Factory Automation

Learning Solutions Catalog 2026

FESTO



Table of Contents

Magazine

Technical Education M6

Holistic Approach M8
Product Catalogs M10
Factory Automation in the Professional World M12

Focus and Trend Topics I4.0 M14

The Digital Factory M18
Machine Learning and AI M20
IIoT Retrofitting M22
Industrial IT Security M24
Collaborative Robotics M26
Mobile Robotics M28
Energy Management M30
Smart Maintenance M32

Our Curriculum M34

Digital Learning Support M42

Festo Learning Experience – Festo LX M44
InfoPortal M48
Augmented Reality M50

Learning Factories M52

Digital Learning Factory M60

The Software Ecosystem M62
Simulation and Digital Twin M64

Learning Spaces M66

Services M72

Competent in the Industry M78

FACT M80
SMSCP M82
NC3 M84
NIMS M86

Learning Through Competitions M88

Table of Contents

Products

Learning Factories

Pallet Circulation – CP Systems 4
Single Workpiece Flow – MPS 26

Learning Factory Building Blocks

Pallet Circulation – CP Systems 44
Single Workpiece Flow – MPS 60

Focus and Trend Topics I4.0

The Digital Factory 120
Networks and IT Security 134
Artificial Intelligence in Application 136
Energy Management 140
Industrial Robotics 142
Mobile Robotics 152

Industrial Control Technology 160

Fundamentals of Factory Automation 200

Learning Media 254

Magazine

Technical Education
The Key to Progress

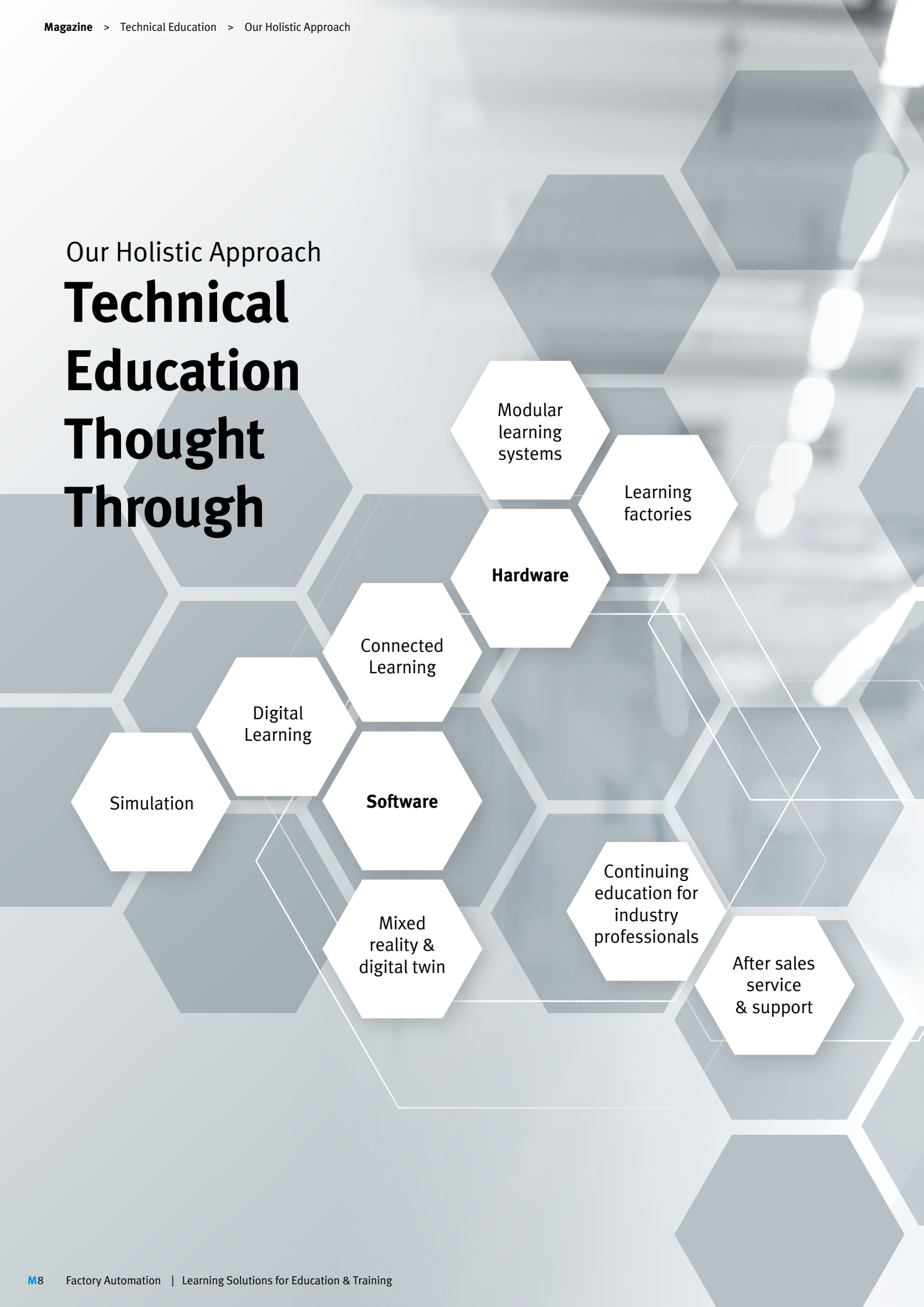
”Stimulating learning environments and programs are investments in our future. Education drives innovation and supports sustainable development across the globe.“

Dr. Nader Imani
VP Global Education

01

Our Holistic Approach

Technical Education Thought Through




Curriculum
Courseware
Festo Learning Experience

Our Product Range

Technical Education for Various Fields of Technology



Pneumatics and Hydraulics
Pneumatics and hydraulics are components of drive and control technology. Knowledge of these areas is essential for automation technology because Industry 4.0 topics build on this fundamental knowledge. Our pneumatics and hydraulics product catalog offers workstation systems, training packages and software as well as components and services. Gain solid expertise with basic and advanced level training.



Electronics and Electrical Engineering
Electrical engineering is the basic prerequisite for our connected and digital world and thus for Industry 4.0. The increasing electrification of industrial processes, buildings and vehicles, as well as renewable energies, enables people to shape a more sustainable and energy-efficient future. In this catalog, you will find qualification solutions with which learners develop competencies in the areas of electrical engineering and electronics, electrical power engineering and drives as well as building systems technology.

→ **Browse and download all catalogs on our website**



Process Automation and Water Management
Factory and process automation are inseparable components of industrial automation technology in most production environments. Process automation deals with continuous production processes and generates products that are often incorporated into factory automation processes. Our learning solutions for process control competency development range from process automation fundamentals and water management to more complex industrial topics.



Festo LX Course Catalog
As the backbone of the Festo Learning Experience, the Festo LX digital portal brings together a broad range of high-quality learning resources across multiple technical fields, all designed to support effective and engaging skill development. This catalog offers a quick overview of available courses and learning paths, helping you identify the right resources within our continuously expanding digital portal.



Factory Automation in the Professional World

Technical Education – the Key to Success

Changing requirements in industry
Industry is undergoing a process of permanent and increasingly rapid change. In addition to core technologies such as pneumatics, hydraulics, and mechatronics, new subject areas are constantly being added to the competencies of factory automation through constant innovation.

Industry 4.0-related technologies such as IT security, machine learning, and energy efficiency are creating new opportunities, and equally new challenges, in the factory environment. Integrating new technologies is only half the story. Finding well-trained specialists remains the decisive factor for manufacturers. Festo Didactic is your trusted industrial education partner for technical competencies and Industry 4.0 skills development.



The skills gap
Technological innovations are finding their way onto factory floors faster than ever before. For successful application, both existing employees and new employees must be trained accordingly.

In practice, it often takes a while for new competencies to become embedded into curricula and training regulations. This process often cannot keep up with the rapid pace at which new technologies establish themselves on the market. Likewise, existing training methods often no longer fit today's requirements for lifelong learning.

This has created a skills gap – that is, a difference between the skills needed in the industry and those that employees actually possess. We are closing this gap through advanced training and development programs.

Focus and Trend Topics I4.0
in the Industrial and Educational Environment

”

Modern industrial technologies, such as AI, are developing at a rapid pace. The art is to prepare them in learning formats that do justice to their complexity without overwhelming.

“

02

Dr. Tobias Schubert
Artificial Intelligence Expert

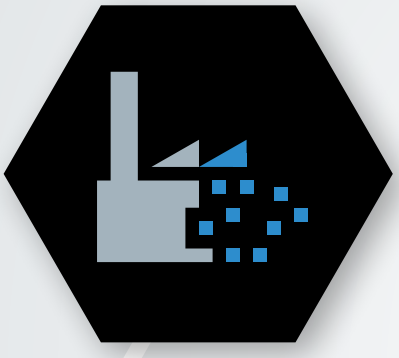
Focus Topics

In Factory Automation and Industry 4.0

Factory automation is a broad field that is becoming increasingly competitive due to continuous technological innovations in Industry 4.0. As I4.0 evolves, new technologies and topic areas emerge in order to meet rising demand and complexity.



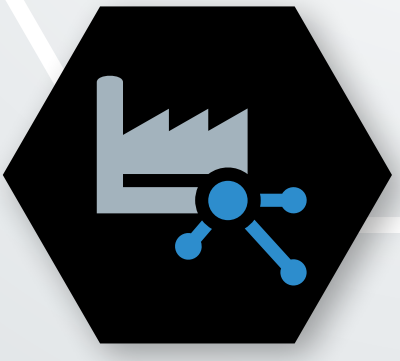
Smart maintenance
→ Page M32



The digital factory
→ Page M18



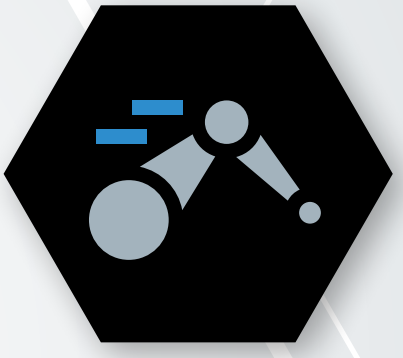
Machine learning and artificial intelligence
→ Page M20



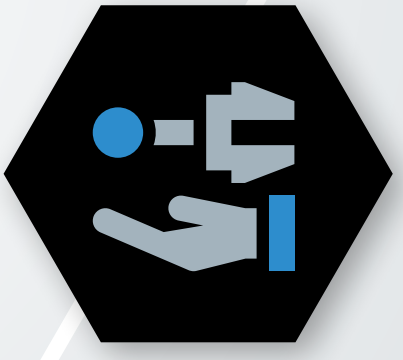
IIoT retrofitting
→ Page M22



Energy management
→ Page M30



Mobile robotics
→ Page M28



Collaborative robotics
→ Page M26



Industrial IT security
→ Page M24

Most Modern Production

The Digital Factory

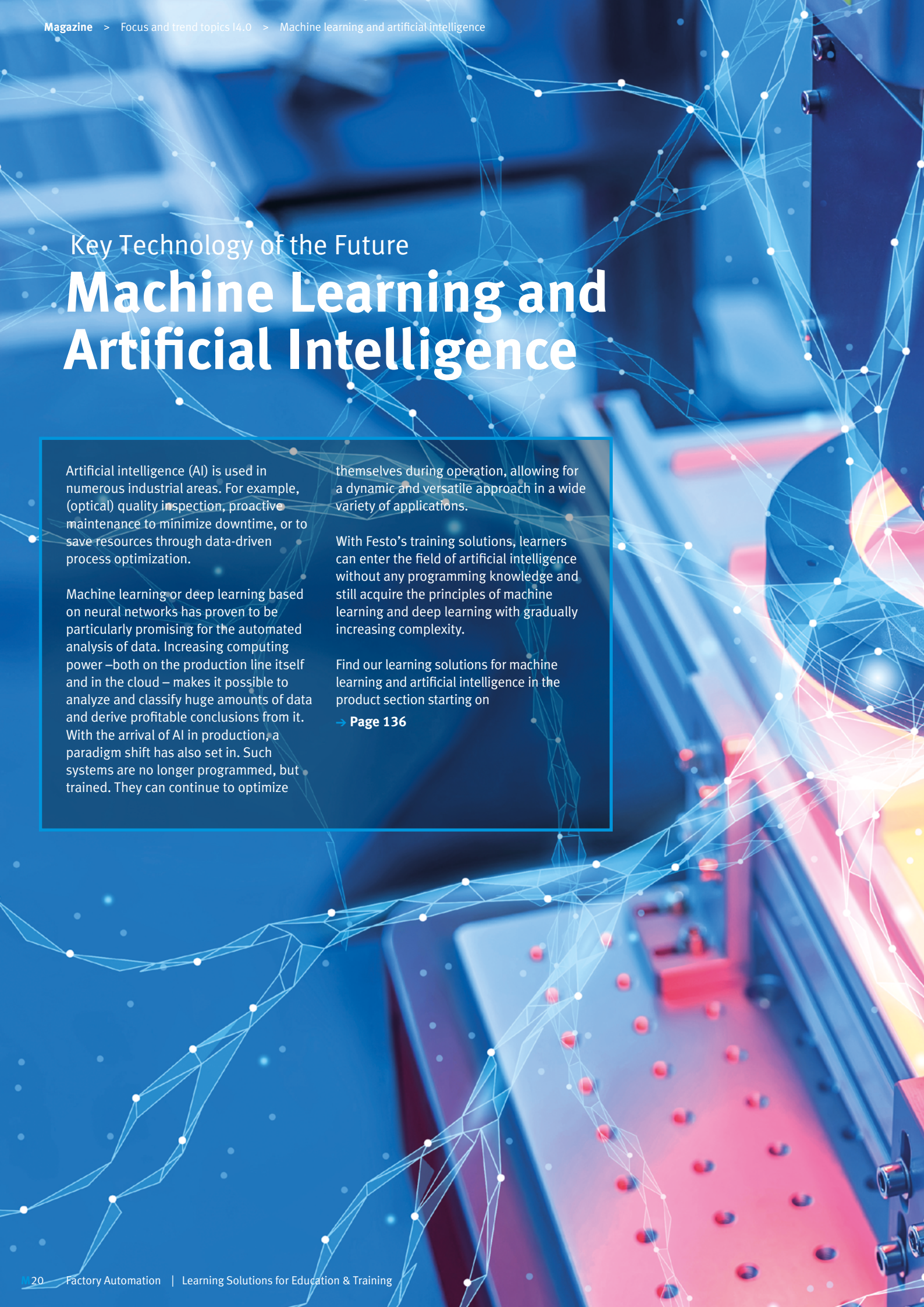


Through digitalization, industrial production is not only becoming increasingly networked, it can also be mapped digitally more and more completely. The basis for this is the system-side integration of processes – from ordering to production planning to logistics. Through constant communication between individual systems, the supply chain can become more dynamic, flexible and intelligent. This allows enormous potential for the entire production process.

An essential part of the digital factory is the Manufacturing Execution System (MES). The MES is responsible for controlling production in real time and manages production resources, processes and operating data. It assumes a central software function in manufacturing. In the digital factory, the MES also communicates continuously with adjacent systems, such as an SAP system, and determines important key figures such as availability or effectiveness, making production processes more transparent and enabling them to be optimized further and further.

Find our learning solutions for the digital factory in the product section starting on

→ **Page 120**



Key Technology of the Future

Machine Learning and Artificial Intelligence

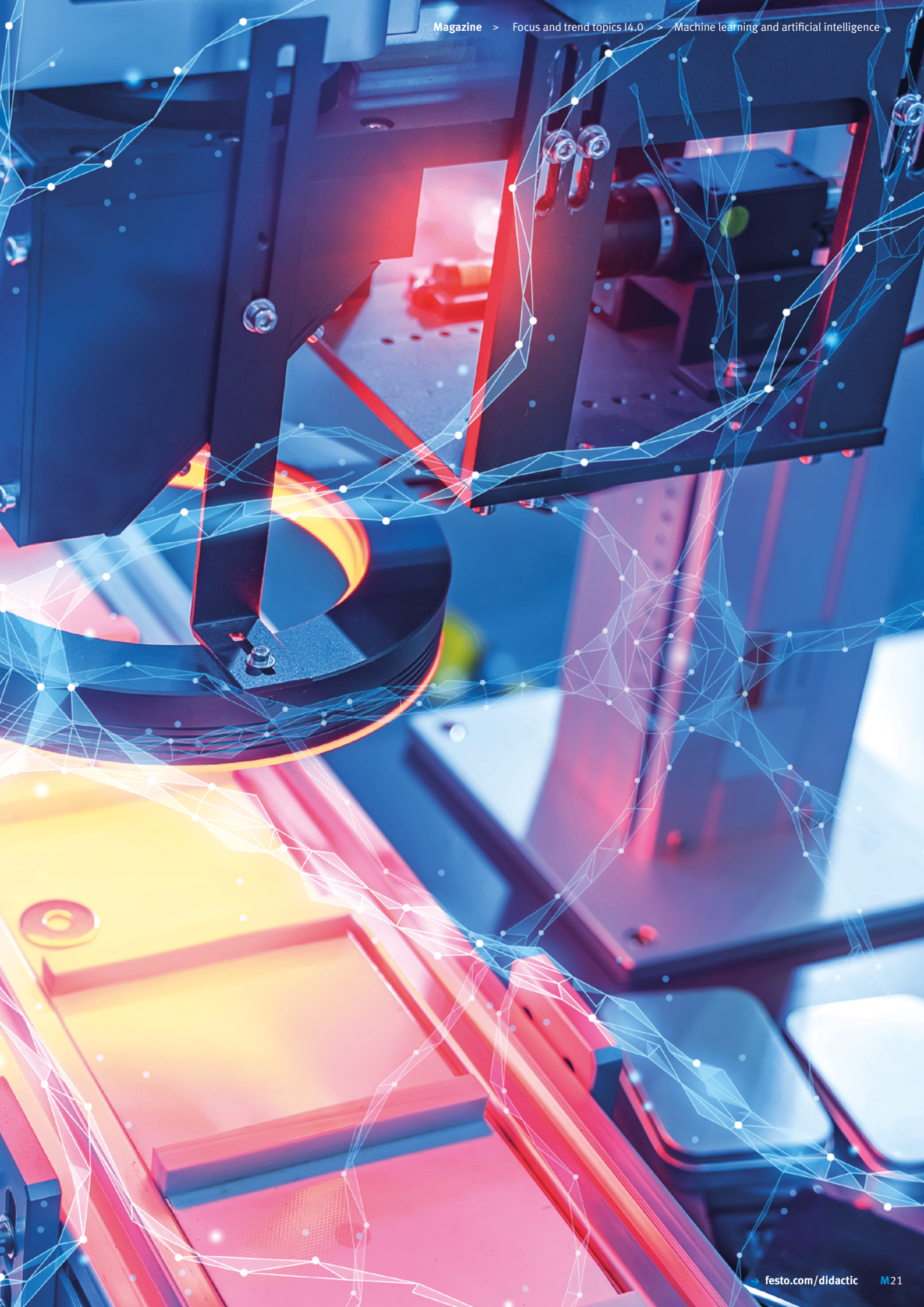
Artificial intelligence (AI) is used in numerous industrial areas. For example, (optical) quality inspection, proactive maintenance to minimize downtime, or to save resources through data-driven process optimization.

Machine learning or deep learning based on neural networks has proven to be particularly promising for the automated analysis of data. Increasing computing power –both on the production line itself and in the cloud – makes it possible to analyze and classify huge amounts of data and derive profitable conclusions from it. With the arrival of AI in production, a paradigm shift has also set in. Such systems are no longer programmed, but trained. They can continue to optimize themselves during operation, allowing for a dynamic and versatile approach in a wide variety of applications.

With Festo's training solutions, learners can enter the field of artificial intelligence without any programming knowledge and still acquire the principles of machine learning and deep learning with gradually increasing complexity.

Find our learning solutions for machine learning and artificial intelligence in the product section starting on

→ **Page 136**



Upgrade to Industry 4.0

IIoT Retrofitting

Unpredictable market conditions exert constant pressure on manufacturing companies to adapt. At the same time, production processes and facilities should not be interfered with to avoid endangering the stability and reliability of the systems.

The so-called retrofitting of existing production plants with IIoT devices (Industrial Internet of Things) offers a sophisticated way to collect additional data. In this process, small sensors equipped with their own intelligence are attached to existing plants in the form of IoT devices. The control architecture is not changed in the process.

The data obtained is often evaluated directly on the device or made available to the business process via open interfaces, such as OPC UA. In this way, processes can be optimized and made more flexible – and the quality of decision-making can be improved.

Festo provides educational insights and hands-on training for learners to understand the real challenges companies face in the course of digital transformation. As a result, learners gain valuable problem-solving skills that help manufacturers increase overall production efficiency.

Find our learning solutions for IIoT retrofitting in the product section on

→ **Page 139**





Effective Against Cyber Attacks

Industrial IT Security

Communication networks are the backbone of modern production facilities. The networking of production sites, systems and components will accelerate continuously. Data flows not only within the company and its sites but also to partners in the value chain. Data security as well as data availability are becoming increasingly important, especially since the amount of data will increase exponentially in the future.

Worldwide, several million cyber attacks are launched every day. In the worst case, they can threaten the existence of small and medium-sized companies in particular. Therefore, not only the basics of networking but also ensuring data security are important content in training professions. In their future working lives, trainees and students will deal intensively with network security.

Festo learning solutions help students acquire relevant skills in the area of applied IT security in the production environment.

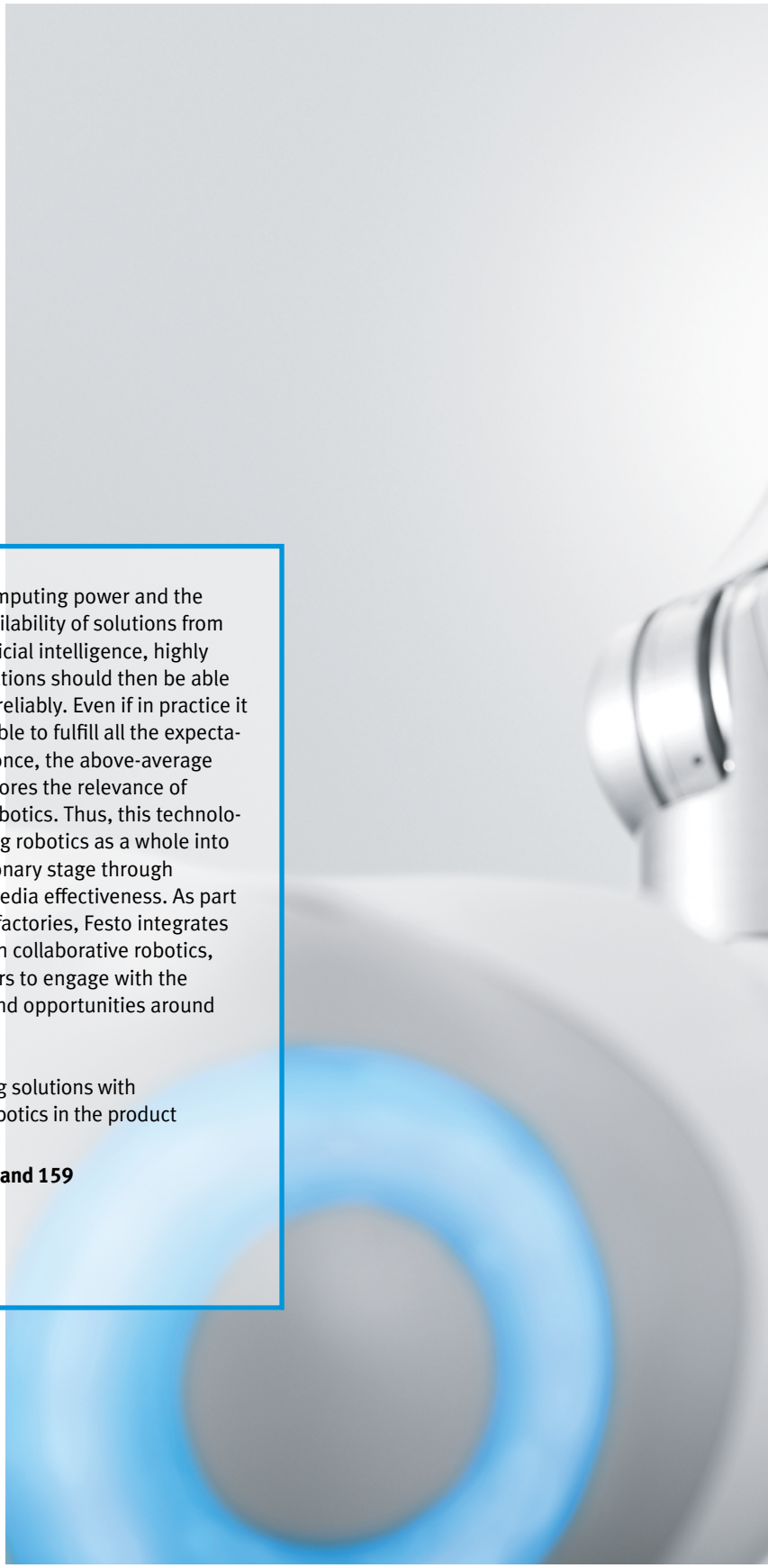
Our learning solutions on the subject of industrial IT security can be found on

→ **Page 134**



Hand in Hand with Robots

Collaborative Robotics

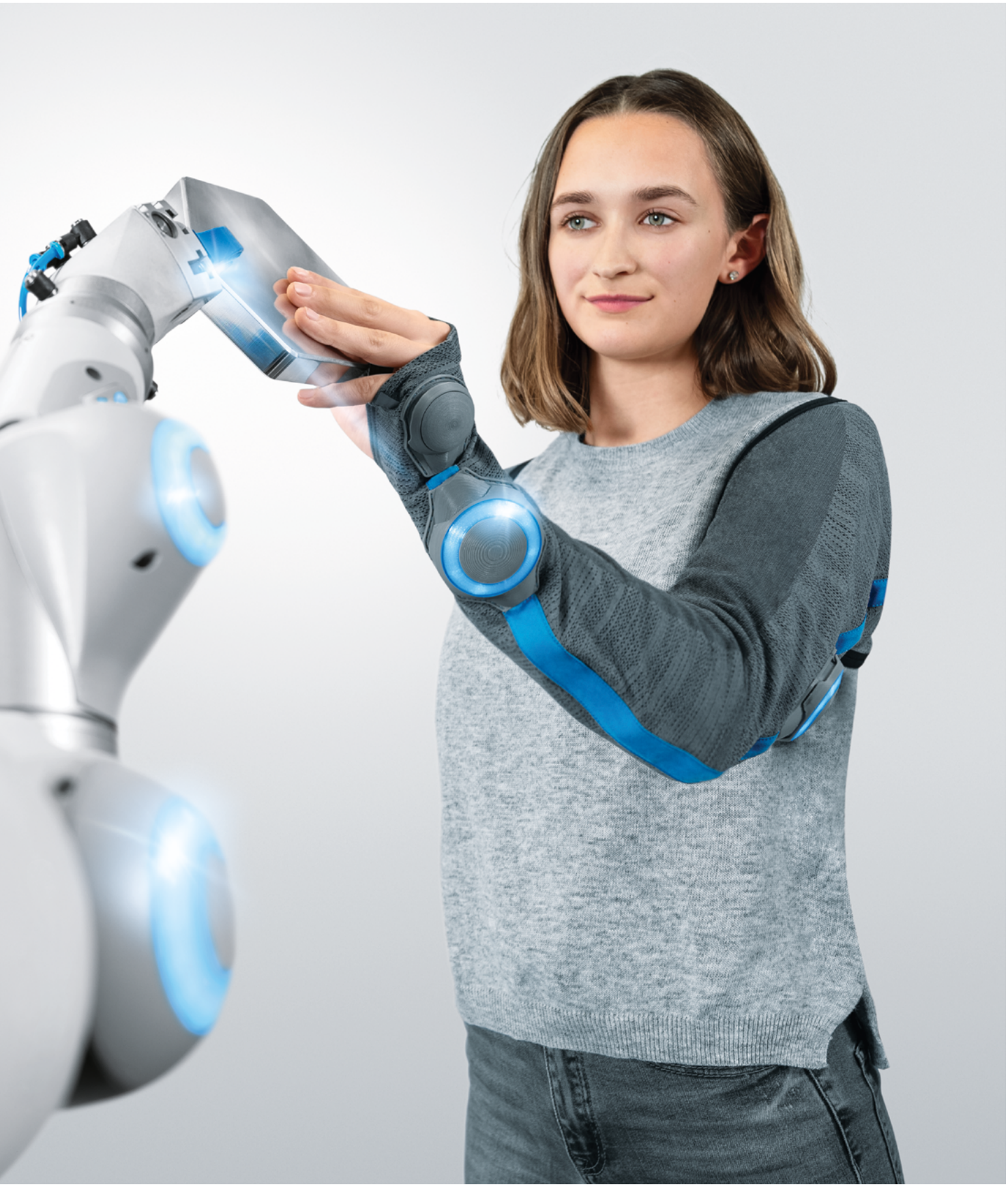


Opening up new areas of application where classic robotics cannot go any further – that is the breeding ground for collaborative robotics. For decades, industrial robotics has been making its way into 4D applications. Thus, dirty, monotonous, dangerous, and uneconomical tasks increasingly do not have to be performed by humans. Robotics cells are implemented by an industry of system integrators who take over the detailed planning, realization and maintenance with high application and interface knowledge.

