

Under control and in motion

FESTO





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Complete subsystems from a single source

Complete subsystems covering the full automation process and control sequence – that is what Festo as a partner offers you for the automation of your processes.

You'll also find the matching control architecture at Festo, tailored to your application, whether it's pneumatic, servopneumatic, electric, or a mechatronic mix.

That is our promise: to deliver more than mere components.

Total mechatronic solutions
Mechatronic Motion Solutions from Festo is a unique system of components, modules, and software. It integrates all types of pneumatic, servopneumatic and (electro)mechanical automation motion and combines them according to your task. Irrespective of the control system environment you use, Mechatronic Motion Solutions always provides the appropriate interfaces.

Programming to standard

A standardised programming environment makes your tasks easier, gets them done faster and with more reliable results. That is why Festo offers you programming with CoDeSys to IEC 61131-3 standard: you can program your applications exactly how you want to without the need to learn an additional programming language.

Selecting the right, compatible solution at the right time is straightforward as we simplify the planning, configuration, layout and commissioning of your subsystem with a host of software tools.

Integration into the control system

Easy integration into your overall system: Festo's control architecture offers a multitude of communication protocols commonly used in industry.



Controls for drive technology

Coordinating level

Control level

Control system

PLC
(ABB, Allen-Bradley,
Rockwell, Siemens
etc.)

Modular control system
CECX



Operation Visualisation

CPX Web Monitor 	Front End Displays 	Visualisation
---------------------	------------------------	-------------------

Controllers

Electrical installation concepts <ul style="list-style-type: none"> • Centralised • Decentralised • On-site • Hybrid 	Installation systems CPI 	Stand-alone units on-site 	Axis controller SPC200 	End-position controller SPC11
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Field level

Activation

Valves 	Decentralised valve terminals 	Valve terminals on-site 	Axis interface SPC-AIF
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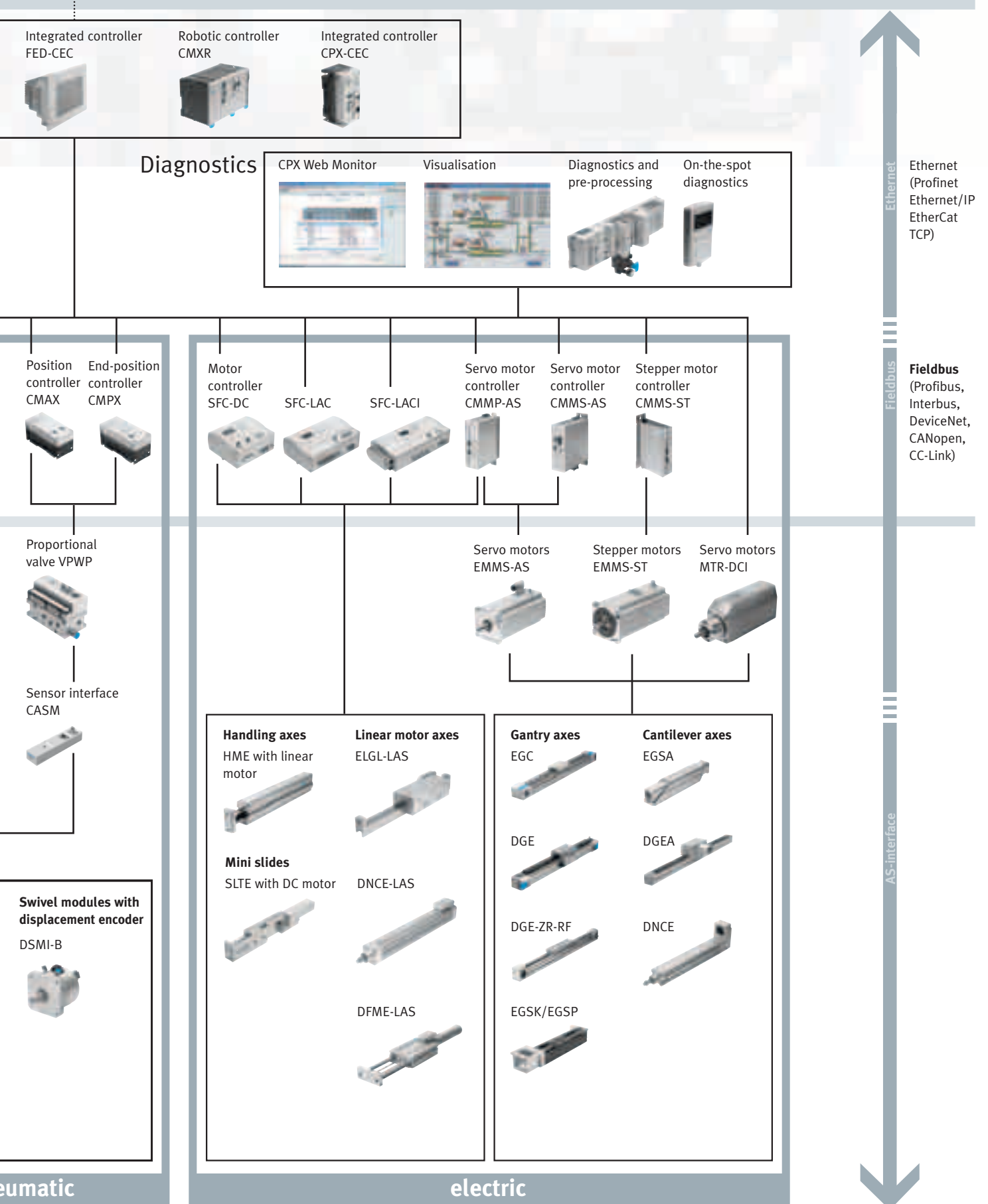
Drives

Standards-based cylinders DNC DNCB Cantilever axes HMP-B HMPL Mini slides DGSL 	Compact/short-stroke cylinders ADN/P ADVC ADVU Round cylinders DSNU Rodless drives DGC 	I/O modules Compact Sturdy Economical 	Proportional valve MPYE 	Linear drives with displacement encoder DNCI DGCI
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pneumatic

servopneumatic

Coordinating system





The application is key

Festo – your partner for every stage of the process automation sequence

Your application determines the solution, even for control technology. Festo's control architecture is designed to meet your needs in three ways:

- Tailored to your application
- Ideal for integration into your overall coordinating/control systems
- Optimally designed for drive activation systems, whether electric, servopneumatic or pneumatic

Just tell us what your requirements are – and we will provide you with a control concept optimised to your application.

