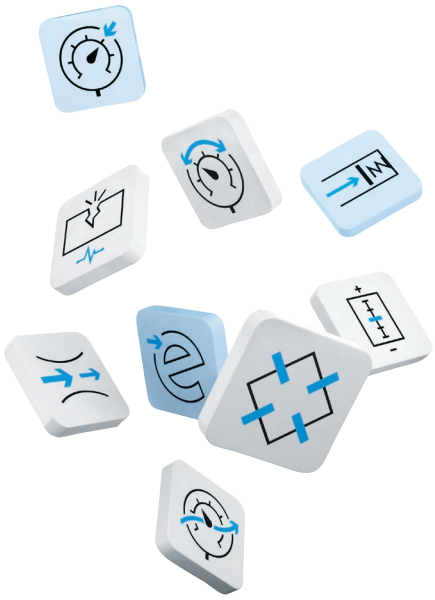
Highlights
- Many functions in a single component thanks to numerous Motion Apps
- Reduced complexity and faster time to market
- Predictive maintenance and easy traceability
- Greater profitability and increased knowledge protection
- Less installation effort and more flexibility
- Increased energy efficiency
- Ideal for Industry 4.0 and digitalisation in automation

Top in every field:
the Motion Terminal really comes into its own in pneumatic regulation of motion, pressure and flow rate. When you combine these three functions in an application, the incredible potential and functionality offered by digitised pneumatics quickly becomes clear. The benefits of this digitalisation are found in all stages of the value chain – both for OEMs as well as for end users.

App-controlled flexibility: digitalised pneumatics for Industry 4.0

Intelligent systems with appropriate software and apps are a key part of Industry 4.0. These systems can communicate with one another and execute processes autonomously using their existing interfaces. The apps in the Motion Terminal allow a level of function integration unlike any seen before.

What's more, many of these apps are self-learning, i.e. they continuously check process parameters and correct them if necessary.



Gain added value and a technological edge
With the app-based Motion Terminal, Festo is digitising pneumatics and propelling it into the future. When you buy a Motion Terminal, you buy more than just a component: VTEM offers you entirely new approaches to solutions.
Having access to new information and being able to process it provides you with added value and gives you a technological edge. It also provides you with huge benefits in engineering, design and programming, and ultimately increases your competitiveness and productivity.

One piece of hardware for all functions
With the Festo Motion Terminal, pneumatic functions are, for the first time, no longer connected to the mechanical hardware, and can be assigned simply using apps. All you now need is just a single valve type for an extremely wide range of pneumatic movements and functions.

What benefits does the Motion Terminal already offer for Industry 4.0?
Adaptability for increased productivity
- Change formats using parameter records without manual pressure regulators
- Modify apps/functions during operation
- Process reliability thanks to self-regulating, autonomous adjustment, e.g. when presetting the travel time
- Flexible production, e.g. via remote control of supply and exhaust air flow control

Digitalisation for reduced complexity
- No need for lots of additional components thanks to digital function integration
- Product key as a digital copy

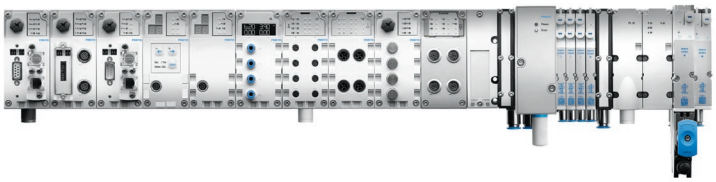
Standardised networking, data-based decisions
- OPC-UA via the automation platform CPX
- Preventive maintenance using condition monitoring apps such as "Leakage diagnostics"

Motion Apps
- Directional control valve functions
- Proportional directional control valve
- Supply and exhaust air flow control
- Leakage diagnostics
- ECO drive
- Selectable pressure level
- Presetting of travel time
- Proportional pressure regulation
- Model-based proportional pressure regulation
- Soft Stop
- Positioning
- Flow control

Find more about the Motion Apps at **www.festo.com/motionapps**

Festo CPX: a bridge to Industry 4.0

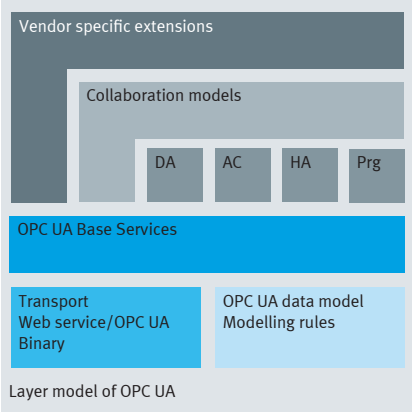
Technology and competency



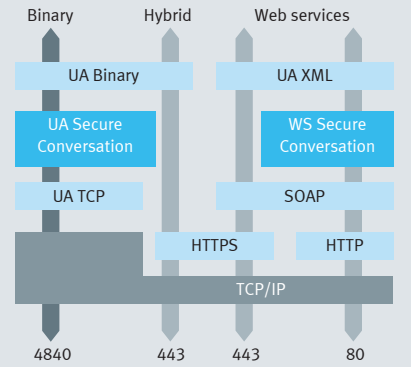
Embedded control from Festo is modular, adaptable and equipped with decentralised intelligence, and has been for more than 20 years. CODESYS V3 and OPC UA are building the bridge to Industry 4.0, also known as the Internet of Things.

Scan, look and discover with the product key
All the information for a modular CPX is contained in the data matrix code: the technical data, CAD, spare parts ordering by mobile phone and access to the cloud – putting Festo unmistakably on the road to Industry 4.0.

OPC UA as communication interface and information protocol



Layer model of OPC UA

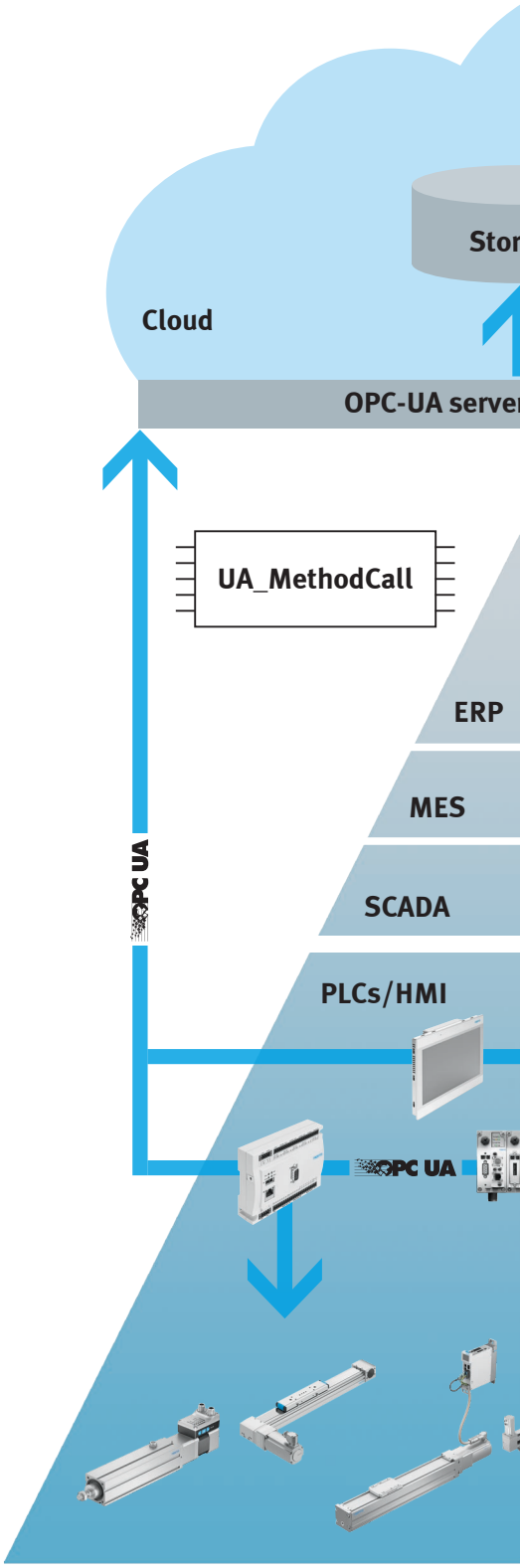


OPC UA transport profiles

OPC UA opens up the way to an architecture which is platform-neutral, manufacturer-neutral, and service-oriented. Ideal for Industry 4.0. Source: OPC Foundation

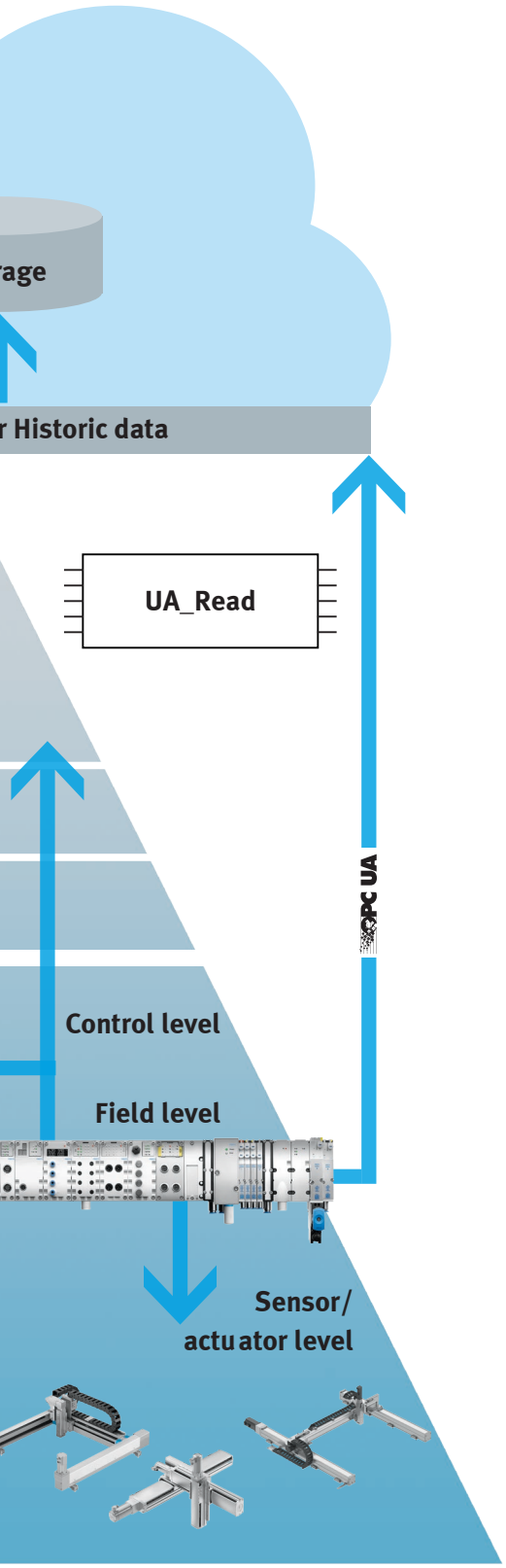
Real solution package for Industry 4.0: tripod with robot control without control cabinet

Made possible by new, intelligent electric drives EMCA with integrated servo controllers and CPX from Festo. A new addition is the networking of the real world with the virtual one via CIROS from Festo Didactic, and in the long term via Automation ML (AML).



Industry 4.0: things communicate with one another
More master-master communication and both horizontal and vertical networking with a single, uniform information model: these are the hallmarks of a fourth industrial revolution – Industry 4.0 or the Internet of

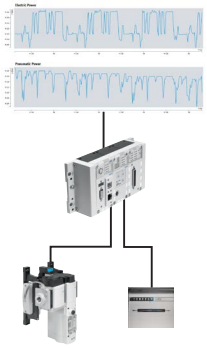
Turning vision into reality



Things. The traditional, inflexible automation pyramid will cease to exist in the foreseeable future.

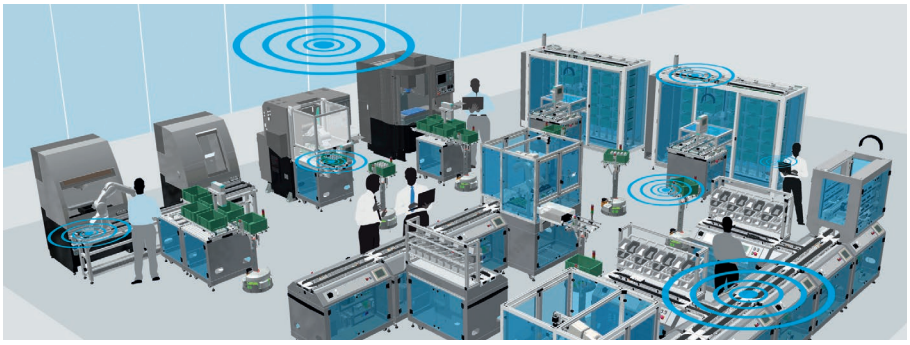
Festo CPX is making an important contribution to this transformation – see next page.