Collaborative robotics sets two new accents at this point. On the one hand, the requirements for safe operation are to be lowered by hardware geared to force control and sensor technology, and on the other hand, new programming concepts enable drastically less specialist knowledge for successful operation with minor adjustments on one's own. This should also allow direct collaboration between humans and robots. With the explosion in computing power and the widespread availability of solutions from the field of artificial intelligence, highly dynamic interactions should then be able to be operated reliably. Even if in practice it is seldom possible to fulfill all the expectations raised at once, the above-average growth underscores the relevance of collaborative robotics. Thus, this technology area is driving robotics as a whole into its next evolutionary stage through concepts and media effectiveness. As part of our learning factories, Festo integrates approaches with collaborative robotics, enabling learners to engage with the requirements and opportunities around the topic.

Find our learning solutions with collaborative robotics in the product section on

→ **Page 11, 48, and 159**



Flexible Production Processes

Mobile Robotics





Small batch sizes increase the competitiveness of production lines. At least that is the theory. Because even with individually trackable workpieces, production lines remain rigid and let the competitive advantages of flexible production evaporate. Only flexible material flows with adaptable work schedules and flexible capacity control can leverage this potential.

To enable manufacturing in production islands, it must be possible to flexibly reroute material flows without production sequences and their throughput times becoming unreliable. To meet this challenge, a deep understanding of mobile robotics is a prerequisite. The strengths and weaknesses of AGVs versus AMR, for example: While established automated guided vehicles (AGVs) score high on robustness and throughput, autonomous mobile robotics (AMR) systems master dynamic route planning, making them more flexible to use. Whether working side-by-side or planning, it is important for learners to internalize the functionalities and limitations of mobile robot systems for successful flexible production.

Find our learning solutions for mobile robotics in the product section starting on

→ **Page 152**



Using Energy Efficiently

Energy Management

The industrial sector accounts for a significant share of global energy demand and costs, placing a heavy strain on the environment. In order to track consumption and therefore achieve better visibility, comparability and evaluation, monitoring systems are installed in modern production plants. Only with this basis can costs be allocated, efficiencies compared, improvement measures derived, and implementation documented. In addition, consumption data provides valuable information for monitoring the condition of machines, so measures can be taken at an early stage to maintain productivity in the event of deviations.

Festo guides learners in understanding the basics of energy efficiency, as well as the associated economic and ecological aspects. This teaches them to derive and evaluate different measures for increased energy efficiency in production.

Find our learning solutions for energy management in the product section on

→ **Page 140**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Festo AG & Co. KG
DE-73734 Esslingen

Keep Production Running

Smart Maintenance







All the productivity-enhancing promises of Industry 4.0 with “mass customization” or “build-to-order” can only be fulfilled with extremely high availability and reliability of machines and systems.

Intelligent and predictive maintenance of production facilities (smart maintenance) contributes significantly to achieving these goals. It is therefore essential for future employees to build up the relevant skills in the area of smart maintenance. If anomalies and wear are made visible in good time before malfunctions and failures, and weak points in machines and systems are identified by means of data analysis, then the risk of failure can be determined and possibly prevented. Festo learning solutions enable learners to familiarize themselves with various predictive maintenance and smart maintenance strategies.

Find our learning solutions that inlude smart maintenance in the product section on

→ **Page 9, 11, 13, 276, 285, 289, and 293**

Our Curriculum
Learning Holistically

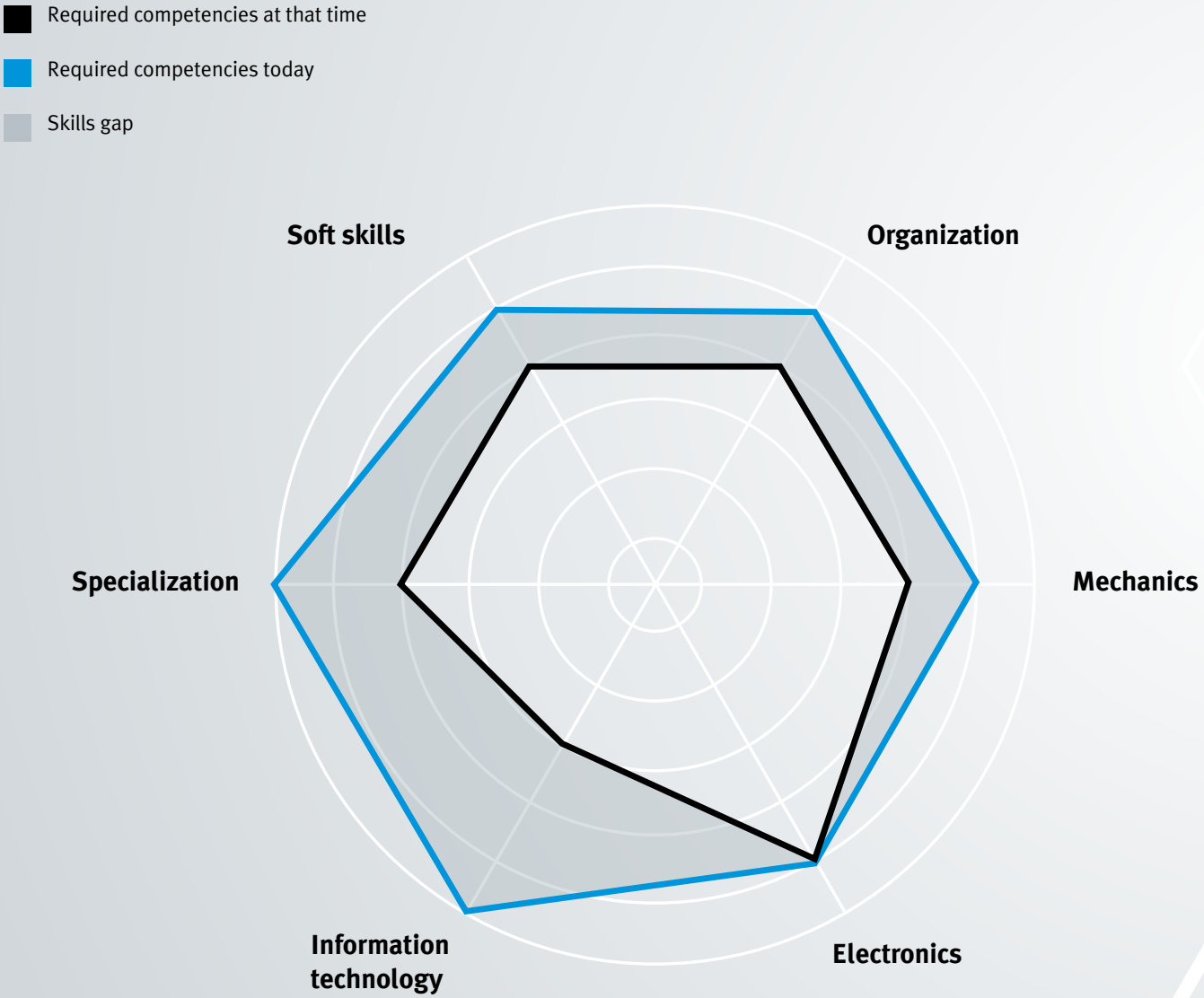
„Anyone who wants to be fit for Industry 4.0 needs a plan. That's exactly why we're developing the I4.0 curriculum."

Dr. Sandra Funk
Curriculum Architect

03

Competency Requirements in View

Tailored Education for the Skilled Workers of Tomorrow



Schematic illustration of the competency profile for the job profile mechatronics technician

The competency diagram of a mechatronics technician shows the technologies and soft skills that will be required alongside the traditional fundamentals of mechanical engineering and automation technology. A clear shift in the need for information technology expertise is also discernible.

As a globally networked education partner with industrial DNA, we first translate current and future skill requirements from industry and educational institutions for various occupational profiles into competence diagrams. These diagrams visualize the changes in competence requirements and thereby make the necessary qualification needs clearly visible.

Technological changes influence the competencies of different job profiles. Our qualification program is based on an analysis of current and future competencies that will adequately prepare the technicians and engineers of tomorrow.

We focus primarily on the following job profiles:

In vocational education
- Mechatronics technician
- Industrial electrician
- Industrial mechanic
- IT specialist

In advanced education
- Maintenance technician
- Automation engineer
- Data scientist/- analyst
- Production specialist

Technical Education Made to Measure

Curriculum to Close the Skills Gap



Based on the competency requirements of various job profiles, we didactically prepare basic, focus, and trend topics in the field of factory automation and Industry 4.0. Thus, we provide you with a comprehensive, competency-based, and digitally available qualification plan for education and training.

We also incorporate the latest technical industry innovations into our learning solutions. In this way, we support vocational programs and educators in imparting the necessary skills to qualify skilled workers for jobs of the future.

Our curriculum consists of individual topic-specific courses. A course usually consists of several complementary elements:

Theory (eTheory and eLearning courses) – to ensure an easy entry into the subject

Practice (eLab courses) – in order to grasp the topic in a practical context, tasks are carried out on Festo Didactic learning systems

Test (learning success control) – to determine whether the learning objectives of the course have been achieved

Teacher's Guide (User Guide) – to make teaching easier for teachers

The basic principles of the curriculum

Action competency
Our curriculum is structured in such a way that not only technical competencies but soft skills and social competencies can be built up.

Motivation
With our curriculum, we ensure that learners can identify with the subject and celebrate small wins along the way.
The respective goal is always clearly defined.

Practical relevance
The learning content is successfully applied using our hands-on training systems.

Flexibility
The curriculum is mapped in our digital learning portal Festo LX, allowing learners to access the learning content anytime and from anywhere.

Gradually increased complexity
The difficulty of the learning content increases slowly so as not to overwhelm learners.

Different types of courses
For more variety and learning enjoyment, we offer an array of course formats, including eLearning-only courses, eLab courses, eTheory courses and evaluations.

Multimedia approach
By using different learning media, various learning styles are taken into account. Media competence can also be increased in this way.

Modularity
The curriculum consists of adaptable learning paths and single topic courses that can be added optionally and individually.

Mechatronics Curriculum

Topic Overview





Mechanical Engineering Fundamentals

Mechanical Manufacturing Fundamentals
– Introduction to the SkillsMagazine Kit Project
– Solderless and permanent connection technology
– Technical Documentation
– Drilling
– Measurement Technology and Quality Assurance
– Turning
– Milling
– Additive Manufacturing and CAx-Systems
– CNC Manufacturing
– Commissioning of the Stacking Magazine

Pneumatic
– Pneumatic Fundamentals

Electropneumatic
– Electropneumatic Fundamentals

Automation Fundamentals

Automation Fundamentals Industry
– Commissioning the SkillsConveyor (unmounted)
– Hard-Wired Programmed Control (Industry)
– AC Motor Control (Industry)
– Basics of PLC Programming LOGO!
– Basics of Sensors
– Basics and Applied PLC Programming S7

Automation Fundamentals Laboratory
– Commissioning the SkillsConveyor (Industry-mounted)
– Hard-Wired Programmed Control (Laboratory)
– AC Motor Control (Laboratory)
– Basics of PLC Programming LOGO!
– Basics of Sensors
– Basics and applied PLC Programming S7

Core hardware required: SkillsMagazine



Additional products for competency deep dive:
TP 101, TP 201, TP 47220, and TP 1011

Core hardware required: SkillsConveyor



Additional products for competency deep dive:
SkillsPackages, TP 1221, EduTrainer

→ **Get a detailed overview of the curriculum and direct links to learning paths in Festo LX**





I4.0-Related Technology Topics

Fundamentals of Smart Automation Technology
– Basics Sensors and Actuators
– Introduction to Industry 4.0
– From Object ID to Product Memory with RFID
– Plant Visualization with HMI
– Smart Sensors for Smart Systems

Smart Safety and Maintenance Technologies
– Basics Pneumatics
– Basics of Machine Safety
– Introduction to Industry 4.0
– Smart Maintenance

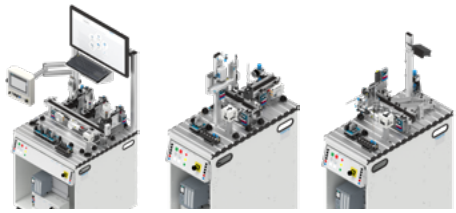
Modern Control Technologies for Intelligent Systems
– Basics of PLC Programming
– System Expansion
– Introduction to Industry 4.0
– PLC Programming for Smart Systems
– Artificial Intelligence in Production

I4.0-Related Infrastructure Topics

Industrial Communication and IT Security
– Industrial Communication with PROFINET
– Industrial Communication with OPC UA
– Plant Control and Commissioning with MES
– Energy Efficiency in Production
– IT-Security for Production Systems

Mobile and Autonomous Robotics
– Mobile and Autonomous Robotics with Robotino 4

Core hardware required: MPS 400 Stations



Additional product for competency deep dive:
TP 1321

Core hardware required: MPS 403



Additional products for competency deep dive:
Energy Efficiency and IT Security packages, and Robotino

Digital Learning Support
Promoting Efficient Learning Processes

”

Digitalization is changing not only what we learn, but also how we learn. Technological advances are creating innovative forms of learning, and with them new opportunities for more sustainable learning success.

“

Daniela Follmer
Product Management Digital Learning

021

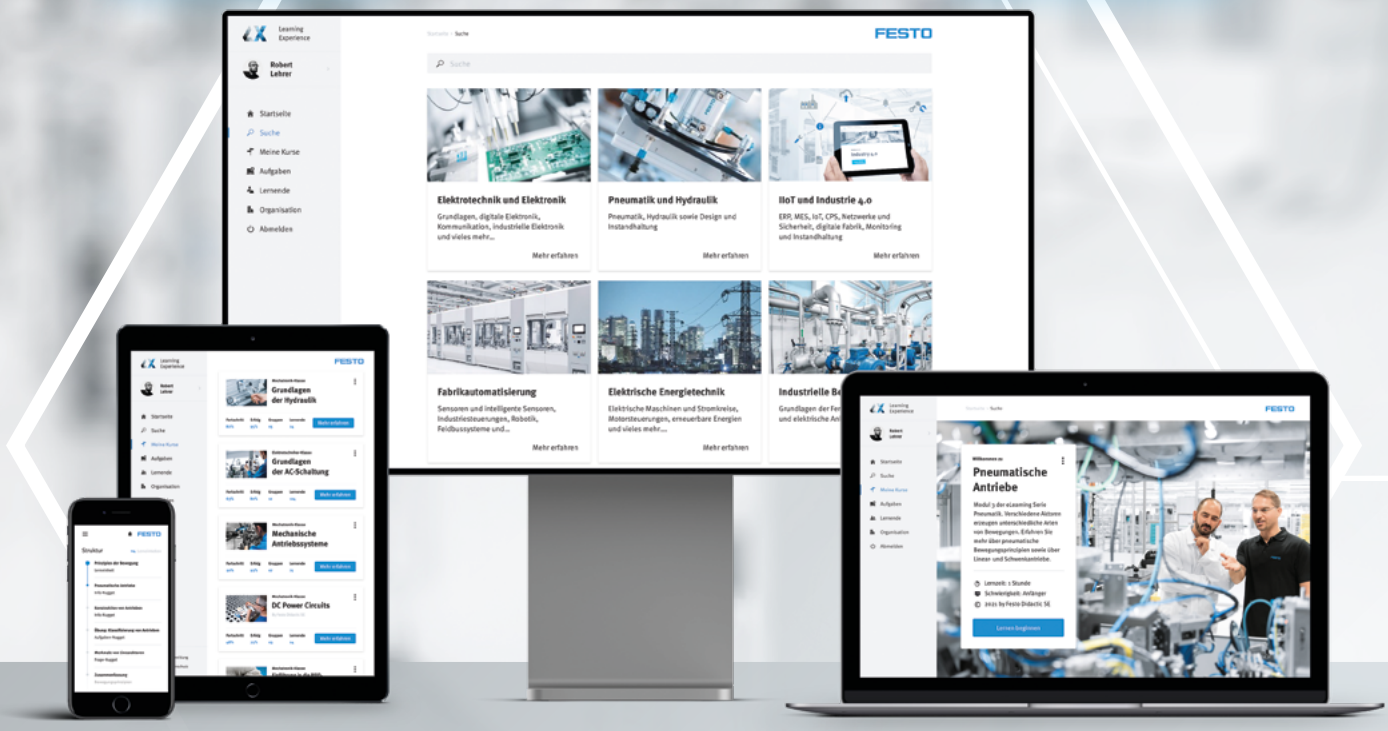
Festo Learning Experience

The Digital Portal for Individual Learning Experiences

Festo LX combines
industry expertise with didactic know-how to create unique learning experiences that match industry requirements.

Festo LX offers
didactically prepared learning content for many technical areas.

Festo LX is based on
multimedia learning nuggets that can be processed in a modular fashion and combined to form individual learning paths.





Festo LX combines
eLearning courses and practical exercises based on industry-approved learning systems for increased employability.

→ **Page 256**

Scan me

Festo Learning Experience Portal

New Features That Take Learning to a New Level



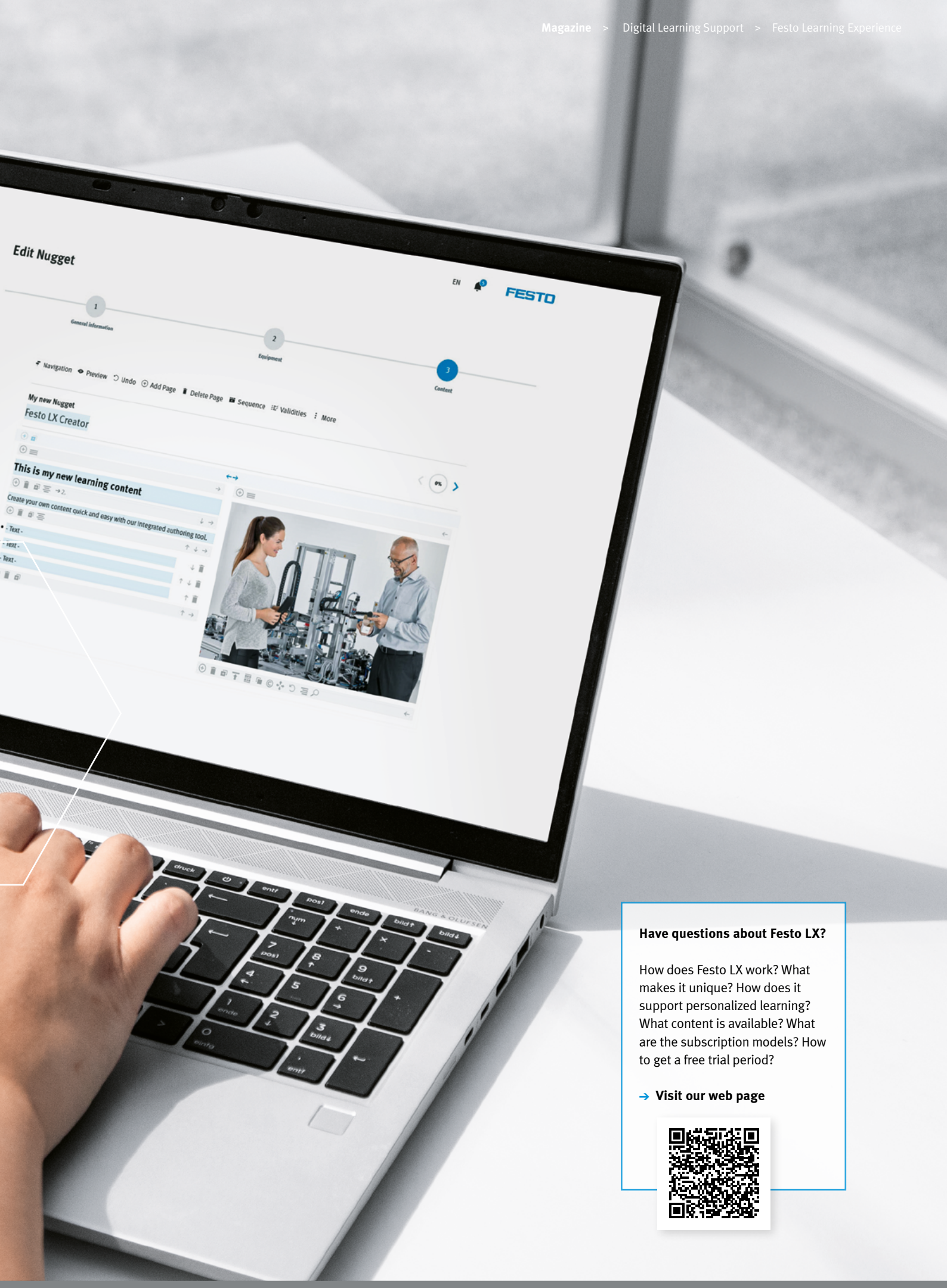
LX Creator AI
helps tailor content to specific needs by enabling the creation and editing of learning nuggets, courses, or paths – with AI support to streamline your work.

FluidSIM 365
is fully integrated into Festo LX, enabling online simulation in electrical engineering, hydraulics, and pneumatics directly within the learning portal.

Learning paths
guide learners through suggested sequences to address specific topics in a structured way. Teachers can create their own paths or choose from pre-set paths.

LX Tutor
is an AI-powered companion designed to enhance the user experience with Festo LX, supporting both learners and teachers through interactive, educational conversations.

LMS integration
securely connects Festo LX with your LMS so that you can access and edit Festo courses or build your own courses in Festo LX, and make them available in your LMS without disrupting your usual workflows.



Have questions about Festo LX?

How does Festo LX work? What makes it unique? How does it support personalized learning? What content is available? What are the subscription models? How to get a free trial period?

→ **Visit our web page**

The Most Important at a Glance

The InfoPortal

The Festo Didactic InfoPortal is a technical service that supports the optimal use of your existing hardware. In this central location, you will find key information for the effective use of your learning system, including videos, operating instructions, circuit diagrams, data sheets, tutorials, and FAQs.

