Decentralised installation and control concepts as per 2017
We drive automation for your success. We are the partner to inspire you. We shape the future together.

→ WE ARE THE ENGINEERS OF PRODUCTIVITY.

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Decentralised installation and control concepts for today and the future

Cleverly networked architectures
Installation and control concepts are influencing each other more than ever before, especially as we move towards Industry 4.0 and the Internet of Things (IoT). It is only through effective interaction between these architectures that modular, flexible and adaptable production concepts with decentralised intelligence, pre-processing, autonomous machines or subsystems, cyber-physical systems – in other words, smart factories – will be successful.

Competency for new ideas
Festo offers you first-hand competency and expertise in pneumatic and electric drive technology. The modular electrical terminal CPX with motion control to IP65/67 has already been on the market for over 15 years. It provides numerous functions and a CPX-IoT gateway has now been added too. The concept on which the CPX is based has proven to be an early pioneer in control technology, paving the way towards Industry 4.0. The new CPX-E is the first complete, highly compact automation system for the control cabinet, while the Festo Motion Terminal is a top innovation and marks the start of the digital revolution in pneumatics.

Then as now, Festo intends to live up to its claim as a driving force in automation. It does so by, among others, being a member of the Industry 4.0 platform established by the German federal government.

Right from the start: Industry 4.0 for you
Turn the page to find out more.
A bridge to Industry 4.0: decentralised control systems from Festo

Embedded control systems from Festo are modular, adaptable and equipped with decentralised intelligence, and have been for more than 15 years. CODESYS V3 and OPC UA are building the bridge to Industry 4.0, also known as the Internet of Things.

Scan, look, discover with the product key
All the information for a modular CPX is contained in the data matrix code: 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 a communication interface and information protocol

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

Actual solution package for Industry 4.0: parallel kinematic system with robotics controller without control cabinet

Made possible by new, intelligent electric drives EMCA with integrated servo drives 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 horizontal as well as vertical connectivity with a single, uniform information model: these are the hallmarks of a fourth industrial revolution – Industry 4.0 or the Internet of Things.
Our adaptable Technology Plant is a good example of what can be achieved with Industry 4.0. OPC UA and CPX are used intensively in production, for example to monitor energy with the energy efficiency module E2M, a world first from Festo.

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: 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 ways forward for visionary automation technology, exclusively at Festo.
One of the main challenges facing manufacturing companies wanting to remain fit for the future is combining flexibility with a high level of automation. To achieve this, it is crucial to integrate and network a wide range of control systems in a complex automation system.

3S-Smart Software Solutions GmbH therefore developed the hardware-neutral software platform Controller Development System CODESYS to IEC 61131-3, which has proven to be successful worldwide. CODESYS integrates all languages defined in the standard and replaces proprietary software. Not only does it make it easier to network control systems from different manufacturers, but the use of a standard language also means that programming is simpler, faster and less prone to errors. Over 250 well-known device manufacturers from various industries currently use the CODESYS software tool as programming software. Thousands of end users in machinery and plant construction as well as other industry sectors use CODESYS. This is no surprise given that it offers users integrated solutions as well as practical support for carrying out their tasks.

Profile: CODESYS ...
• integrates everything you need for programming, fieldbus and I/O configuration, visualisation, motion control and other tasks – even your own plugins!
• adapts to your system requirements via profiles, plugins, modules, specific libraries, enhancements, external libraries, etc.
• can fit into just about any system structure, with interfaces to standards such as OPC/OPC UA, to other automation technologies such as FDT, with their own drivers
• is powerful thanks to integrated compilers, object-oriented programming, 3D CNC calculation, alarm management, additional tools from the world of IT, such as Unified Modeling Language (UML) or Apache Subversion, centralised revision control (SVN)

CODESYS pbF (provided by Festo) – global programming standard with Festo added value

CODESYS SoftMotion V3: a CAN bus for all devices. You can connect standard CAN devices (DS 402) and SoftMotion drives to a CAN bus interface.

CODESYS SoftMotion V3: PLCopen CAM functions, OPC UA, and much more.

Become a CODESYS expert: with training from Festo Didactic

Training course 1:
PLC371 – CODESYS Version 3
A hardware-independent introduction to CODESYS
Article number 577954

Training course 2:
PLC381 – CODESYS Version 3
A hardware-independent introduction to PLC programming
Article number 577956

More information:
→ www.festo-didactic.com
CODESYS pbF: standard with added value from Festo

Festo supports all customers with special drivers, function blocks and complete basic software packages for our products. Complete applications and subsystems can be created with the CODESYS pbF package (provided by Festo). We are working closely with 3S, sharing our extensive application knowledge and practical experience in order to optimise the CODESYS software package. Our expertise extends from vision systems and motion control (robotic functions) to concepts for condition monitoring.