Early collaboration for greater success

The sooner you get us involved the better. The greatest potential for optimisation is to be had when our system experts can support you right from the beginning and are thus able to tailor the solution perfectly to your needs.

Make the most of our core competency right from the start and reduce your total cost of ownership (TCO). By taking advantage of a total solution, which is adapted and optimised to your machine or application, you can achieve savings in day-to-day operations, for example through higher output or maximised process reliability.



Engineering

Supply Chain

Assembly

Operation

Cost saving
Time saving
Process security



Application example: automation of manual workstations

When automating workstations such as those for manual welding, there are special challenges that must be met:

- Very compact manufacturing cells require space-efficient solutions
- Components in the immediate working environment must be sturdy and resistant to disturbances
- Quick and easy commissioning

- Interfacing with valves and I/Os
- Integrated peripheral equipment for easy and quick channel diagnostics and error elimination without fieldbus
- Simple communication with higher-order controllers

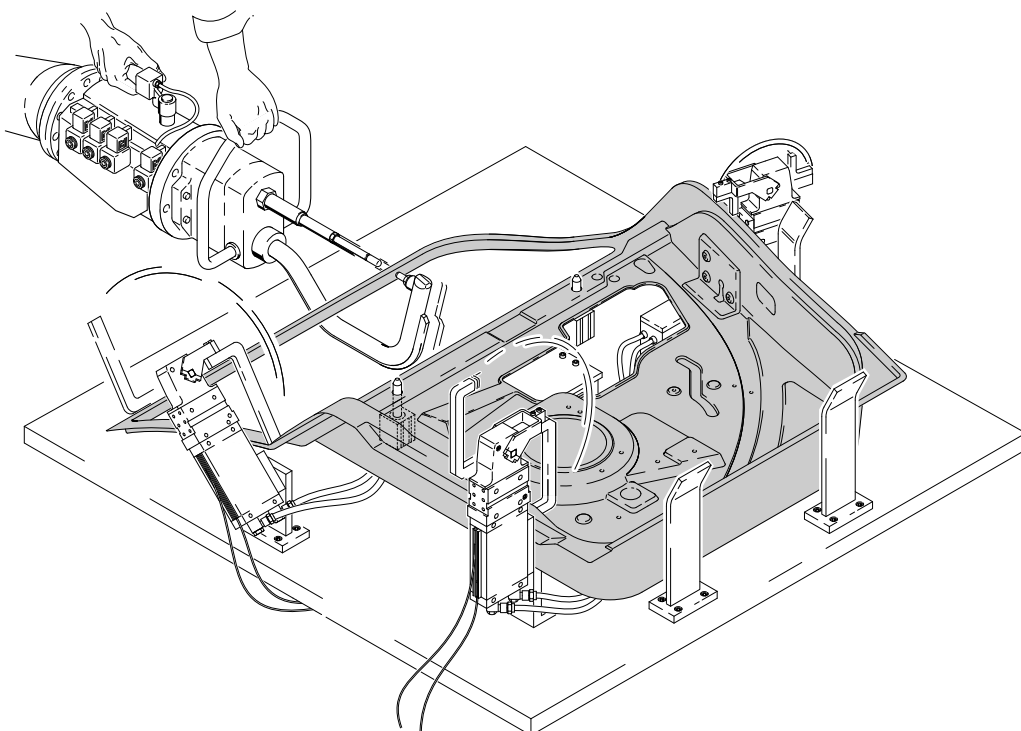
The valve terminal CPX with integrated CPX-CEC controller meets these challenges with ease and many others too. The CPX-CEC is right for your application if you

are looking for a compact solution for:

- Direct interface for valves
- Digital I/Os
- Quick and direct error detection

If, in addition to the control system, you also require visualisation for the automation of the manual workstation, the space-efficient FED-CEC control concept is the perfect choice:

- Integrates visualisation and control in the Front End Display (FED)
- Low-cost and space-saving solution
- Easy activation of valve terminals and electric drives
- No operating buttons – programming done on the display screen





Centralised or decentralised control: the choice is yours

Centralised solutions

Are you looking for a centralised control solution, for example for integration into a control cabinet? Then you'll appreciate these advantages:

- A simple structure that is easier to program and commission due to the elimination of additional nodes
- A larger and more attractively priced range of components
- Tamper protection

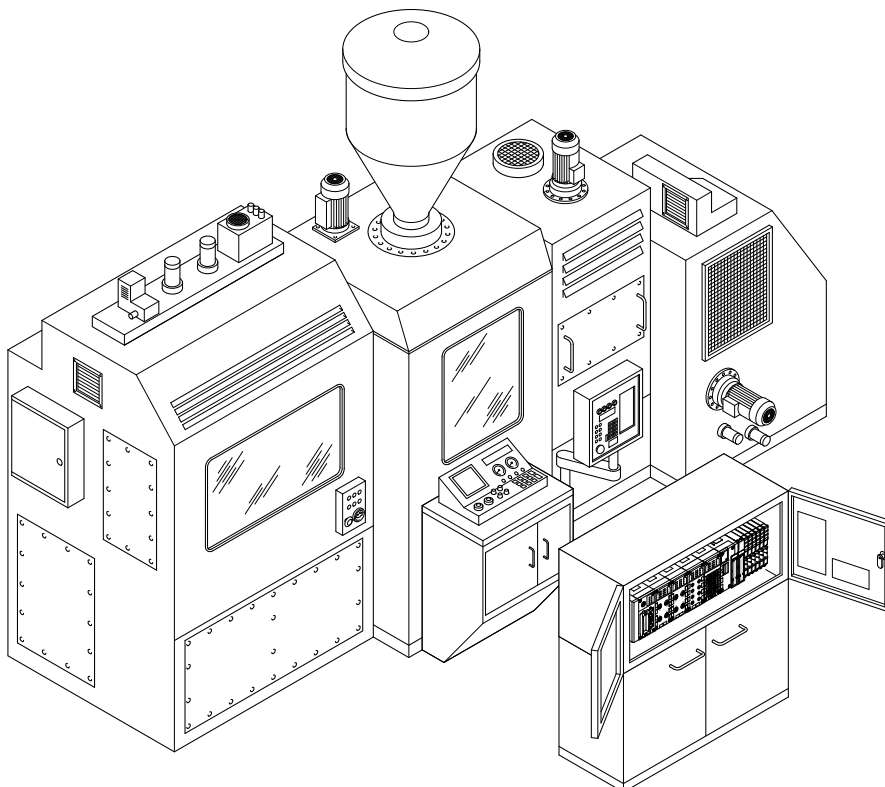
If you would like to combine these advantages with a modular control system that gives you further benefits, we recommend the CECX control range:

- Simple, powerful programming environment to IEC 61131-3 standard
- Configuration tools, drivers, and libraries of modules are included
- Plus numerous interfaces such as Profibus, CANopen and Ethernet

Depending on the application, CECX is used as a traditional PLC or with motion control for the activation of electric drives.

When everything is supplied from a single source, as in the case of the control cabinet solution described above, you could reduce your TCO further by letting us construct your control cabinet. That lowers costs in

areas where the invisible costs are usually highest, i.e. in engineering, procurement, assembly and operation. The cost of the components alone usually makes up only a small part of the total cost. You can cut that cost by opting for a complete solution for the control cabinet: assembled, adjusted, programmed – and tested and documented as well.





Decentralised solutions

With a decentralised control design, you benefit from the following:

- Savings on tubing and cable lengths of up to 65%
- Increased energy efficiency
- Up to 35% higher cycle rate with
- Up to 50% reduction in flow rate at the same time.

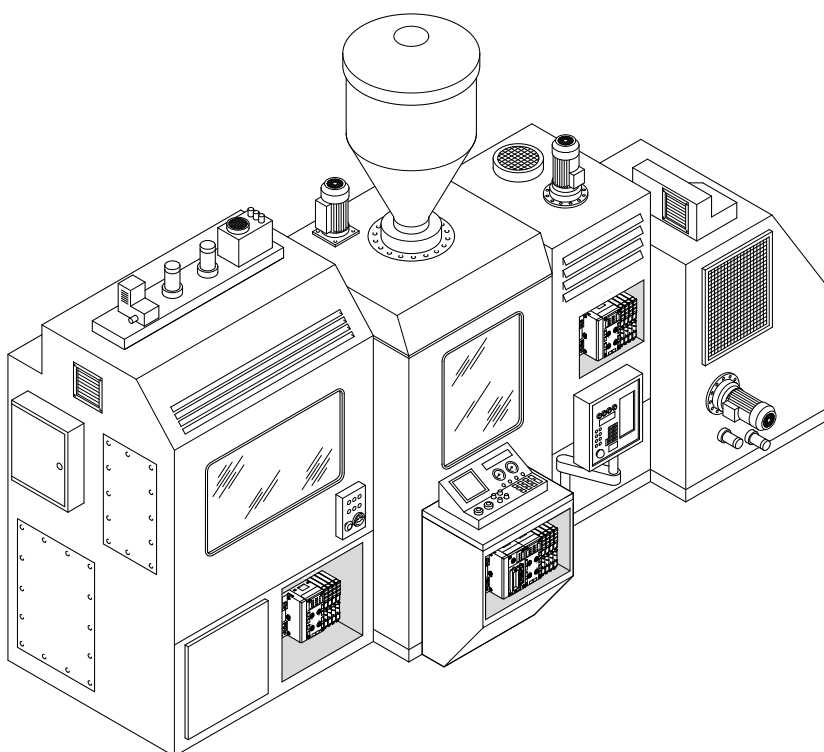
The valve terminal platform with integrated CPX controller provides an optimised solution.

With CoDeSys integrated in the CPX-CEC control system, you benefit from the advantages of a stand-alone, on-site control unit and from a customisable system with a wide variety of modules for diverse tasks.

- Stand-alone control of a sub-system – costs for control cabinet are eliminated
- Integrated diagnostic function
- Architecture is easy to upgrade due to the connection options for any fieldbuses and networks
- Flexibility for IO expansion with CANopen master

Your application determines the solution.

Ask your local Festo sales engineer for advice.





Motion control for assembling and packing

Asynchronous processes

If a pick and place process is asynchronous and not very complex – such as packing bars of chocolate into cartons, for example – a multi-axis control system with the CPX-CM-HPP gateway will generally be suitable. The bars are fed to the packaging station at irregular intervals. The X and Y move into the pick-up position and wait until the next

bar comes; the Z-axis then grips it and places it in the carton.