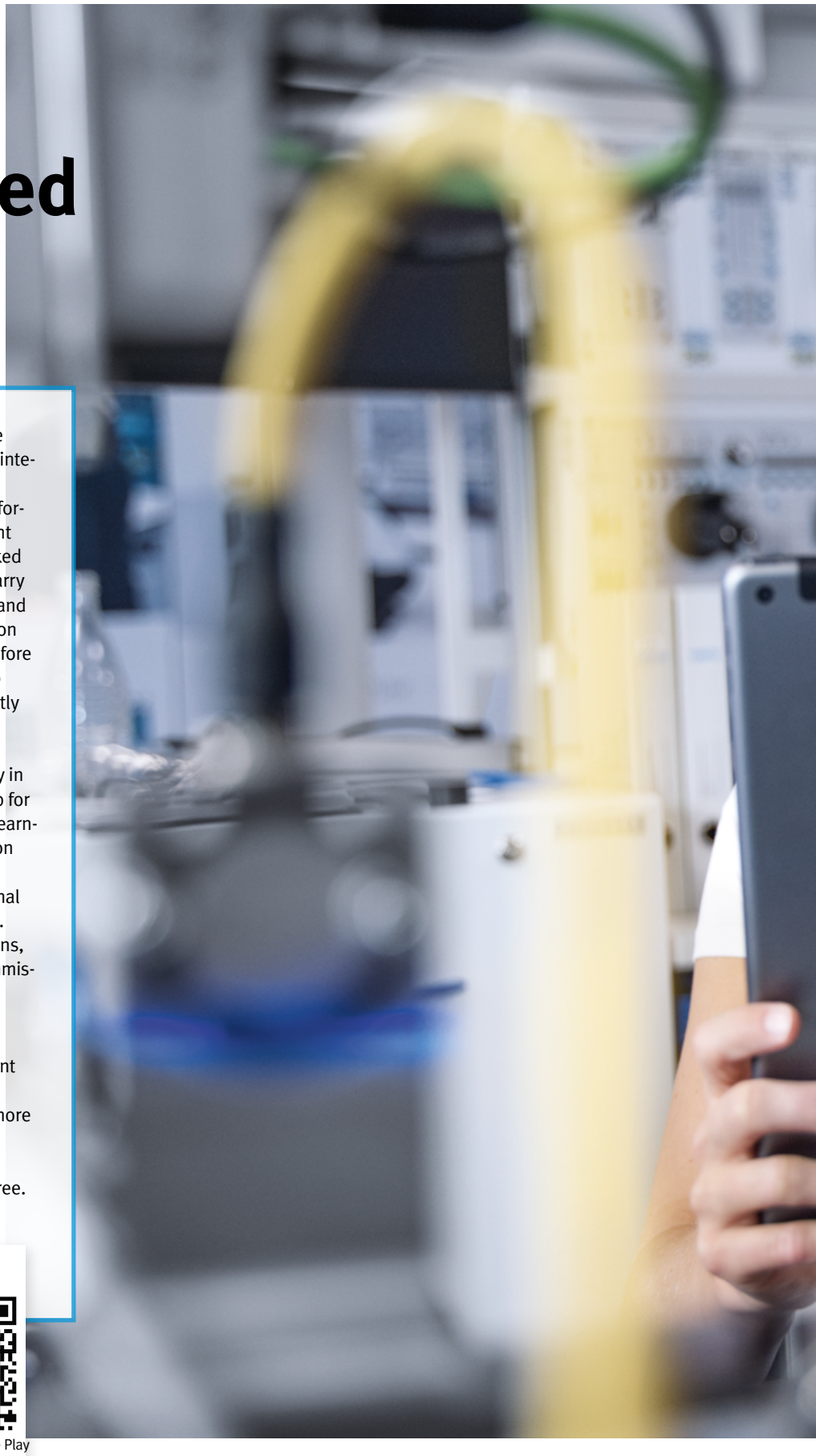
Scan me




InfoPortal
Lernsysteme
Apps
Hilfe
Welches Lernsystem setzen Sie ein?
FESTO
CT 4.0
Compact Trainer 4.0
Factory / Lab
Courseware
Support
Industrie 4.0 von Anfang an
Das Cyber-Physical Lab ist das professionelle und kompakte Industrie 4.0-Lernsystem von Festo Didactic. Es enthält die relevanten Technologien und Komponenten, um umfassende Industrie 4.0-Kenntnisse zu vermitteln.
Der modulare und flexible Aufbau ermöglicht die Arbeit in verschiedenen Lernszenarien: vom einzelnen Palettentransfersystem mit integrierter Steuerung bis hin zur vernetzten Produktionsanlage mit Cloud-Diensten.
Überblick
Lernsystem
Lerninhalte
FAQ
Tutorials
10 of 19
MES4
admin
sign in

Multimedia
Learning Concept

Augmented Reality



Augmented reality digitally expands the perception of reality. Used sensibly, maintenance staff, technicians or planners in industry can receive exactly the right information or interaction options at the right time, and in the right place, via networked mobile devices. This enables them to carry out their work more quickly, efficiently and safely than with conventional information sources or operating options. It is therefore best for future production specialists to learn how to use this technology correctly during their training.

At Festo Didactic, we use AR technology in an educational context. Our free AR app for iOS and Android digitally enriches our learning factories with content and interaction options. By scanning AR markers or QR codes on our learning systems, additional content can be precisely superimposed. Technical data sheets, videos, animations, live data, the control connection or commissioning steps are stored in a structured manner in the InfoPortal and can be accessed easily via the QR codes. Augmented reality supports independent learning and thus not only ensures a smoother teaching process but also a more efficient learning process.

Get the AR App – Download it now for free.

Scan me

App Store

Scan me

Google Play


MPS® Station Vertellen / Band
AR

Learning Factories
Practical Learning on Industry-Related Factory Models

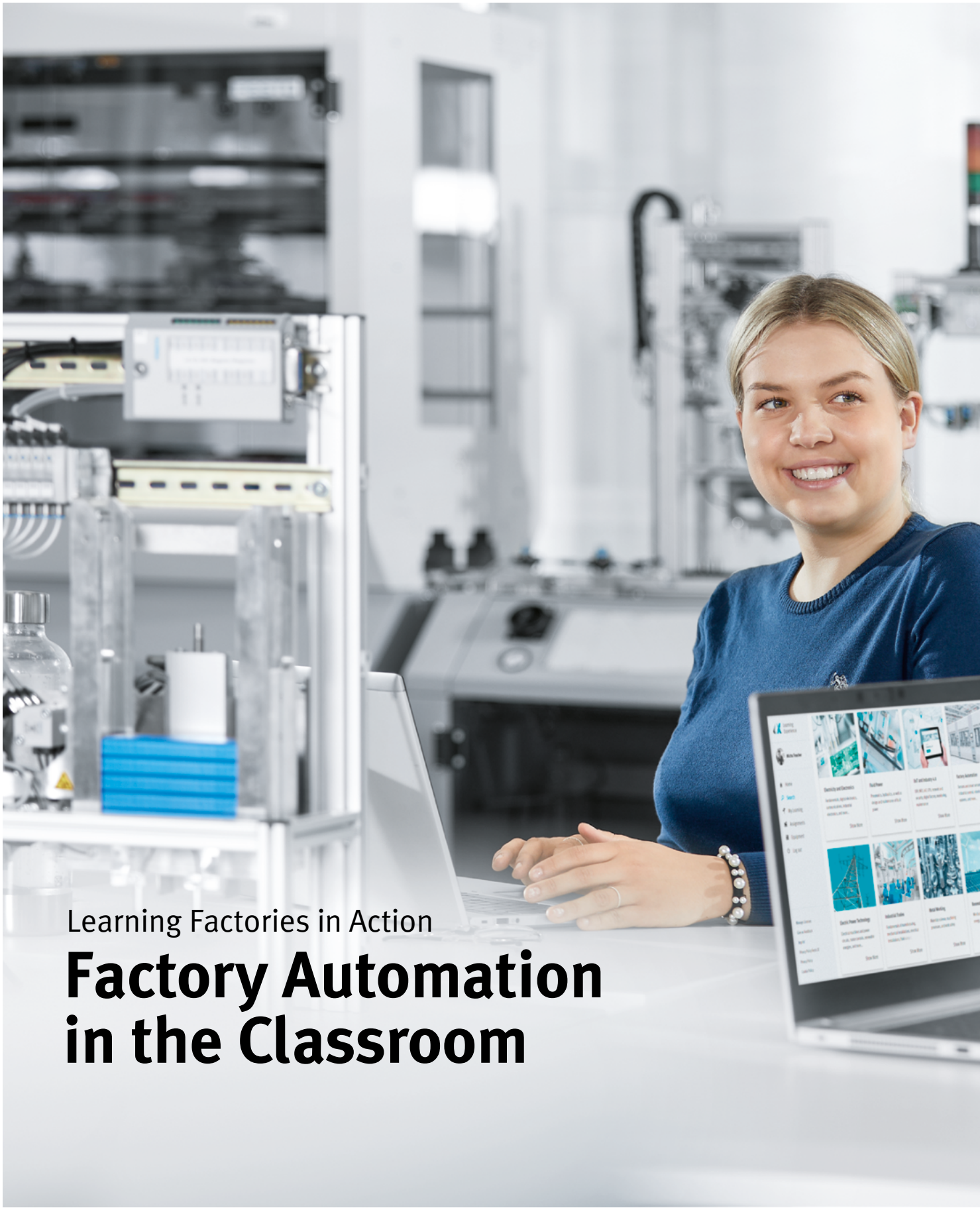
”

As the British philosopher Herbert Spencer said, the real goal of learning is not knowledge but action competence. That’s exactly what we achieve with our learning factories.

“

Alexander Abdo
Product Manager for MPS from 2016 to 2025

05



Learning Factories in Action

Factory Automation in the Classroom



Industrial processes must follow a strict schedule for maximum cost efficiency and productivity. In today's industrial workplaces, there is less room for mistakes. Away from live production facilities, learning factories provide learners with the opportunity to learn about and to deal with the challenges in the field of factory automation in a protected and intuitive environment. In this way, they can acquire precisely the competencies they will need in the future workplace.

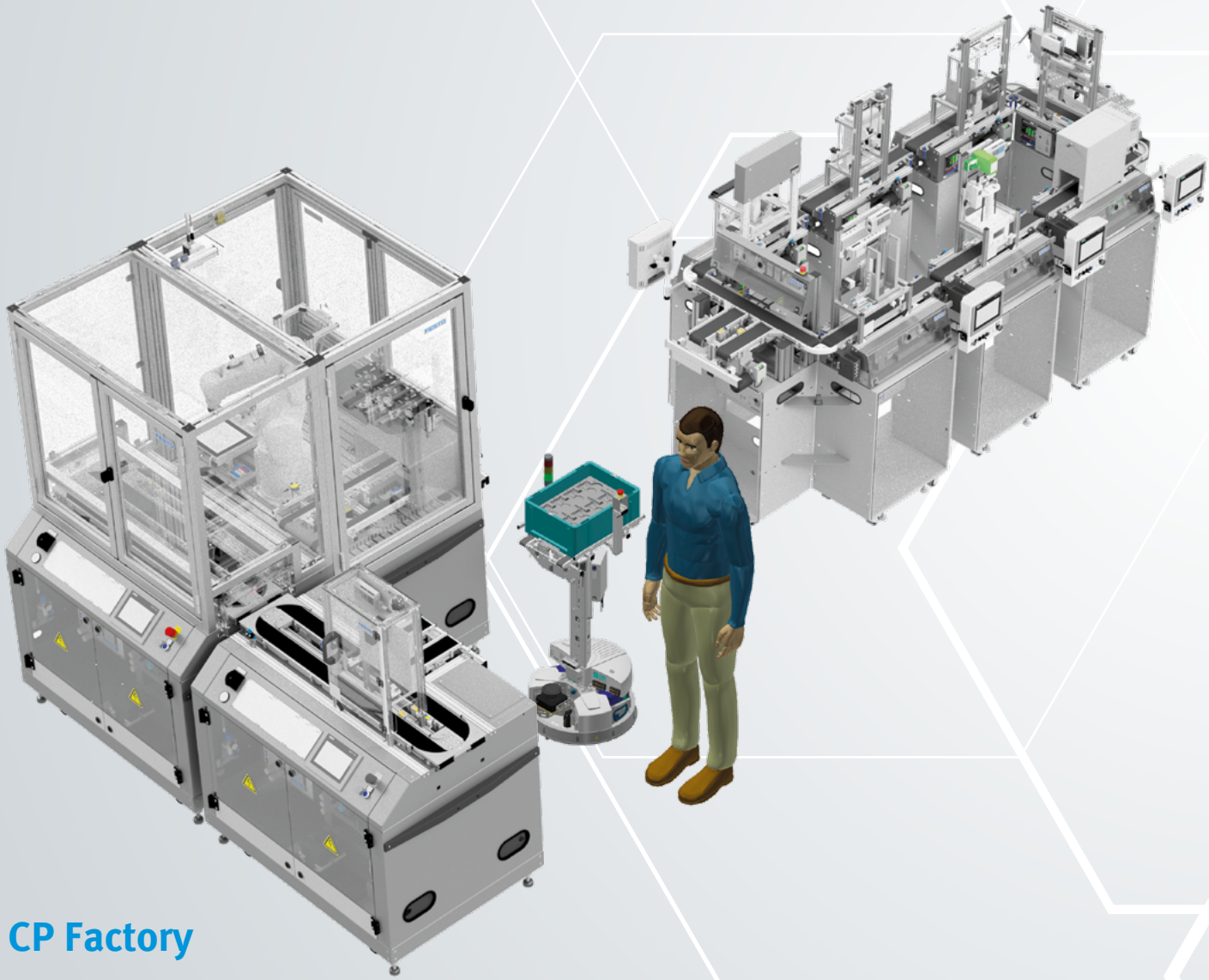
Depending on the industry, the desired learning content, and financial possibilities, we offer various customizable learning factories to teach important topics in Industry 4.0 and factory automation in a practical way.

The Right Solution for Every Requirement

Industry 4.0 Learning Factory Portfolio

CP Lab

Festo CP Lab learning systems are used for Industry 4.0 competitions at WorldSkills and SkillsUSA.



CP Factory

Our universal cyber-physical learning and research platform for Industry 4.0 models the technologies of networked production and provides a smart factory construction kit for teaching and research.

Learning factories pallet circulation

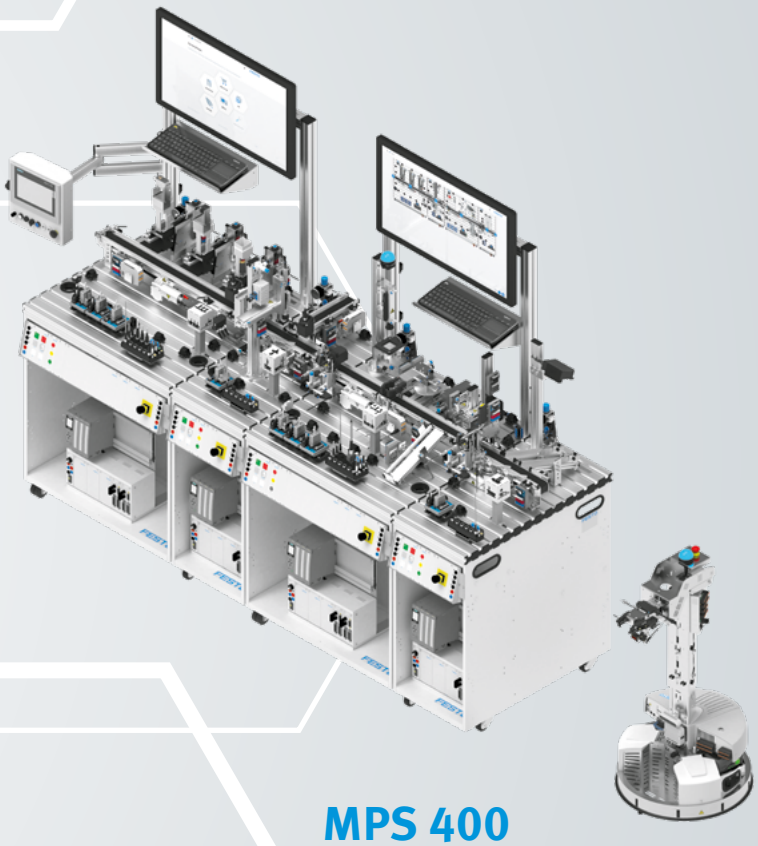
Comprehensive I4.0 learning factories – CP Systems
Our cyber-physical learning factories are the right choice for those with the highest demands for industry proximity, seamless extensibility and customization in education, research and training. They are based on a pallet transfer system and enable closed-loop layouts. CP systems support the teaching of in-depth I4.0 knowledge of fully automated digital production facilities with robotics and flexible manufacturing concepts for highly individualized products – from the simplified lab version (CP Lab) to the authentic factory model (CP Factory).

Learn more in the product section on
→ **Page 4**

Learning factories single workpiece flow

Compact I4.0 all-round learning factories – MPS 400
The MPS 400 all-round learning factories are the right choice for those who want access to a lot of learning content in one workstation MPS 400 covers not only a wide range of state-of-the-art Industry 4.0 content, but also the fundamentals of mechanics, mechatronics, and automation. Learning factories for different occupational and training profiles can be assembled from modular system modules.

Learn more in the product section on
→ **Page 26**



MPS 400

Festo MPS learning factories are used as part of the Siemens Mechatronic Systems Certification Program (SMSCP), a comprehensive industry certification program from Siemens. The MPS series is also the preferred training equipment for the world championship of trades, WorldSkills, in mechatronics.

worldskills

Preconfigured or Special Solution

We Have the Learning Factory that Suits You





Whatever requirements you have for a learning factory, we will find the right solution for you.

As a globally networked education partner with industrial DNA, we have developed a wide range of preconfigured learning factories for a wide variety of needs based on our many years of experience in factory automation training.

These predefined systems are didactically polished to deliver consistent, meaningful workflows with a coordinated thematic focus and matching learning materials. Short delivery times and cost-efficient implementation make these systems the first choice for most of our customers worldwide.

Find our custom solution options in the learning factory kit section in the product area starting on

→ **Page 4**

Through individual configuration options, we not only meet specific customer requirements, but we also address the needs of geographically surrounding industry segments. In this way, learning content can be optimally tailored to the competency requirements of the local working environment.

In addition, customized solutions offer the opportunity to address special requirements and scientific issues, especially in the university research environment. Our learning factories serve as realistic test beds for top-level research and teaching worldwide.

Find our custom solution options in the learning factory kit section in the product area starting on

→ **Page 44**

Digital Learning Factory
Fit for the Smart Factory

”

The most relevant innovations in the smart factory environment arise in the software area. We pay particular attention to making these topics visible and thus understandable.

“

Dr. Stefan Kapp
Product Manager for Factory Automation Software

06

FactoryViews

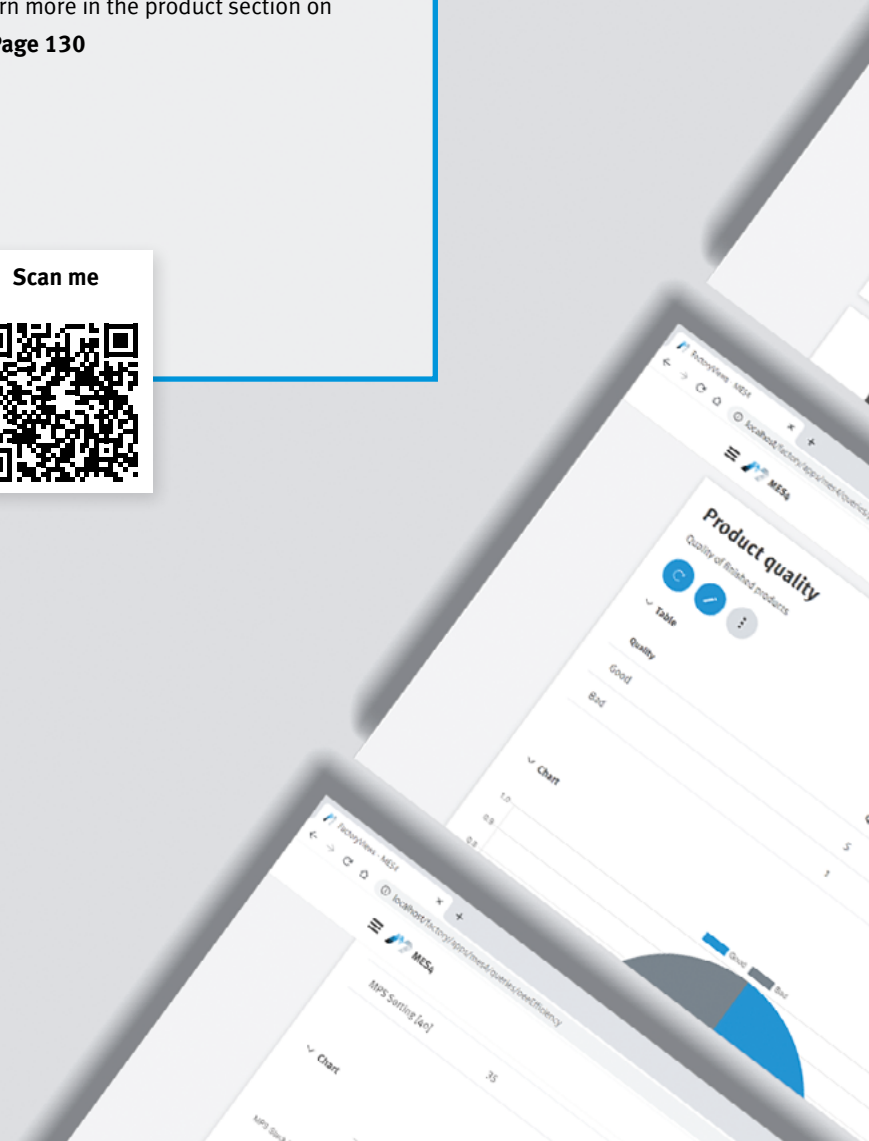
The Software Ecosystem of the Learning Factory

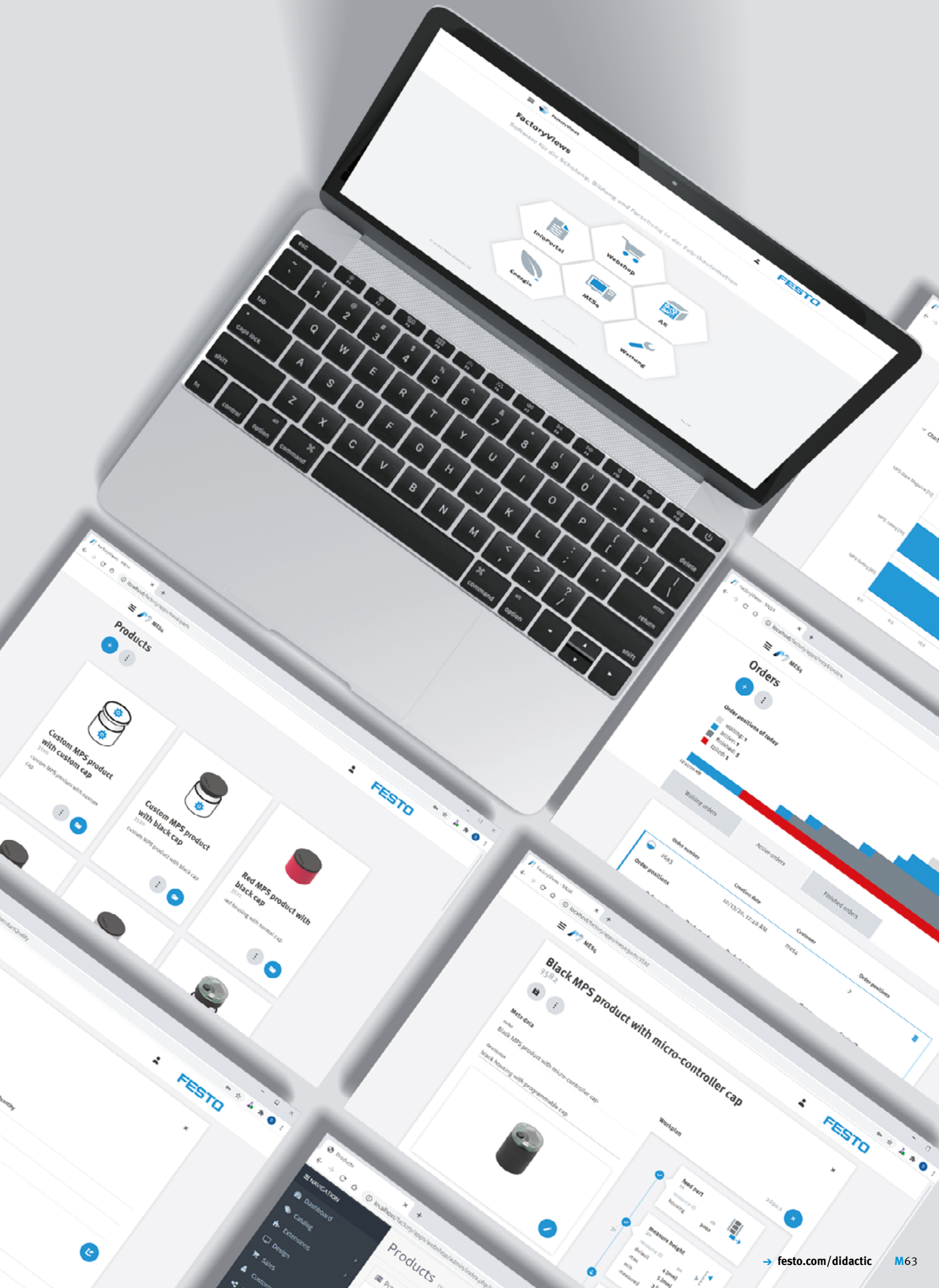
The biggest developments in factory automation are happening in the invisible – the software area. Products are ordered online via web stores to which ERP systems are linked. Manufacturing Execution Systems (MES) then control production in real time and thus assume a central software function in manufacturing. Software for smart maintenance and energy management transfers live data to dashboards to further optimize production and maintenance processes.

The maintenance of the entire supply chain can only be ensured through the coordinated application of special software tools. Today's and tomorrow's specialists will learn the essential skills for this with the help of our didactically prepared software solutions. The user-friendly access point for this is FactoryViews – our new software portal, through which learners, researchers and teachers can centrally access all software modules for our learning and research factories in factory automation.

Learn more in the product section on
→ **Page 130**

Scan me




FactoryViews
Products
Orders
Black MPS product with micro-controller cap
FESTO

Digital Learning Factory Models

Digital Twin and Factory Simulation



Simulations enable learners, students and researchers to analyze scenarios that would be difficult or costly to implement in practice. Simulations, such as virtual commissioning with the digital twin of a plant, not only save time but also money. In addition to the classic simulation on a PC or laptop, learning solutions with virtual reality allow for new perspectives in the learning and working world. The real and virtual worlds complement each other by enriching the learning environment with computer-based information. A new dimension of learning is created.

In the realistic environment of our learning factories, and their digital mapping in the corresponding simulation software, both perspectives – real and digital – can be combined. One of the reasons why this works particularly well is that we use the same MES system for both our factory simulation and our learning systems. This mix of real and digital elements is crucial for effective learning processes.

Learn more in the product section on

→ **Page 124**



Learning Spaces
Innovative Learning Environments for Modern Teaching

”

Our goal is to promote individual learning success. Setting up a classic learning space in a completely modular and flexible way is the essential basis for this.