You can use the CODESYS V3 pbF programming software to commission and program the controller CPX-CEC-...-V3, for example. The convenient user interface gives you access to the following functions:

- Configuration and parameterisation of the CPX-CEC-...-V3 with control configuration and diagnostics
- Programming in accordance with IEC 61131-3
- Programming, communication and visualisation via Ethernet
- Integrated module libraries
- Library Manager for integrating additional libraries
- Simulation mode on the PC without PLC
- Integration of a visualisation option; configuration using Designer Studio (available separately)
- Integrated project documentation
- Debugging: testing program sequences, monitoring and changing variables, troubleshooting
- Process visualisation within CODESYS using an operator unit CDPX and the Software Designer Studio (available separately)
- Use of the OPC server for connecting to an OPC client or use of the web visualisation under CODESYS
- Addition of OPC UA for integration in HOST environments for Industry 4.0 or the Internet of Things (IoT) in CODESYS Service Pack SP10

Quick and easy commissioning: SoftMotion NC basic software for CODESYS

One basic software yet so many possibilities in so many dimensions. The low-cost basic modules can be combined to create many different applications, from pick & place to bonding applications. Contours are imported as a DXF file and newly created contours in the NC editor can be imported in different file formats. Even without SoftMotion knowledge customer-specific solutions can be created quickly, easily and intuitively – thanks to defined interfaces.

Servo press kit YJKP for electrical press-fitting applications with CODESYS SoftMotion

Festo added value: the modular servo press kit YJKP gives you just the software functions you need for your application. You get an extremely precise press-fitting system with a high level of repetition accuracy and an excellent price/performance ratio. Simple, cost-effective and quick to install.

Pre-installed software

The pre-installed operating software is ready to use straight away and you don’t need to be a programming expert to parameterise it, it’s that easy and intuitive. The modular software in CODESYS, featuring application-specific functions, can be used on a PC, iPad or other types of human-machine interface and is compatible with all kinds of platforms. The controller CECC-X with OPC UA interface makes the system ready for Industry 4.0.
Open to all standards: networking concepts and communication

Complete subsystems from a single source

As your partner, Festo offers you complete subsystems for automating your processes, covering the full process and control sequence for factory and process automation.

Integration in the management system

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

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. (→ Page 26)
Your application determines the solution – that applies to control technology, too. Festo’s control architecture is designed to meet your needs in three ways:

- Tailored to your application
  - Ideal for integration into your overall control/management system
  - Optimally designed for actuating drive systems, whether electric, servo-pneumatic or pneumatic

- Detailed installation and control concepts for electric and (servo) pneumatic subsystems can be found on the following pages.

Important note
Since early 2016, Festo has released the version CODESYS V3 with Service Pack SP7, and will release it with SP10 at the end of 2017. This will automatically include various new MC functions as well as OPC UA for horizontal and vertical networking within Industry 4.0 host environments.
Centralised and decentralised control

Festo offers several options for controlling electric handling systems – for simple Cartesian systems as well as for more complex functions for planar surface and three-dimensional gantries or the parallel kinematic system EXPT. Controllers for asynchronous axes and basic valve actuators, which can be taught through web parameterisation from the Festo Cloud, round off the portfolio.

**Centralised control**

A motion controller controls multiple subsystems, however complex they are. This requires a high-performance motion control system, a fast, real-time bus system and in most cases a large central control cabinet.
Decentralised control

Here, each subsystem has a suitable motion controller which is specifically adapted to the application and enables stand-alone operation. The solution is based on small, decentralised control cabinets or IP65 controllers without a control cabinet. Coordination is carried out either using batch control in the SCADA system via OPC UA, a mini control system or directly via the MES (manufacturing execution system, e.g. SAP).

A new option in line with Industry 4.0 involves direct coordination between stand-alone subsystems in interaction with an intelligent workpiece. Time-critical processes use a real-time Ethernet protocol.
Installation and control concepts
Electric automation technology and motion control

Motion control from Festo: from simple solutions with the Optimised Motion Series OMS to motion control for 3D robotics – everything including the axis mechanism, motor, servo drive, control system, control cabinet and software comes from a single source. And in a wide range of variants.

The Optimised Motion Series OMS with simple positioning drives, rotary drives and valve actuators is designed for basic motion and for format changes. Programming skills are not required to commission OMS. Just download the parameters from the Festo Cloud to travel to defined positions – and you’re done! Almost as easy to use a pneumatic system.

Level 1: Quick and easy with OMS

Level 2: For up to 128 individual axes asynchronously – CANopen

Asynchronous applications with up to 128 individual axes can in theory be controlled via CANopen with CODESYS products from Festo. The controllers CPX-CEC-C1-V3, CDPX and CECC can be used here.
Innovative kinematics takes motion to a new level. Festo offers planar surface or three-dimensional gantries with CPX-E and/or CPX and other innovative kinematic solutions as a complete package. The classic control concept with control cabinet is supplied by Festo as a complete solution.