Synchronous, fast, simple

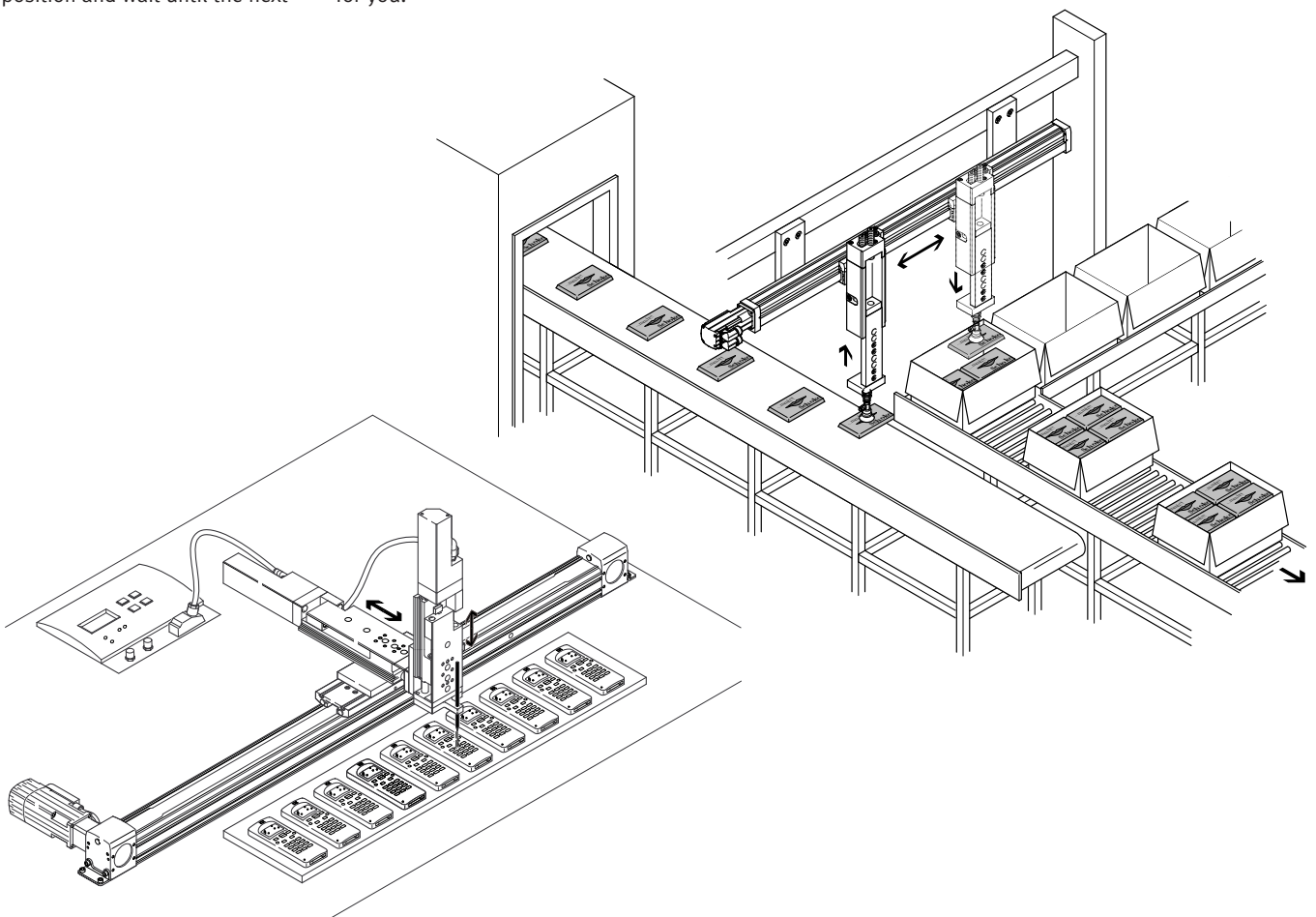
If you want to use a synchronous and simpler motion of the electric axes without interpolation with the advantages of the CPX platform, then it's highly likely that the multi-axis interface CPX-CMXX is the right solution for you.

Quick, precise, coordinated

When manufacturing electronic products, the electric drives must work with the greatest precision and speed. To maximise speed, the positioning axes are coordinated and travel is smoothed. The control platform CECX handles this challenge superbly.

Perfectly matched – through development in partnership

Tell us what you need, and together we can work out the right control architecture for your application.





Motion control for gluing and cutting operations

Gluing and cutting in 2D space

When cutting tiles, cardboard, textiles or other flat materials, the finished product is cut from a continuous strip. This process requires a controlled gluing or cutting operation.

The continuous material flow cannot be interrupted while the material is being processed. A special motion sequence is therefore needed and the processing axis must be synchronised with the speed of the material flow.

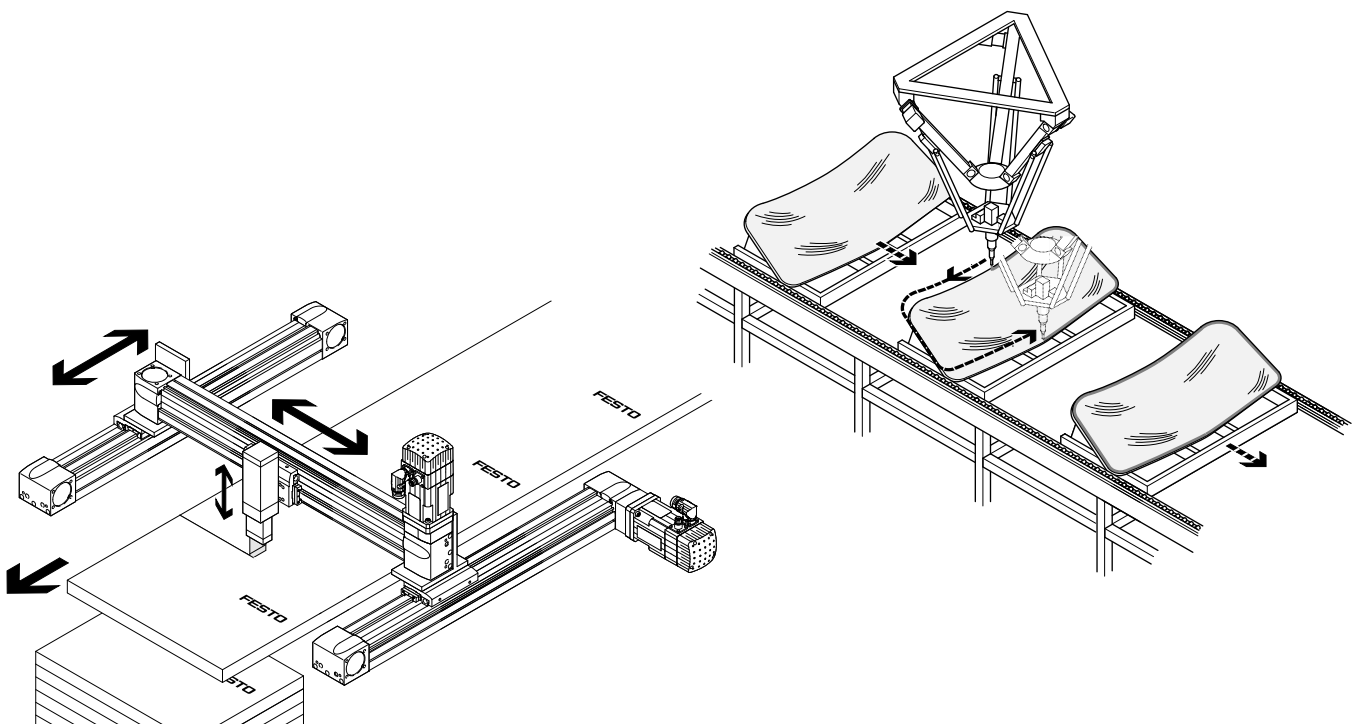
CECX provides a solution for these demanding multi-axis motions. Thanks to the CoDeSys SoftMotion module libraries (PLCopen), even quite complex multi-axis applications can be realised very simply in a PLC environment. If the axis for material flow is not controlled by the CECX, the speed of the conveyor belt can be loaded into the control system via an encoder input.