“

Alexander Bickel
Head of Sales DACH

07



Learning Space Design

The Environment Makes the Difference



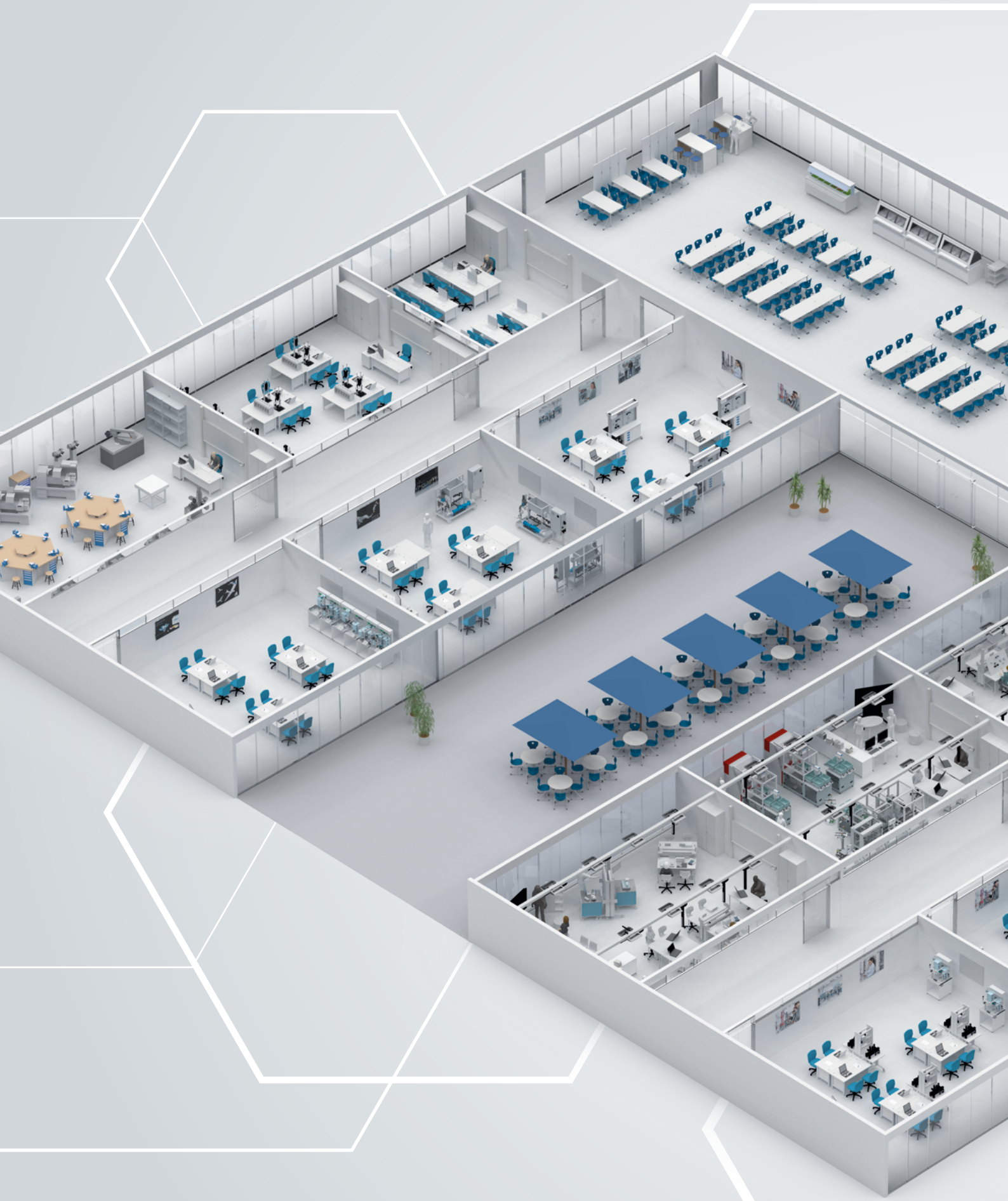
The learning space as a third educator

A number of research projects by renowned institutions demonstrate a decisive influence of the learning environment on learning behavior. Thus, the design of the learning space has an effect on various factors, such as the creativity, productivity and thinking ability of the learners.

We have made it our mission to maximize the potential of innovative learning spaces to promote the highest levels of learning outcomes.

We invite you to join us in designing thoughtful learning spaces. View sample rooms with ready-to-use workplace systems.

Scan me



Customized Solutions

Design of Laboratories and Workshops



Our long-standing history of leadership and expertise in industry allows us to define your qualification needs precisely.

For an optimal market orientation, we support you in the far-sighted middle and long-term orientation. With the help of the 2D space concept and 3D planning, your laboratory design becomes realistic and convincing.

We are highly experienced automation specialists in all industries who excel at the didactic knowledge transfer of technologies. Equipped with the most modern learning systems, we cover the full spectrum of necessary laboratories for almost all technical professional fields, for example:

- CAD/CAM/CNC
- Industry 4.0
- Electrics/electronics/drive technology
- Fluid technology
- Multimedia and simulation
- Metalworking
- Automation technology
- Process automation
- Welding technology

Scan me

Services
We are Here for You

”

We invest in the professional development of our team members to ensure they can deliver an optimal and valuable experience to all our customers.

“

Markus Bellenberg
Head of Global Technical Customer Service



Seminars

New Competencies for Education and Industry



For industry professionals, having access to the latest modern technologies and machines can be critical for success.

However, investing in technologies and machines alone is not enough. Companies need highly skilled, reliable workers in order to thrive. This requires an adaptability of employees in a world that's experiencing an unprecedented way of working.

This global trend toward continuous change and lifelong learning affects everyone: emerging economies on their way to industrialization as well as already highly industrialized countries – all due to the rapid introduction of new technologies that have emerged from Industry 4.0 innovation.

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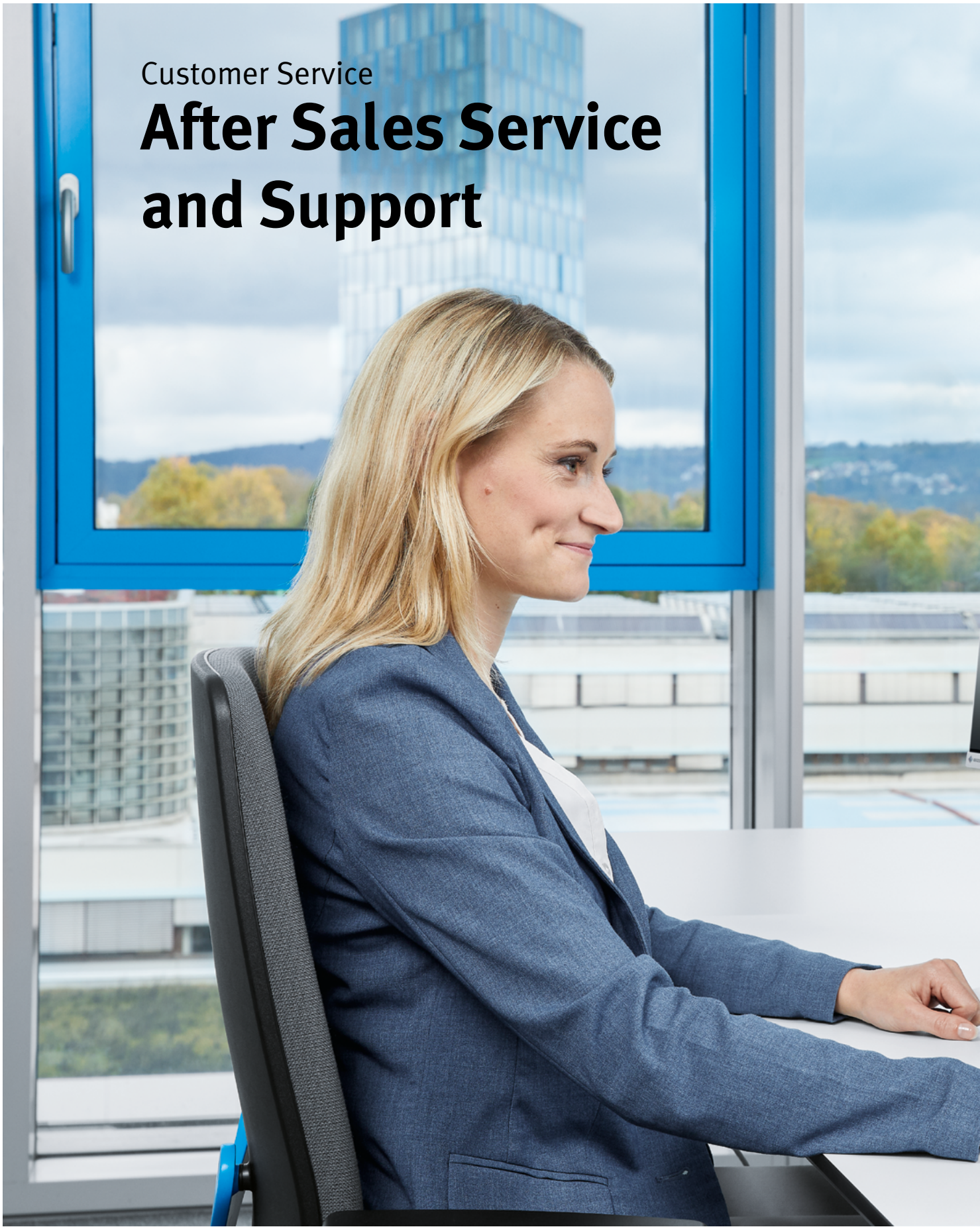


Customer Service

After Sales Service and Support



Worldwide support

We see our customers as long-term partners, which is why we continue to provide you with unrestricted support after delivery.

Our service portal is available at any time for technical and non-technical topics, as well as for software-related questions. Our employees from sales, product management or development can answer individual email inquiries quickly and competently in your local language. Our ticket system guarantees maximum transparency of the processes.

Remote access to your computer is another effective and cost-efficient way to support you. At their premises, our on-site service can take care of commissioning, technical instruction and repairs, if needed.

Ready for Industry Expertise
Employability Through Certifications

”

Our mission is to optimally empower skilled workers for their jobs in Industry 4.0. Qualification according to industry standards is an important milestone in achieving this goal.

“

09

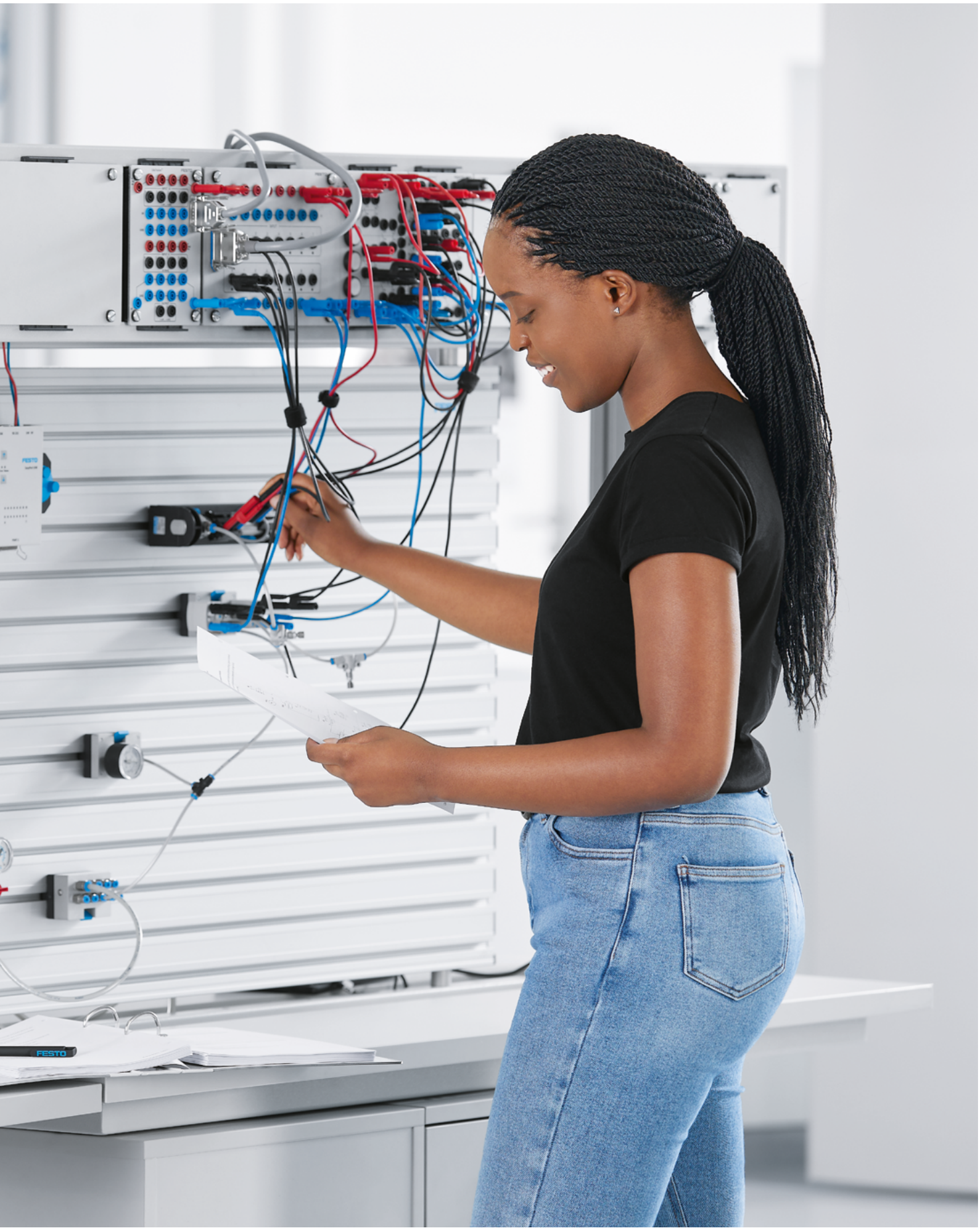
Michael Linn
Skills Competition Manager Mechatronics

FACT – Festo Authorized and Certified Training

Certification to the Highest Standards

Festo Authorized and Certified Training (FACT) is a seal of quality that we award to selected customers for the high quality of their training labs and instructors. We conduct regular audits to verify compliance with our high standards in terms of learning equipment, didactic methods, and technical equipment. We not only support our customers in equipping first-class learning labs but also offer on-site teachers and trainers compact training as standard, so that they can familiarize themselves with the new technology and use it properly. In doing so, we focus not only on the transfer of technical expertise but also on pedagogical recommendations.

Whether they are public training providers for trainees or private training providers for industrial companies, together, all FACT centers are characterized by practice-oriented knowledge transfer with state-of-the-art equipment for maximum learning success.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SMSCP – Siemens Mechatronic Systems Certification Program

Hand-in-Hand with Partners from Industry





The growing need for highly qualified employees with an in-depth understanding of integrated mechatronic systems was the catalyst for the development of the Siemens Mechatronic Systems Certification Program (SMSCP). By incorporating international standards, SMSCP is recognized throughout the industry and offers exam-based certifications at three different levels. As part of the "systems approach", participants learn about the complexity of mechatronic systems in a holistic way. This enables them to easily transfer their knowledge to other systems, making them flexible and independent employees. The comprehensive industry certification program launched by Siemens is based on Festo's MPS 400 learning system series to facilitate knowledge transfer through practical relevance and make complex topics easier to understand.

Learn more in the product section on
→ **Page 35**

Scan me

Solution Partner

Automation Drives

SIEMENS

NC3 – National Coalition of Certification Centers

Strong Partnerships Between Education and Industry



The NC3 National Coalition of Certification Centers implements sought after, transferable and industry-recognized certifications based on qualification standards. Its train-the-trainer program helps empower instructors from partner schools to teach courses independently at their school and ensure a consistent level of qualification. As an industry partner of NC3, we have developed the FI4.0CP – the Festo Industry 4.0 Certification Program – a plan that was developed by industry experts and educators. With it, we ensure that learners have a wide range of skills upon graduation – including soft skills such as effective communication, people management and critical thinking, in addition to technological competencies. In the process, certification takes place at three levels of complexity: Fundamentals, Mechatronics, and Industry 4.0.

Scan me


HOHENLOHER
FESTO

NIMS – National Institute for Metalworking Skills

Common Standards to Close the Skills Gap



Our mission is to optimally qualify skilled workers of tomorrow for jobs in Industry 4.0. We share this goal with the National Institute for Metalworking Skills (NIMS), a highly respected national organization in the U.S. that develops competency-based skill standards, credentials and training frameworks to better align the skills of the modern manufacturing workforce with industry needs. These standards are used by industry for recruitment and promotion, and by training and educational institutions as performance measures.

Close collaboration with NIMS has enabled us not only to develop new qualification standards for digitalized production and IIoT technologies but also to set up a corresponding training and certification program. Our Industry 4.0 learning factories, courseware and eLearning offerings are part of this.



Aligned to NIMS® Standards

Professional Competitions
We Make Winners

> Skills competitions spark passion for technical jobs while celebrating the innovation and talent needed to shape our future.

Elfi Klumpp
Head of Partnership Development Global Education





WorldSkills International

30 years of Partnership – WorldSkills and Festo

Promote talents
Young talents who participate in the WorldSkills vocational competitions are already winners. That's because the first milestone on the way to becoming the world's best skilled worker is a national competition in their own country. Proud winners then compete at regional competitions, e.g. EuroSkills, AfricaSkills or AsianSkills, or the WorldSkills World Championships.

Festo was the first Global Industry Partner (GIP) of WorldSkills in 1991. Global Industry Partners play a key role in collaboration between industry, education, government and policy makers. Their common goal is to improve education and recognition of skilled professionals around the world.

This is where Festo Didactic provides cutting-edge industry-focused learning and training solutions for WorldSkills competitions. Together with WorldSkills, we are contributing to nextgen education and innovation in vocational fields.

Find our official competition equipment for Industriy 4.0 and mechatronics in the product section starting on
➔ Page 14 and 76

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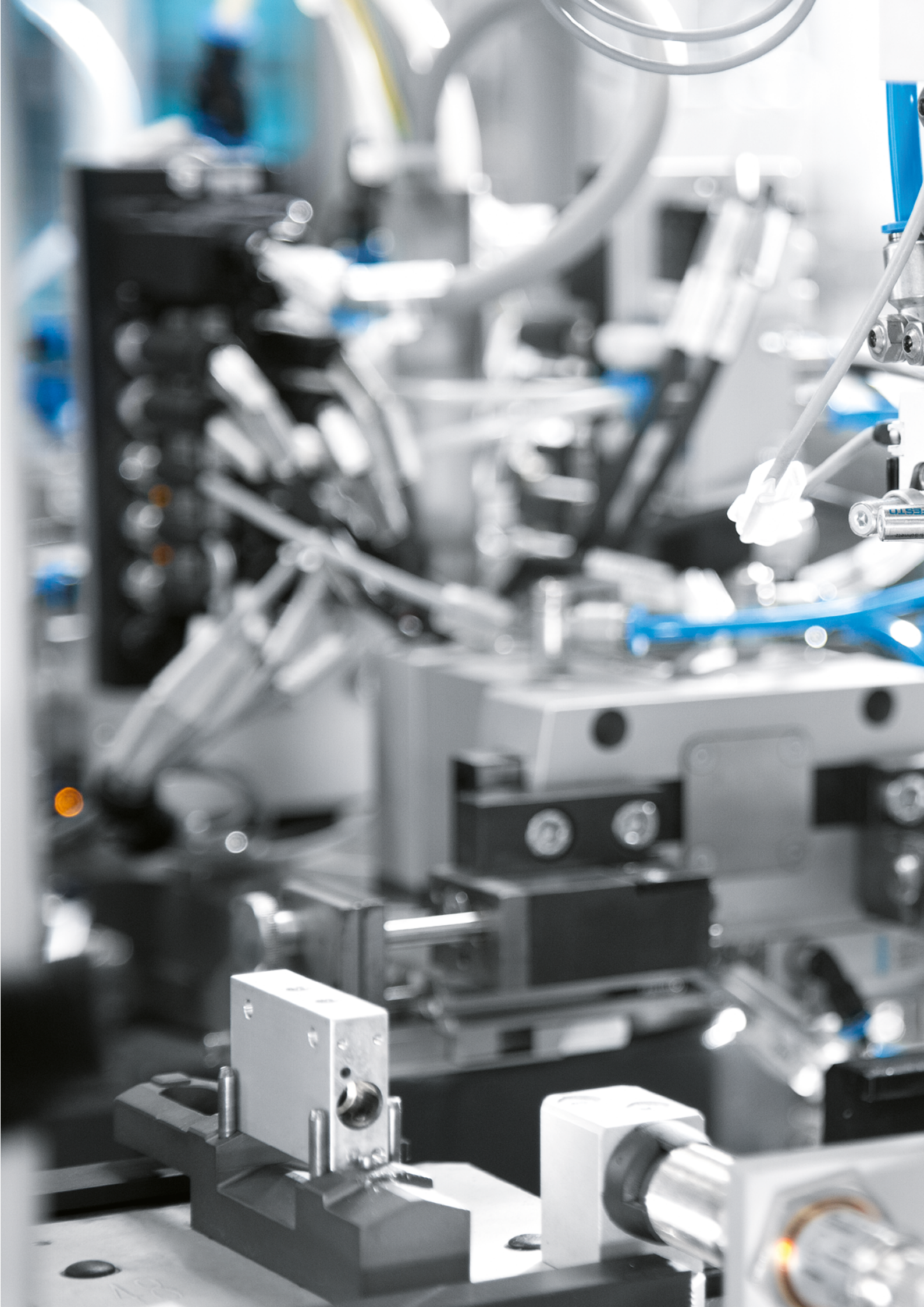
YATO
BERNSTEIN

Products



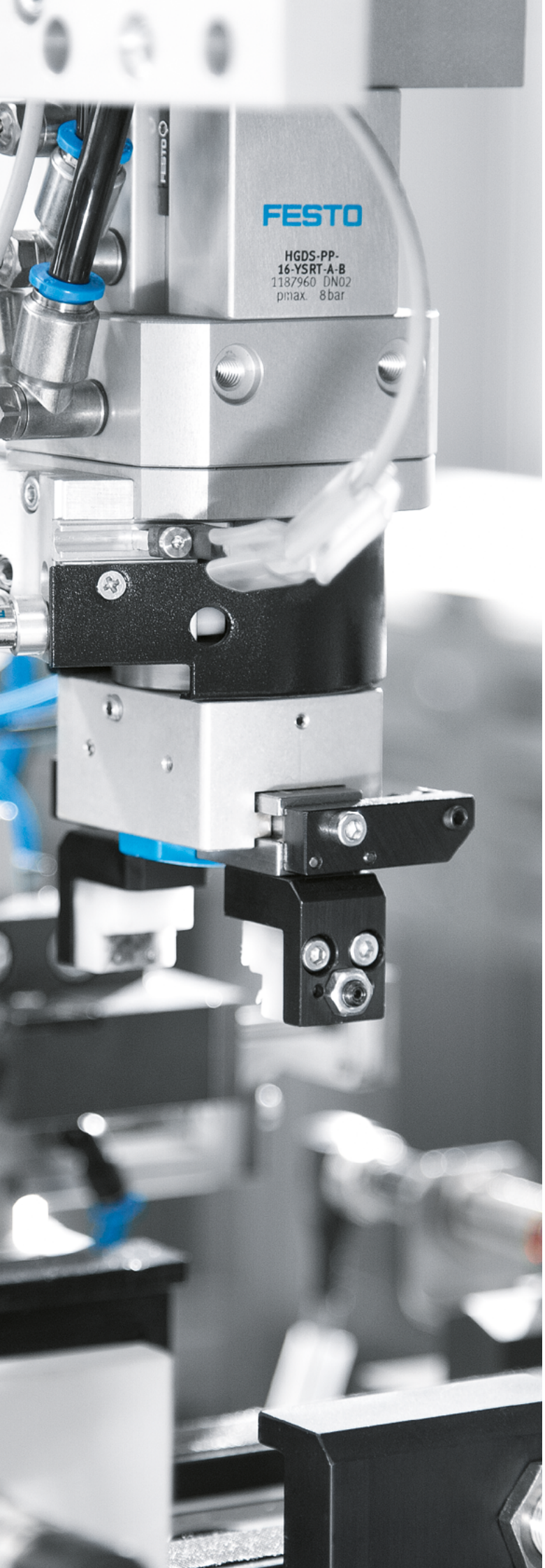


Table of contents
Products

Learning factories
Learning factories pallet circulation, CP Systems 4
Learning factories single workpiece flow, MPS 26

Learning factory kit
Learning factory kit pallet circulation, CP Systems 44
Learning factory kit single workpiece flow, MPS 60

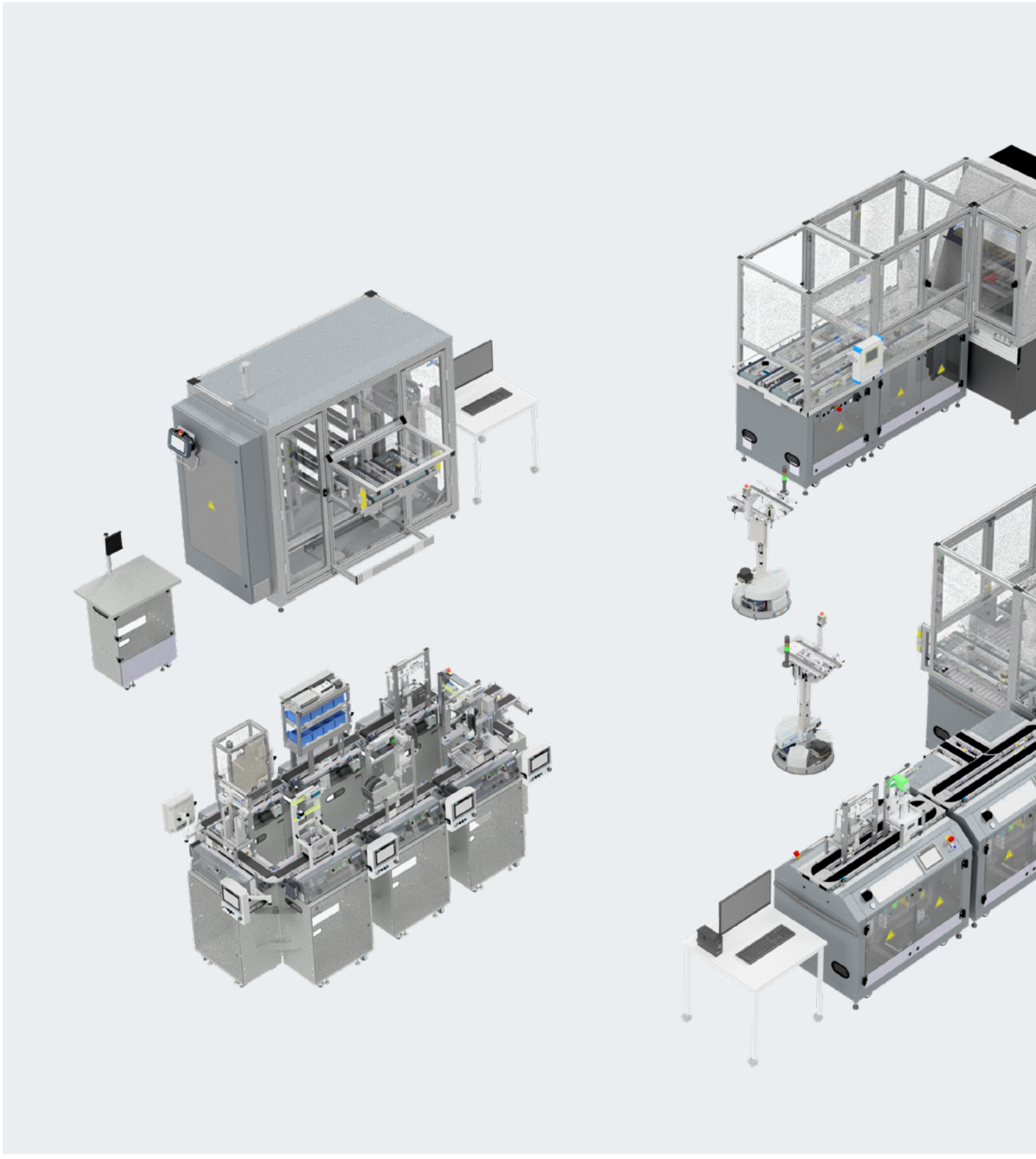
Focus and trend topics I4.0 116
The digital factory 120
Network and IT security 134
Artificial intelligence in application 136
Energy management 140
Industrial robotics 142
Mobile robotics 152