New:
- The handling system YXMx as a complete solution comprising mechanical and electrical systems, hardware/software, designed as a modular system for easy integration (see above).
- Last but not least, the parallel kinematic system with CPX/EMCA (tripod) as a research project shows how Festo is achieving function integration: the robot-capable controller and integrated drive EMCA to IP65 are built in directly on site. (For details see Page 34/35)
The vision of the future is now a reality. New installation concepts in industrial automation.

The seamless combination of pneumatics, electronics and software is radically expanding the range of possibilities for installation and control concepts. Applications can be developed and installed faster – and customised by developers.

This new triad gives developers more freedom to adapt their applications directly to the requirements of the product environment. The development process for a machine is thus greatly simplified and construction times are much shorter because all functions can be pre-assembled quickly and easily in a wide range of small subsystems.

Festo’s unique three-step approach makes the process of selecting the right installation concept for valves, valve terminals and remote I/O platforms easy and reliable. Mounting electromechanical and servo-pneumatic drives allows additional functions to be integrated in the CPX platform.

Expertise and training

The integration of modern installation concepts with fieldbuses in machines requires a significantly higher level of expertise than systems with individual valves or multipins. But these fieldbus technologies help to reduce total costs as well as machine downtime. Festo advises and trains customer engineers in connecting Festo products via fieldbus with the PLC and in handling error messages. Modern industrial Ethernet fieldbuses offer an open standard with a host of new options as well as greater system transparency for users and software developers.

More productivity with training from Festo Didactic

Training course: PN111 – Modern industrial pneumatics/Fundamentals Article number 559395

More information: www.festo-didactic.com

Enter the article number in the search field.
Valve terminal and CPX platform in the automation pyramid

The correct and consistent use of fieldbuses helps you to build machines faster and significantly reduces installation costs. This approach also enables you to bring highly innovative systems and machines onto the market.

Three steps to the right solution

1. Stand-alone or with manifold rail?
2. Which pneumatic/electrical functions?
3. How to integrate them and in which control architecture?
Stand-alone with multiple valves

**Individual valves VUVG/VUVS**
- Very high flow rate for reduced cycle times
- Compact design for air-saving mounting directly on the cylinder
- Large number of functions in a very compact space

**VUVG:**
**Halves the number of valves**
The 2x3/2-way valve function integrated in the VUVG ensures that you can actuate two cylinders independently of one another using one valve. With a conventional valve you need two.

**VUVS:**
**Robust and versatile**
The robust VUVS with individual coil actuation is available as a piston spool for universal use and as a poppet valve for critical ambient conditions.

<table>
<thead>
<tr>
<th>VUVG</th>
<th>VUVS</th>
<th>VTSA (ISO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1300 l/min</td>
<td>2400 l/min</td>
<td>2900 l/min</td>
</tr>
<tr>
<td>1000 l/min</td>
<td>600 l/min</td>
<td>500 l/min</td>
</tr>
<tr>
<td>780 l/min</td>
<td>780 l/min</td>
<td>1300 l/min</td>
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<tr>
<td>600 l/min</td>
<td>1000 l/min</td>
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<td>380 l/min</td>
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<td>2400 l/min</td>
<td>700 l/min</td>
<td>400 l/min</td>
</tr>
<tr>
<td>125 l/min</td>
<td>360 l/min</td>
<td>360 l/min</td>
</tr>
<tr>
<td>0 l/min</td>
<td>300 l/min</td>
<td>870 l/min</td>
</tr>
</tbody>
</table>

**Functionality**
- Semi in-line
- Sub-base
- Multi-pin plug connection
- Fieldbus
- Multipin
- Sub-base
**Summary: Stand-alone “with multiple valves”**
- Valve types
- Number of valves
- Flow (l/min)
- Number of switching operations/min
- Valve functions
- Air quality
- Connection dimensions
- Semi in-line or sub-base
- Electrical or pneumatic
- Internal or external pilot air
- IP degree of protection

**Valve terminal VTUG/MPA**

One size
- VTUG with plug-in
  - 10, 14, 18 mm wide

Modular size
- MPA1
  - 10 mm wide
- MPA14
  - 14 mm wide
- MPA2
  - 20 mm wide

**VTUG with plug-in**
- Multiple sub-bases

**MPA-S**
- Communicative

**MPA-L**
- Extremely modular

VTUG with plug-in is the ideal choice for a compact assembly of valves with the same widths, either 10, 14 or 18 mm.

Creating different pressure zones and flow rates in the same application is not a problem. MPA1, MPA14 and MPA2 can easily be assembled with an MPA-S and MPA-L. You can thus combine valves extremely efficiently and don’t have to fall back on oversized valves.