Gluing operation in 3D space

Motion control for gluing processes requires great precision and control as the same amount of glue has to be applied to a surface each time. The robotic controller CMXR, with its synchronised path motions, can master applications which were hitherto reserved for robots. Even working on an inclined surface or tilted workpieces is easily and quickly dealt with; the tool

coordinate system ensures easy set-up of applications even with inclined tools. The CDSA handheld terminal makes it easy to define the positions and quickly enter them.

Just tell us what you need and together we can work out the right control architecture for your application. Your task defines the solution and you'll only pay for the functions that are really needed.





An overview of control platforms and their functionality

A quick overview of the entire portfolio of motion control and multi-axis control systems and their possible applications. More detailed information can be found on the following pages.

Embedded control: control concept FED-CEC

The focus is firmly on function integration and compact performance with FED-CEC as the space-saving control concept is integrated into a Front End Display.

Key features

- Small
- Compact
- Integrated visualisation



CoDeSys integrated: controller CPX-CEC for CPX terminals

As an intelligent remote I/O terminal to IP65/IP67 directly on the machine, the CPX-CEC reduces installation costs. It's ideally suited to CPX and motion applications with up to 31 electric drives – and ideal for effortless activation of valve terminal configurations with MPA or VTSA.

Key features

- On-site installation
- Control platform to IP65
- Integrated in a valve terminal



Modular: control units CECX and CMXR

A high performance option for electric and pneumatic drives, CECX expands the control range to include fieldbus master functionalities and electric actuation options.

Key feature

- Compact mini control systems



CMXR with robotics functions ensures minimal positioning times and enables path applications with up to six degrees of freedom.



Multi-axis control systems

	FED-CEC		CPX terminal		Modular control									
	Integrated controller FED-CEC		CoDeSys controller CPX-CEC	FHPP gateway CPX-CM-HPP	Multi-axis interface CPX-CMXX	Modular controller CECX-X-C1	Motion controller CECX-X-M1	Robotic controller CMXR						
	<p>SFC-DC MTR-DCI CMMx Single axis (point-to-point asynchronous)</p>		<p>SFC-DC MTR-DCI CMMx Single axis (point-to-point asynchronous)</p>		<p>SFC-DC MTR-DCI CMMx Single axis (point-to-point asynchronous)</p>		<p>SFC-DC MTR-DCI CMMx Simple multi-axis control (point-to-point synchronous)</p>		<p>SFC-DC MTR-DCI CMMx Single axis (point-to-point asynchronous)</p>		<p>SFC-DC MTR-DCI CMMx Interpolation (2.5D)</p>		<p>SFC-DC MTR-DCI CMMx Robotics (3D)</p>	
Maximum number of possible axes	Max. 8 axes Note: one axis is treated as a CANopen node. 128 nodes are possible (as defined by CANopen specifications).		Max. 4 axes		Max. 8 axes (2 groups with 4 axes per group)		Max. 16 axes Note: one axis is treated as a CANopen node. 128 nodes are possible (as defined by CANopen specifications).		Max. 16 axes		<ul style="list-style-type: none"> • Max. 6 axes interpolated, comprising max. 4 kinematic axes and 3 auxiliary axes • Supports a variety of kinematic axes from simple 2-axis kinematics up to a tripod 			
Motion	<ul style="list-style-type: none"> • Point-to-point asynchronous • Every axis moves with its own pre-defined parameter • The axes do not reach their end positions at the same time and the path is not defined 				<ul style="list-style-type: none"> • Motion control mode • Synchronous point-to-point motion (the axes reach their end positions at the same time) • Smoothed approaches 		<ul style="list-style-type: none"> • Point-to-point asynchronous • Every axis moves with its own pre-defined parameter • The axes do not reach their end positions at the same time and the path is not defined 		2.5D interpolation		<ul style="list-style-type: none"> • 3D interpolation • Point-to-point synchronous • Permanent 2D and 3D path control • Wrist axes (alignment axes) on the front end • Definition of tools • Teach function • Simple programming in the Festo Teach Language (FTL) 			
Typical applications	<ul style="list-style-type: none"> • Handling systems • Pick and place, packing and palletising 							<ul style="list-style-type: none"> • Path control, gluing, cutting • Handling, flying saw, gluing • Camming function 		<ul style="list-style-type: none"> • Handling, e.g. pick and place, packing and palletising • Gluing, metered feeding, painting • Cutting • Assembling 				
Pre-defined function					●	●								
CoDeSys freely programmable	●	●					● (+ SoftMotion)	●		●	●			



CoDeSys-based control systems

For function integration and compact performance: controller FED-CEC

The simple and compact FED-CEC automation platform combines the advantages of a control system with those of a Front End Display (FED). Standardised to IEC 61131-3, FED-CEC is quick and easy to commission thanks to the CoDeSys programming platform.