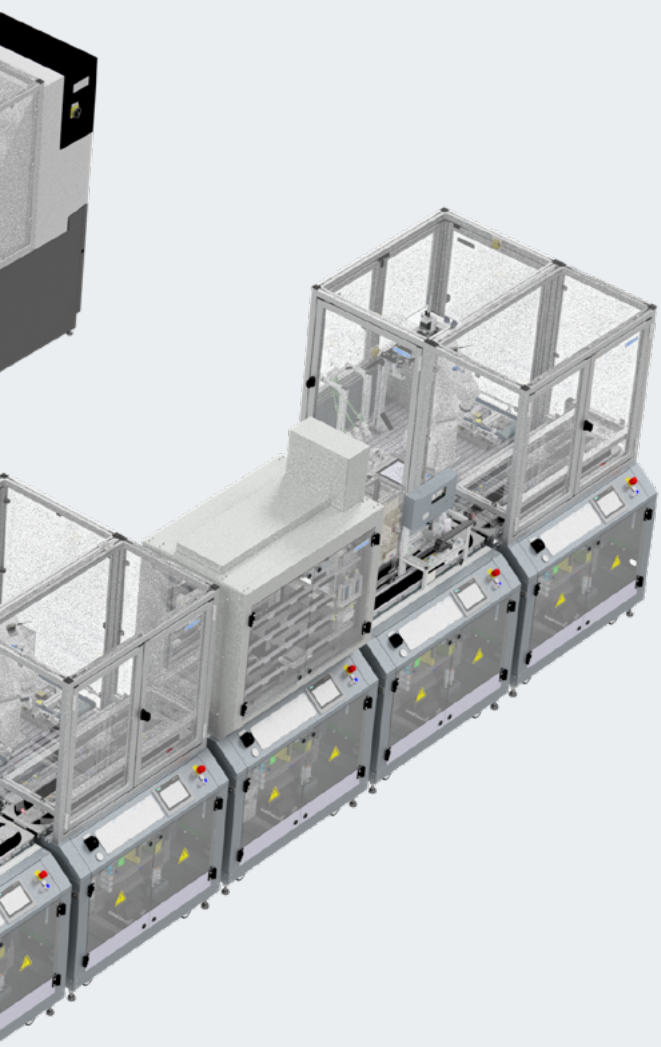
Industrial control technology 160

Fundamentals of factory automation 200

Digital learning and learning materials 254

Learning Factories





Learning Factories – Pallet Circulation
CP Factory 4
Sample Configurations Pallet Circulation 7
CP Lab 14
CP Lab 400 16

Learning Factories – Single Workpiece Flow
MPS 400 26
MPS 400 Accessories 40

CP Factory

Customized Learning Factories
Ideal for Education and Training, Teaching, and Research



Training area: Assembly line
Batch sizes of 1 and the assembly of product variants place demanding requirements on production in line with Industry 4.0. To meet these requirements, the CP Factory offers:
– Modularity
– Mobility
– Short setup times
– RFID technology
– Plug & produce
– Standard interfaces
– Service-oriented program architecture

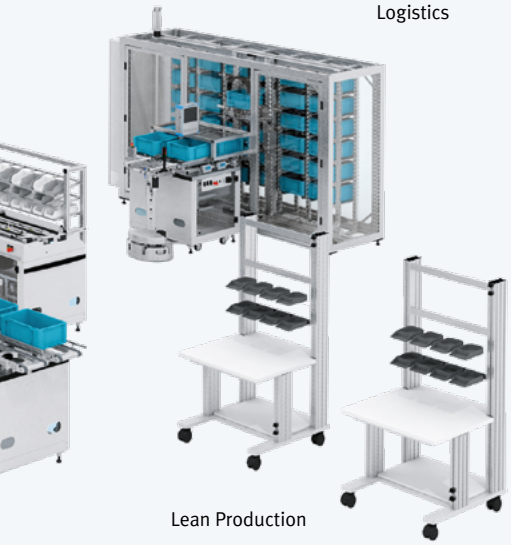
Training area: Production
CNC machines and flexible manufacturing systems play a major part in the creation of customized products down to batch size 1.

The CP Factory integrates CNC technologies for use in industrial training projects and scenarios. It therefore adds:
– Robot integration
– CAD/CAM products
– Simulation

Training area: Quality assurance
From a caliper gage to a fully-automatic 3D measuring machine – all standard measuring devices can be integrated into the CP Factory as a quality laboratory. The SPC module in the MES4 is used both to enter setpoints and carry out evaluations.

Training area: ERP/MES
In a modern factory, intelligent machines and workpieces communicate with each other and with the IT systems ERP (enterprise resource planning) and MES (manufacturing execution system) both inside and outside the factory, up to cloud level.

MES4 is Festo's MES for a smart factory, based on an Access database. For SAP users, the learning factory can be custom-connected to SAP ME. We can produce further MES and ERP links on request.



CP Factory – The universal Industry 4.0 learning factory
CP Factory reflects the new developments in networked production for Industry 4.0 and offers a modular smart factory system for teaching and research purposes. The learning system includes not only the assembly line, but also different areas of production, such as lean production, logistics and quality assurance.



A modular system par excellence!
Our decades of experience in the construction of modular learning systems are reflected in many of the details of a CP Factory. All stations and application modules are equipped with the very latest industrial technology. The concept and equipment demonstrate our innovative approach.

Discover our comprehensive training program for the future
→ festo.com/didactic

Training area: Lean production
Industry 4.0 is also gaining ground in the field of lean production. Based on your requirements, we can offer facilities for producing anything from assembly cells to a supermarket with a "milkrun":
– Automated material supply for workstations
– RFID technology
– Avoiding errors through intelligent assembly monitoring
– Link to MES4
– Visualization

Training area: Logistics
An intelligent flow of materials and networked logistics are important drivers for Industry 4.0. The CP Factory offers a versatile training and research platform for several different logistical problems:
– RFID
– MES
– Automatic warehouse
– Production stores and magazines
– Pallet transfer systems
– Autonomous transport robots

Systematic variety
The exceptional flexibility of a CP Factory system is based on the basic design of its cells, which is always identical: dimensions, track rollers, control cabinet, conveyor, control console, system cable.

As a stand-alone or system network
The basic features of the CP Factory determine the appearance of the system:
– Wide transfer belt for pallet transportation
– Application modules above the conveyor
– Variable system layout, providing freedom for designing individual, partner and group workstations

The standardized stations can be positioned differently. A laboratory made up of individual workstations can very quickly be turned into one or more production lines focusing on different areas of automation.

Training content stored in the application module
The core of the learning system is based around flexibly combinable modular stations, which are used to realize different application modules. These determine the training content provided by the stations. Thanks to the use of standard interfaces, application modules can be interchanged in just a few minutes. This allows fast conversion for different training situations and content.

CP Factory

The Concept in Detail





Cells on wheels
All CP Factory cells are equipped with rollers. This enables them to be freely positioned in the laboratory without tools or lifting trucks.

RFID process control
The product takes on process control in the CP Factory. To achieve this, the workpieces and controllers are equipped with RFID technology.

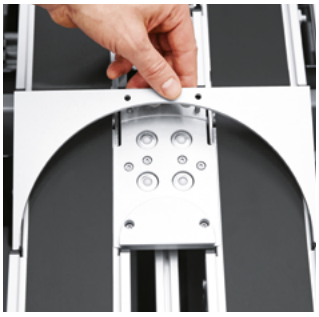


Optimum connections
The cells are supplied by a special system cable. There is no need for rewiring, fitting new tubing or additional installations when changing the layout. This saves valuable training time, and the laboratory remains free of additional supply ducts and trip hazards.



Modular control concept
The controllers in the CP Factory cells have a modular design. All control components are housed in the control cabinet:
- Controllers with PROFINET networking
- PROFIsafe components
- Drive components such as frequency converters, contactor controllers and servo motor controllers

The production line can be operated with or without a master control system.



Patented material flow
The passive workpiece holder routing is a patented development by our engineers. The unique option of using the Transfer Factory cells individually or in a network with no additional work is based on this development:
- Workpiece holders can circulate within a cell.
- Commissioning the subsystems is no problem.
- Subprocesses can be isolated without modifying the software.

Sample Configurations
Individual Solutions



Requirements analysis
Standard solutions might seem like a good value at first glance, but at Festo we focus on the long-term benefit for the customer. For this reason, a qualified requirements analysis is performed before each CP Factory quotation. In this analysis, experienced project advisors discuss the expectations for the new training equipment with the customer and share insights from everyday use in order to avoid poor investments.

Consulting
On the basis of the requirements analysis, the customer receives expert advice about the suitable training equipment. Our primary objective here is to meet the customer's objectives, irrespective of the product range. Because Festo cooperates with a number of renowned partners, we will design the optimal solution for you. Festo is a Siemens Automation solution partner.

Engineering service
The experienced technicians and engineers at Festo Didactic are specialists in planning and equipping learning systems and have at their disposal powerful, state-of-the-art tools. PLC and robot programming systems, simulation systems, EPLAN and CAD programs are efficient tools for translating customer requirements into reality. Festo will help you to implement your ideas – quickly, reliably and cost-effectively.

System integration
Existing system parts can often be integrated as subsystems, provided suitable interfaces are available. This protects earlier investments.

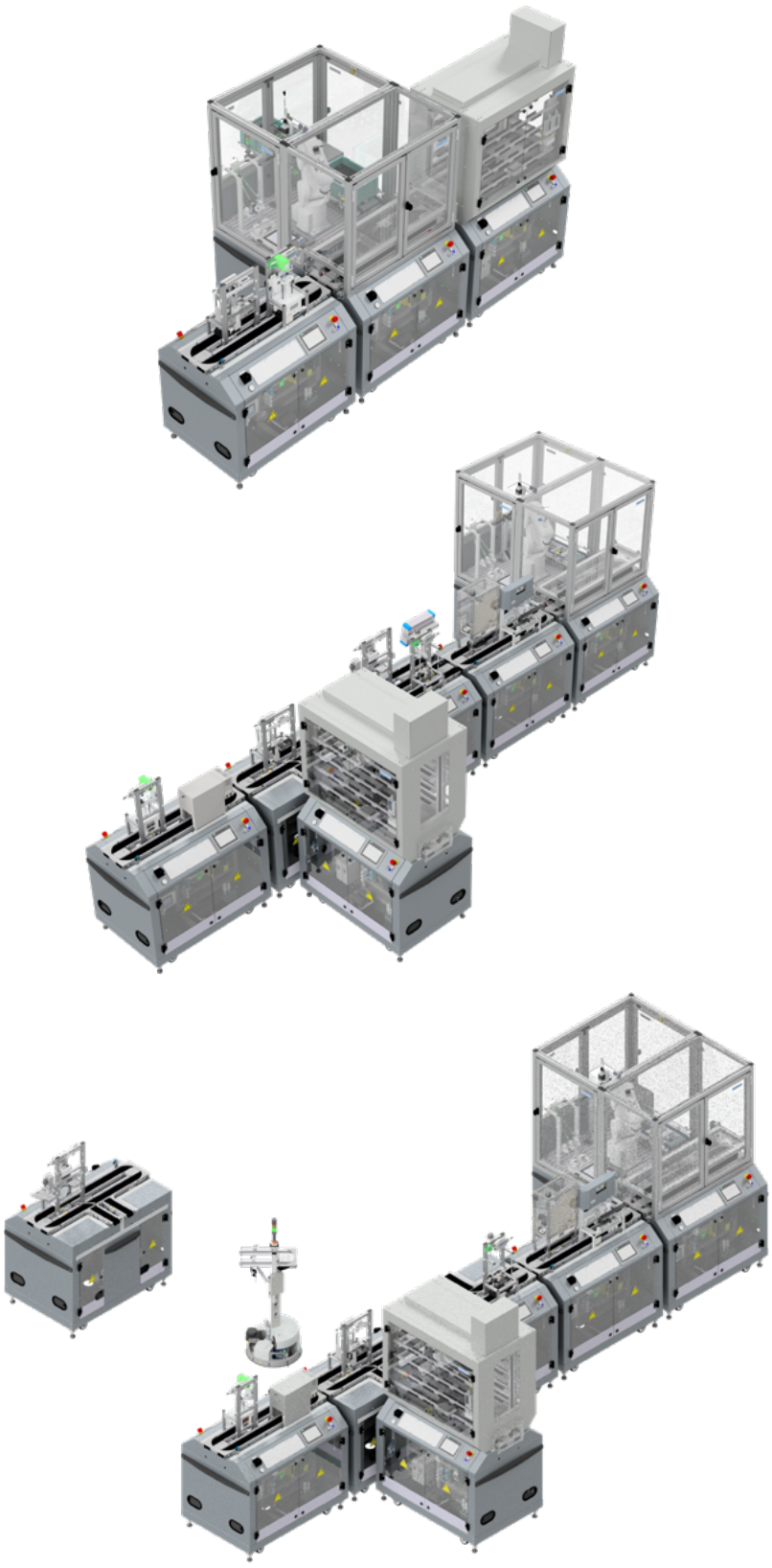
Customized training
You know your strengths – and your weaknesses. Festo gives you the opportunity to define your training profile. The result? A training course tailored to your exact personal requirements!
– Networking
– Robotics
– Cyber-physical systems
– IT systems
– MES production control systems
– Energy efficiency
– Image processing
– PLC programming
– Fieldbus
– RFID technology
– System simulation
– Troubleshooting
– Logistics, etc.

Upgrade
Festo Didactic offers planning reliability and continuity. Systems can be gradually expanded and updated over a number of years. Give us a call – we're happy to assist you with your stage-by-stage project planning.

CP Factory – Industry 4.0 research and learning platform
The learning platform is used worldwide for research and technical training in the areas of production and automation technology as well as for mechatronics.

CP Factory

Recommended Configurations



Variant F1, comprising:
– 1x CP Factory Station Straight
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 1x Magazine application module
– 1x Muscle Press application module
– 1x MES software, including PC
– 1x programming package
– 1x accessory package
Including commissioning and technical instruction on-site.

CP Factory – Variant F1	On request

Variant F3, comprising:
– 2x CP Factory Station Straight
– 1x CP Factory Station Deflector
– 1x CP Factory Station Bypass
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 1x Magazine application module
– 1x measurement application module
– 1x iDrilling application module
– 1x Camera application module
– 1x Muscle Press application module
– 1x Heating tunnel application module
– 1x Output application module
– 1x MES software, including PC
– 1x Smart Maintenance package
– 1x programming package
– 1x accessory package
Including commissioning and technical instruction on-site.

CP Factory – Variant F3	On request

Variant F4, comprising:
– 2x CP Factory Station Straight
– 3x CP Factory Station Deflector
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 1x mobile robot for pallet transport
– 1x Magazine application module
– 1x measurement application module
– 1x iDrilling application module
– 1x Camera application module
– 1x Muscle Press application module
– 1x Heating tunnel application module
– 1x Output application module
– 1x MES software, including PC
– 1x Smart Maintenance package
– 1x Energy Management package
– 1x programming package
– 1x accessory package
Including commissioning and technical instruction on-site.

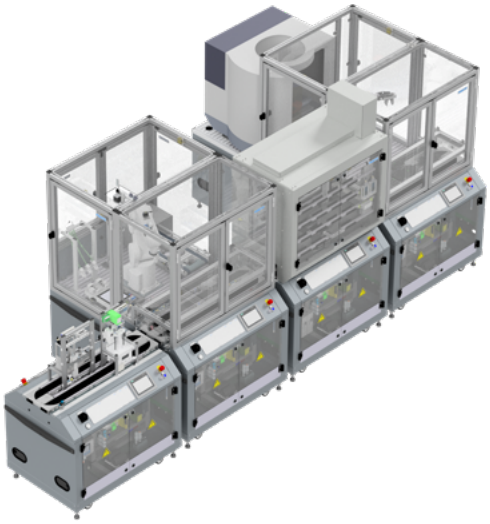
CP Factory – Variant F4	On request

CP Factory
Recommended Configurations

Variant F5, comprising:
– 1x CP Factory Station Straight
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 1x CP factory robot loading station CNC with CNC Mill55
– 1x Magazine application module
– 1x Muscle Press application module
– 1x MES software, including PC
– 1x programming package
– 1x accessory package

Including commissioning and technical instruction on-site.

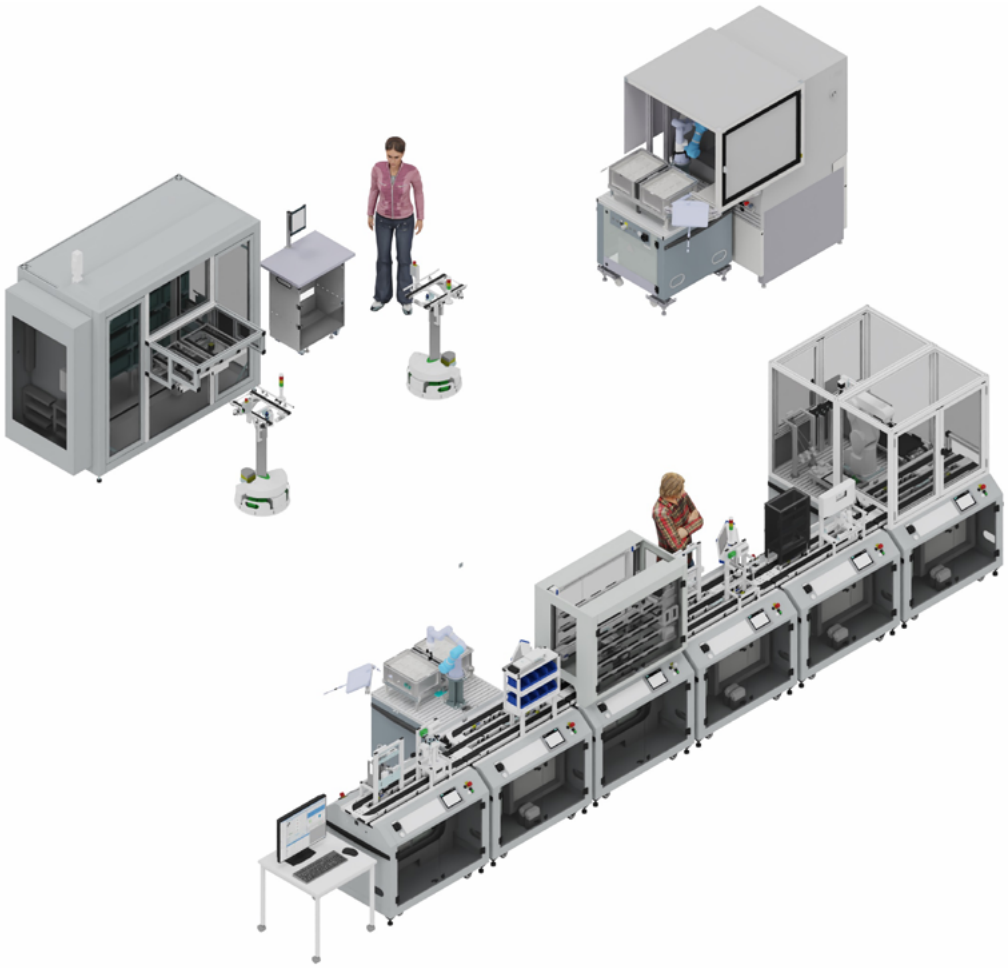
CP Factory – Variant F5	On request



Variant F7, comprising:
– 2x CP Factory Station Straight
– 1x CP Factory Station Bypass
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 2x mobile robot for shipping crate transport
– 1x CP system Automatic Warehouse for shipping crates
– 1x CP system loading shipping crates, unloading with robot
– 1x CP system shipping crate loading station CNC with CNC Mill105
– 1x Magazine application module
– 1x iDrilling application module
– 1x Pick-by-Light application module
– 1x Camera application module
– 1x Muscle Press application module
– 1x Output application module
– 1x MES software, including PC
– 1x Smart Maintenance package
– 1x Energy Management package
– 1x IT security package
– 1x programming package
– 1x accessory package

Including commissioning and technical instruction on-site.

CP Factory – Variant F7	On request



CP Factory
A Reference Project

Advanced I4.0 Training at MSW Mechatronics School Winterthur:
To prepare learners for the demands of mechatronics and Industry 4.0, MSW relies on state-of-the-art training technologies, including an Industry 4.0 learning factory acquired in 2018. Beyond functionality, the breadth of the system was key. In hands-on projects, trainees designed, built, and implemented modules for chocolate handling and packaging. Integrated sensors enable full order traceability–clearly demonstrating the seamless integration of theory and practice.





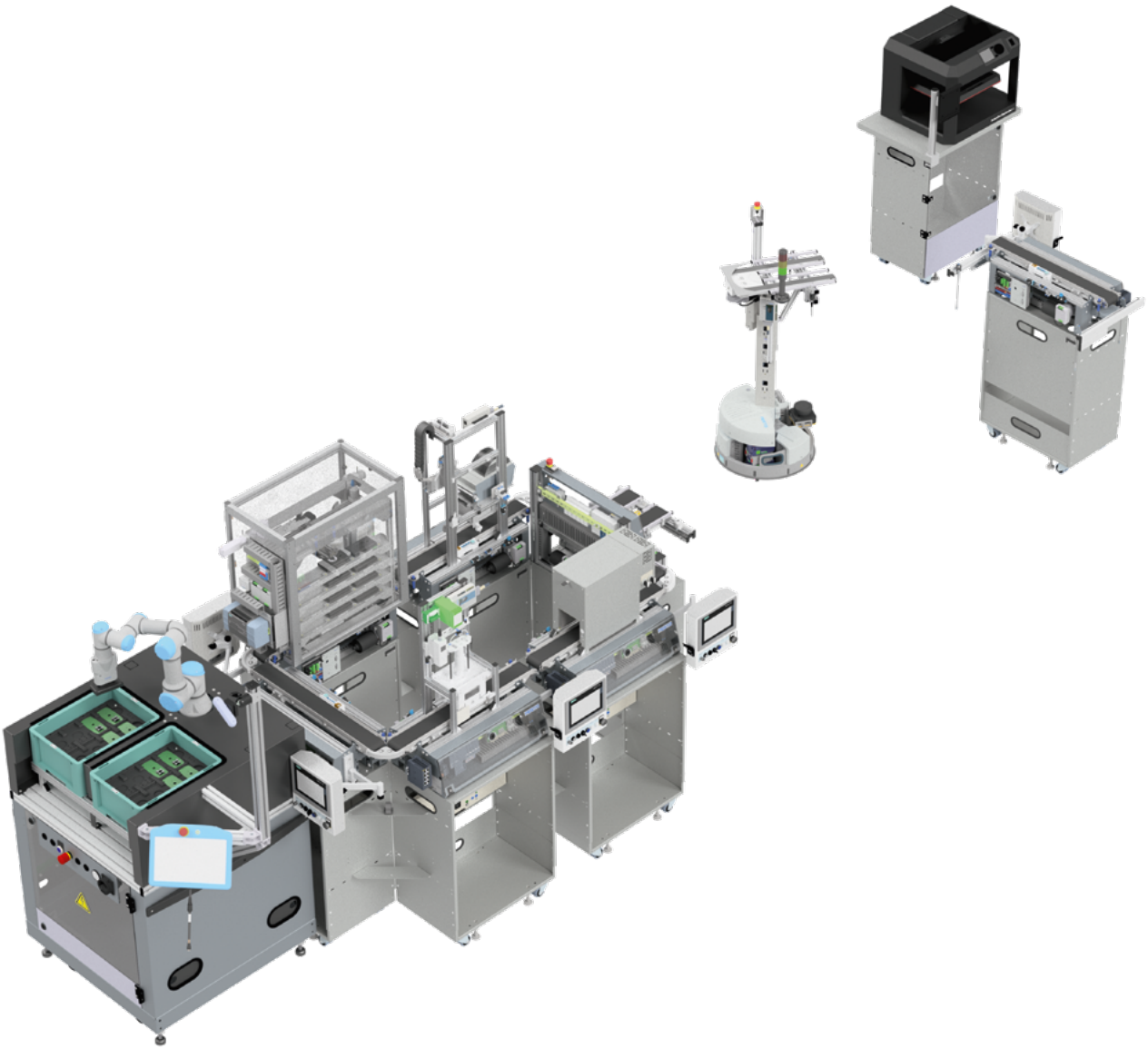




Watch the CP Factory in action at MSW

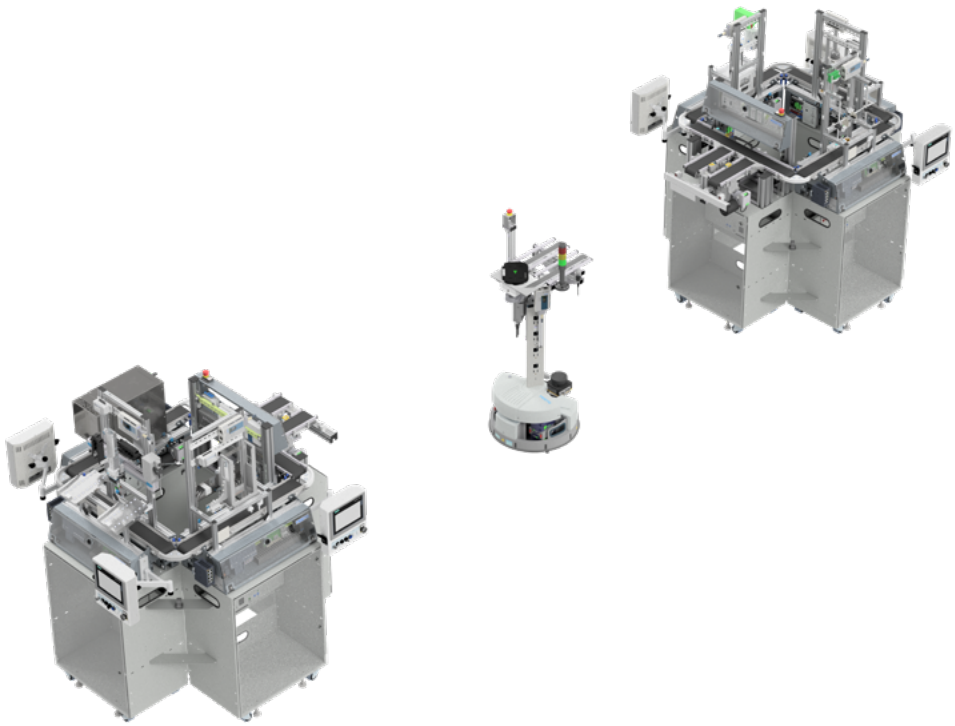
CP Factory and CP Lab

Recommended Configurations



CP Factory and CP Lab

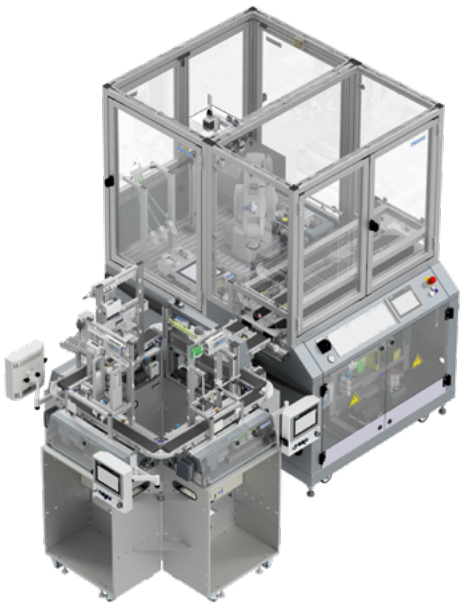
Recommended Configurations



Variant L1, comprising:
– 6x CP Lab basic module
– 4x system trainers with A4 frames
– 2x CP Bridge
– 1x mobile robot for pallet transport
– 2x Magazine application module
– 1x measurement application module
– 1x Muscle Press application module
– 1x Tunnel Furnace application module
– 1x workpiece output application module
– 1x MES software, including PC
– 1x programming package
– 1x accessory package

Including commissioning and technical instruction on-site.