**In short:**
Product innovations from Festo give you a host of new ideas for energy efficiency and flexibility.
Valve terminal “multiple valves with multipin or fieldbus”

The electrical CPX remote I/O terminal can be connected to all standard and Ethernet fieldbuses and conforms to company-specific installation standards. With a choice of three installation concepts, you can reduce cycle times by 30% and compressed air consumption by 50%. Thanks to the extensive range of integrated pneumatic and electric drive functions, system costs can be reduced by up to 20% and installation times by up to 60%. Production costs are also lowered.

**Actuating electric axes**

Various special modules can be integrated in the CPX system for the actuation of electric and pneumatic drive functions and for safety functions. Diagnostics, i.e. storing of the last 40 messages, is available as standard. This saves time and money during the installation as well as in the operating phase. For example, the CPX can function as a remote I/O platform with or without integrated CODESYS controller; the fieldbus module and the front-end controller each have fieldbus communication options for machines with degree of protection IP20/IP65.

CPX in combination with a CODESYS V3 front-end controller supports the implementation of decentralised machine control, which limits installation costs and allows preprocessing or even fully autonomous machine control. The SoftMotion controller with CANopen master facilitates the synchronous control of electric drives.

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**Summary: “Multiple valves with multipin or fieldbus”**

- IP class
- Pressure zones
- Sub-base
- Flexibility
- Multipin
- IO-Link
- Fieldbus system
- Pressure reducer
- Hot swap
- Multi-pin plug connection

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**Fieldbus modularity**

- **VTUG with plug-in**
  - 1300 l/min
  - 150 l/min

- **MPA-L**
  - 860 l/min
  - 360 l/min

- **VTSA**
  - 2900 l/min
  - 400 l/min

- **Industry standard**
  - 7500 l/min
  - 1500 l/min
  - 700 l/min
  - 500 l/min
  - 250 l/min
  - 125 l/min
  - 0 l/min
Centralised intelligence

IO-Link/I-Port

Motor controller
CMMO-ST

Servo motor controller
CMMP-AS

Stepper motor controller
CMMP-ST

Integrated positioning drive EMCA

Cost-effective design

Decentralised intelligence with CODESYS

IO-Link/I-Port

Servo-pneumatic drive technology

Electromechanical drives

Ethernet, Modbus TCP, EtherNet/IP, PROFINET, EtherCAT, Sercos, Powerlink

Fieldbus, INTERBUS, DeviceNet, PROFIBUS DP, CANopen, CC-Link

IO-Link

CTEU

VTUG with plug-in

MPA-L

VTUG with plug-in

MPA-L/MPA-C

CPX-E
Modular controller as automation system

VTUG with plug-in

MPA-L

VSNC Namur

CODESYS

Modular controller as automation system

Ethernet

Fieldbus
Remote I/O terminals with specific functionality

**Control and communication**
Compatible with every control system and conforms to all specifications: communication control via any bus system.

Festo adheres to open fieldbus standards. Autonomous control is possible via CODESYS including OPC UA communication with MES/ERP systems. CODESYS and the fieldbus module can work side by side.

The CPX-IoT gateway collects the data of up to 31 OPC UA devices from Festo, converts it using AMQP/MQTT and establishes a secure connection to a cloud.

**Servo-pneumatic motion controller**
Integral power control for efficient and reliable positioning applications.

**Decentralised installation concepts**
Valves positioned close to the cylinders ensure shorter cycle times and reduced air consumption.

**Electric drives**
Synchronous, asynchronous, 3D. Without additional components or compatibility problems.

**Measuring and controlling**
Complete integration for every conceivable application.

**Safety functions**
Safely switch off electric and pneumatic energy sources. Detect safe inputs. PROFIsafe provides additional safety.

**Pneumatics**
Integration of proportional pneumatic pressure regulators, pressure sensors, power supply and manual pressure regulators. Includes integrated safety functions (for VTSA valve terminal).

<table>
<thead>
<tr>
<th>CPX/VTSA</th>
<th>400/2900 l/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPX/MPA-S</td>
<td>360/700 l/min</td>
</tr>
<tr>
<td>CPX/MPA-L</td>
<td>360/870 l/min</td>
</tr>
<tr>
<td>CPX/VTEM</td>
<td>550 l/min</td>
</tr>
</tbody>
</table>

**Decentralised installation concepts**
Valves positioned close to the cylinders ensure shorter cycle times and reduced air consumption.
**Which function goes where?**