The integrated CANopen master interface enables valve terminals and electric drives from Festo to be actuated with ease. Integrated digital and analogue channels are available in the optional FED-UIM I/O module.

Benefits

- Only one component needs to be taken into account during the design stage
- Hardware-neutral software platform for quick and easy configuration, programming and commissioning of pneumatic and electric automation solutions
- Extensive module libraries for single or multi-axis positioning motions

- Flexible and open for all types of control tasks, due to IEC 61131-3 standard
- Extremely flexible and modular: offline and online functions, as well as components for hardware configuration and visualisation. User-friendly IEC function block extension
- Parameter entry directly at the machine controller, e.g. for simple point-to-point positioning tasks

Features of FED-CEC

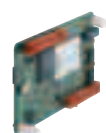
- 32 bit MIPS RISC processor
- Scan time 350 us/K
- Ethernet 10 Base-T
- Integrated diagnostics for
 - Hardware detection
 - Short circuit on the outputs
 - 24 V DC not present

Features of FED-UIM

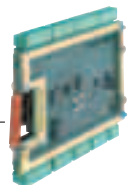
- 20 inputs, digital 24 V DC
- 12 outputs, digital 24 V DC/0.5 A
- 8/4 analogue inputs, 12 bit, voltage/current/Pt100
- 4 analogue outputs, 12 bit, voltage or current (selectable via software)

Embedded control

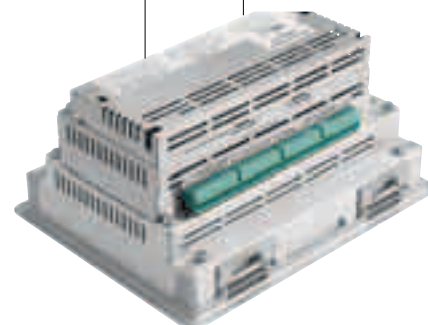
The Front End Display with integrated controller



FED-CEC



FED-UIM





Intelligent and simple at the same time: controller CPX-CEC for CPX terminals

As an intelligent remote system to IP65/IP67 installed directly on the machine, CPX-CEC reduces installation costs. It's ideally adapted for CPX and motion applications with up to 31 electric drives. On top of that, the activation of valve terminal configurations with MPA or VTSA can be realised quickly and with the greatest of ease.

The CANopen master is integrated in the control system for intelligent control of pneumatic and electric axes via fieldbus. The specialised CoDeSys function library provides diagnostics and condition monitoring options. With R232 interface or CANopen master, depending on the application.

Benefits

- Total flexibility with modular I/O system; up to 512 I/O
- Economical: e.g. for manual workstations where control is on a stand-alone basis

- Connection to all fieldbuses as remote controller and for pre-processing
- Diagnostics with flexible monitoring possibilities for pressure, flow rate, cylinder run time, air consumption, early warnings and visualisation options
- Control of decentralised installation systems based on CPI, and of proportional and servopneumatics
- AS-interface control via gateway

Features

- CPX-CEC variants:
 - RS232: CPX-CEC
 - CANopen master: CPX-CEC-C1
- High performance 32-bit microprocessor, 20 MB flash, 8 MB RAM
- Data memory 32 MB flash/ 32 MB RAM
- Communication network Ethernet 10/100 Base-T
- CANopen optional, only with CPX-CEC-C1
- Handheld for CPX terminal
- RS 232 interface optional, only with CPX-CEC
- OPC server for connection to any SCADA packages
- Run/stop switch
- LED indicators





**Powerful:
control unit CECX**

The modular control unit CECX expands the control range to include fieldbus master functionalities and electric actuation options.

Simple commissioning, programming and servicing: the CoDeSys software supplies a powerful programming environment via the SoftMotion module for the control of all electric drives with CANopen fieldbus connections. Libraries, configuration tools and drivers are also available.

The IEC 61131-3 standard means that CECX is flexible and open, and compatible with all types of control tasks. Whether for individual control of electric drives or interpolation with 2.5 degrees of freedom, CECX is the ideal combination of control and motion.

Benefits

- Control of electric drives with CANopen fieldbus connection
- Certified for CE, UL/CSA
- With top expertise for innovative front-end solutions built in
- Standard CoDeSys software
- For PLC functions and multi-axis motions with interpolation

- Full compatibility through Profibus, CANopen and Ethernet
- Compact assembly, easy to handle
- Can be mounted on an H-rail

Properties

- Automatic module detection
- DHCP-compatible

Module selection

- CPU unit
- Power PC 400 MHz
- Ethernet
- CAN bus
- RS 485
- USB
- CF (CompactFlash) card as removable storage
- Slots for optional modules

Optional modules

- Ethernet interface
- CAN bus interface
- RS232 serial interface
- RS485/422 serial interface

Input/output modules

- Digital modules
- Analogue modules for current and voltage
- Temperature input modules (PT 100, NiCrNi, FeCuNi)
- Counter modules (encoder, SSI)

Communication

- Profibus master DP V1
- Profibus slave DP V1



Two product versions	
CECX-X-C1	Modular master controller with CoDeSys
CECX-X-M1	Motion controller with CoDeSys and SoftMotion



Motion control for multi-axis motions

The gateway to multi-axis motion: CPX-CM-HPP

Uniform control of up to four Festo electric drive units for handling, via fieldbus gateway and positioning profile FHPP. The gateway is ideally suited for integrating single-axis applications (point-to-point, asynchronous) on fieldbus/ Ethernet. It also provides fast commissioning and reduced downtime.