Highly flexible: Festo's Scharnhausen Technology Plant



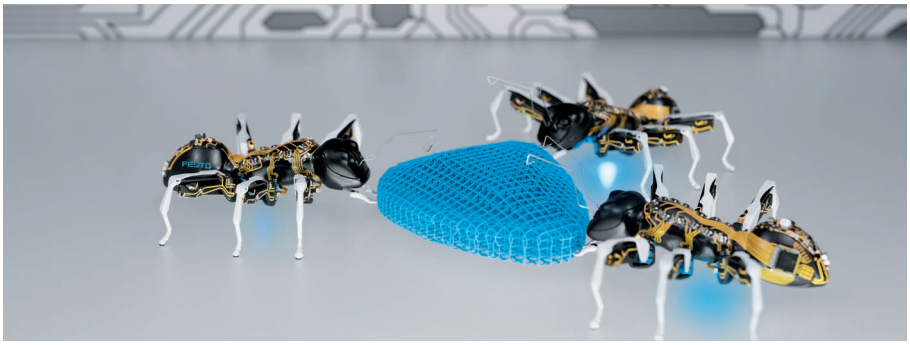
Our adaptable Technology Plant is an example of where Industry 4.0 can lead. OPC UA and CPX are used intensively in production, for example in energy monitoring with the energy efficiency module E2M, a world first from Festo.

Teaching Industry 4.0: Festo Didactic



With subjects like simple and flexible networking in production, communication between components in industrial systems, interaction between people and technology, and the production environments of the future, Festo Didactic offers technical basic and further training for the practical implementation of Industry 4.0.

Bionics as an inspiration for Industry 4.0

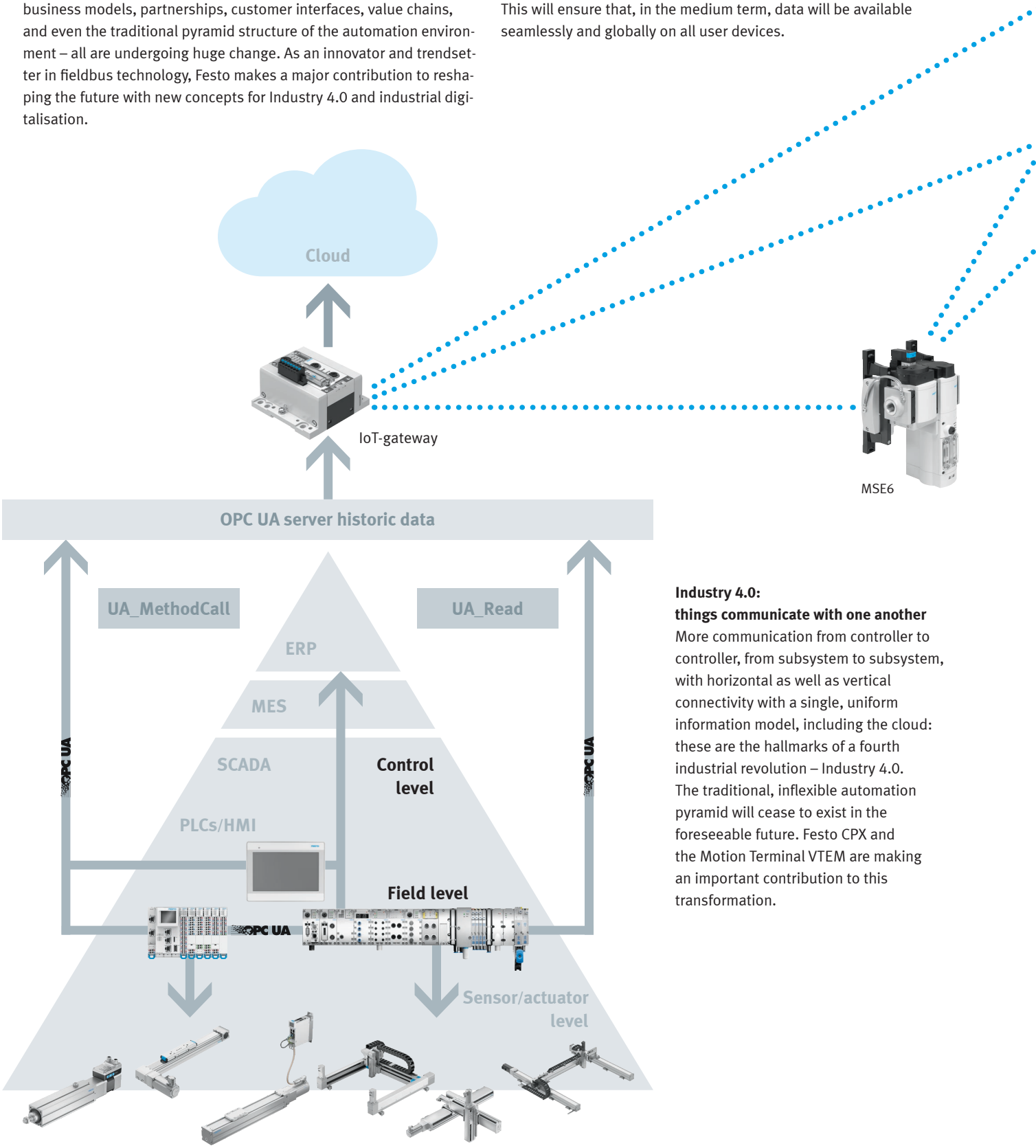


Bionics as an inspiration for Industry 4.0: the collaborative behaviour of ants, collective flight behaviour of butterflies, or an extremely versatile gripper modelled on the tongue of a chameleon are revealing new pathways for visionary automation technology, exclusively at Festo.

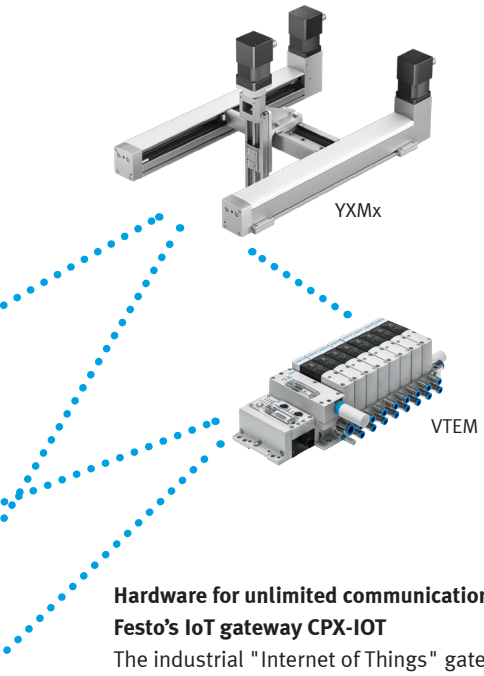
Industry 4.0 –
always a finger on the pulse thanks to complete networking

Many traditional concepts have been overtaken by the fourth industrial revolution and by the ever-increasing digitalisation: business models, partnerships, customer interfaces, value chains, and even the traditional pyramid structure of the automation environment – all are undergoing huge change. As an innovator and trendsetter in fieldbus technology, Festo makes a major contribution to reshaping the future with new concepts for Industry 4.0 and industrial digitalisation.

This includes new products, cloud services, apps, as well as a modern online shop with comprehensive, integrated engineering concepts. This will ensure that, in the medium term, data will be available seamlessly and globally on all user devices.



Industry 4.0:
things communicate with one another
More communication from controller to controller, from subsystem to subsystem, with horizontal as well as vertical connectivity with a single, uniform information model, including the cloud: these are the hallmarks of a fourth industrial revolution – Industry 4.0. The traditional, inflexible automation pyramid will cease to exist in the foreseeable future. Festo CPX and the Motion Terminal VTEM are making an important contribution to this transformation.



Hardware for unlimited communication: Festo's IoT gateway CPX-IOT
The industrial "Internet of Things" gateway is based on the CPX module format. CPX-IOT collects information about Festo devices and their statuses via an Ethernet connection and a standardised communication protocol such as OPC UA, for example. It sends that information via a second Ethernet connection using IoT protocols such as AMQP or MQTT. Suitable IT security mechanisms ensure data security.

Integration as a subsystem or as a non-hierarchical system
Festo products, such as electric and pneumatic drives, valves/valve terminals, I/O terminals, compressed air supply or sensors, can thus be integrated as subsystems from the traditional pyramid if needed, e.g. via decentralised controllers such as CPX, CPX-E or CECC.

Or alternatively they can be integrated directly, with no hierarchy:
- The handling system YXMx
- The energy efficiency module MSE6
- The Festo Motion Terminal VTEM

These products thus constitute cyber-physical systems in line with Industry 4.0. They take in application and device data, process the data into diagnostic modules in CODESYS V3 in accordance with VDMA 24582 and forward the information to the cloud.

Cloud services: increased productivity for machine builders and end users
Cloud concepts and services will be very heavily dependent on the particular approach, partner or provider selected. Data will undergo further processing and long-term analysis in the cloud, with a dashboard visually presenting the information acquired. Festo supports machine builders and end users on the road to increased productivity.
This includes:
- Simple visual presentation of complex interrelationships
- Analysis function for rapid data processing
- Greater transparency, e.g. by condition monitoring online
- Optimisation of the applications, preventive maintenance, etc.

The result: increased productivity through improved utilisation and less downtime.

Realising functions digitally with product-related apps
- Motion apps for the Festo Motion Terminal VTEM simplify the programming of automated movements, even without advanced knowledge of pneumatics
- Motion apps for YXMx handling systems with electric drives

Realising functions digitally with software and service apps
- Fluid Draw app: CAD functions for electrical and pneumatic circuit diagrams
- Festo Design Tool 3D: a 3D product configurator for generating Festo-specific CAD product combinations with all accessories
- EPLAN schematic services: macro libraries created by Festo for E-CAD software EPLAN Electric P8, version 2.1 or higher.
- Engineering tools from calculation and sizing to commissioning and operation, including easy data and parameter transfer

Make the most of maximum modularity and flexibility

Unique on the market thanks to its flexibility as remote I/O: what was once complex has now become simple.

Global trend of function integration: One terminal – one remote I/O – many modules
- State-of-the-art and efficient automation, particularly with Industry 4.0, will be fundamentally determined by modularity, adaptability and communication ability.
- CPX can be easily adapted to all applications, environments and company standards, and enables huge savings to be made on engineering and installation thanks to function integration
(→ pages 14/15)

Incredible variety of I/O modules
- Use as remote I/O
- Expandable up to 17 I/O modules
- Up to 256 local and 512 decentralised inputs
- Flexible adaptation with software parameterisation reduces inventory requirements

Maximum modularity and flexibility
- 15 connections variants in IP20/IP65/IP67 – for faster installation and compatibility with company standards
- Connection accessories M8/M12/Sub-D/quick connector
- Modular system for M8/M12/cage clamp connecting cables
- Plastic or metal threads
- Perfect for direct machine mounting and adaptation to machine concepts
- 24 V DC power supply (max. 16 A) for electronics plus sensors and actuators plus valves

Modular cable system
- Choice of any cable lengths: 0.1 ... 30 m
- Adapted to all devices with M8 and M12 plugs or solenoid coils
- Cable types: standard cable, robotics cable, cable suitable for use with energy chains

A choice of scalable pneumatic installation concepts
- Centralised installation
- Decentralised installation (I-Port; IO-Link)
- Hybrid installation

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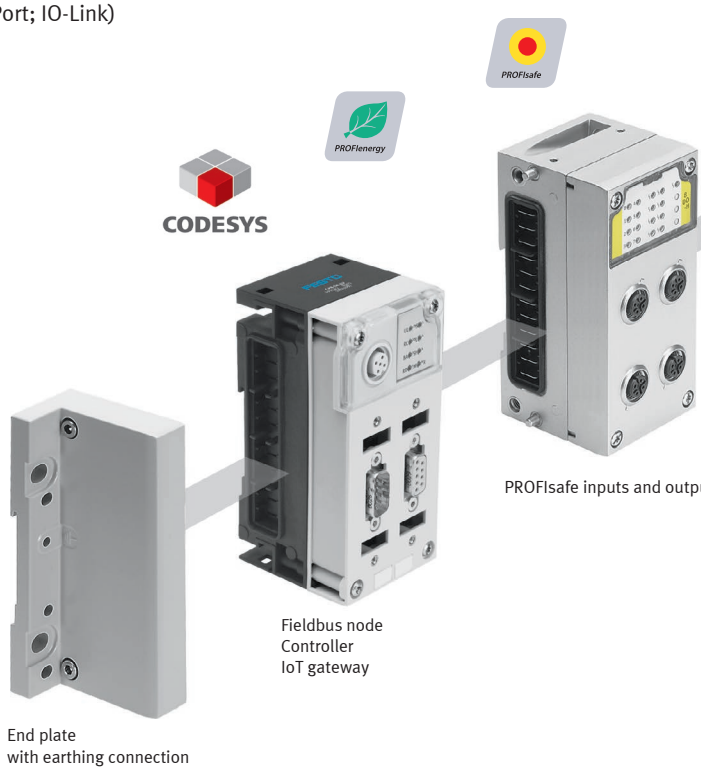
Front-end controller CPX-CEC with CODESYS
With serial interface (-S1-V3)
- Ethernet: Modbus TCP, EasyIP

With CANopen master (-C1-V3 and -M1-V3)
- Ethernet: Modbus TCP, EasyIP
- Optional OPC-UA interface
- M1: CODESYS Softmotion library for motion control up to 3D