**A brief overview**

1. **CEC, CEC-C1 CODESYS motion controller, CEC-M1 CODESYS SoftMotion controller, with 3D synchronous motion control.**
2. **FBx EtherNet/IP, Modbus® TCP, EtherCAT, Profinet, Powerlink, Sercos III, DeviceNet®, PROFINBUS, CC-Link®, CANopen, Interbus®, CPX-IoT gateway.**
3. **CMXX – electric multi-axis controller, CM-HPP 4-axis motion interface (not synchronous).**
4. **CMPX – servo-pneumatics with Soft Stop, the innovative end-position controller for faster pneumatic motion sequences.**
5. **CMAX – the unique servo-pneumatic position controller offers the advantages of closed-loop control and is as sturdy as pneumatics.**
6. **4AI-P – the first integrated pressure sensor with protection class IP65. No more I/O conversion, wiring and panel mounting.**
7. **8DI – like all digital I/O modules, available for all possible connections and cables as well as every environment: M8, M12, clamping connector, and many more.**
8. **8AO – like all other analogue CPX modules, available for all standard industrial connection systems, including TC and RTD.**
9. **CPI/I-Port – decentralised installation system for the fast and precise connection and installation of additional I/Os and valves.**
10. **FV-DO-P PROFIsafe for safely switching off the power supply in the event of emergency off. CPXF8DE-P for eight safe inputs. Both PL e/Cat. 4/SIL3.**
11. **MPA adapter – interface for pneumatics.**
12. **VPPM – the only bus-integrated proportional pressure regulator on the market. No more analogue I/O wiring or adjustment required. Supplies adjacent valves or the actuator directly with regulated compressed air.**
13. **Four valve sizes for MPA1 – for all valve and control functions. Two valve formats MPA1 and MPA2 can be freely combined and assembled. Different pneumatic pressure zones can also be combined.**
14. **Power supply for the valves can be divided into electrical zones – significantly improving safety for people and machines.**
15. **Pressure sensor for valve terminal MPA – can be installed anywhere in the valve terminal.**
16. **Two valve sizes for MPA2 – for all valve and control functions.**

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**Summary: Remote I/O "which functionality"**

- With or without standard
- Decentralised or centralised
- Fieldbus
- CODESYS controller
- Decentralised via IO-Link®, CPI
- Analogue, digital I/Os
- PT100/thermocouple
- Pressure sensors
- Fast counters
- Electric drives
- (Servo)pneumatic
- Hot swap
- Pressure zones
- Safety (SIL)
- Preventive maintenance
- Condition monitoring
- OPC UA client/server functionality

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**Codesys**

The programming system to IEC 61131-3

- Sensors
- Analogue
- Digital
- Vision
- Motion in control
- Safety
- Decentralised
Decentralised control systems are easier to install and manage. What’s more, they offer compressed air savings of up to 50%.

The platform CPX from Festo provides an ideal installation concept for decentralised control. Monitoring, programming and modification are fast and efficient. Smaller devices or machines can easily be connected to large installations via hard I/O or fieldbus.

Festo compares this installation concept to a PLC. The existing PLC must also be programmed. The decentralised CODESYS programming environment for CPX can be modified quickly and easily within the program.

With centralised control, anyone working on the installation must have an overview of the entire installation. An incorrect assessment can have fatal consequences. This requires extensive expertise and experience on the part of anyone carrying out this task. Specialists must also be familiar with any agreements reached. Decentralised control systems are much easier to install and manage.

Festo CODESYS – flexible and open for all types of control tasks
- IEC 61131-3
- Platform-independent
- Object-oriented (from V3+)
- OPC UA interface to Industry 4.0 host environments
- CODESYS is user friendly to implement, can be put into action immediately and corresponds exactly to market demands.

More productivity with training from Festo Didactic

Training course:
PN163 – Valve terminal CPX
Commissioning, modification and fault elimination
Article number 559389

More information:
⇒ www.festo-didactic.com

Enter the article number in the search field.
Tomorrow:
decentralised control

Decentralised control (CPX + CMMP + EGC)

Decentralised control (valve terminal MPA and cylinder)

Centralised PLC control
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.

**New display generation: CDPX with integrated controller**

Powerful processors are combined with widescreen technology for greater functionality, higher resolution and versatile access options.

**Features**
- Perfect graphic displays
- Extremely simple and intuitive project engineering and programming
- Visualisation and remote access to data from anywhere in the world
- CODESYS V3 (>SP7)
- OPC UA client for Industry 4.0 integration

**Compact controller CECC**

Compact and with more functions. For controlling electric and pneumatic drives for small tasks. Stand-alone or in mechatronic solutions via CODESYS provided by Festo.

**Features**
- Innovative: IO-Link® master
- Hybrid: control electric and pneumatic drives directly and connect valve terminals
- Can be integrated into higher-level systems with TCP/IP
- CODESYS V3 (>SP7)
- OPC UA server for Industry 4.0 integration

**CODESYS integrated: controller CPX-CEC for CPX terminal**

As an intelligent remote system to IP65/IP67 installed directly on the machine, CPX-CEC reduces installation costs. Ideal for CPX and motion applications with up to 8 electric drives.

**Features**
- On-site installation
- Control platform to IP65
- Integrated in a valve terminal
- For easy control of valve terminal configurations with MPA or VTSA, or the Festo Motion Terminal VTEM
- Motion control up to 3D and robotic functionality via Soft-Motion
- CODESYS V3 (>SP10)
- OPC UA server for Industry 4.0 integration
- CPX-IoT gateway for a direct cloud connection and for integrating Industry 4.0

**Automation system CPX-E-CEC with motion control**

CPX-E-CEC is an extremely compact, modular remote I/O and powerful control system. Can be used universally process automation as well as in more complex multi-axis applications in factory automation.