CP Lab – Variant L1	On request



Variant FL1, comprising:
– 3x CP Lab basic module
– 1x CP Lab Deflector
– 1x CP Factory Robot Assembly
– 1x Magazine application module
– 1x measurement application module
– 1x Output application module
– 1x MES software, including PC
– 1x programming package
– 1x accessory package

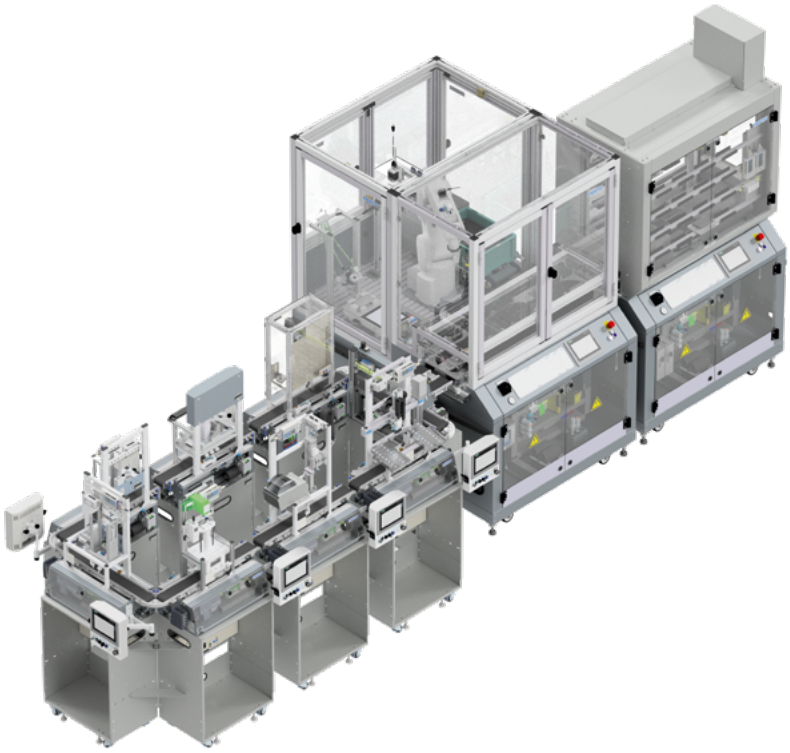
Including commissioning and technical instruction on-site.

CP Factory/Lab – Variant FL1	On request

CP Factory and CP Lab
Recommended Configurations

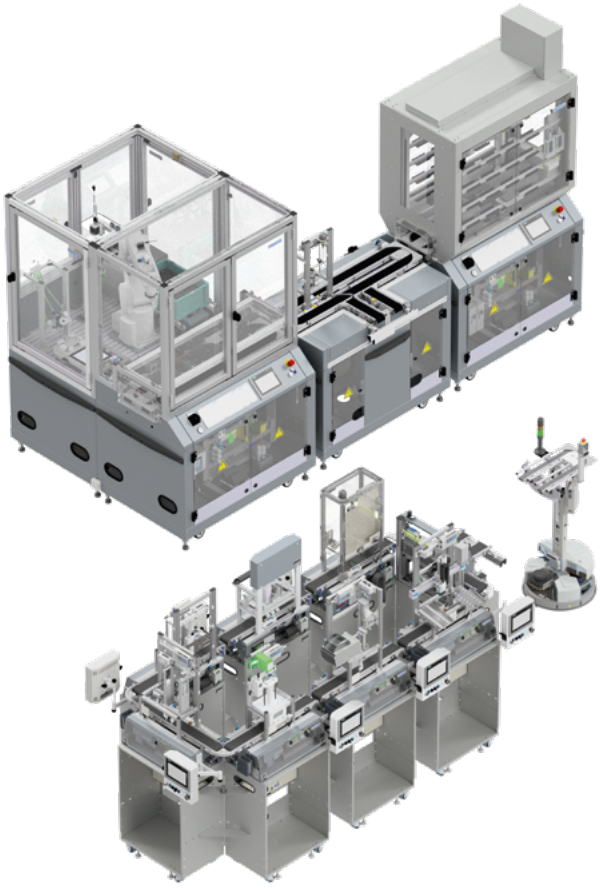
Variant FL2, comprising:
– 7x CP Lab basic module
– 1x CP Lab Deflector
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 2x Magazine application module
– 1x Camera application module
– 1x iDrilling application module
– 1x Muscle Press application module
– 1x Labeling application module
– 1x Output application module
– 1x MES software, including PC
– 1x Smart Maintenance package
– 1x Energy Management package
– 1x programming package
– 1x accessory package

Including commissioning and technical instruction on-site.
CP Factory/Lab – Variant FL2 On request



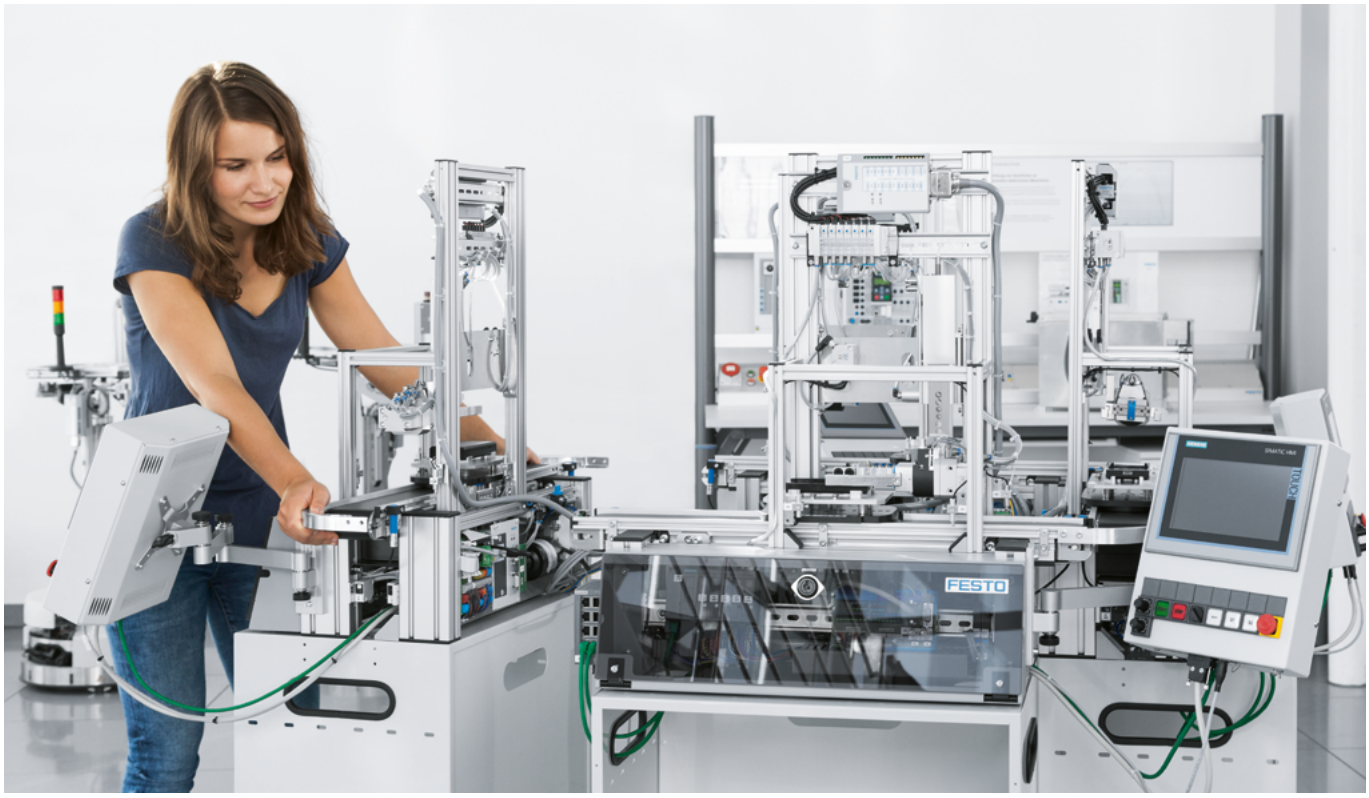
Variant FL3, comprising:
– 7x CP Lab basic module
– 1x CP Lab Deflector
– 1x CP Factory Robot Assembly
– 1x CP Factory Automatic Warehouse
– 1x CP Factory Station Deflector
– 1x mobile robot for pallet transport
– 1x measurement application module
– 2x Magazine application module
– 1x Camera application module
– 1x iDrilling application module
– 1x Muscle Press application module
– 1x Labeling application module
– 1x Output application module
– 1x MES software, including PC
– 1x Smart Maintenance package
– 1x Energy Management package
– 1x programming package
– 1x accessory package

Including commissioning and technical instruction on-site.
CP Factory/Lab – Variant FL3 On request



CP Lab

Industry 4.0 from the Outset



CP Lab – The compact Industry 4.0 learning system

The Cyber-Physical Lab is the professional and compact Industry 4.0 learning system from Festo Didactic. It includes all the technologies and components needed for communicating an in-depth knowledge of Industry 4.0.

The modular and flexible design has a range of learning scenarios, from individual pallet transfer systems with integrated controller right up to a connected production system with cloud services.

Your benefits

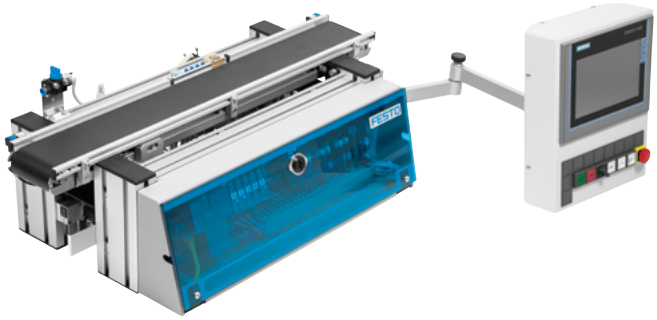
– Modular design
– Flexible learning content
– Easily expandable
– State-of-the-art technology
– Designed for IoT devices
– Seamless transition to the CP Factory
– Expandable using mobile robotics
– Compact and space-saving size: can be used on laboratory tables or trolleys

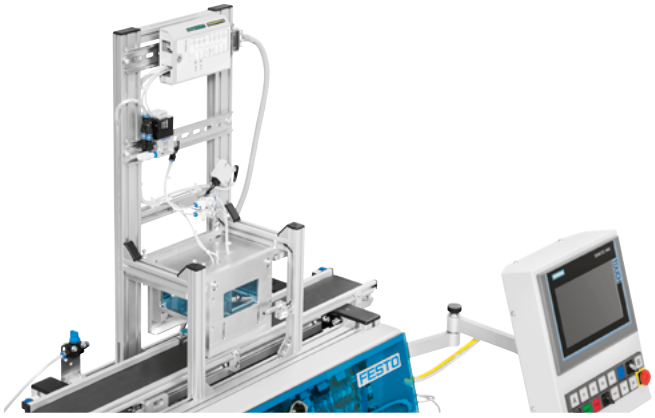




System Overview

Pallet Transfer System and Application Modules





The system consists of an **Application Module** which is placed on a **Pallet Transfer System**.

Main components of the Pallet Transfer System
Every individual Pallet Transfer System consits of the following main components:
– Integrated controller
– Mono-belt transfer system
– Pallet stopper
– 3/2-way valve
– Inductive sensor
– Capacitive sensors at the start and the end of the belt
– RFID read/write system
– Binary ID system
– Optical transmitter and receiver
– AC or DC motor
– Motor controller, bi-directional with 2 speed levels
– Incremental shaft encoder
– IO Link master
– IO Link device
– Analog I/O using IO Link
– Control panel

Options
Control variants:
– Festo CECC with 14 DI/8 DO
– Siemens S7 ET200SP CPU1512-F with 16 DI/16 DO
– Decentralized peripherals Siemens ET200SP with IM155 module

HMI variants:
– Siemens Touch Panel TP700, 7”
– Festo touch panel CDPX, 7”

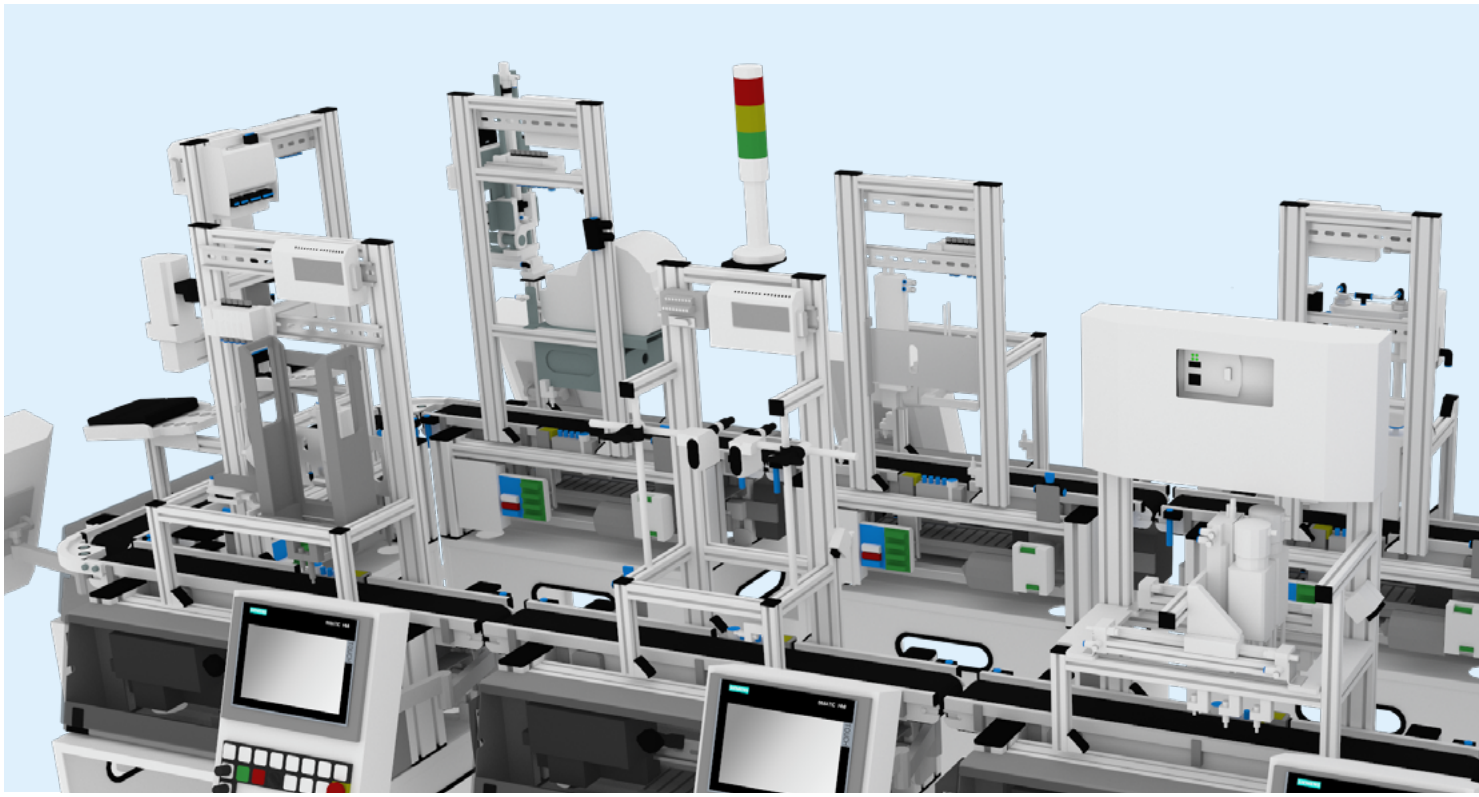
Motor variants:
– DC motor
– Three-phase motor 230 V
– Three-phase motor 400 V for star/delta circuit

Application Modules
The following application modules can be selected:
– Magazine
– Drilling and iDrilling
– Pick-by-light
– Measuring
– Turning
– Camera inspections
– Muscle press
– Labelling
– Tunnel furnace
– Output
– Automatic Warehouse for workpieces

Other application modules on request.

Training content
– Design and structure of the CP Lab:
  – Sensors/actuators
  – Process modules
  – Conveyor belt
  – Network
  – Process and plant management level
  – MES
– Recording information using intelligent sensors
– Control using PLC
– Communication based on bus technologies
– Binary pallet identification
– Identification via RFID
– Plug & produce: quick integration of new application modules using cyber-physical systems
– Manufacturing execution system (MES): creating, managing, controlling and visualizing customer orders

CP Lab 400 Complete Systems



The CP Lab 400 complete systems include four predefined systems.

These are compiled based on the experience of many implemented CP Lab systems, and form typical, logical combinations for an introduction to the world of of Industry 4.0.

Fully-equipped with the application modules, each system represents a production process. This enables the diverse areas of Industry 4.0 to be clearly illustrated and taught.

The configurations build upon one another, creating meaningful processes from even the smallest system.

Industry 4.0 topics:

– Digital product memory
– RFID, QR, data matrix
– UID product identification*

– System planning
– System simulation
– SIL/HIL*

– Error control
– Maintenance planning*
– Predictive maintenance*

– Safer networking*
– Remote service concepts*
– Cloud applications*

– Cyber-physical systems
– Embedded controller
– Web technology

– Energy efficiency
– Energy monitoring*
– Energy management*

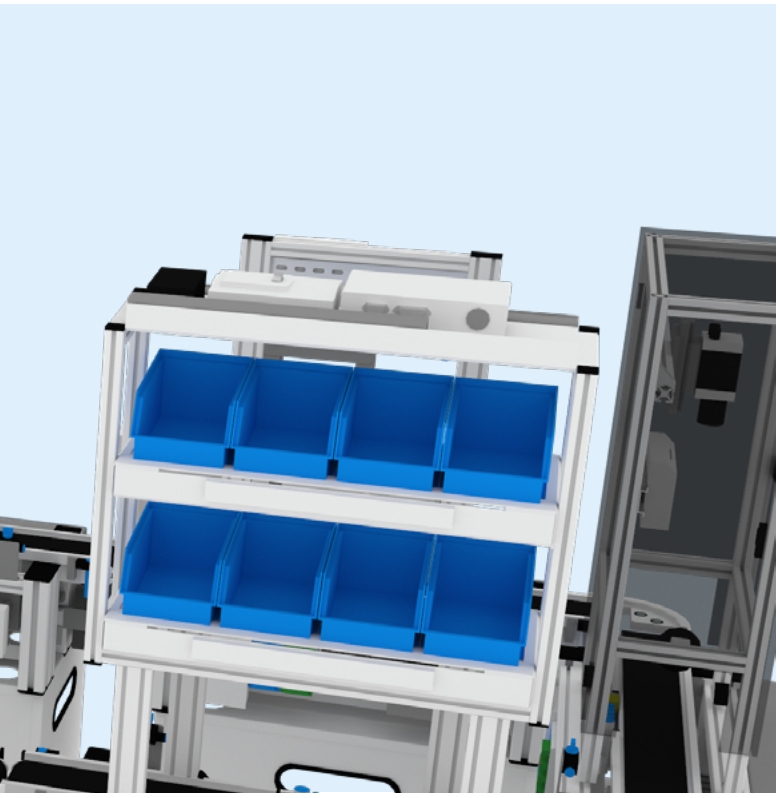
– Modern, decentralized control technology
– HMI, touch panels

– MES
– ERP*
– Web store*
– Data analytics*

– IP communication
– Open industrial standards
– Web standards

Worker guidance
Virtual reality (VR)*
Augmented reality (AR)*

* Optional supplements for CP Lab 400





For example:
Identification and object-related data

Clear product labeling, or UID (Unique Identification), and the storage of product and production data in digital product memory, form the foundation of all flexible and customized production systems. CP Lab 400 uses industry standard technologies, such as RFID, QR code, data matrix, and databases.



For example:
Next generation HMI – AR, smart glasses

The universal availability of decision-relevant and role-specific data and information is an important success factor in varied production. The latest human-machine communication technologies and use of visual data processing are integrated in the CP Lab 400.



CP Lab 404-1

Process operation:
– Feeding components
– Quality inspection I, SPC
– Flexible production with parameters
– Flexible handling, logistics



CP Lab 406-1

Process operation:
– Feeding components
– Quality inspection I, SPC
– Flexible production with parameters
– Feeding components, assembly
– Connecting components, assembly
– Flexible handling, logistics



CP Lab 408-1

Process operation:
– Feeding components
– Quality inspection I, SPC
– Flexible production with parameters
– Feeding components, assembly
– Connecting components, assembly
– Process-dependent operation
– QR code, UID, product tracking
– Flexible handling, logistics



CP Lab 410-1

Process operation:
– Feeding components
– Quality inspection I, SPC
– Flexible production with parameters
– Worker guidance, PCB assembly
– Quality inspection II
– Feeding components, assembly
– Connecting components, assembly
– Process-dependent operation
– QR code, UID, product tracking
– Flexible handling, logistics

CP Lab 404-1
with Four Application Modules

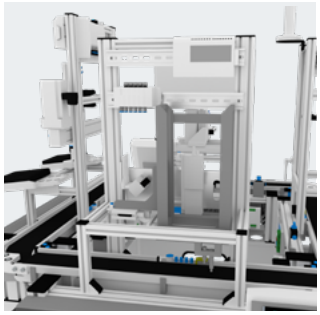


How the system works

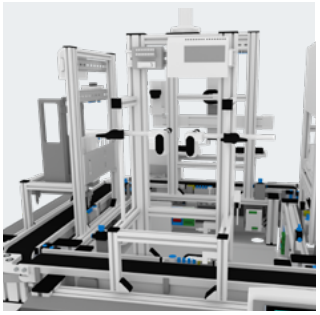
The CP Lab 404-1 system represents a networked production system consisting of four pallet transfer systems with different application modules.

Prerequisites for creating the following process sequence after linking and starting a batch size 1 routing:

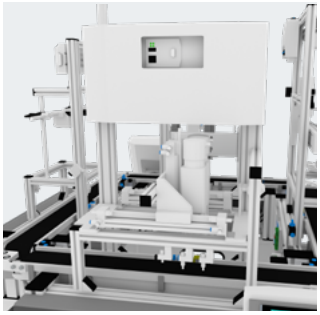
- The magazine module provides a housing shell.
- The quality data collection is performed using the measuring module's analog distance sensors.
- The drilling module performs an order-based, simulated drilling operation on the front shell.
- The output module performs the process end: workpiece output.