Versatility through competency: CPX communicates in multiple languages and is suitable for numerous control concepts

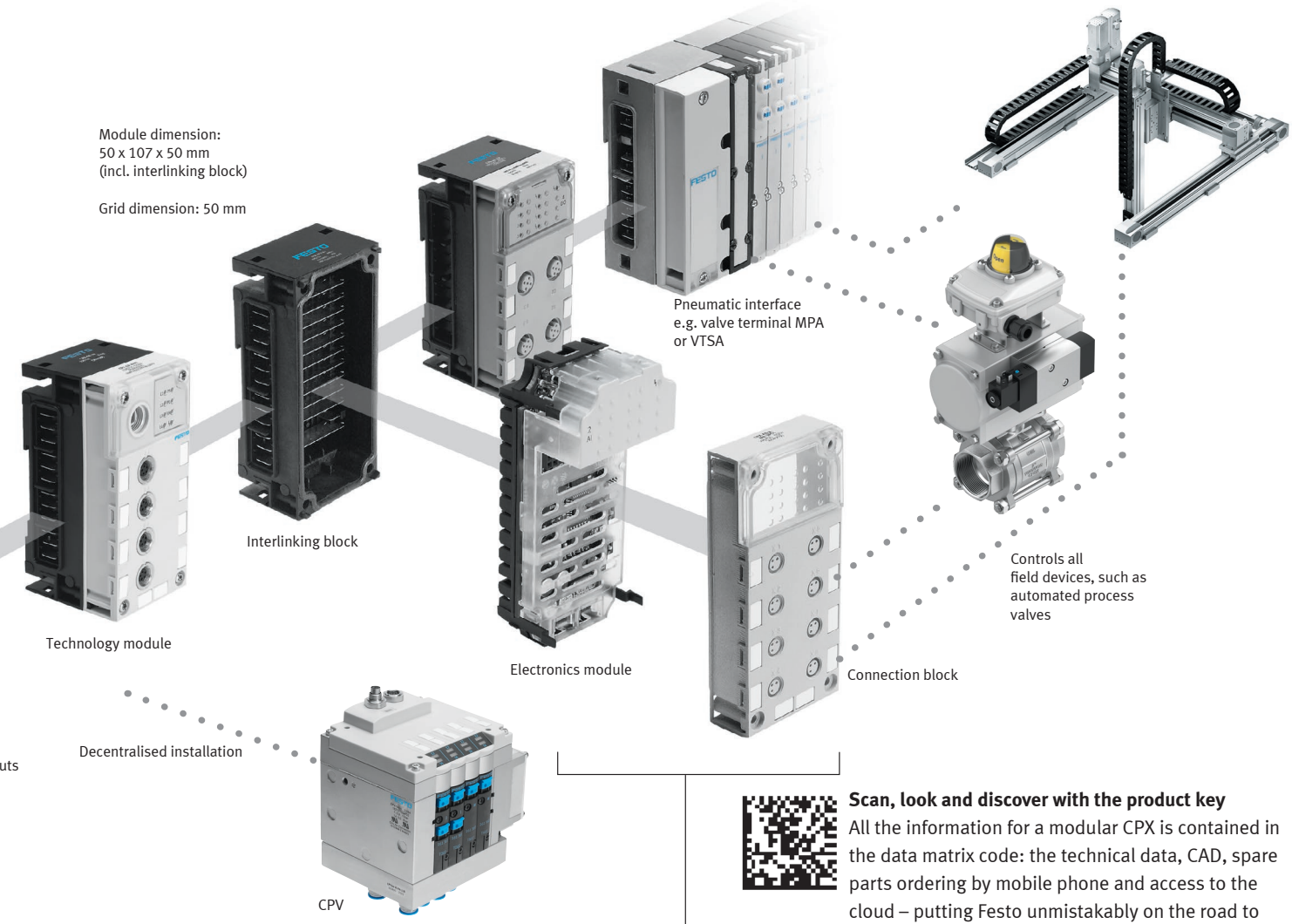
Perfect networking for universal communication
Focal point of CPX: maximum openness for all installation, communication and control concepts.
- Standardised communication with a single platform, from the management and operational level to the actuator/sensor or field level.
- Integration of pneumatic and electrical control chains into all automation concepts – even company-specific ones.
- Open to all fieldbus protocols as well as Ethernet

PROFIBUS · CANopen · PROFINET · DeviceNet · INTERBUS · EtherNet/IP · CC-Link · ETHERNET POWERLINK · sercos the automation bus · EtherCAT · Modbus TCP

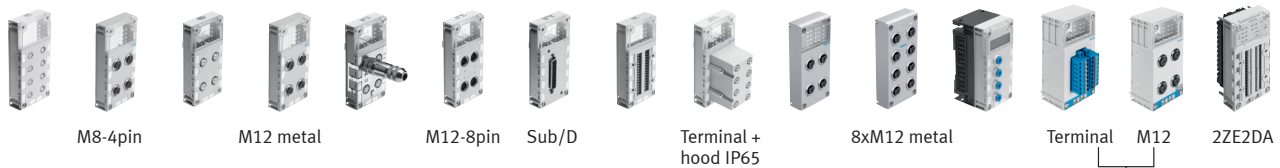
Front-end control: possible electrical control concepts
- Remote I/O on fieldbus/Ethernet
- Stand-alone operation (IP65/67 stand-alone control)
- Fieldbus remote controller
- Ethernet remote controller including use of IT technology
- Preprocessing
- Motion control for electric and servo-pneumatic drives

Rapid data transmission and real-time capability thanks to built-in preprocessing.
→ Pages 18/19

Core competency in automation



Scan, look and discover with the product key
All the information for a modular CPX is contained in the data matrix code: the technical data, CAD, spare parts ordering by mobile phone and access to the cloud – putting Festo unmistakably on the road to Industry 4.0.




NEBV coil socket


NEBV M12/M8


NEDY: Y-distributor for M8/M12
solenoid coils, up to 30 m


NEDY: Y-distributor for solenoid
coils as per standard, up to 30 m


NEDY: Y-distributor for
Festo solenoid coils, up to 30 m


NEDY: T-distributor
M12/M12, M8/M8, M12/M8

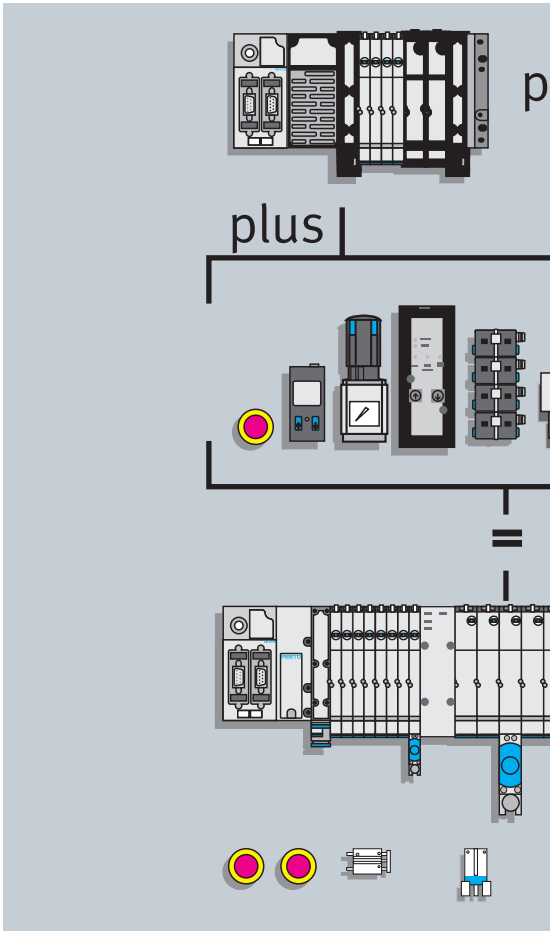

NEDY: Y-distributor for everything:
All combinations M8, M12 from 0.30 to 30 m

Maximum efficiency through function integration

Lowers costs, saves time, provides limitless possibilities and reduces TCO: the modular electrical terminal CPX.

Thanks to maximum modularity and functionality, multiple functions can now be integrated into valve terminals and the CPX as remote I/O, providing virtually limitless possibilities.

These single-source solutions drastically reduce your installation costs and minimise total costs.

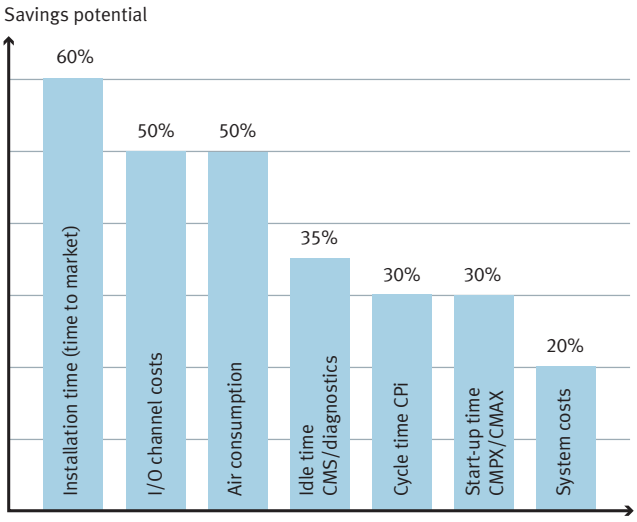


Single-platform solutions
- Digital and analogue standard tasks
- Demanding I/O tasks with single-channel diagnostics and parameterisation
- Temperature, displacement and pressure measurement
- Rapid pulse counting and measuring in single, periodic and constant modes
  - Measuring frequency, duty cycle, and rotational speed
  - Position detection by measuring travel length, travel direction, speed, and angle
  - Fast pulse output for pulse train, pulse-width modulation, switch-on delay, switch-off delay, and frequency output variants
  - 24 V DC motor control
  - 5 V and 24 V encoder supply
- Electrical and pneumatic safety functions
- Integrated, comprehensive diagnostics and condition monitoring
- Subordinate, decentralised installation system

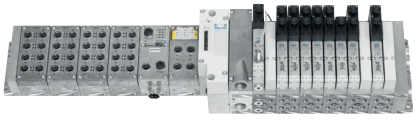
Combine this information directly with the operating elements
- Pilot or process valves
- Control valves for cylinders, grippers, vacuum
- Pressure regulators for proportional control systems
- Servo-pneumatic positioning systems
- Electric drives and axes

Choice of control via fieldbus/Ethernet as remote I/O or with front-end controllers
- CPX-CEC-S1-V3
- CPX-CEC-C1-V3
- CPX-CEC-M1-V3
  (CODESYS V3 controller with 32 bit processor, 800 MHz, CANopen master (-C1, -M1) or serial interface (-S1). M1 with motion control package).

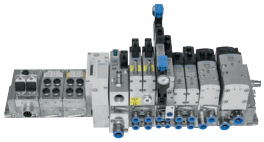
Reduce TCO – your savings potential with CPX



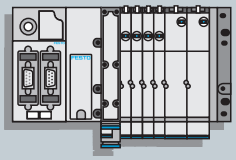
Learn from the best – customer examples of function integration and reduced TCO

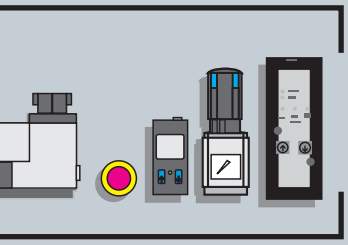

Car assembly – saves 762 minutes

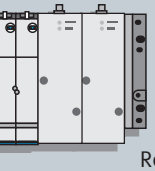

Label production – saves 1060 minutes


Thin film processing – saves 849 minutes

lus





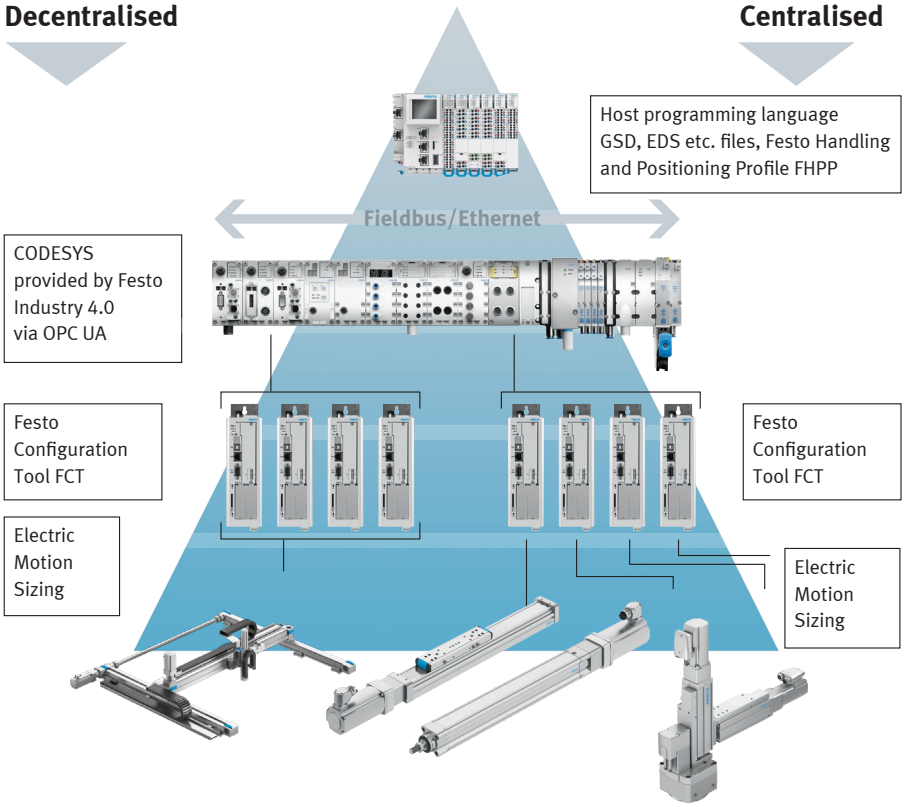


Resource-saving function integration with CPX: multiple valve terminals, voltage zones and many other single components can be combined without any problem.