**Features**
- Installation in a control cabinet
- Automation platform in IP20
- Multi-axis controller with interpolation
- Motion control up to 3D and robotic functionality via Soft-Motion
- CODESYS V3 (>SP10)
- OPC UA server for Industry 4.0 integration
- Remote target visualisation and web server
- Optional bus connection to Profinet and EtherNet/IP

In addition to standardised handling systems and customer-specific solutions, Festo provides complete control cabinets based on a configurable standard modular system. These always include the right control system, and can be customised on request.
### Multi-axis controllers

<table>
<thead>
<tr>
<th>Module</th>
<th>Compact controller</th>
<th>Integrated controller</th>
<th>CPX terminal</th>
<th>CPX-E automation system in the control cabinet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Controller</td>
<td>CODESYS V3 controller</td>
<td>CODESYS V3 controller</td>
<td>Modular controller</td>
</tr>
<tr>
<td></td>
<td>CECC-D</td>
<td>CDPX</td>
<td>CPX-CEC-C1-V3</td>
<td>CPX-E-CEC-C1-PN</td>
</tr>
<tr>
<td></td>
<td>CECC-LK</td>
<td></td>
<td>Motion controller</td>
<td>Modular motion controller</td>
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<td></td>
<td></td>
<td></td>
<td>CPX-CEC-M1-V3</td>
<td>CPX-E-CEC-M1-PN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single axis (PTP asynchronous)</td>
</tr>
<tr>
<td>Single axis (PTP asynchronous)</td>
</tr>
<tr>
<td>C1: single axis</td>
</tr>
<tr>
<td>M1: interpolation (3D)</td>
</tr>
<tr>
<td>C1: single axis</td>
</tr>
<tr>
<td>Robotics (3D)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum number of permissible axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 axes</td>
</tr>
</tbody>
</table>

One axis is treated as one CANopen participant. 128 participants (spec. acc. to CANopen).

One axis is treated as one CANopen participant. 128 participants (spec. acc. to CANopen).

** Number of participants acc. to EtherCAT specification

<table>
<thead>
<tr>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP asynchronous</td>
</tr>
<tr>
<td>Each axis moves with its own predefined parameter</td>
</tr>
<tr>
<td>The axes do not reach their end positions at the same time and the path is not defined</td>
</tr>
<tr>
<td>3D interpolation with M1 variants for up to 31 axes</td>
</tr>
<tr>
<td>C1 versions: PTP asynchronous</td>
</tr>
<tr>
<td>M1 versions: 3D path interpolation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand-alone controller</td>
</tr>
<tr>
<td>Integration of two fast inputs (200 kHz)</td>
</tr>
<tr>
<td>4 IO-Link® masters for CECC-LK</td>
</tr>
<tr>
<td>CODESYS V3</td>
</tr>
<tr>
<td>OPC UA server</td>
</tr>
<tr>
<td>Integrated controller in a display</td>
</tr>
<tr>
<td>CODESYS V3</td>
</tr>
<tr>
<td>OPC UA client</td>
</tr>
<tr>
<td>Function integration on the CPX terminal</td>
</tr>
<tr>
<td>CODESYS V3</td>
</tr>
<tr>
<td>32 bit/800 MHz processor</td>
</tr>
<tr>
<td>OPC UA server</td>
</tr>
<tr>
<td>CODESYS V3 PLC SP10</td>
</tr>
<tr>
<td>Encoder interface</td>
</tr>
<tr>
<td>Interrupt function</td>
</tr>
<tr>
<td>High-speed clock pulse inputs</td>
</tr>
<tr>
<td>Digital/analogue I/O modules</td>
</tr>
<tr>
<td>Digital input modules*</td>
</tr>
<tr>
<td>Digital output modules*</td>
</tr>
<tr>
<td>Analogue input modules</td>
</tr>
<tr>
<td>Analogue output modules</td>
</tr>
<tr>
<td>IO-Link® master module*</td>
</tr>
<tr>
<td>Two EtherCAT interfaces, one EtherCAT master</td>
</tr>
<tr>
<td>Integrated full CPU</td>
</tr>
<tr>
<td>Host integration via fieldbus interface as slave to:</td>
</tr>
<tr>
<td>Profinet (Version PN)</td>
</tr>
<tr>
<td>EtherNet/IP (Version EP, on request)</td>
</tr>
<tr>
<td>USB interface</td>
</tr>
<tr>
<td>SD card interface</td>
</tr>
</tbody>
</table>

* These modules meet the interference immunity requirements for process automation applications in accordance with NE21 for process and laboratory control equipment.