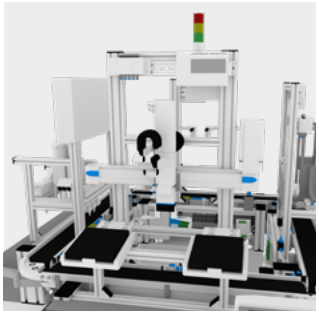
Magazine application module
- RFID
- Process start



Analog measuring application module
- QS
- SPC
- Analytics



Drilling application module
- CPS
- Production parameters
- Variants



Output application module
- Parameter processing
- Flexible handling
- Logistics
- Process end

CP Lab 404-1	**8092833**

Main components:

4x Pallet Transfer System
1x Magazine application module
1x Analog measuring application module
1x Drilling application module
1x Output application module
4x Switch
4x Power supply unit
4x Trolley
1x Workpiece set

Services for CP Lab 404-1

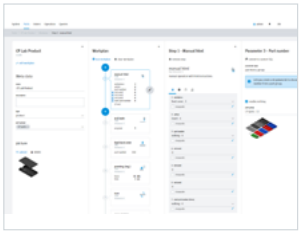
Installation and commissioning, 1 day	609400
Technical instruction, 2 days	609404

Training content
- CP Lab design and layout:
  - Sensors/actuators
  - Process modules
  - Conveyor belt
  - Network
  - Process and operations management level
- Recording information using intelligent sensors
- Control using PLC
- Communication based on bus technologies
- Binary pallet identification
- RFID identification
- Flexible production, one-off orders
- Quality management and SPC
- Plug & produce: quick integration of new application modules using cyber-physical systems

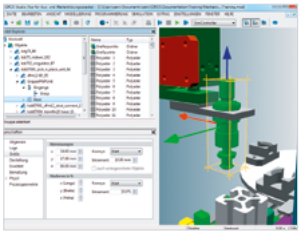
Technical data
- Operating pressure: 600 kPa (6 bar)
- Dimensions (W x D x H): approx. 1800 x 1800 x 1800 mm

MES training content
- Define and edit order workflows and process plans
- Read orders and update status
- Sort order lines
- Write goods carrier allocations to the order
- Create a material master, incl. workpiece graphics
- Add machines, incl. power consumption
- Add warehouse data and material buffers
- Add and manage customer data
- Define system layouts with icons
- Generate OEE, SPC and malfunction reports, incl. graphics

Included software
- 1x MES4 V3 with six network licenses, incl. 1x PC with TFT monitor → Page 131



- 1x CIROS Studio with six network licenses Educational, the professional working tool for creating simulation models → Page 124



- 1x CP Lab Model Library for CIROS

Recommended learning material

Courseware
Complete overview ➔ Page 274

For example:

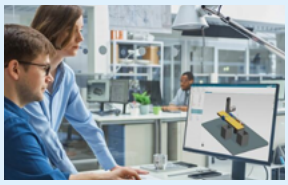
eLearning courses
- Introduction to Industry 4.0
- Industrial Safety in the Workplace

eTheory courses
- Introduction to RFID Technology



- AAS – Communication Architecture of I4.0

eLab courses
- Basics of CAD Design with NX



- Basics of Modeling with NX MCD
- HMI – Operation and Visualization I Part 1: Hardware, Basic Objects, and Elements

Evaluations
- Basics of Plant Visualization with HMI
- Basics of CAD Design with NX

User Guides
- Introduction to CAD Design with NX

CP Lab 406-1

With Six Application Modules

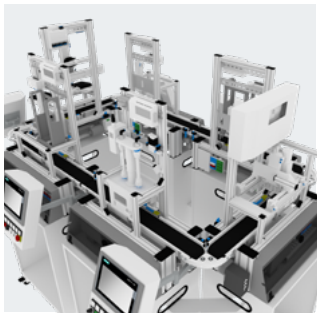


How the system works

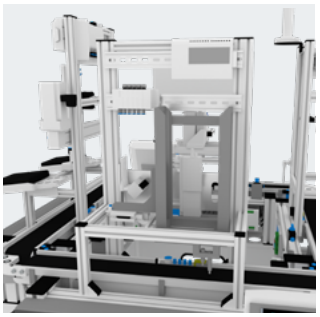
The CP Lab 406-1 system represents a networked production system consisting of six pallet transfer systems with different application modules.

Prerequisites for creating the following process sequence after linking and starting a batch size 1 routing:

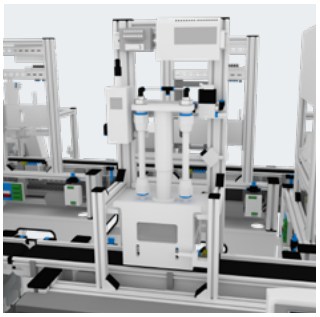
- The magazine module provides a housing shell.
- The quality data collection is performed using the measuring module's analog distance sensors.
- The drilling module performs an order-based, simulated drilling operation on the front shell.
- As an additional assembly step, the rear shell is placed using the magazine module.
- The press module finalizes the product through the pressing process.
- The output module performs the process end: workpiece output.



- **Magazine application module**
- **Analog measuring application module**
- **Drilling application module**
- **Output application module**



Magazine application module
- Rear shell placement



Press application module
- Press parameters
- Joining
- Assembly

CP Lab 406-1	**8092834**

Main components:

6x Pallet Transfer System
1x Magazine application module I
1x Analog measuring application module
1x Drilling application module
1x Magazine application module II
1x Press application module
1x Output application module
6x Switch
6x Power supply unit
6x Trolley
1x Workpiece set

Services for CP Lab 406-1

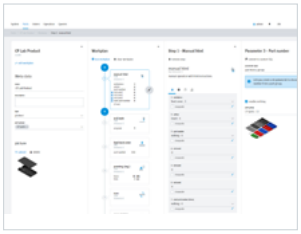
Installation and commissioning, 1 day	609401
Technical instruction, 2 days	609405

Training content
- CP Lab design and layout:
  - Sensors/actuators
  - Process modules
  - Conveyor belt
  - Network
  - Process and operations management level
- Recording information using intelligent sensors
- Control using PLC
- Communication based on bus technologies
- Binary pallet identification
- RFID identification
- Flexible production, one-off orders
- Quality management and SPC
- Plug & produce: quick integration of new application modules using cyber-physical systems

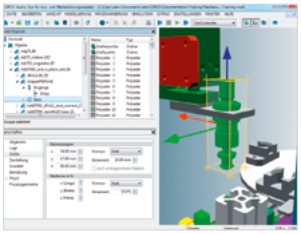
Technical data
- Operating pressure: 600 kPa (6 bar)
- Dimensions (W x D x H): approx. 2500 x 1800 x 1800 mm

MES training content
- Define and edit order workflows and process plans
- Read orders and update status
- Sort order lines
- Write goods carrier allocations to the order
- Create a material master, incl. workpiece graphics
- Add machines, incl. power consumption
- Add warehouse data and material buffers
- Add and manage customer data
- Define system layouts with icons
- Generate OEE, SPC and malfunction reports, incl. graphics

Included software
- 1x MES4 V3 with six network licenses, incl. 1x PC with TFT monitor → Page 131



- 1x CIROS Studio with six network licenses Educational, the professional working tool for creating simulation models → Page 124



- 1x CP Lab Model Library for CIROS

Recommended learning material

Courseware
Complete overview ➔ Page 274

For example:

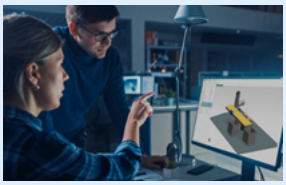
eLearning courses
- Introduction to Industry 4.0
- Industrial Safety in the Workplace

eTheory courses
- Introduction to RFID Technology



- AAS – Communication Architecture of I4.0

eLab courses
- Basics of Modeling with NX MCD



- Virtual Commissioning with NX MCD
- HMI – Operation and Visualization I Part 1: Hardware, Basic Objects, and Elements

Evaluations
- Basics of Plant Visualization with HMI
- Basics of CAD Design with NX
- Basics of Virtual Commissioning with NX MCD

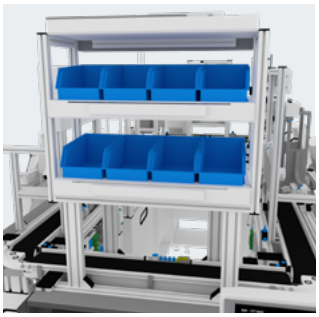
User Guides
- Introduction to CAD Design with NX

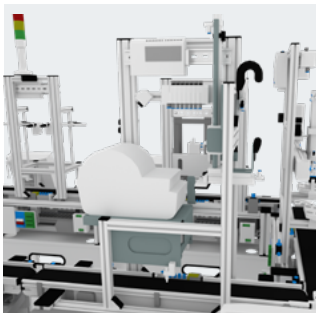
CP Lab 408-1

With Eight Application Modules









– Magazine application module
– Analog measuring application module
– Drilling application module
– Output application module
– Magazine application module
– Press application module

Pick-by-Light application module
– Variant assembly
– Worker guidance

Label printer application module
– QR Code
– UID
– Product tracking

How the system works

The CP Lab 408-1 system represents a networked production system consisting of eight pallet transfer systems with different application modules.

Prerequisites for creating the following process sequence after linking and starting a batch size 1 routing:

– The magazine module provides a housing shell.
– The quality data collection is performed using the measuring module's analog distance sensors.
– The drilling module performs an order-based, simulated drilling operation on the front shell.
– The Pick-by-Light module enables flexible, complete assembly with worker guidance.
– As an additional assembly step, the magazine module places the rear shell on top.
– The press module finalizes the product through the pressing process.
– The label printer provides the product with a QR code and a customized label.
– The output module performs the process end: workpiece output.

CP Lab 408-1	**8092835**

Main components:

8x Pallet Transfer System
1x Magazine application module I
1x Analog measuring application module
1x Drilling application module
1x Pick-by-Light application module
1x Magazine application module II
1x Press application module
1x Label printer application module
1x Output application module
8x Switch
8x Power supply unit
8x Trolley
1x Workpiece set

Services for CP Lab 408-1

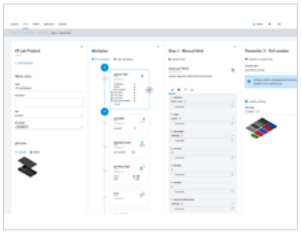
Installation and commissioning, 2 days	609402
Technical instruction, 3 days	609406

Training content
– CP Lab design and layout:
Sensors/actuators
Process modules
Conveyor belt
Network
Process and operations management level
– Recording information using intelligent sensors
– Control using PLC
– Communication based on bus technologies
– Binary pallet identification
– RFID identification
– Flexible production, one-off orders
– Quality management and SPC
– Plug & produce: quick integration of new application modules using cyber-physical systems

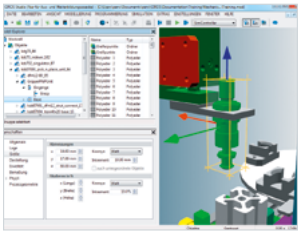
Technical data
– Operating pressure:
600 kPa (6 bar)
– Dimensions (W x D x H):
approx. 3200 x 1800 x 1800 mm

MES training content
– Define and edit order workflows and process plans
– Read orders and update status
– Sort order lines
– Write goods carrier allocations to the order
– Create a material master, incl. workpiece graphics
– Add machines, incl. power consumption
– Add warehouse data and material buffers
– Add and manage customer data
– Define system layouts with icons
– Generate OEE, SPC and malfunction reports, incl. graphics

Included software
– 1x MES4 V3 with six network licenses, incl. 1x PC with TFT monitor → Page 131



– 1x CIROS Studio with six network licenses Educational, the professional working tool for creating simulation models → Page 124



– 1x CP Lab Model Library for CIROS

Recommended learning material

Courseware
Complete overview ➔ Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– Metal Working: Drilling

eTheory courses
– CIROS – First steps



– AAS – Communication Architecture of I4.0

eLab courses
– Virtual Commissioning with NX MCD
– Production Planning and Control with MES4

Evaluations
– Basics of Virtual Commissioning with NX MCD



– Basics of MES

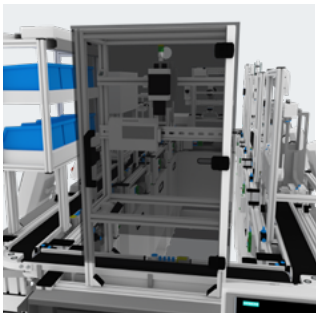
User Guides
– Introduction to CAD Design with NX

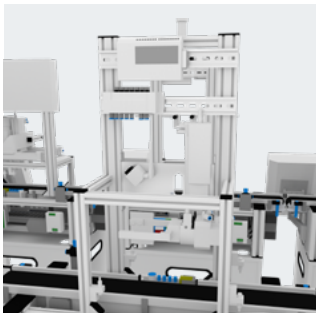
CP Lab 410-1

With Ten Application Modules









How the system works
The CP Lab 410-1 system represents a networked production system, consisting of ten pallet transfer systems with different, application modules.

Prerequisites for creating the following process sequence after linking and starting a batch size 1 routing:

- The magazine module provides a housing shell.
- The quality data collection is performed using the measuring module's analog distance sensors.
- The drilling module performs an order-based, simulated drilling operation on the front shell.
- The Pick-by-Light module enables flexible, complete assembly with worker guidance.
- The camera module is used for quality assurance and assembly control.
- As an additional assembly step, the magazine module places the rear shell on top.
- The press module finalizes the product through the pressing process.
- The turning module turns the workpiece to prepare it for printing on the front and back.
- The label printer provides the product with a QR code and a customized label.
- The output module performs the process end: workpiece output.

- **Magazine application module**
- **Analog measuring application module**
- **Drilling application module**
- **Output application module**
- **Magazine application module**
- **Press application module**
- **Pick-by-Light application module**
- **Label printer application module**

Camera application module
- Vision system
- Quality assurance

Turning application module
- Process variance
- Conditional operation

CP Lab 410-1	**8092836**

Main components:

10x Pallet Transfer System
1x Magazine application module I
1x Analog measuring application module
1x Drilling application module
1x Pick-by-Light application module
1x Camera application module
1x Magazine application module II
1x Press application module
1x Turning application module
1x Label printer application module
1x Output application module
10x Switch
10x Power supply unit
10x Trolley
1x Workpiece set

Services for CP Lab 410-1

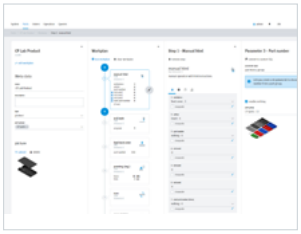
Installation and commissioning, 2 days	609403
Technical instruction, 3 days	609406

Training content
– CP Lab design and layout:
  – Sensors/actuators
  – Process modules
  – Conveyor belt
  – Network
  – Process and operations management level
– Recording information using intelligent sensors
– Control using PLC
– Communication based on bus technologies
– Binary pallet identification
– RFID identification
– Flexible production, one-off orders
– Quality management and SPC
– QR code, UID
– Quality assurance with camera
– Plug & produce: quick integration of new application modules using cyber-physical systems

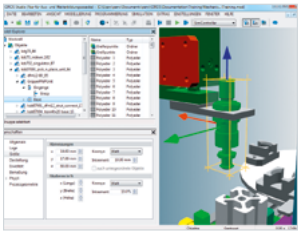
Technical data
– Operating pressure: 600 kPa (6 bar)
– Dimensions (W x D x H): approx. 3900 x 1800 x 1800 mm

MES training content
– Define and edit order workflows and process plans
– Read orders and update status
– Sort order lines
– Write goods carrier allocations to the order
– Create a material master, incl. workpiece graphics
– Add machines, incl. power consumption
– Add warehouse data and material buffers
– Add and manage customer data
– Define system layouts with icons
– Generate OEE, SPC and malfunction reports, incl. graphics

Included software
– 1x MES4 V3 with six network licenses, incl. 1x PC with TFT monitor → Page 131



– 1x CIROS Studio with six network licenses Educational, the professional working tool for creating simulation models → Page 124



– 1x CP Lab Model Library for CIROS

Recommended learning material

Courseware
Complete overview ➔ Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– Metal Working: Drilling

eTheory courses
– CIROS – First steps



– AAS – Communication Architecture of I4.0

eLab courses
– Virtual Commissioning with NX MCD
– PLC Programming for IIoT Systems



Evaluations
– Basics of Plant Visualization with HMI
– Basics of Virtual Commissioning with NX MCD



– AAS – Communication Architecture of I4.0

User Guides
– Introduction to CAD Design with NX

MPS 400

Learning Factories – Single Workpiece Flow









Fundamentals and Industry 4.0
MPS 400 learning factories cover a wide range of modern Industry 4.0 content and as well as fundamentals of mechatronics and automation technology. Among other things, students gain initial insights into artificial intelligence and machine learning algorithms. Through a didactically prepared MES and the associated software landscape, relevant digitization content is thematized. In addition, students go through the entire training using a uniform training system.

Industry-relevant skills
You will be guided through the complete learning plan step by step, exercise by exercise. The modular hardware enables an equally modular approach to learning for better success in learning. Dealing with industrial components and technologies ensures good opportunities in the job market after completion of the training.

Learning support
Teachers benefit from comprehensive technical documentation, didactically prepared course materials and supporting media such as AR and QR for a smooth teaching process and an efficient learning process. High-quality industrial components ensure reliable operation for many years. Moreover, the option to extend the training system and its space-saving design help create a cost-efficient overall solution.



Flexible learning factories
The MPS 400 series is our latest product line from the MPS family and makes it particularly easy to assemble individual Learning factories from system modules. In this way, the requirements of different training professions and job roles can be optimally met on the training system side.



For students
– Students receive extensive training using a uniform learning system.
– Students are guided through the complete curriculum step-by-step, exercise-by-exercise.
– Learning content is comprehensive, from the basics to very complex topics.
– Modular hardware creates flexible experiential learning.
– Industry-proven components and technologies increase employability after completion of the training.
– Adjustable trolley heights ensure an ergonomic and low-fatigue work environment.

For teachers
– The step-by-step course materials enable learners to work independently most of the time.
– Teachers can be confident that the system will function reliably for many years thanks to high-quality components.
– The expandability of the learning system and the space-saving design ensure an overall cost-efficient solution.

For pioneers
– The training system covers a wide range of modern IIoT content and at the same time fundamentals of mechatronics and automation technology.
– The training system offers first insights into artificial intelligence and machine learning algorithms.
– By means of a didactically prepared MES and the associated software landscape, the focus is on the relevant digitization content.
– The adjustable carriage height enables low-fatigue and ergonomic work.
– Extensive technical documentation, didactically prepared course materials and supporting media such as AR and QR guarantee a smooth teaching process as well as an efficient learning process.

Information for commissioning and troubleshooting the MPS 400 is available here:

MPS 400

Overview of Preferred Variants

	Distribution Pro	Joining	Measuring Pro	Sorting Inline	Assembly Robot
MPS 401-1					
MPS 402-1/402-1 R					
MPS 403-1 / 403-1 R					
MPS 404-1 / 404-1 R					
MPS 405-1 / 405-1 R					

Robotino (optional)

The systems in detail

MPS 400 Distribution Pro – Central infrastructure for all systems
The MPS 400 system module Distribution Pro forms the basis for all MPS 400 systems. It offers the necessary IT and software infrastructure with FactoryViews including an MES4lite license, with which up to four Stations can be integrated into a system free of charge. Many basic topics can already be trained on this system module. In addition, it provides deep insights into intelligent sensors and modern human-machine communication.



MPS 402-1 – Small but mighty
Our most compact learning factory reproduces a complete production process. Here, workpieces are distributed and picked onto different chutes after a short quality check. MPS 402-1 is the ideal entry into the world of Industry 4.0 for smaller budgets and addresses topics such as artificial intelligence and IoT in production.

Extensions:
Through the optional integration of Robotino, the MPS 402-1 can be transformed into an **MPS 402-1 R**. Robotino forms the bridge between the Station Distribution Pro and the Station Sorting Inline.



MPS 403-1 – Learning from a value-added production process
In the MPS, great importance has always been placed on practical application. In addition to the use of real industrial components, a value-added production process is an important building block for creating a learning system that is as close to practice as possible. MPS 403-1 is a reliable, all-around learning system that covers most basic topics in the field of mechatronics and Industry 4.0.

Extensions:
In addition to the optional Robotino integration **MPS 403-1 R**, MPS 403-1 can be supplemented with various expansion packages. In this way, current topics such as IT security, energy monitoring and machine safety can be configured as required or added at a later date.



MPS 404-1 – Complete manufacturing in a learning format
MPS 404-1 offers all the basic aspects of complete, automated production. The value-added production process of the MPS 403-1 is supplemented by solid industrial measurement technology for quality control. A pneumatic valve terminal controlled via IO-Link for controlling a rotary-stroke unit also deepens the electropneumatic learning content in the direction of digitalization.

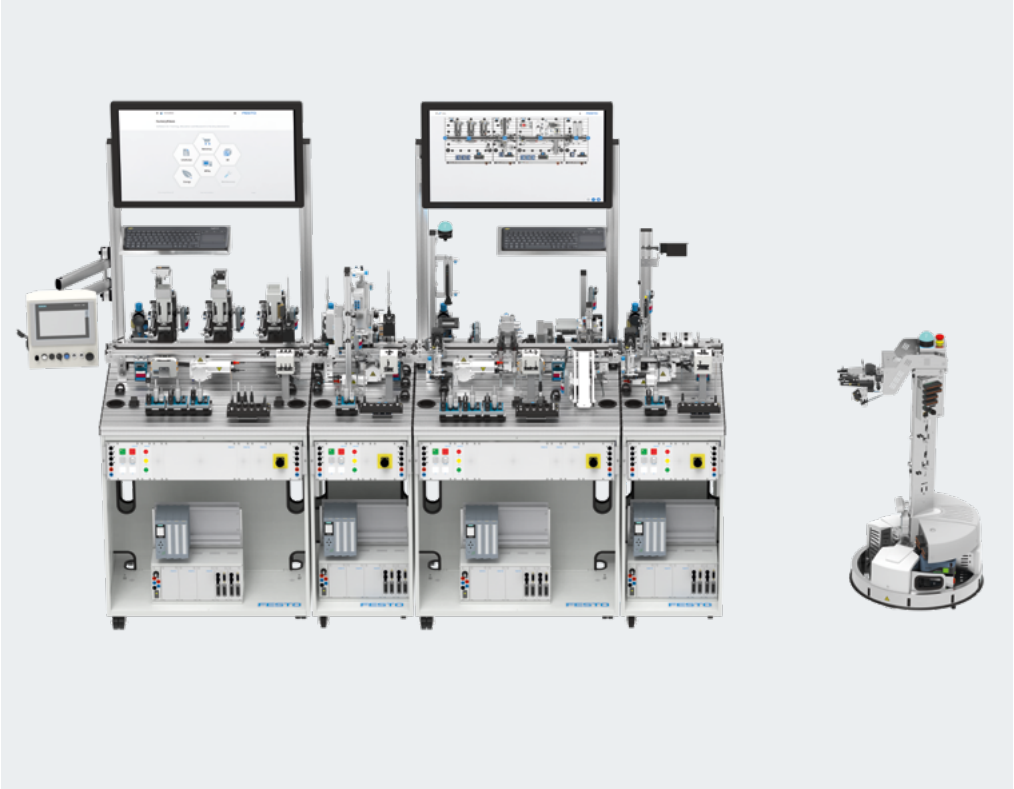
Extensions:
MPS 404-1 can also be optionally supplemented with Robotino (**MPS 404-1 R**) and expanded with various learning packs.



MPS 405-1 – Industrial robot applications for automated assembly
MPS 405-1 provides a comprehensive introduction to industrial robot applications within an automated assembly process. The value-added process is realized through robot-based assembly of a pneumatic cylinder, combining handling, assembly, sensing, and quality checks in a realistic industrial workflow, and enabling systematic skill development across the full lifecycle of robot-based work cells.

Extensions:
MPS 405-1 can also be optionally supplemented with Robotino (MPS 405-1 R) and expanded with various learning packs.

MPS 400 Learning Factories
General Characteristics



Broad spectrum
The compact Industry 4.0 learning factories of the MPS 400 series are training programs in basic skills and specialist knowledge in the area of automation technology and mechatronics. In addition, they offer a broad learning spectrum of cutting-edge Industry 4.0 technologies. As miniaturized production lines, they provide in-depth insight into intelligent networking of machines in the production environment, and their work processes.

Training approach
FactoryViews, a web-based software environment built around a didactic MES, forms the core of the digital network of these learning factories. Modules such as an integrated online shop and system-specific apps integrate seamlessly into this software. Training programs supported by augmented reality (AR) and clear, pedagogical preparation of all content with extensive training documentation make MPS 400 learning factories the ideal learning solution with a wide range of topics surrounding production.

Intuitive operation
Control and monitoring of the system is performed via a large touch screen and a keyboard. The core of the software environment is an educational web-based MES system, which can be expanded by adding further applications. The ergonomic design of the learning system ensures efficient and fatigue-free working and learning.

Siemens SMSCP
The MPS 400 series also fulfils the requirements of the Siemens SMSCP. With MPS 403-1 for SMSCP Level 1 and MPS 404-1 for SMSCP Level 2, we offer the core of a compact and cost-effective and cost-efficient learning solution. This can be supplemented with other SMSCP-relevant learning topics to fully cover the requirements of the SMSCP requirements in full.
→ Page 35

Modular hardware
An MPS 400 system building block is an MPS station built on a trolley containing all elements for seamless integration into a learning factory, which might consist of several system building blocks. Each system module represents a process step that is modelled on real-world production.

The trolley is equipped with a control panel that contains buttons for basic controls and signals the status of the station by means of three lights. An emergency stop button stops all actuators within the system module. Some of the input and output signals as well as 24 V and GND can be tapped at 4mm safety lab sockets on the left and right of the control panel.

Industry 4.0 right from the start
The system building blocks are equipped with an Ethernet switch and PLC. The PLC program connects the system module with the MES and the entire plant. An RFID read/write device is connected to the PLC via an RFID controller. This can read and write the digital product memory in RFID tags of individual workpieces.

Vertical integration
The required production steps (with individual parameters if needed) can be transferred individually for each workpiece from the MES to the PLC of the system building block. This teaches the learner concepts such as variant diversity in production up to batch size 1.





MES with online shop
– System configuration
– Product configuration
– Order entry and management
– Order tracking
– Order data storage
– Role-based information

Digital product memory
All workpieces are equipped with RFID tags, giving them a digital product memory, which is read and individually described as part of the production process. The product memory allows for the highest level of customization in the production process, right down to batch size 1.

Basic principles of mobile robotics (MPS 4xx-x R)
The basic principles of mobile robotics are taught through the use of Robotino, especially in the production environment. Integrating the mobile robot into the learning factory via QR codes makes it easy to approach this extensive subject area without the need for complex software configurations. Here, the mobile robot equipped with a gripper forms a bridge between two stations by transporting workpieces from one processing station to the next station as required.

Expansion options
By integrating additional MPS 400 system modules, the learning system can be expanded into a larger system network. This allows learning content to be expanded extensively and for more complex production processes to be mapped at the same time.