We make function integration on the CPX easy – whether integrated decentrally or centrally into your control architecture and cloud concepts

Universal selection, configuration, optimisation of control chains, and the smooth integration of all data with engineering tools from Festo all make an important contribution to your success. Your automation solution becomes easy, complete and decentralised.

If you decide on a centralised automation architecture, you can seamlessly integrate a CPX – also available as a complete unit – into your control architecture and control system.



Choice of control via fieldbus/Ethernet, remote I/O – or with the front-end controller CPX-CEC

CPX-CEC with CODESYS V3 controller with 32-bit processor (800 MHz)

- CPX-CEC-S1-V3: serial interface
- CPX-CEC-C1-V3: CANopen master
- CPX-CEC-M1-V3: CANopen master, Motion Control Package

As a stand-alone system, Festo CPX can completely control compact machines and systems such as testing stations, making higher-level controllers obsolete (➔ pages 18/19).

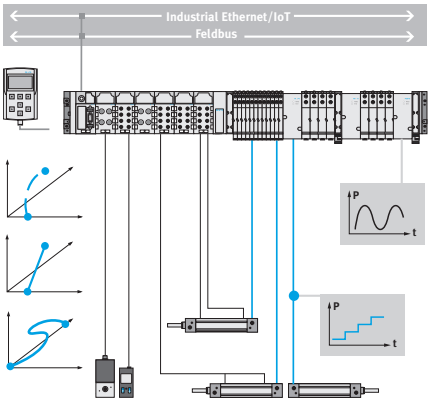
More online at
http://www.festo.com/funktionsintegration
Here you can find 12 real customer examples of function integration on our CPX platform. Discover how to optimise pneumatic and electric systems and integrate safety.

Your Festo sales engineer will be happy to discuss the details with you and provide an estimate of the potential savings for you.

Function integration as a guiding principle:
On the next few pages you will find an overview of all available options.

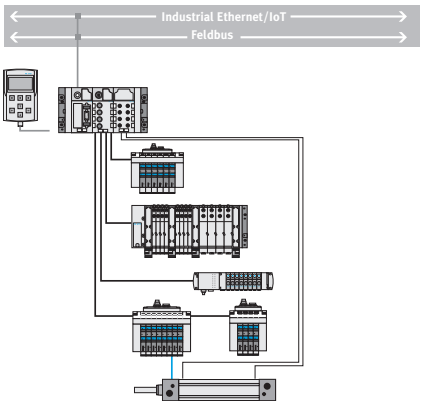
Always the ideal installation concept = maximum efficiency

Centralised or decentralised: CPX can be optimally adapted to your machine/system concept



Centralised installation
- Control of several drives and functions via one valve terminal
- Short control loop system, only a few metres long
- Typical number of I/Os between 16 and 128

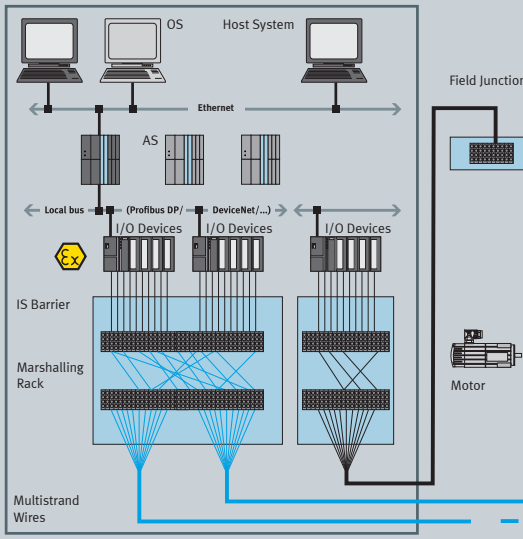
Benefits
- Up to 60% more efficient thanks to function integration
- Channel costs reduced by up to 50%
- Up to 40% better performance



Decentralised installation system
- Subordinate, Festo-specific, self-configuring bus system
- Individual functions on a small valve terminal
- Installation-saving hybrid cable for data and power for connecting up to 16 modules via fieldbus nodes

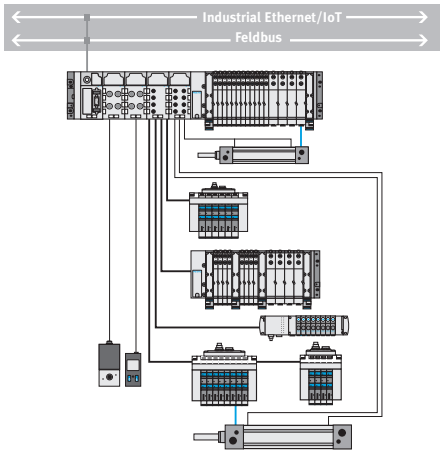
Benefits
- Cycle times shortened by up to 30% thanks to very short tubing lengths
- Space reduced by up to 70%
- Air consumption reduced by up to 50%

Installation environment with control room



Easier than ever: installation concepts in Ex zones with CPX-P and NAMUR sensors in Ex zones 0 and 1
- CPX-P modules are optimised for the process industry
- They can be combined with CPX standard modules, all CPX versions certified for zone 2/22

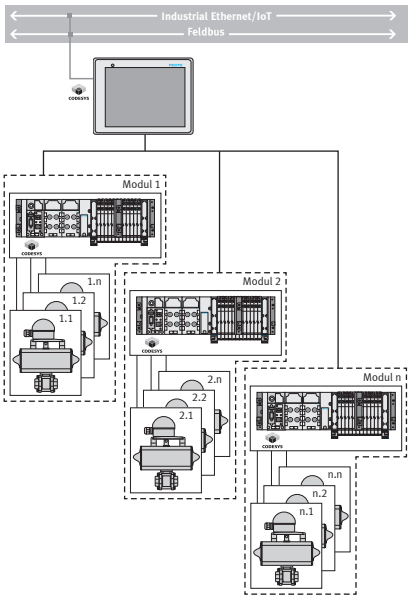
Only from Festo: the combination of centralised and decentralised machine/system concepts

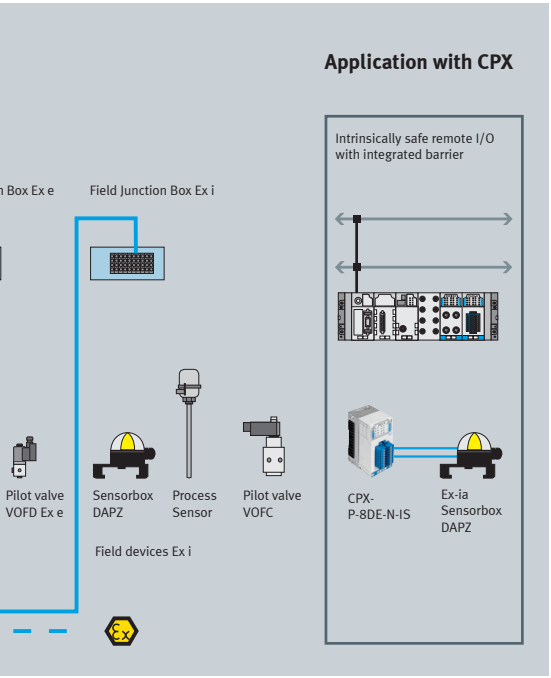


Hybrid installation system (centralised/ decentralised)
Only available from Festo!
- Individual systems can be combined and expanded as needed
- Also ideal in a control cabinet or on a control cabinet wall.

Benefits
- Excellent combination
- Short cycle times and high machine performance
- Greatly reduced system costs in terms of TCO

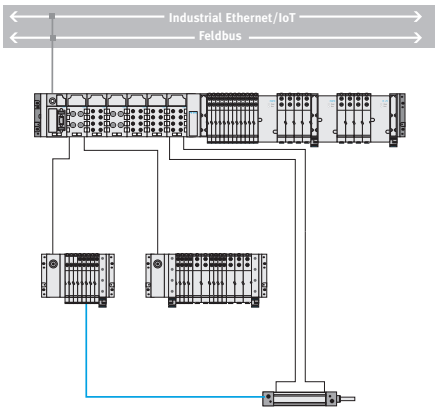
Trends and requirements in the process indust





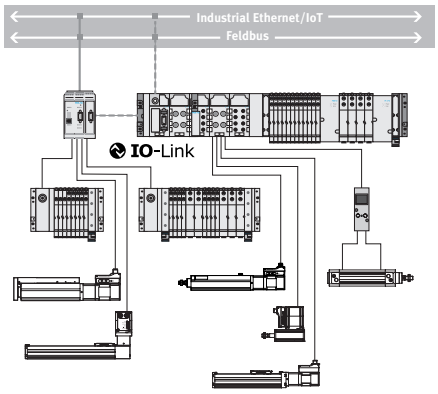
- Certified for use in a control cabinet in Ex zone 2
- NAMUR sensors in Ex zone 1 or 0 can be connected to the blue, intrinsically safe CPX-P modules
- Online product configurator – for error-free configuration!

System expansions made cost-effective



System expansion Festo I-Port/CTEL
- CPX-CTEL master with 4 I-Port interfaces
- I-Port: Festo-specific, uniform M12 interface for connecting to subordinate input modules and valve terminals
- Point-to-point connection for up to 20 m
- Self-configuring system
- Basic diagnostics: undervoltage, short circuit

Benefits
- Self-configuring
- Inexpensive basic functions
- Everything from a single source



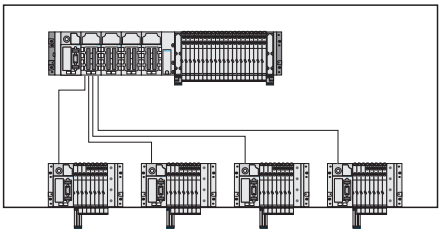
Festo IO-Link master
- Controller CECC with Ethernet, 4 IO-Link master ports or 1 CANopen master.
- IO-Link interface CPX-CTEL-...-LK with 2 IO-Link ports (PROFINET, SERCOS)
- IO-Link: universal, standardised M12 interface for connecting to subordinate devices from various manufacturers
- Point-to-point connection for up to 10 m
- Configuration via device descriptions (IODD) and PC/laptop.

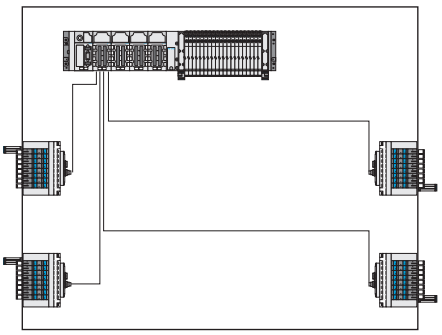
Benefits
- Open, standardised system
- External functions can be integrated

ries: modular automation

Modular automation concepts with CPX
- Faster time to market for products
- Reduced planning and setup costs due to the standardisation of subassemblies (modules)
- Savings in investment and operating costs over the product lifecycle
- Process intensification for improved energy efficiency
- Reduced number of process steps, conversion of batch process sections into continuous process sections

I-Port or IO-Link – fast, easy, economical for your control cabinet



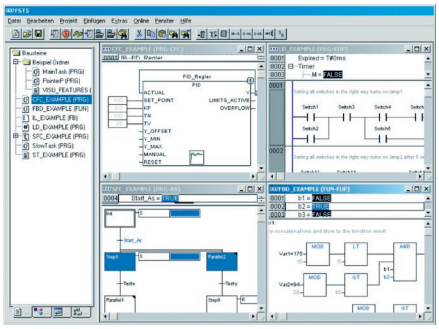


In combination with the I-Port extensions, innovative control cabinet installation concepts that are both space- and cost-optimised can be realised as follows:
- Simple control cabinet execution
- Fast electrical and pneumatic installation
- Easily adaptable to cleaning, installation space and Ex protection concepts
- Technically and economically optimal system design
- Construction of the entire control cabinet by Festo on request.

Competency built-in:
stand-alone control with CPX as front-end controller

Stand-alone automation platform: CPX-CEC with CODESYS as embedded controller

With CPX-CEC, the remote I/O can be expanded into a modular PLC in IP65/67. Direct machine mounting enables preprocessing or completely autonomous control, while reducing installation costs – in every sector and application. It all makes CPX into an unprecedented, stand-alone automation platform. It can be used to control manual workstations, relatively small machines or interlinked subsystems.