<table>
<thead>
<tr>
<th>Application examples</th>
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</thead>
<tbody>
<tr>
<td>Handling systems</td>
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<tr>
<td>Pick &amp; place, palletising</td>
</tr>
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</tr>
<tr>
<td>Path control</td>
</tr>
<tr>
<td>Gluing</td>
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<tr>
<td>Cutting</td>
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<tr>
<td>Handling</td>
</tr>
<tr>
<td>Flying saw</td>
</tr>
<tr>
<td>Cam disc</td>
</tr>
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</tbody>
</table>

### Codecys V3 Controller

- CECC-D
- CECC-LK

### Codecys V3 Terminal

- CPX-CEC-C1-V3
- CPX-CEC-M1-V3

- Make a note of the controller specifications and their functions.

- Identify the maximum number of permissible axes and their configurations.

- List the motion types supported by the controllers, including PTP and interpolation.

- Summarize the special characteristics of the controllers, including integration options and hardware specifications.

- Categorize the application examples for a clear understanding of the controllers' practical use cases.
Software tools for faster project planning, 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.

**Convenient configuration**

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 and regular updates for electric and servopneumatic positioning systems

Convenient communication:
Festo Handling and Positioning Profile FHPP
- Optimised data profile
- For handling and positioning tasks
- FHPP enables the actuation of Festo motor controllers via standardised control and status bytes

Convenient design:
Positioning-Drives engineering tool for electric drives (single-axis systems)
- Simple and fast design of axis-motor combinations
- Calculates the ideal combination of electric linear axes, motors, gear units and controllers
- Displays characteristic load values

**Note:**
The Handling Guide Online for the design of multi-axis systems can be found on page 30/31.
Convenient and flexible programming with CODESYS software
CODESYS allows standardised programming to IEC 61131-3 and is perfect for configuring, programming, commissioning and maintaining automation solutions.

Multifunctional
- Flexible and open for all types of control tasks, module libraries, configuration tools and drivers for controlling electric drives with fieldbus
- Ethernet communication
- From CODESYS V3 SP7 with OPC UA for Industry 4.0
- Festo macros/function blocks for motion control and visualisation

Multiple languages and functions
- Ladder diagram
- Structured text
- Instruction list
- Function chart
- Sequential function chart
- Extension to object-orientated programming
- Function block library for all Festo drives
- All programming languages can be used in combination with one another

Possible pilot projects with the Festo Cloud could also include:
- VDMA traffic light for current status
- Transfer to other clouds
- Further options and project partners available from Festo on request

Simple visualisation of the status of mechatronic subsystems via Festo apps
- Component details via “drill down” – everything at a single click
- Further analyses and evaluations in the cloud via optional condition monitoring and predictive maintenance apps – on request

More productivity with training from Festo Didactic
Training course 1: HSN171 – Mastering machinery safety 1
Article number 577959

Training course 2: SN182 – Mastering machinery safety 2
Article number 577961

More information:
www.festo-didactic.com
All the information you need in one place with the Support Portal and product key

Our Support Portal is the central platform for all information. This where you will find everything relating to products along with device description files, relevant function blocks and firmware. In short: it is your informal gateway to the world of Festo automation. You can download everything from here.

Reliable, safe, efficient: the product key

Find information quickly and without lengthy searches – that is the aim of the Support Portal and product key.

Enter it manually or scan it – and the product key gives you access to all available information for the product. This increases the reliability of processes. It also boosts efficiency, speed and profitability.

How does it work?

Computer
• The product has a product key that is human-readable – plain text
• Open the Support Portal in your language on the official Festo website
• Enter the product key in the search field – access data by clicking

Mobile/tablet
• The product has a machine-readable product key – data matrix code
• Install a barcode reader on your mobile device (data matrix code-capable/Internet access)
• Scan the code – access data by scanning

Features
• The product key provides access to other after-sales tools
• For PC, mobile phone, tablet, barcode scanner
• No new interface: integration on the product label
• Dual coding: human- and machine-readable (plain text and 2D code)
• Mobile for common apps (iOS, Android, Windows phone, etc.)
• Unique number assigned during production, product key stores other product IDs
• Search function is a combination of the part number and ident. code 1 + 2
• Unique for tracing the smallest unit
• Data directly from SAP
• Information can be filtered for 2 views
• Information from delivery status as digital product image suitable for other systems:
  – When was the product produced?
  – To whom was it delivered (customer-specific order)?
  – Where was the product produced?
  – Was it tested?
  – When was it tested?
  – What is the revision status of the product?
At a glance:
electric drives and drive systems (motor controllers)

We offer a complete range of drive systems for servo motors and stepper motors as well as the corresponding axis mechanics.
The Handling Guide Online – the right handling system in just three steps

The Handling Guide Online is an all-in-one configuration and ordering system, and is integrated into our online product catalogue. This unique online engineering tool supports you in configuring and ordering your standard handling system. It cuts your engineering time and effort to a minimum and guides you to the right handling system in record time.