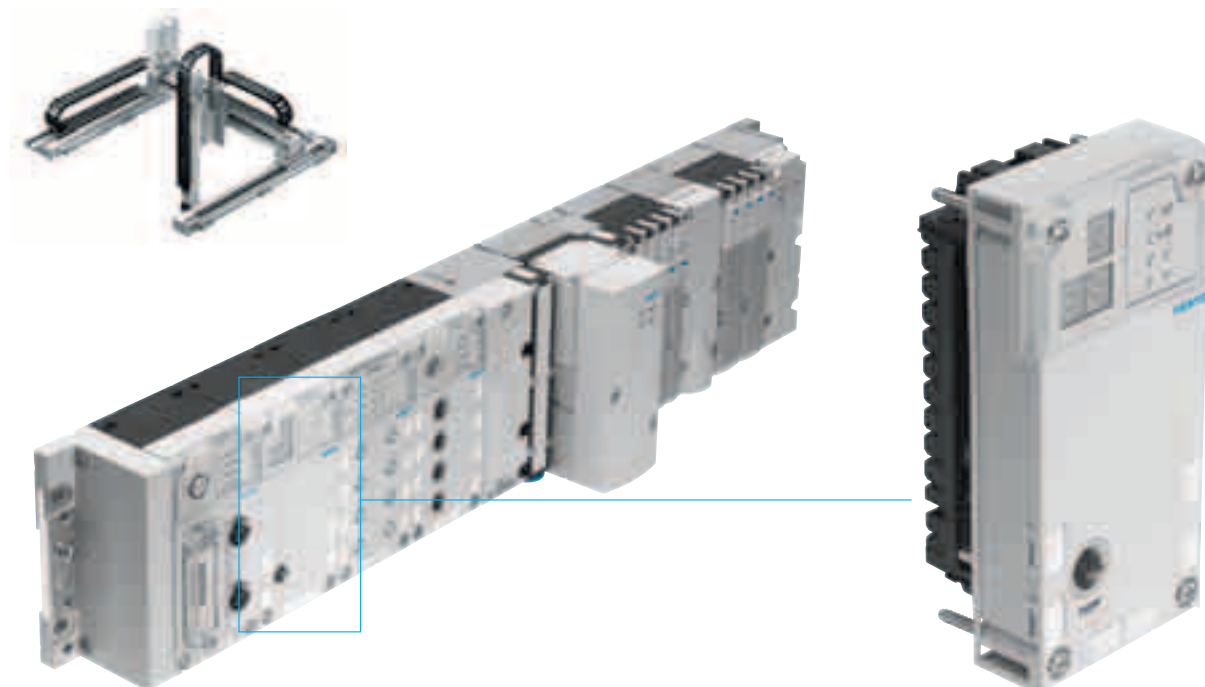
Benefits

- Highly flexible: compatible with all electric drive units from Festo
- Reduced complexity: no programming of the CPX-CM-HPP module required
- Fast commissioning and reduced downtime due to improved diagnostics with error messages in plain text
- Simplified engineering through uniform actuation of all Festo electric drive units

- Fast commissioning and reduced downtime due to improved diagnostics with error messages in plain text
- Outstanding efficiency: up to eight single axes can be controlled in the system

Features

- No interpolation
- Configuration via CPX-MMI





Designed for multi-dimensional control: multi-axis interface CPX-CMXX

The control block CPX-CMXX controls up to eight Festo electric drive units in two groups. As a module in the CPX terminal, it provides a PLC-compatible interface for multi-dimensional axis control. Both individual axis motions and coordinated motions can be carried out via its CAN bus interface.

As the only IP65 multi-axis interface for decentralised peripherals, it also stands out for its quick and easy installation and parameterisation using the Festo Configuration Tool FCT.

Benefits

- Time saving due to simple parameterisation or teach-in – no programming required
- Complete commissioning and parameterisation possible in advance
- Support for Cartesian kinematics

- Decentralised control of motion relieves the load on the higher-order PLC
- Teach-in or input of positions into a pre-defined record structure
- Reduction of cycle times by “smoothing” the motions
- Integrated fault management for maximum process reliability
- Possible configuration of two axis groups with up to four axes each

- Configuration via FCT configuration tool
- Synchronous axis travel is possible

Features

- Ethernet 10/100 BaseT (RJ45)
- DIP switch for operating modes and RUN/STOP
- Service interface (M12) for connecting the CPX-MMI handheld
- 1024 positioning records
- CAN bus interface
- Coupling to additional field-buses (Ethernet/IP, EtherCAT, DeviceNet, ProfiNet, Profibus-DP, CC-Link)





**For minimal positioning times:
robotic controller CMXR**

The multi-axis controller CMXR with robotic functions ensures minimal positioning times and allows path applications with up to six degrees of freedom, for tasks such as adhesive application, labelling or laser welding. The intelligent dynamic limiter monitors the limit values of the connected motors and mechanical drive components, resulting in 100% path accuracy and optimum cycle times.

Another advantage: quick application creation thanks to efficient engineering with the Festo Configuration Tool (FCT) and intuitive programming with the Festo Teach Language (FTL).

Benefits

- Control of simple and complex kinematics: free path control in 3D
- Fast commissioning due to harmonised interfaces to higher-order systems

- Reduced cycle times through skipping of positions, ramping of accelerations and constant path speed

Features

- Modular controller with a number of extension modules from the CECX range, e.g. digital, analogue I/O
- Powerful motion control core:
 - Synchronous point-to-point (PTP) motion
 - Cartesian linear and circular interpolation
- Optional wrist axes for aligning tools

- Individual programming of speed, acceleration and jerk
- Definition of tool centre points (TCP) and tool coordinate system for easy teaching

Optional: teach pendant CDSA for easy teach-in of positions

- With 2-channel permission button and emergency off
- With teach-in and positioning function with plain text display
- Flexible: online optimisation of motion programs with graphical dialogue system





Software tools – faster project design, commissioning and operation

Intelligent automation

Festo continuously analyses and identifies potential improvements so that tasks can be made faster, simpler, better and more targeted through the use of software tools, Festo is active, with continuous analysis and identification of potential improvement.