Programming in a global language to IEC 61131-3. CODESYS enjoys widespread acceptance on the control system market. Optional OPC UA package for Industry 4.0 HOST environments.

Festo CPX offers three control variants, all with Ethernet connection

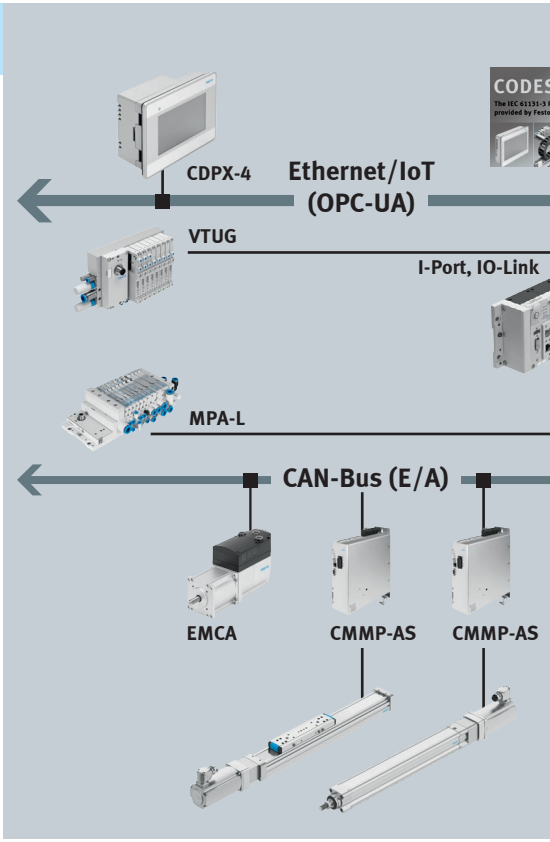
- CPX-CEC-S1-V3 and serial interface module
- CPX-CEC-C1-V3 with CANopen master
- CPX-CEC-M1-V3 plus Softmotion library for MC applications in up to 3D

CODESYS

The CANopen master integrated in the control system can actuate pneumatic and electric axes intelligently via fieldbus. The extensive CODESYS V3 function library provides diagnostics and condition monitoring options.
CODESYS V3 simplifies your life with standardised controller programming to IEC 61131-3: you benefit from simple commissioning, and fast programming and parameterisation. This also includes the new Softmotion library for motion control and interpolation in up to 3D with the controller CPX-CEC-M1-V3.

Summary of benefits:

- Increased performance
- Reduced costs (central control and separate engineering process steps can be eliminated)
- Improved cycle times
- More actuators can be connected
  - 127 axes on CPX-CEC-C1-V3
  - 31 axes with interpolation (3D) on CPX-CEC-M1-V3



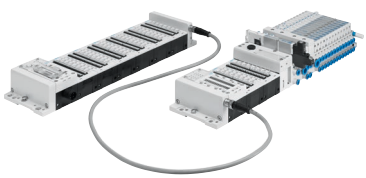
CPX-CEC with CANopen and CODESYS make CPX fully autonomous. The top part of the illustration shows which additional components can be docked on and controlled by CPX-CEC; the lower part of the illustration shows which work options this gives you.

Simple system design and many expansion options

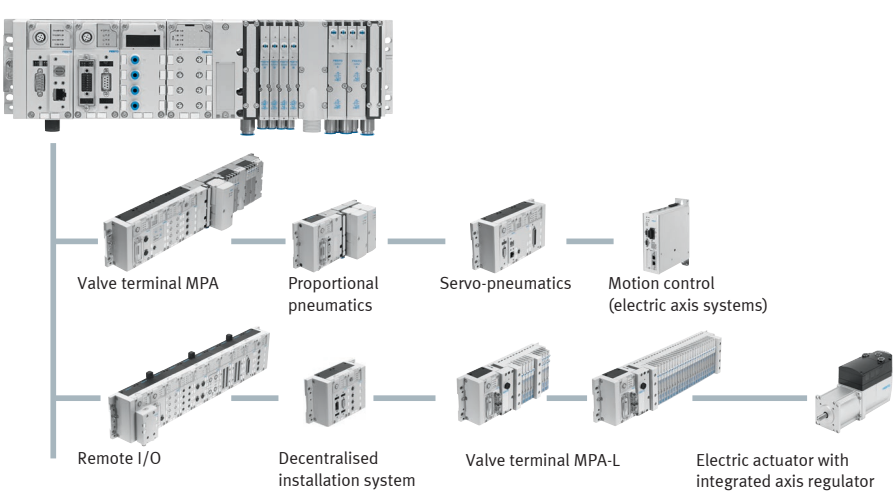
System design and expansion

- 9 CPX modules with 4 … 16 DI/O or 2 … 4 AI/O each
- Second-row CPX extension: up to 17 CPX modules on one fieldbus node, up to 11 on one CPX-CEC
- Up to 127 CANopen slaves in CPX-CEC-C1, fewer depending on the required system performance.

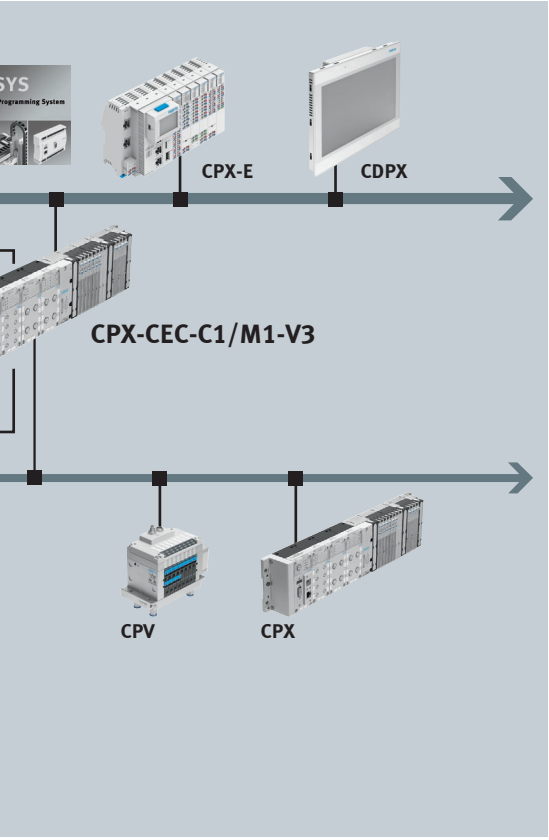
System expansion with CPX extension



System expansion with CANopen



Core competency in automation



Excellent solution package for diagnostics and condition monitoring in pneumatic (sub)systems

Fast and simple implementation of diagnostic functions, enhanced energy efficiency, process optimisation for customer projects, or support with air consumption measurement and system analysis. It is all possible with the software library for all Festo CODESYS controllers. Ready-made software components support the monitoring of pressure, flow rates and air consumption.
Other diagnostic functions include:

- Standard functions (mean/maximum values, etc.)
- Counting functions
- Time functions, such as travel times
- Pressure build-up times for actuators
- Detailed diagnostics, such as wear or leak detection

CODESYS can also be used to interpret the information acquired. Detailed diagnostics and plausibility checks (if-then analyses) are also possible, as is integration into SCADA systems via an OPC server/OPC UA

Integrated IT service

The CPX-CEC provides among others:

- TCP/IP
- Data transfer
- Remote service, remote diagnostics
- FDT/DTM
- Web server, OPC server
- Web monitor as integrated homepage
- Text message and e-mail alert
- Maintenance tool with USB adapter for PCs

This opens up opportunities for integrated diagnostic concepts, reduces unscheduled downtime of your system by up to 35%, saves costs and can be seamlessly integrated into host systems.
→ Pages 28/29

Easy with integrated motion control

Control electric drives easily: individual modules

Motion control with CPX-CEC-C1-V3

Benefit from automation programming based on IEC 61131-3.
Directly mounted on the machine as an intelligent remote I/O terminal in IP65/IP67, CPX-CEC is perfectly adapted to the CPX terminal and decentralised control tasks in the machine.

- Extensive CODESYS function library
- Integrated CANopen master for several thousand I/Os
- Motion control with up to 127 asynchronous electric drives

Benefits

- Reduced installation costs
- Improved cycle times
- Significantly more functionality

CPX-CEC-C1 V3 CODESYS controller with CANopen master for multiple asynchronous axes – controlled decentrally in the field.

Motion control with CPX-CEC-M1-V3
As the CPX-CEC-C1, with additional CODESYS Softmotion library. This allows the controller to perform a 3-dimensional interpolation for up to 31 synchronous, electric axes. With flexible electronic camming functions and CNC editor included.

New: predefined profiles are available in the library as function blocks and visualisation components for highly dynamic applications such as T- and H-gantries
(“Festo Robot Lib”).

Benefits

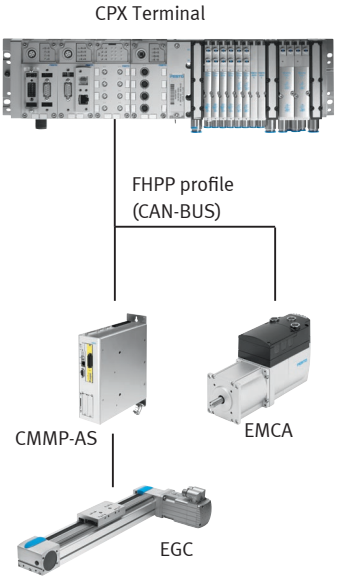
- Efficient open- and closed-loop control
- The world’s only fully integrated IP65 automation platform for standard, proportional and closed-loop pneumatics, electric drives and sensors.

CPX-CEC-M1 V3 with additional CODESYS Softmotion library for 3-dimensional interpolation in the field.

Easy positioning with servo-pneumatics or electric drives

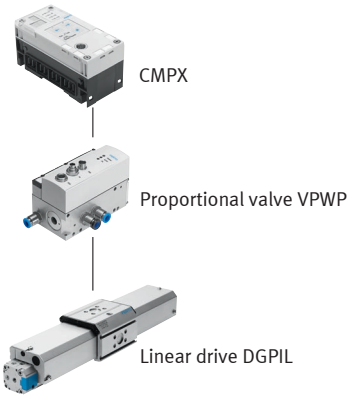
Fieldbus gateway CPX-CM-HPP
With Festo Handling and Positioning Profile FHPP for efficient control of up to 4 electric drives per module, with up to 8 in the CPX system.

Benefits
- High flexibility: all electric drive units from Festo are integrated in fieldbus/Ethernet
- Simplified engineering
- Reduced complexity
- Faster commissioning



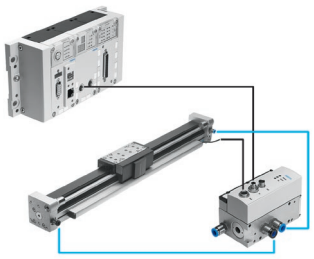
Soft Stop electric end-position controller CPX-CMPX
The CPX-CMPX is based on the SPC11. The CPX-CMPX speeds up cycles times by up to 30% for up to 8 drives and reduces air consumption by 30% compared to standard pneumatic systems, by providing cushioning for strokes up to 2 metres, depending on the drive.

Benefits
- "Auto-teach" function thanks to the pressure sensors in the proportional valve VPWP
- Fast, vibration-free travel between two fixed stops
- Highly dynamic movement of loads up to 300 kg
- Increased cylinder service life



The world's only servo-pneumatic position controller CPX-CMAX for pneumatic drives
Whether for linear or rotary motion, IP65-rated CPX-CMAX controls the positioning of several pneumatic drives on up to 8 axes per CPX terminal. And it allows switching from positioning to force control. This eliminates an entire work step and makes your application considerably simpler.

Benefits
- Travel speeds of up to 3 m/s
- Acceleration of up to 30 m/s² with accuracies ≥ ± 0.2 mm
- For loads of 1 kg to 300 kg
- 64 configurable positioning records available via fieldbus
- Force control

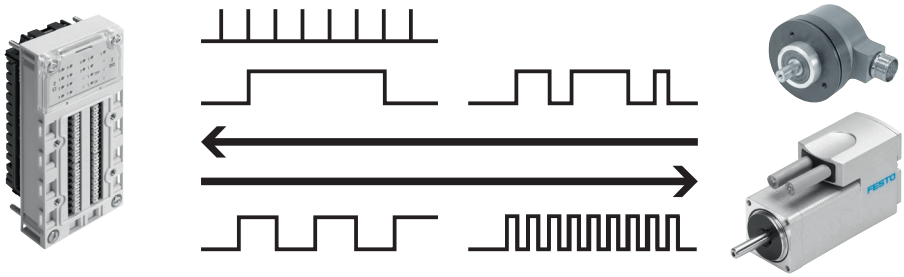


Robust and cost-effective positioning within a range of up to ± 0.2 mm with simultaneous force control in the current position for gluing, welding, etc.

Competency at work:
modules for measurement and proportional technology

Far more than just counting! Many new options with counting and measuring modules for CPX.