Three steps to your handling system

**Step 1**
Choose the type of handling system and enter your application data into the Handling Guide Online. The tool calculates appropriate handling systems, including price.

**Step 2**
Select the most suitable handling system from the list of suggestions. The correctly configured CAD model and the data sheet with all the relevant figures are immediately available for download.

**Step 3**
You can use additional options to configure your selected system in accordance with your requirements. Then add the preferred handling system to your shopping basket and confirm your order. Festo will deliver a ready-to-install system, including all user documentation in accordance with the EC Machinery Directive, as quickly as possible.

The benefits to you

- **Efficient.** The Handling Guide Online cuts your engineering time and effort to a minimum, and you don’t need any detailed product knowledge.
- **Fast.** The right standard handling system in just 20 minutes, including CAD model
- **Intuitive.** The Handling Guide Online is very easy to use and features structured data prompts.
- **Reliable.** Immediate display of net prices allows you to calculate your costs with certainty.

[www.festo.com/handling-guide]
If you have specialised technical requirements, you can simply send the application data you have entered in the Handling Guide Online to our experts with a single mouse click, and receive a customised offer.

Enter all the application data in the Handling Guide Online

**Standard handling systems**

You configure your handling system directly in the Handling Guide Online.

**Option of ordering directly in the Handling Guide Online**

Once you have entered your data, you will immediately be shown a number of suggested solutions for you to choose from, including the correctly configured CAD model and data sheet and your net price.

**Custom-designed handling systems**

If your requirements go beyond the scope of standard handling systems, our project engineers will plan the project for you – for full flexibility in terms of load, dynamic response, working space and the mechanical system.

**Customised offer from our experts**

You will receive a customised offer based on the data you enter.
Typical application examples with decentralised installation and control concepts from Festo

**Standard handling systems**

- Palletising
- Pick & place

**Highly dynamic handling systems**

- Loading & unloading
- End line packaging

**Small-scale handling systems**

- Applying labels
- Feeding
Checking quality
Sorting components
Separating
Loading crates
Testing
Joining
Industry 4.0: robotics without a control cabinet!

Robotics is getting ready for Industry 4.0 with the high-speed handling system with CPX/EMCA. CPX control technology from Festo for an IP65/67 environment and the numerous functions included in the new “integrated drive” EMCA facilitate robotic functionality without a control cabinet that is close to revolutionary.

The pioneering and cost-effective combination of standard components is further enhanced by the latest Festo hardware and software. It also offers virtual commissioning, OPC UA interfaces for Industry 4.0 or the Internet of Things (IoT) and CODESYS V3 SoftMotion transformation models with calibration options. The pick & place system is highly dynamic and features delta kinematics with free movement in space.

**Light, compact, agile**
The extremely lightweight and compact research model with CPX/EMCA saves space when it comes to integration and is very economical. All components are above the working space, wiring is minimised and the control cabinet-free IP65 design makes it quick to install. Connect 24 V and you’re done.

Parallel kinematic system EXPT (tripod) from the regular Festo catalogue range can be adapted to the application
- Length of the axes, angle of incidence and thus load and dynamics
- Up to 150 picks/s
- Type of control
- Integration in existing installations and control concepts
- Camera/vision systems
- Path synchronisation
  (currently not available for parallel kinematic system EXPT with CPX/EMCA)
Virtual modelling and commissioning

With the CIROS software from Festo Didactic, the virtual behaviour model is created and configured using the library. This serves as a simulation for the real system which is still to be produced. This means that the controller can already be developed and tested for the entire installation. This paves the way for Industry 4.0.

Function integration EMCA and CPX

The latest generation of intelligent electric drives is particularly easy to use and efficient. The maintenance-free EC motors are brushless DC motors with absolute position recording, integrated regulator, power electronics, absolute encoders and offer the option of adding absolute multiturn encoders, integrated holding brakes and fieldbus interfaces.

Its functions meet the criteria of the upcoming standard for Industry 4.0: Automation Markup Language or AML, which enables virtual modelling and commissioning. AML is able to map the geometry, kinematics, behaviour and sequence of programs, as well as represent hierarchies. Conveyor belts and the parallel kinematic system EXPT are synchronised and operated by linking the real and virtual worlds. The data can be further processed virtually to ensure that PLC programming is continuously optimised before the hardware is delivered. Software tools for programming can thus benefit from data from other software tools.

Space-saving design

\[ -98\% \text{ volume reduction} \]

The CPX terminal as a delta kinematics controller and the integrated drives EMCA.
Maximum productivity is a question of ambition
Do you share this attitude? We will be glad to help you achieve this goal – through our four outstanding qualities:
- Security
- Efficiency
- Simplicity
- Competency

We are the engineers of productivity.

Discover new dimensions for your company:
→ www.festo.com/whyfesto