Configuration made easy:

Festo Configuration Tool FCT

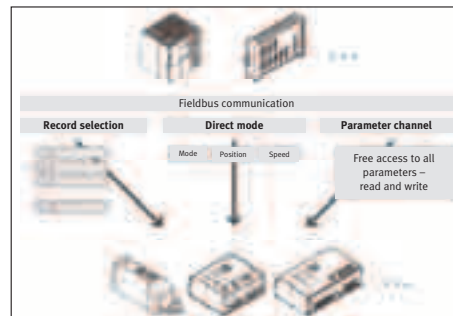
- All the drives in a system can be managed and stored in a common project
- Project and data management for all supported device types
- Simple to use thanks to graphically supported parameter entry
- Universal mode of operation for all drives



Communication made easy:

Festo Handling and Positioning Profile, FHPP

- Optimised data profile
- For handling and positioning tasks
- FHPP permits the actuation of Festo motor controllers via standardised control and status bytes



Designing made easy:

Positioning Drives planning tool for electric drives

- Simple and fast design of axis-motor combinations
- Calculates the ideal combination of electric linear axes, motors, gear units and controllers
- Display of characteristic load values





Easy and flexible programming: CoDeSys software

The CoDeSys software allows standardised programming to IEC 61131-3 and is perfect for configuring, programming, commissioning and maintaining pneumatic and electric automation solutions.

Multifunctional in use

- Flexible and open for all types of control tasks, due to IEC 61131-3 standard
- Very easy commissioning, programming and service: module libraries, configuration tools

and drivers for control of electric drives with fieldbus

- Quick parameterisation and programming of the FED display and operating units via the Designer Tool
- Data interface to VipWin
- Ethernet communication for simple programming



Numerous languages and functions

- Ladder diagram
- Structured text
- Sequential function chart (SFC)
- Expansion for object-oriented programming

- Function block library for simple control of all Festo drives: Festo_Motion.Lib
- All programming languages usable in combination

Easy teach-in and intuitive programming:

Festo Teach Language FTL

Motion programs for kinematics: you don't need extensive programming training to use the FTL programming language (Festo Teach Language). FTL focuses completely on the application – just as the user requires and according to the principle of “short time to application”.

- Intuitive FTL language with macros
- FTL programs are stored in text format and can therefore be easily edited and generated using an existing programming system
- Straightforward storage of project data thanks to clear project structures
- The data with its freely selectable project and program names can easily be imported and exported using the FCT or a USB stick
- Positioning can be corrected quickly with the optional teach

pendant CDSA or transferred into the FTL program via the teach mechanism

- Forward processing: the CMXR controller and the

FTL programs calculate events in upcoming positioning commands, e.g. in order to reduce drive dynamics in time so as not to overload them.

Example of FTL program



Customised handling systems

Festo's problem-solving expertise means more than just products

Whether you're "just" using our components or you want a complete system solution, our specialists use suitable software tools to make sure that the solution is always right for your machine. We accompany you every step of the way, from offering advice to designing complete handling solutions through to the commissioning of turnkey subsystems – not to mention our comprehensive after-sales service.

Components for handling

Everything for the entire handling chain.

- Linear motion: with numerous linear axes such as the powerful and stable electric linear axis EGC.
- Rotating, gripping, vacuum solutions, for example with the highly modular vacuum generator OVEM, the sturdy T-slot gripper HGPT-B, or the extremely precise and compact swivel module DSM-B.

- For quality assurance, diagnostics, commissioning and function monitoring of rapid motions: the low-cost compact vision systems SBOx-M or SBOx-Q.

Turnkey handling systems from the multi-axis modular system

Our wide portfolio of handling systems is based on many years of experience. Whether pneumatic, servopneumatic, electric or a combination – all systems are tested and ready for installation:

- Pick and place
- Linear gantries
- Cantilevers
- Three-dimensional gantries
- Tripod kinematics

Profit from our know-how

Our experts will design the complete system solution according to your requirements and will take care of testing and commissioning. Not only that, they'll use suitable control architecture to integrate the complete solution into your communications networks and coordinating systems.





Compact vision systems

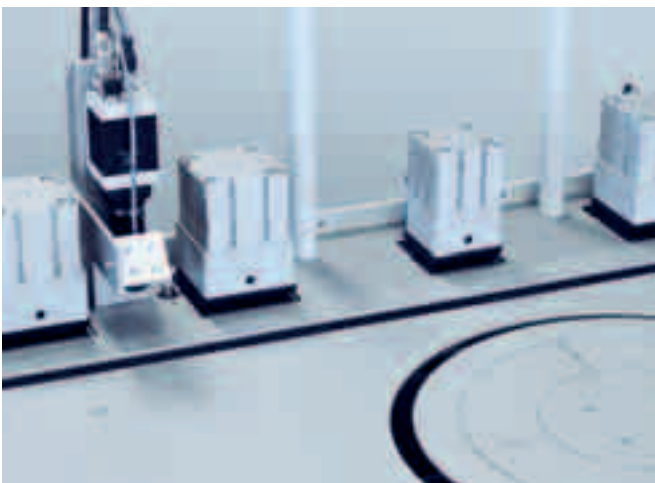
Our innovative and intelligent compact vision systems are versatile in application thanks to their compact, industrial design, while also being simple to integrate thanks to standardised interfaces and open fieldbus communication.

Compact vision system SBO..-Q CoDeSys 2.3 embedded:

Intelligent cameras for a wide range of applications, such as 100% quality inspection and measuring of parts, position sensing and rotary orientation sensing, or reading 1D and 2D codes and normal text. The parameters for test and inspection programs can be set easily using the CheckKon & CheckOpti software packages – no programming knowledge required.

Complex inspection sequences can be simple to create using the integrated PLC with the standardised languages of IEC 61131-3. Even small, stand-alone production areas can be controlled via the camera. With CANopen master functionality, servo controllers and decentralised I/O can be connected directly without detouring through a centralised PLC. A further advantage is the optimal connection of the camera to a host of Festo and third-party

control systems through standardised software interfaces via Ethernet (TCP-IP, Easy IP, Telnet, ModbusTCP) and CAN, as well as integrated 24V I/O.



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