Counter and measuring module (fast counter) CPX-2ZE2DA



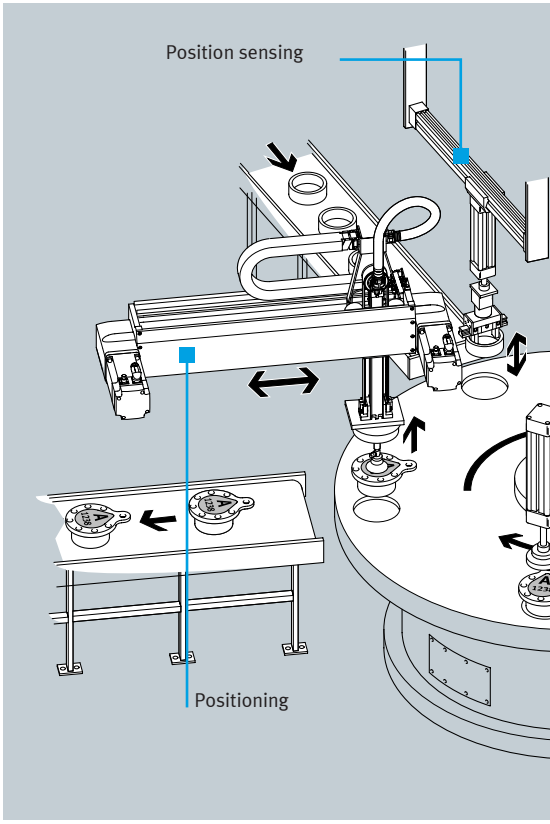
The dual-channel counter module substantially expands CPX as an automation platform, providing highly efficient operation. The signals, the counting and measuring modes, and the output functions are extraordinarily flexible and each channel has the following functions:

- Rapid counting of pulses in single, periodic and constant modes
- Measuring frequency, duty cycle, and rotational speed
- Position detection by measuring travel lengths, travel direction, speed, and angle
- Fast pulse output, pulse train, pulse-width modulation, switch-on delay, switch-off delay, and frequency output variants
- 24 V DC motor control
- 5 V and 24 V encoder supply

The functions shown here are supplemented by additional features, such as a latch function, synchronisation, counter limits, limit monitoring with diagnostics, comparator unit, load value, hysteresis, and polarity. The range of functions and associated settings are determined through parameters and process data. This means each channel can be used as a counter/pulse input or an encoder/SSI input, depending on parameterisation.

Benefits

- Economical thanks to high function integration in one module
- An extensive range of functions provides flexibility for the application
- Open- and closed-loop control of fully-fledged applications with motion control via CPX



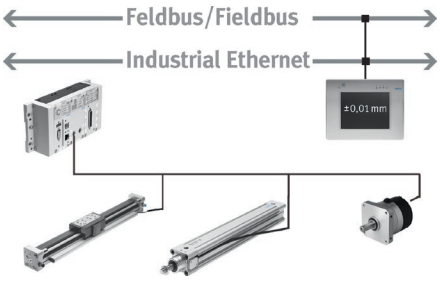
The rotary indexing table shows just some of the many possibilities offered by the rapid counter CPX-2ZE2DA.

Measuring module CPX-CMIX-M1-1

Turns pneumatic cylinders into sensors. And is the only one of its kind in the world thanks to fully digital data acquisition* and data transmission. Repetition accuracy of ± 0.01 mm, and with integration of both analogue and digital transducers.

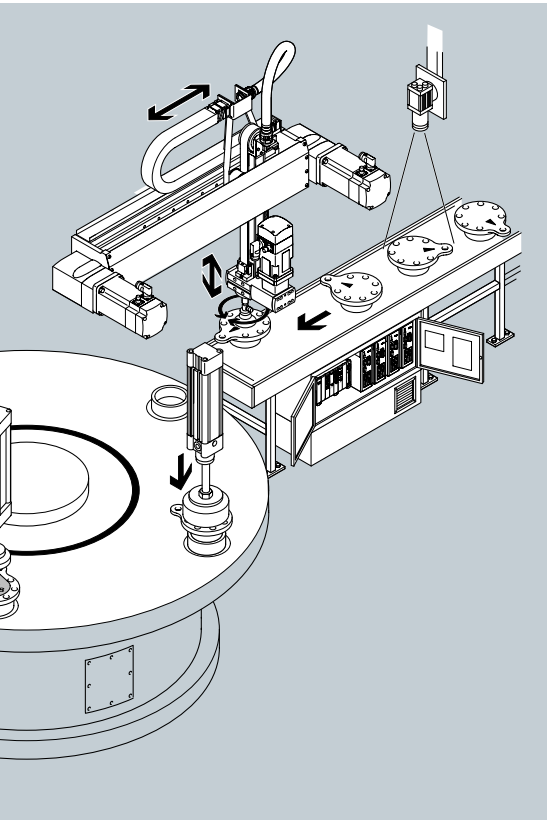
Benefits

- Space and time-saving: retracting/advancing and measuring in one step
- Reduced cycle time: subsequent process steps can be triggered based on the stroke
- Improved quality: process steps are measured and documented
- Faster and more reliable commissioning thanks to a co-ordinated system



Better communication and productivity through optimised cycle times, since subsequent processing steps can be optimally triggered based on the stroke.

*Depending on the measuring system



Extremely simple and time-saving: integrated pressure sensor modules for CPX

Analogue input module with 4 pressure sensors CPX-4AE-P

The new pressure sensor modules offer extreme function integration in a tiny space, and with IP65 protection. They greatly simplify installation in the field, and make engineering far easier.

Pressure sensor module CPX-4AE-P

Benefits

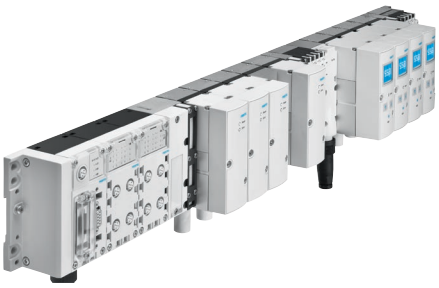
- Parameterisation, commissioning, evaluation as an absolute value in mbar, psi, kPa without conversion – extremely efficient!
- Parameterisable pressure sensor for 4 relative pressure measurements or 2 differential pressure measurements. Versions for 1 ... 10 bar or a vacuum of -1 ... +1 bar.
- No external sensors – greatly reduced installation costs and space requirements
- Pre-assembled and tested unit
- Channel-oriented diagnostics for reduced downtime

Proportional pressure regulator VPPM on CPX/MPA

The proportional pressure regulator VPPM for reliable and precise closed-loop control. It has preselectable presets plus multi-sensor control. Integrated into the electrical terminal CPX-MPA, VPPM enables many additional diagnostic functions and variable pressure zones.

Benefits

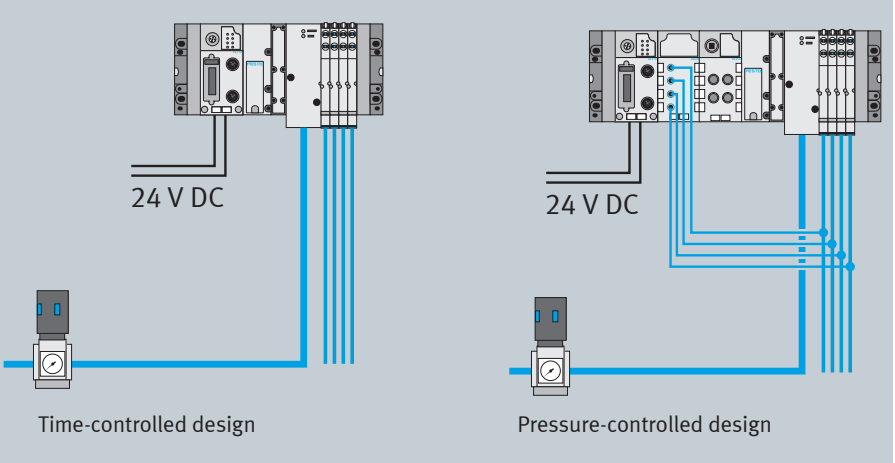
- Reliable and trouble-free pressure regulation and diagnostics via fieldbus/ Ethernet
- Efficient: up to 8 VPPM per CPX/MPA valve terminal, can be subsequently expanded
- Reliable: pressure is maintained if the supply voltage or bus communication fails
- Economical: long service life, 100% tested and pre-assembled units
- Energy-efficient: on-site control



Proportional pressure regulator VPPM on CPX/MPA

Multiplexing – full functionality with fewer proportional valves

Multiplexing saves up to 8 proportional valves per pressure zone on a valve terminal. Multiple pressures can be sequentially transferred to various actuators through downstream directional valves. This allows 8 downstream directional valves on the valve terminal MPA to be controlled by one proportional valve, providing significant savings compared to a more conventional design. Multiplexing can be either pressure-controlled or time-controlled.



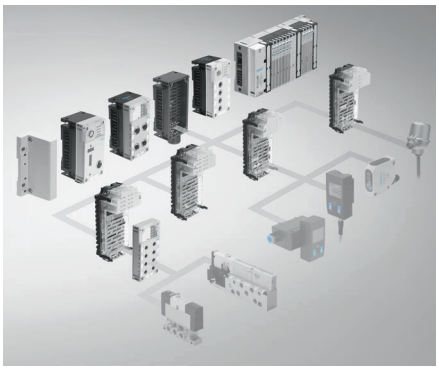
Time-controlled design

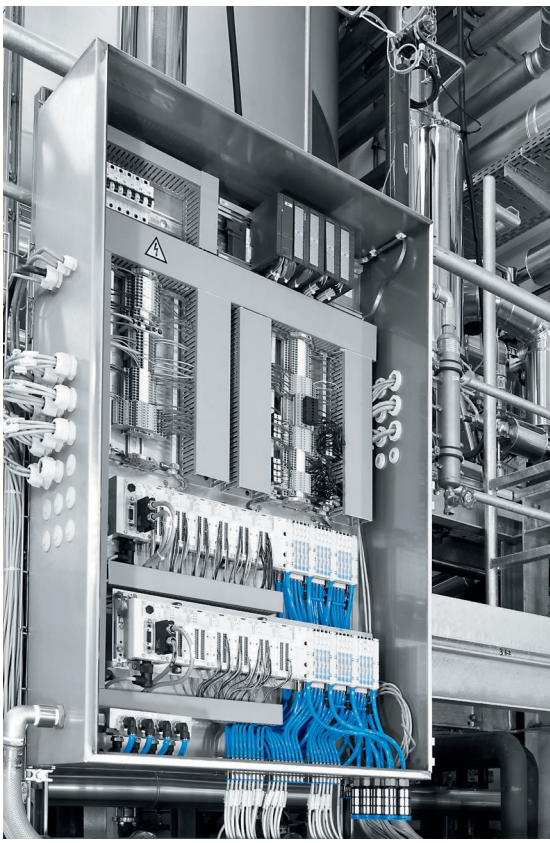
Pressure-controlled design

Consistently simple: measurement and control

Competency creates simplicity and flexibility in measurement and control

Up until now, measurement and control were separate subsections of automation, which could only be implemented with complex and mostly external solutions. The incredible variety of I/O modules, together with technology modules for measuring and controlling pressures and pneumatic or electric drives, dramatically simplifies measurement and control – which also makes the electrical peripheral CPX truly universal and unique.

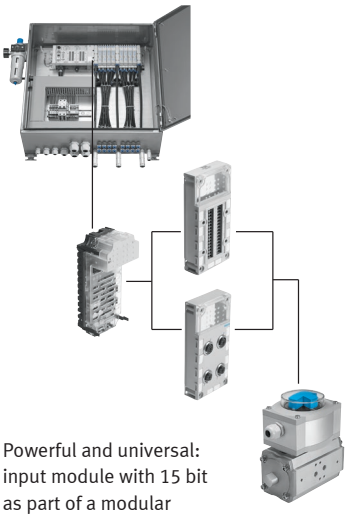




High-resolution analogue input module with four 15-bit inputs CPX-4AE-U-I

Very flexible for complicated tasks in factory and process automation, such as level measuring, pressure measuring and distance measuring. Many technical functions, limit monitoring, diagnostics, and the following measurement ranges can be programmed per channel:

- Bipolar
  - -20 ... +20 mA
  - -10 ... +10 V
  - -5 ... +5 V
- Unipolar
  - 0 ... 20 mA
  - 0 ... 10 V
  - 4 ... 20 mA
  - 1 ... 5 V



Powerful and universal: input module with 15 bit as part of a modular system.

Benefits

- Economical: numerous signal types integrated into a single module
- Reliable thanks to overload protection included as standard
- Reduced downtime thanks to comprehensive, channel-oriented diagnostics
- Powerful and can be used universally
- Analogue module with a high degree of protection integrated in the field

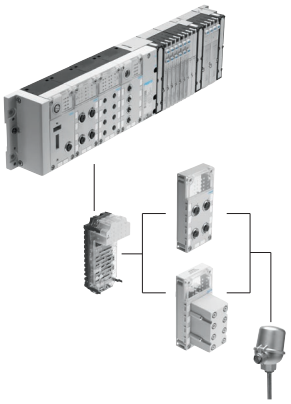
Example: analogue input modules for 4 thermocouples or temperature sensors CPX-4AETC/CPX-4AE-TH

Whether in process automation or in manufacturing processes, the new temperature sensor modules are designed for:

- Thermocouple types B, E, J, K, N, R, S and T (-270 ... 1820° C)
- Temperature sensors PT 100, PT 200, PT 500, PT 1000, Ni 100, Ni 120, Ni 500, Ni 1000 (-200 ... 850° C)

Benefits

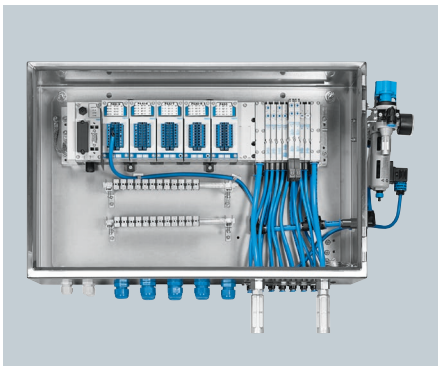
- Reduced channel costs due to 4 channels per module
- No need for expensive sensors with integrated signal converters
- Reduced downtime thanks to channel-oriented diagnostics
- Reduced system costs thanks to simple function integration in fieldbus/Ethernet networks



Simpler: CPX as platform for Ex and non-Ex zones

CPX-P-AB-...-8DE-N-IS/ CPX-P-AB-...-8DE-N
NAMUR sensors can be directly connected to a CPX. These NAMUR modules are available in 4 versions:

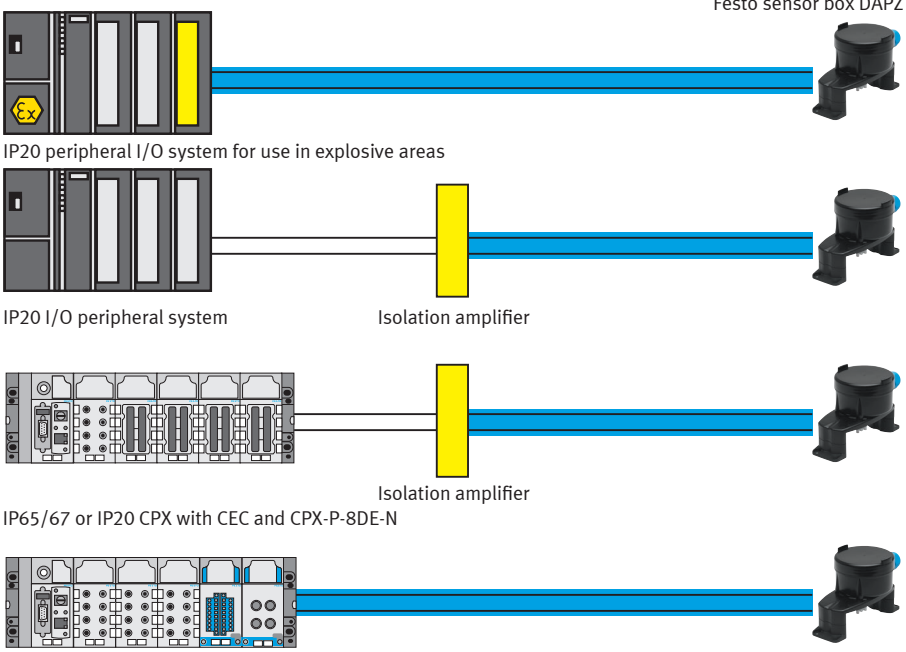
- IP20 with terminal connection, intrinsically safe feature optional (-IS)
- IP65 with M12, intrinsically safe feature optional (-IS)



Benefits:

- No separate isolating amplifier or special barriers for connecting intrinsically safe devices when mixing signals.
- Control cabinet installations in Ex 2 zones in the process industry for controlling valves and connecting to NAMUR sensors in hazardous Ex zones 0 and 1
- Direct machine mounting in safe zones and connection of sensors in Ex zones 0 and 1
- In combination with valve terminal MPA for electrical and pneumatic control of applications in the process industry and in hybrid sectors

CPX-P with NAMUR I/O modules – safety made easy

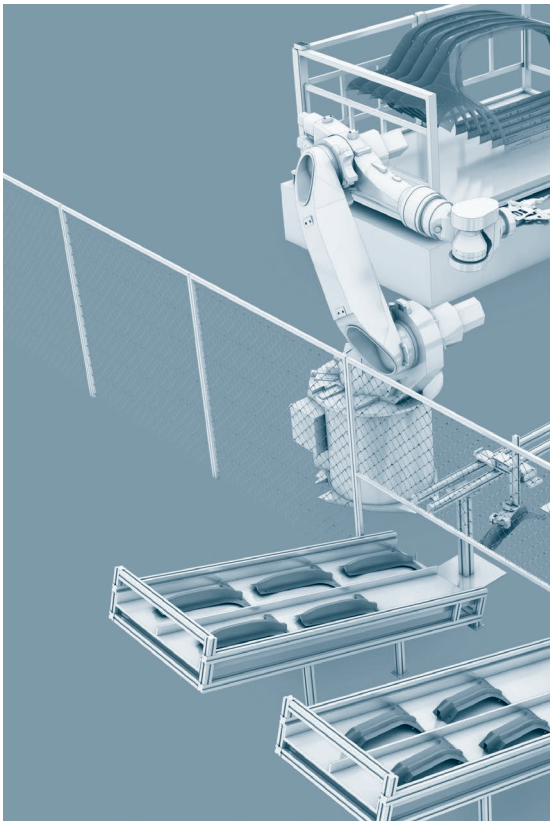


CPX with CEC and CPX-P-8DE-N-IS makes your safety concept extremely simple.
You only need one module – that's just how Safety@Festo works.

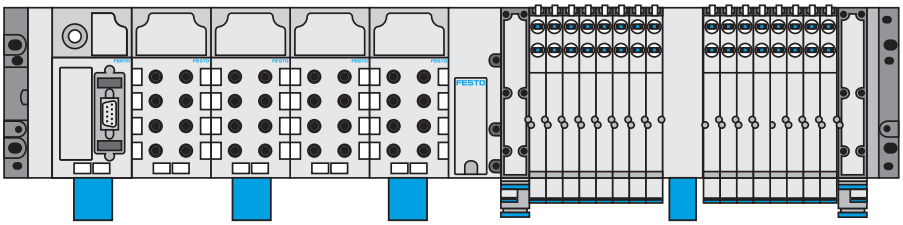
Integrated safety: diagnostics management and safety engineering

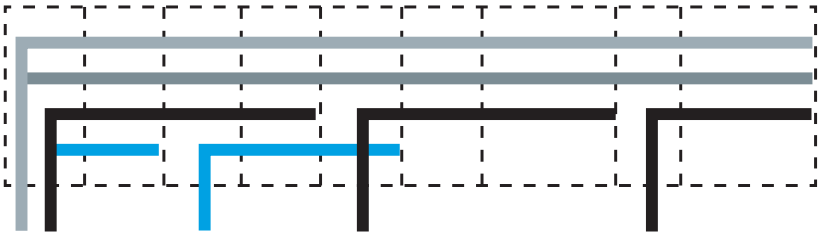
Safety engineering to EN ISO 13849-1 and IEC 61508/61511/62061

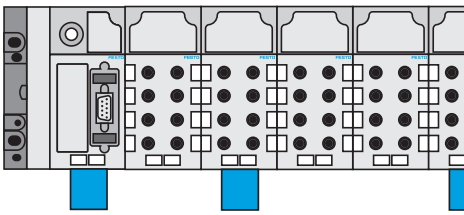
Safety@Festo
Quality has many aspects at Festo, one of which is working safely with machines. This has led to our safety-oriented automation technology. These components ensure that optimum safety is achieved in the workplace.
→ See “Guideline for functional safety”



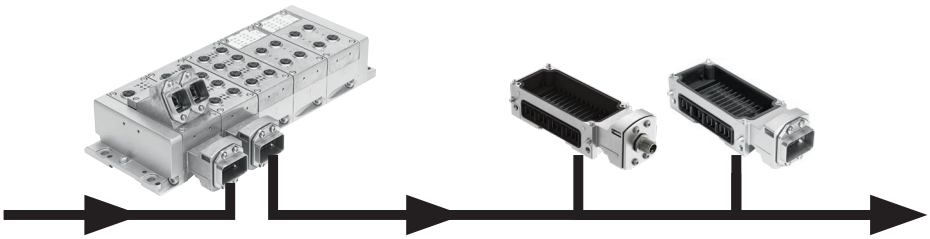
Voltage zones
Basic CPX power supply: 24 V DC, max. 16 A each for electronics/ sensors and outputs/valves







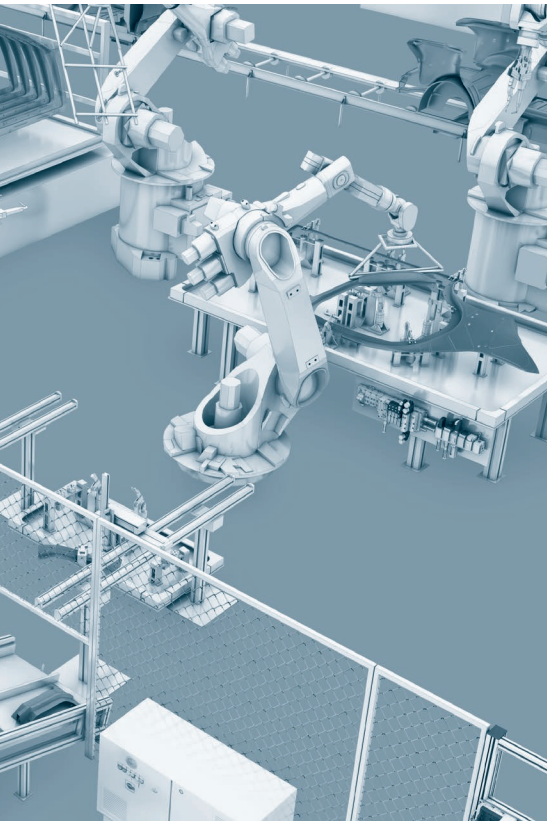
PROFIsafe input module CPX-F8DE-P
On-site sensing for the entire safety chain
- Simple and clear installation: inputs – logic via PROFIsafe – outputs
- Simple connection of safety-oriented switching devices, such as emergency stop, through-beam sensors or roller levers (OSSD/contacting sensors)
- Compact, sturdy, 8-channel PROFIsafe input module
- High level of safety
- Simple: preprocessing on the module and secure parameter data thanks to process image



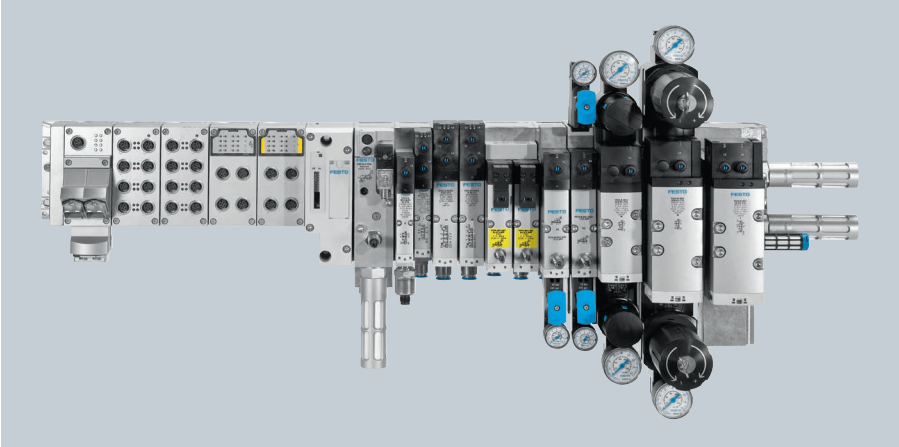
AIDA connection technology
For voltage supply looping

Connection via M12x1 plug, L-coded, 5-pin, metal interlinking block

Connection via push-pull plug (AIDA), 5-pin, metal interlinking block

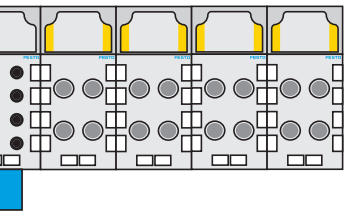


Valves: Safety@Festo with VTSA

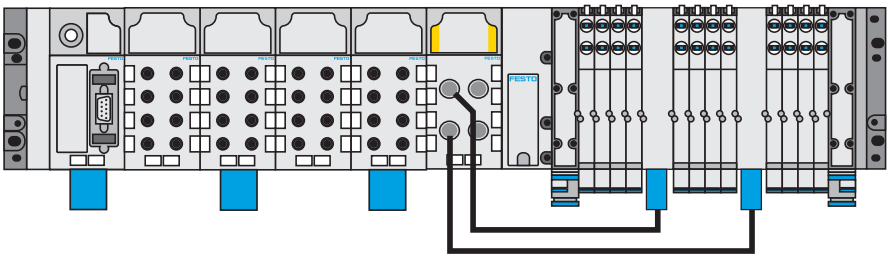


Unique: VTSA offers the most comprehensive safety functions worldwide.
- More built-in safety for systems and machines with VTSA.
- Ready-to-install solution on a valve terminal

Functions:
- On/off and soft-start valves for greater process reliability during switch-on
- Multiple voltage zones on one valve terminal
- Switching position sensing for greater safety, such as for press actuation (single-/dual-channel)
- Special valves for pneumatic manual clamps, lifting cylinders and rotary cylinders
- Switchable pilot air supply: protects against unexpected system restarts up to max. PL d in accordance with EN 13849-1
- Optional check valves for dual-channel pneumatic stopping. These are also controlled by the pilot air supply valve.



- Channel-granular passivation
- Multiple PROFIsafe input modules possible per CPX
- Smart and intuitive design engineering:
  - Predefined operating modes for the input functions
  - No selection of parameters necessary
  - No additional software tools required
  - All configuration carried out in STEP7 or TIA
  - Quick and simple validation



AIDA connection technology
For voltage supply looping

PROFIsafe output module CPX-FVDA-P2
The internal valve supply is shut-off, and two independent and safe external outputs are additionally supplied. This allows other voltage zones or valve functions to be supplied externally.

Pressure zones
To provide for different safety concepts, valve terminal platforms MPA and VTSA offer multiple pressure zones and valves with separate pressure supply for each valve. MPA also permits regulated pressure zones that are monitored by integrated sensors for process documentation purposes.

Integrated safety: diagnostics management and safety engineering

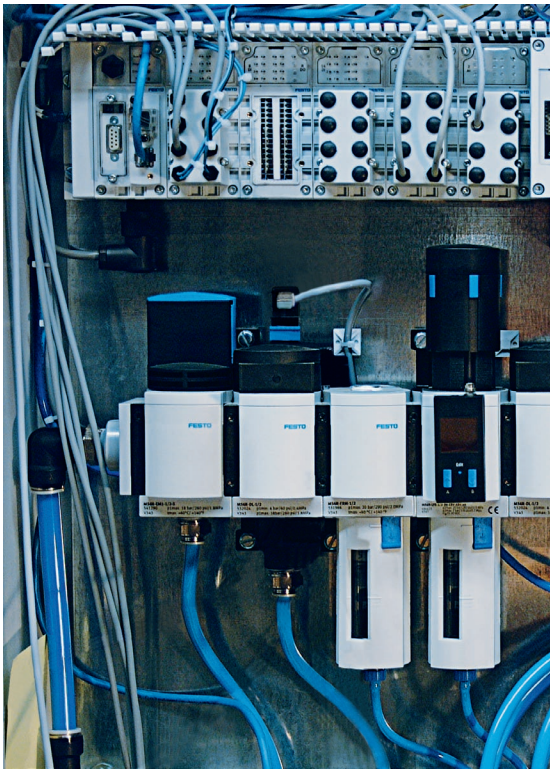
Diagnostic options in the valve terminal range from Festo

Three error modes for simple detection

Current errors – LED-supported diagnostics on the CPX modules provide immediate assistance. Fieldbus or Ethernet transmits details at channel level for process visualisation.

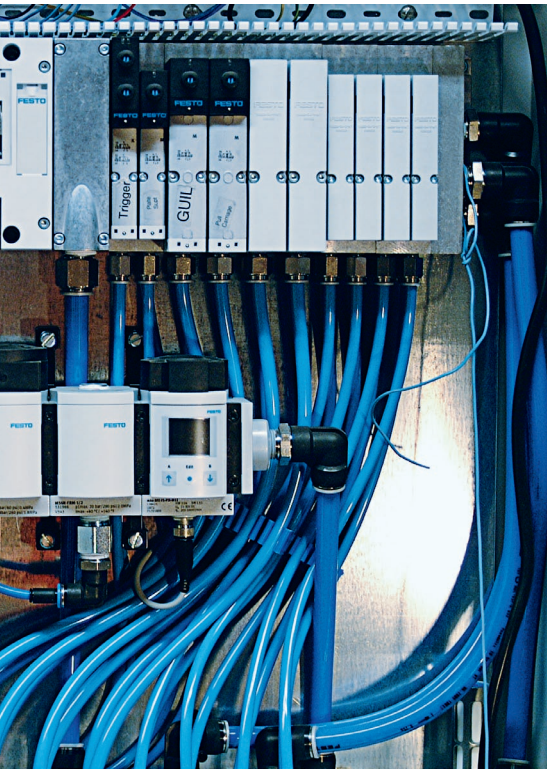
Future errors – hopefully these will not even occur thanks to automatic condition monitoring for preventive maintenance. Numerical data and warning messages – at channel level, e.g. for up to 128 solenoid coils.

Random errors/history – analysed and detected faster thanks to a diagnostic trace that automatically stores the 40 most recent errors. No need for time-consuming investigations, even for intermittent errors!

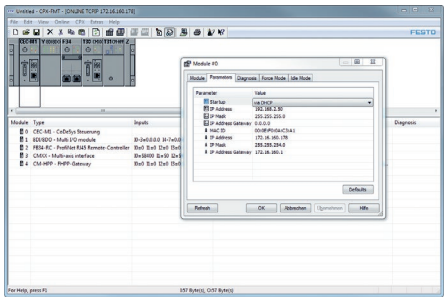


	CPX-4DE	CPX-8DE	CPX-P-8DE-N(-IS)	CPX-16DE	CPX-L-16DE	CPX-8DE-D	CPX-16DE-D	CPX-4DA	CPX-8DA/8DA-H	CPX-8DE-8DA	CPX-L-8DE-8DA	CPX-2AE-U-I	CPX-4AE-U-I	CPX-4AE-I	CPX-4AE-P	CPX-4AE-TC/TH	CPX-2AA-U-I	VTSA	MPA-L	MPA-S	MPA diagnostics	MPA pressure sensor
	Digital I/O											Analogue I/O						Pneumatics				
Undervoltage																						
Short circuit – signal																	U					
Short circuit – supply																						
Wire break												I	I	I								
Lower limit value																						
Upper limit value																						
Parameterisation error																						
Condition monitoring																						
Sensor overload																						
Measuring range exceeded																						

☐ No diagnostics ☐ Module-oriented diagnostics ☐ Module-/channel-oriented diagnostics



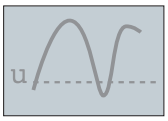
FMT – Festo Maintenance Tool for CPX
- Module scan
- EDS/GSD export
- Configuration
- Diagnostics
- Service functionalities



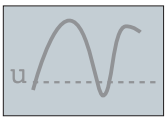
Perfect process reliability – the diagnostics and condition monitoring package with CPX

Integrated diagnostic concept – for up to 35% less downtime for your system.
CPX integrates internal diagnostics and condition monitoring functions. Each channel in the corresponding valve terminals such as MPA or VTSA can be tracked down to the last detail thanks to the integrated serial interface or a fieldbus module from the CPX series. In-process diagnostics, e.g. with CPX-CEC or with compact vision systems, are also integrated.
→ Pages 12/13

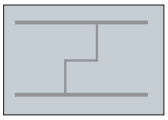
Convenient: save diagnostic data in your host environments
This option integrates IT services into CPX. Depending on the fieldbus system and the control/visualisation system, the diagnostic data from your CPX can be seamlessly transferred and integrated. Specific diagnostic components make engineering easy. You can also find expert information on device files, drivers, PCS7, firmware questions, etc. on our Support Portal.



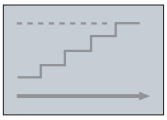
Undervoltage per module
- Electronics -25%
- Load -10%/valves -25%
- Emergency off ≤10V



Undervoltage per valve block
- Auxiliary power supply to valves monitored separately
- Load/valves -25%

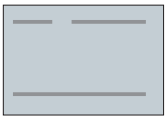


Short circuit can be selected
- Per channel
- Per module
- Per valve

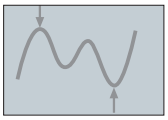


Condition monitoring
- Setpoint specification for each valve
- Monitoring of downstream mechanical systems/processes
- Preventive diagnostics/maintenance

Error memory
- Last 40 messages
- With timestamp
- Detects sporadic errors



Wire break can be selected
- Per channel
- Per module
- Per valve



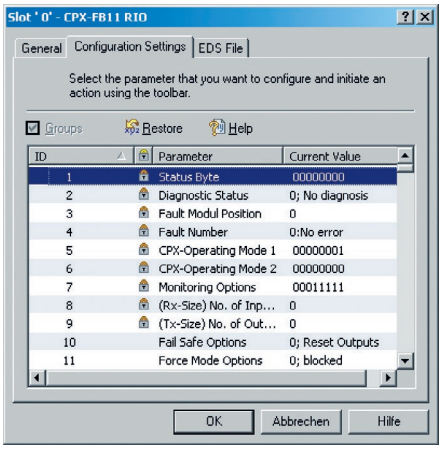
Upper/lower limit value
- For each analogue channel
- Voltage
- Current
- Temperature
- Pressure
- Counting

Other specific diagnostic options for measuring pressure and distance, for counter and measuring modules, all electric and servo-pneumatic axes, our proportional pneumatic systems or motion control can be found on the relevant pages and manuals in our electronic catalogue.

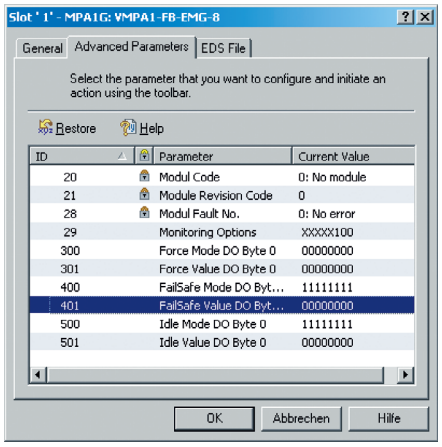
Easy and reliable: commissioning and software services

Uncomplicated commissioning with software from Festo

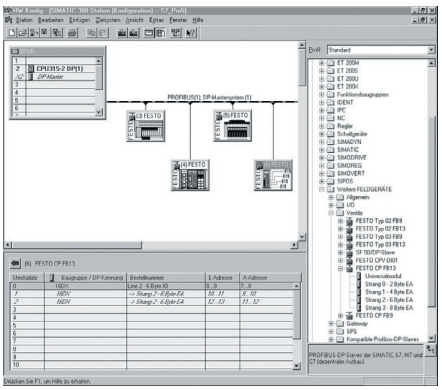
CPX not only handles special functions without any problem, it can also communicate independently and flexibly via fieldbus/Ethernet – anywhere in the world, and from the management level down to the field level. The modular electric terminal is quickly setting the benchmark in industrial communication. These benefits are easy to implement in the versatile, modular world of CPX. Without them, features such as comprehensive diagnostics would not even be possible.



Status byte and diagnostic status interface
CPX provides comprehensive diagnostic information. If this information is not supported by the fieldbus or host system in use, some of the information can also be transferred through the process data. This allows at least some of the data to be evaluated.



Fail-safe/fault mode
Ideal for risk management: safety-critical processes can be planned precisely with fail-safe or fault mode, since output behaviour during a bus interruption can be defined in advance (e.g. OFF or Hold Last State). This function is available for PROFIBUS, DeviceNet, Ethernet/IP, PROFINET and EtherCAT.



Parameterisation via PLC/fieldbus
Depending on the fieldbus (Profibus, DeviceNet, CANopen, Ethernet/IP, PROFINET), startup configuration can be defined for each field device and loaded through the fieldbus after power-on.

Benefits
- Uniform user interface in the PLC
- In the event of a fault the field device can be easily replaced and parameterised with the old values

Modular device configuration
This function makes CPX and other subsystems easier to configure via Feldbus (Profibus, DeviceNet, CANopen, PROFINET).

Benefits
- Clear configuration
- Differentiated planning, even with different data types
- Simple parameterisation

This function is available for Profibus, DeviceNet, CANopen and PROFINET.

The Festo Field Device Tool (FFT) – for a complete overview on Ethernet

The Festo Field Device Tool (FFT) supports Ethernet-based products from Festo during commissioning and maintenance, e.g. secure firmware updates, updating new features with no additional costs, safe updates (checks compatibility between installed hardware and selected firmware revision). It provides CPX with extremely convenient diagnostic details on every Festo network station, or offers an LED- or LCD-based identification function with a single click.

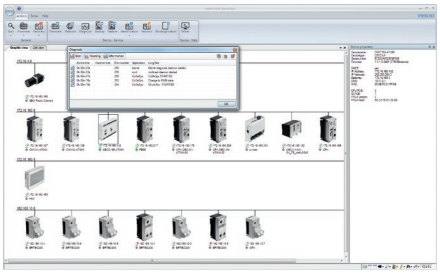
FFT – Festo Field Device Tool

- Firmware updates
- Network scan
- Diagnostics
- Network settings
- Backup and restore

More information on the Festo Field Device Tool can be found on the Support Portal: → **www.festo.com**

Summary

- For secure updates of firmware on various devices
- Clearly structured and extremely detailed graphical overview
- Preselection of scanning process
- Time-saving, particularly in large systems through parallel updates of multiple devices
- Update logs for system documentation
- Local firmware database for updates and downgrades without Internet connection
- Backup of remaining data before updating for immediate restart



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