The learning system can be expanded with a variety of optional packages. This allows topics such as IT security in industrial environments, energy management in industrial systems, as well as machine safety and mobile robotics to be seamlessly integrated into the complete concept.

Training documentation
Customized training documentation as eLearning courses and PDF files ensure an optimum learning experience. The modular use of these materials, allows the learning path to remain flexible and expandable. This makes it possible to divide up wide-ranging and complex topics into small learning units that are easy for students to understand.

Digital learning support
The learning process is supported by augmented reality (AR) and QR codes. QR codes on the individual components of the learning system allows for rapid and targeted retrieval of relevant technical information.

Benefits
– In addition to the basics of mechatronics and automation technology, you also get quick, simple, and broad access to the most important Industry 4.0 topics.

– The high degree of modularity ensures a clear and manageable learning path made up of modules from stations through to a software-controlled learning factory.

– The modular design allows you to make changes and extensions to the mechatronic system independently as part of project work.

– Comprehensive training documentation breaks down complex topics into small steps and learning units, allowing teaching to be designed in a structured yet flexible manner.

– The didactic software environment surrounding an MES (Manufacturing Execution System) specially developed for didactic use provides easy access to complex software topics in the factory automation environment.

– The learning process is supported by modern media such as QR codes and AR for provision of information as well as interaction with the learning system based on augmented reality.

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 110/230 V, 50/60 Hz
– Square/round workpiece dimensions: max. 40 mm

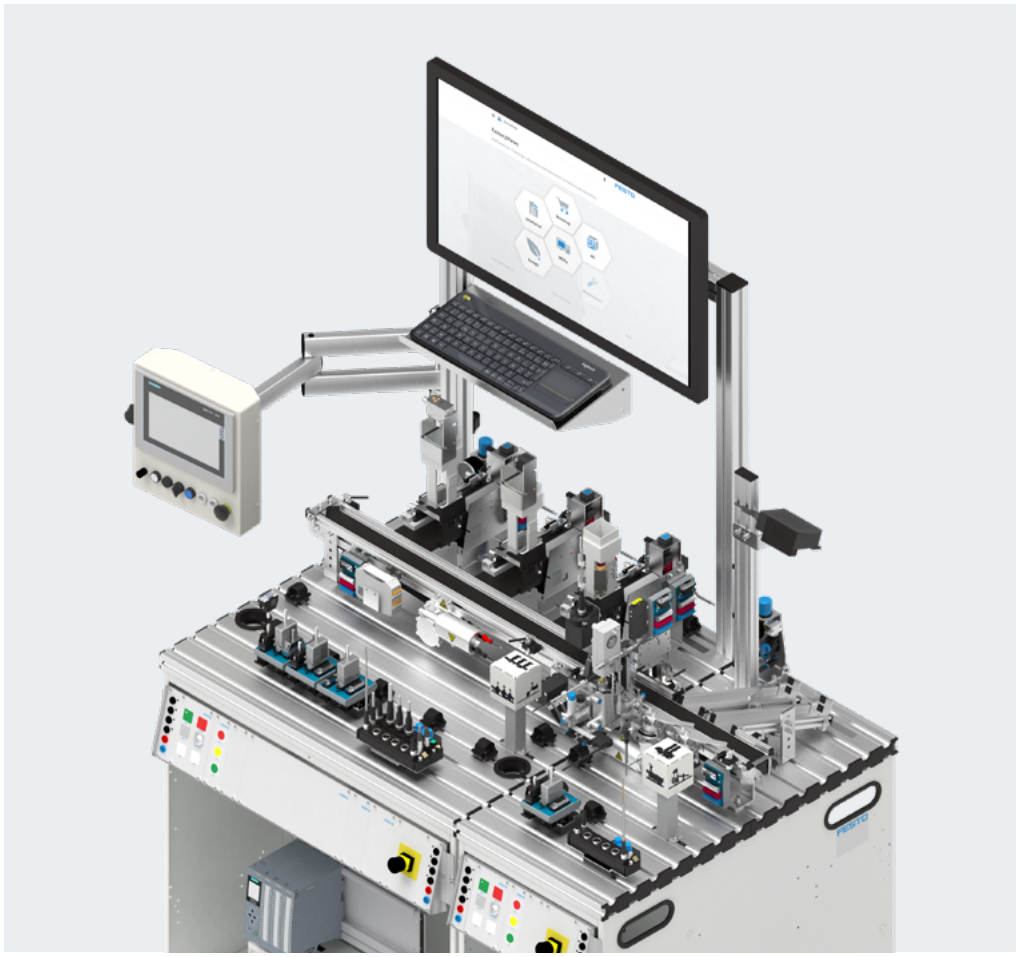
Recommended accessories for all MPS 400 Learning factories

1x Simulation box, digital	170643
1x Simulation box, analog	526863
2x EasyPort	548687
1x Error simulation box	8074292
1x Lockout-tagout module	8064829

Information for commissioning and troubleshooting the MPS 400 is available here:

MPS 402-1/MPS 402-1 R

Smallest Entry into Industry 4.0 Learning Factories

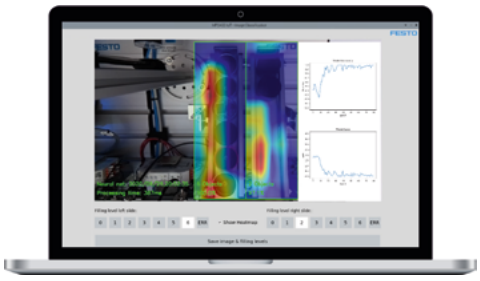


Brief description
The MPS 402-1 learning factory consists of the MPS 400 system modules Distributing Pro and Sorting Inline. The system modules are networked with the MES, equipped with RFID writing and reading devices and intelligent IO Link-based sensors, and form an autonomous system.

MPS 402-1 R contains a Robotino in addition to the system modules mentioned, and therefore expands the learning topics to include the field of mobile robotics and related topics in production.

Process
Processing in this learning factory begins when a production order is entered by means of an intuitively designed MES user interface. The first station separates workpieces out of three fill level-monitored stacking magazines and then writes data onto the corresponding RFID tags. The next Sorting station distributes the workpieces into two slides or passes them on to additional stations downstream, according to the order and quality control.

The learning factory can be divided into several parts, with Robotino then transporting workpieces as a mobile robot between the production cells (MPS 402-1 R).





Machine learning
As a subfield of artificial intelligence with a wide range of possible applications in production, machine learning is increasingly becoming a part of industrial practice.

The course material focuses on the practical application of these kinds of algorithms without the need to introduce complex theory.

IIoT retrofitting
An IIoT system based on a microcomputer and a webcam offers the students new perspectives for innovative business models by retrofitting existing industrial systems. Cutting-edge technologies and algorithms from the field of machine learning are used in the process.

MPS 402-1	**8160307**
MPS 402-1 R, 230 V	**8160309**
MPS 402-1 R, 110 V	**8160308**

Essential components:

MPS 400 Distributing Pro System building block	8129394
MPS 400 Sorting Inline System building block	8129438
MPS 400 Robotino System building block (MPS 403-1 R), 230 V	8159801
MPS 400 Robotino System building block (MPS 402-1 R), 110 V	8159799

Recommended accessories:

Networks and IT Security, Equipment set TP 1333 ➔ Page 134

IO Link and OPC-UA
The students learn all about intelligent IO Link-based laser, ultrasound and capacitive sensors, get to know their advantages when compared with conventional sensors, and are then able to address, interpret, and service them and integrate them into production systems. The basic principles of PROFINET and OPC-UA are also taught in addition to IO Link. This gives the students a solid introduction into the most important network-based protocols in automation environments.

Touch panel
The training system teaches how to program touch panels with a structured display of all relevant information. This involves not only the visual preparation of live data from the system, but also ways of controlling and interacting with the system.

Technical data
– Max. dimensions (W x D x H):
1050 x 700 x 1705 mm
(Variable height)

Training content
– Networking multiple stations, controllers, and I/O units with an MES-centered software environment via network-based protocols (OPC-UA, IO Link, PROFINET, TCP-IP, Node-RED)

– Programming industrial touch panels and familiarity with modern human/machine interfaces such as augmented reality and web interfaces

– Familiarity with RFID and network technology as well as intelligent IO Link-based sensors

– Learning about new business models using IIoT retrofitting by means of a webcam and micro computer as well as learning the use of machine learning algorithms

– Production of customized products using production orders developed through an online store

– Basic principles of mobile robotics in the production environment (MPS 402-1 R)

Recommended learning material

Complete overview ➔ Page 274

For example:

eLearning courses
– Introduction to Industry 4.0

eTheory courses
– Introduction to Robotics
– Introduction to RFID Technology



eLab courses
– From Object Identification to Product Memory with RFID



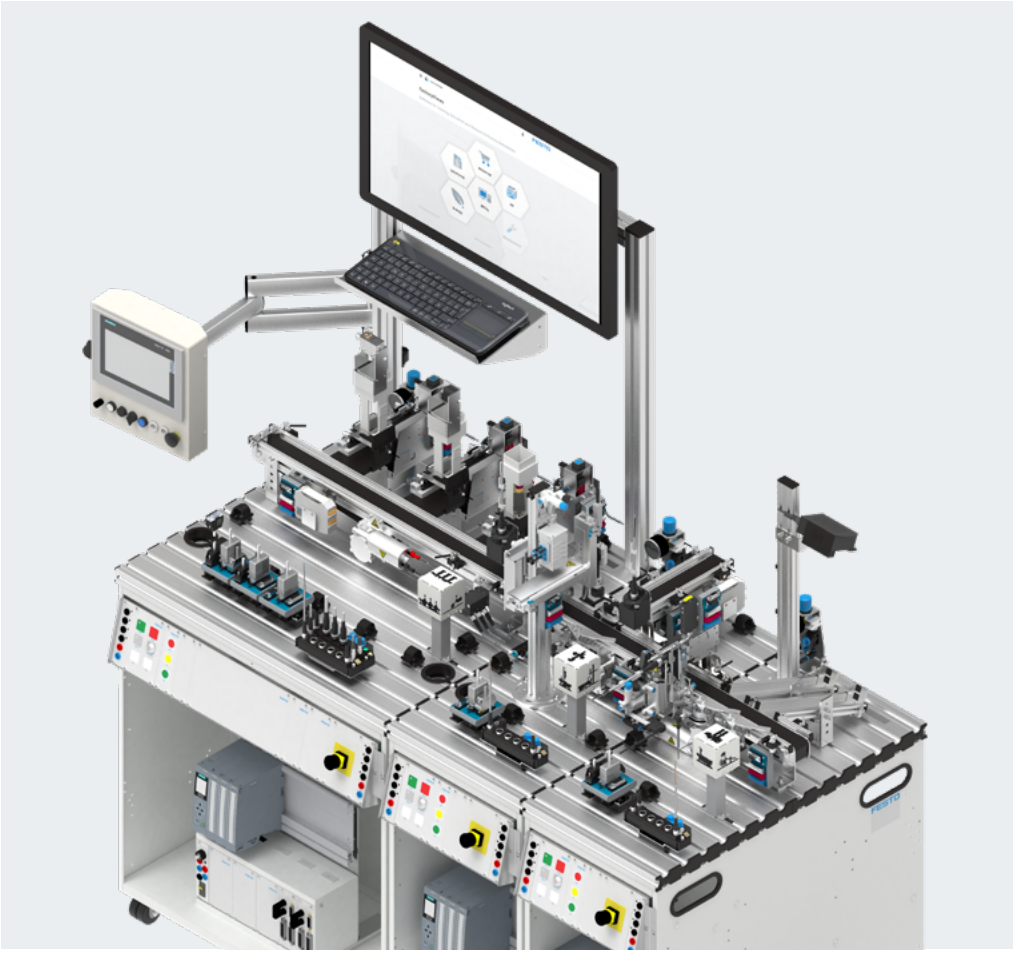
– Plant Visualization with HMI
– Smart Sensors for Smart Systems
– PLC Programming for Smart Systems
– Autonomous Mobile Robotics with Robotino 4

Evaluations
– Basics of Plant Visualization with HMI
– Smart Sensors for Smart System
– PLC Programming for Smart Systems

User Guides
– Smart Sensors – First Steps

MPS 403-1/MPS 403-1 R

Compact All-Round Learning Factory Mechatronics and Industry 4.0

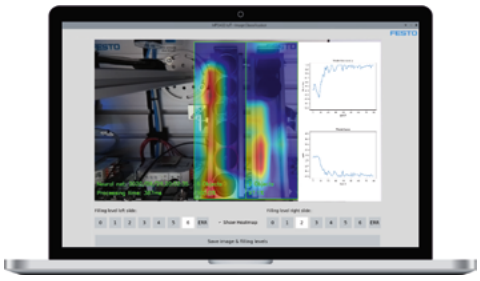


Brief description
The MPS 403-1 learning factory consists of the MPS 400 system modules Distributing Pro, Joining and Sorting Inline. The system modules are networked with the MES, equipped with RFID writing/reading devices and intelligent IO Link-based sensors, and form an autonomous system.

MPS 403-1 R contains a Robotino in addition to the system modules mentioned, and therefore expands the learning topics to include the field of mobile robotics and related topics in production.

Process
Processing in the learning system begins when a production order is entered by means of an intuitively designed MES user interface. The first station separates workpieces out of three level-monitored stacking magazines and then writes data onto the corresponding RFID tags. The downstream Joining station reads the RFID tag and, depending on the production order, joins a top part to the workpiece. In the process, it can either add a simple cover or, after the appropriate conversion, an intelligent microcontroller to the basic body of the workpiece. The third Sorting station distributes the workpieces into two slides or passes them on to additional stations downstream, according to the order and quality control.

The learning factory can be can be divided into several parts, with Robotino then transporting workpieces as a mobile robot between one production cell and the next (MPS 403-1 R).





Machine learning
As a subfield of artificial intelligence with a wide range of possible applications in production, machine learning is increasingly becoming a part of industrial practice.

The course material focuses on the practical application of these kinds of algorithms without the need to introduce complex theory.

IIoT retrofitting
An IIoT system based on a microcomputer and a webcam offers the students new perspectives for innovative business models by retrofitting existing industrial systems. Cutting-edge technologies and algorithms from the field of machine learning are used in the process.

MPS 403-1	**8130882**
MPS 403-1 R, 230 V	**8160311**
MPS 403-1 R, 110 V	**8160310**

Essential components:

MPS 400 Distributing Pro System building block	8129394
MPS 400 MPS 400 Joining System building block	8129125
MPS 400 Sorting Inline System building block	8129438
MPS 400 Robotino System building block (MPS 403-1 R), 230 V	8159801
MPS 400 Robotino System building block (MPS 402-1 R), 110 V	8159799

Recommended accessories:

1x Networks and IT Security, Equipment set TP 1333 ➔ Page 134
1x Machine Safety, Equipment set TP 1321 ➔ Page 216
1x Machine Safety mounting kit for MPS, Equipment set TP 1321 ➔ Page 217
1x Energy efficiency package for MPS 403 ➔ Page 141

Siemens SMSCP

Essential components **SMSCP Level 1**:

MPS 403-1	8130882
EasyPort	548687
FluidSim ➔ Page 122	
Simulation box, digital/analog	526863
Error simulation box	8074292

Additional components extension from **SMSCP Level 1 to Level 2**:

MPS 400 Measuring Pro System building block	8137077
Equipment set TP 1321 Machine Safety	8112539
Equipment set TP 1321 Machine Safety mounting kit for MPS	8131471
Networks and IT Security, Equipment set TP 1333 ➔ Page 134	
MPS PA Compact Workstation (230 V) ➔ festo.com/didactic	

IO Link and OPC-UA

The students learn all about intelligent IO Link-based laser, ultrasound and capacitive sensors, get to know their advantages when compared with conventional sensors, and are then able to address, interpret, and service them and integrate them into production systems. The basic principles of PROFINET and OPC-UA are also taught in addition to IO Link. This gives the students a solid introduction into the most important network-based protocols in automation environments.

Technical data

– Dimensions (W x D x H): approx. 1400 x 700 x approx. 1705 mm (variable height)

Touch panel

The training system teaches how to program touch panels with a structured display of all relevant information. This involves not only the visual preparation of live data from the system, but also ways of controlling and interacting with the system.

Accessories

In addition to a digital simulation box, a digital interface (EasyPort) and a FluidSIM license are also included. This allows the components to be controlled in a number of different ways, e.g. via a PLC, using the simulation box, or simulation software.

Training content

– Networking multiple stations, controllers, and I/O units with an MES-centered software environment via network-based protocols (OPC-UA, IO Link, PROFINET, TCP-IP, Node-RED)

– Programming industrial touch panels and familiarity with modern human/machine interfaces such as augmented reality and web interfaces

– Familiarity with RFID and network technology, and intelligent IO Link-based sensors

– Learning about new business models using IIoT retrofitting by means of a webcam and microcomputer as well as learning the use of machine learning algorithms

– Production of customized products using production orders developed through an online store

– Vacuum and parallel gripper technology as well as retrofitting production plants

– Basic principles of mobile robotics in the production environment (MPS 403-1 R)

Information for commissioning and troubleshooting the MPS 400 is available here:

Recommended learning material

Complete overview ➔ Page 274

For example:

eLearning courses

– Introduction to Industry 4.0

eTheory courses

– Introduction to Robotics
– From Maintenance to Smart Maintenance

eLab courses

– From Object Identification to Product Memory with RFID
– Plant Visualization with HMI
– Smart Sensors for Smart Systems
– Industrial Communication with PROFINET
– Industrial Communication with OPC UA
– Plant Control and Commissioning with MES



– Energy Efficiency in Production



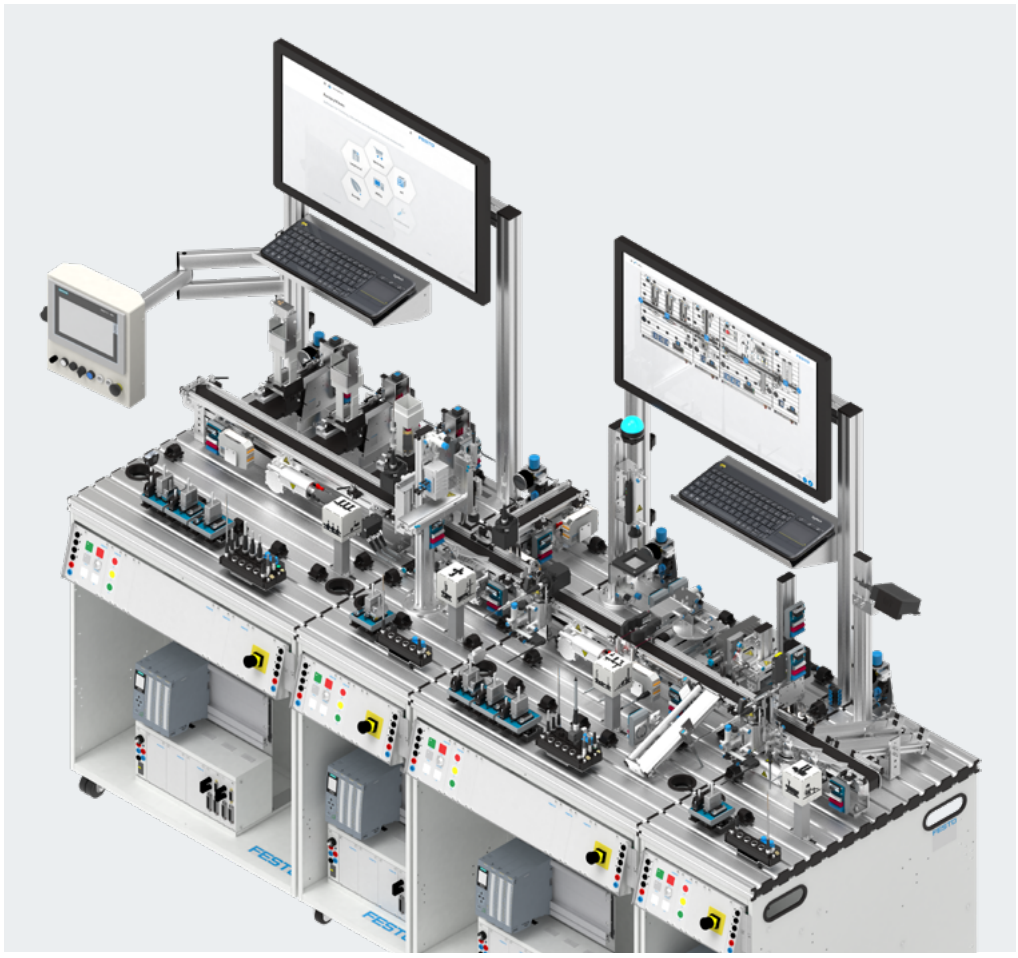
– IT Security for Production Systems
– Autonomous Mobile Robotics with Robotino 4
– CIROS – Basics of 3D Simulation

Evaluations

– Basics of PROFINET
– Basics of OPC UA
– Basics of MES
– Basisc of Energy Efficiency

MPS 404-1/MPS 404-1 R

The Complete Production in Learning Format



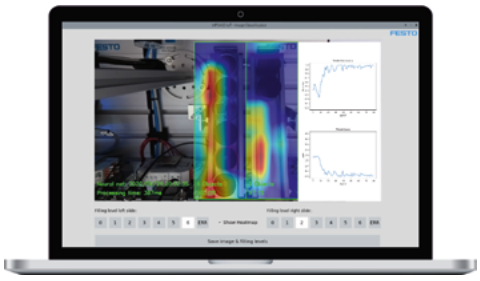
Brief description
The MPS 404-1 learning factory consists of the MPS 400 system modules Distributing Pro, Joining, Measuring Pro and Sorting Inline. The system modules are networked with the MES, equipped with RFID writing/reading devices and intelligent IO Link-based sensors, and form an autonomous system.

MPS 404-1 R contains a Robotino in addition to the system modules mentioned, and therefore expands the learning topics to include the field of mobile robotics and related topics in production.

Process
Processing in the learning system begins when a production order is entered by means of an intuitively designed MES user interface. The first station separates workpieces out of three fill level-monitored stacking magazines and then writes data onto the corresponding RFID tags. The downstream Joining station reads the RFID tag and, depending on the production order, joins a top part to the workpiece. In the process, it can either add a simple cover or, after the appropriate conversion, an intelligent microcontroller to the basic body of the workpiece.

The Measuring Pro station uses a tactile method to measure the height or fill level of a workpiece, as well as its weight. The Rotary/lifting module moves the workpiece between the Measuring modules and the belt. Depending on the results of the measurement, the workpieces are then passed to a station downstream or discharged from the process on a separate slide. The Sorting station distributes the workpieces into two slides or passes them on to additional stations downstream, according to the order and quality control.

The learning factory can be divided into several parts, with Robotino then transporting workpieces as a mobile robot between one production cell and the next (MPS 404-1 R).





Machine learning
As a subfield of artificial intelligence with a wide range of possible applications in production, machine learning is increasingly becoming a part of industrial practice.

The course material focuses on the practical application of these kinds of algorithms without the need to introduce complex theory.

IIoT retrofitting
An IIoT system based on a microcomputer and a webcam offers the students new perspectives for innovative business models by retrofitting existing industrial systems. Cutting-edge technologies and algorithms from the field of machine learning are used in the process.

MPS 404-1	**8150260**
MPS 404-1 R, 230 V	**8160313**
MPS 404-1 R, 110 V	**8160312**

Essential components:

MPS 400 Distributing Pro System building block	8129394
MPS 400 MPS 400 Joining System building block	8129125
MPS 400 Measuring Pro System building block	8137077
MPS 400 Sorting Inline System building block	8129438
MPS 400 Robotino System building block (MPS 403-1 R), 230 V*	8159801
MPS 400 Robotino System building block (MPS 402-1 R), 110 V*	8159799

* Only included with the MPS 404-1 R

Recommended accessories:

- 1x Networks and IT Security, Equipment set TP 1333 ➔ Page 134
- 1x Machine Safety, Equipment set TP 1321 ➔ Page 216
- 1x Machine Safety mounting kit for MPS, Equipment set TP 1321 ➔ Page 217
- 1x Energy efficiency package for MPS 403 ➔ Page 141

IO Link and OPC-UA
The students learn all about intelligent IO Link-based laser, ultrasound and capacitive sensors, get to know their advantages when compared with conventional sensors, and are then able to address, interpret, and service them and integrate them into production systems. The basic principles of PROFINET and OPC-UA are also taught in addition to IO Link. This gives the students a solid introduction into the most important network-based protocols in automation environments.

Touch panel
The training system teaches how to program touch panels with a structured display of all relevant information. This involves not only the visual preparation of live data from the system, but also ways of controlling and interacting with the system.

Industrial measuring technology
A measuring unit with a tactile measuring tip, which measures the height of workpieces with different geometries, gives the students access to industrial measuring technology in the production sequence. A strain gauge with a corresponding measurement amplifier broadens and consolidates knowledge of industrial measuring technology and provides a foundation for subsequent learning such as with statistical process control.

Training content
- Networking multiple stations, controllers, and I/O units with an MES-centered software environment via network-based protocols (OPC-UA, IO Link, PROFINET, TCP-IP, Node-RED)
- Programming industrial touch panels and familiarity with modern human/machine interfaces such as augmented reality and web interfaces
- Familiarity with RFID and network technology, and intelligent IO Link-based sensors
- Learning about new business models using IIoT retrofitting by means of a webcam and microcomputer as well as learning the use of machine learning algorithms
- Production of customized products using production orders developed through an online store
- Vacuum and parallel gripper technology as well as retrofitting production plants
- Capturing source data for statistical process control (SPC)
- Tactile height measurement and weighing technology with strain gauges and measurement amplifiers
- Basic principles of mobile robotics in the production environment (MPS 404-1 R)

Technical data
- Dimensions (W x D x H): approx. 2100 x 700 x approx. 1705 mm (variable height)

Recommended learning material

Complete overview ➔ Page 274

For example:

eLearning courses
- Introduction to Industry 4.0

eTheory courses
- Introduction to Robotics
- From Maintenance to Smart Maintenance

eLab courses
- From Object Identification to Product Memory with RFID
- Plant Visualization with HMI
- Smart Sensors for Smart Systems
- PLC Programming for Smart Systems
- Industrial Communication with PROFINET



- Plant Control and Commissioning with MES
- Energy Efficiency in Production
- IT Security for Production Systems



- Mobile and Autonomous Robotics with Robotino 4

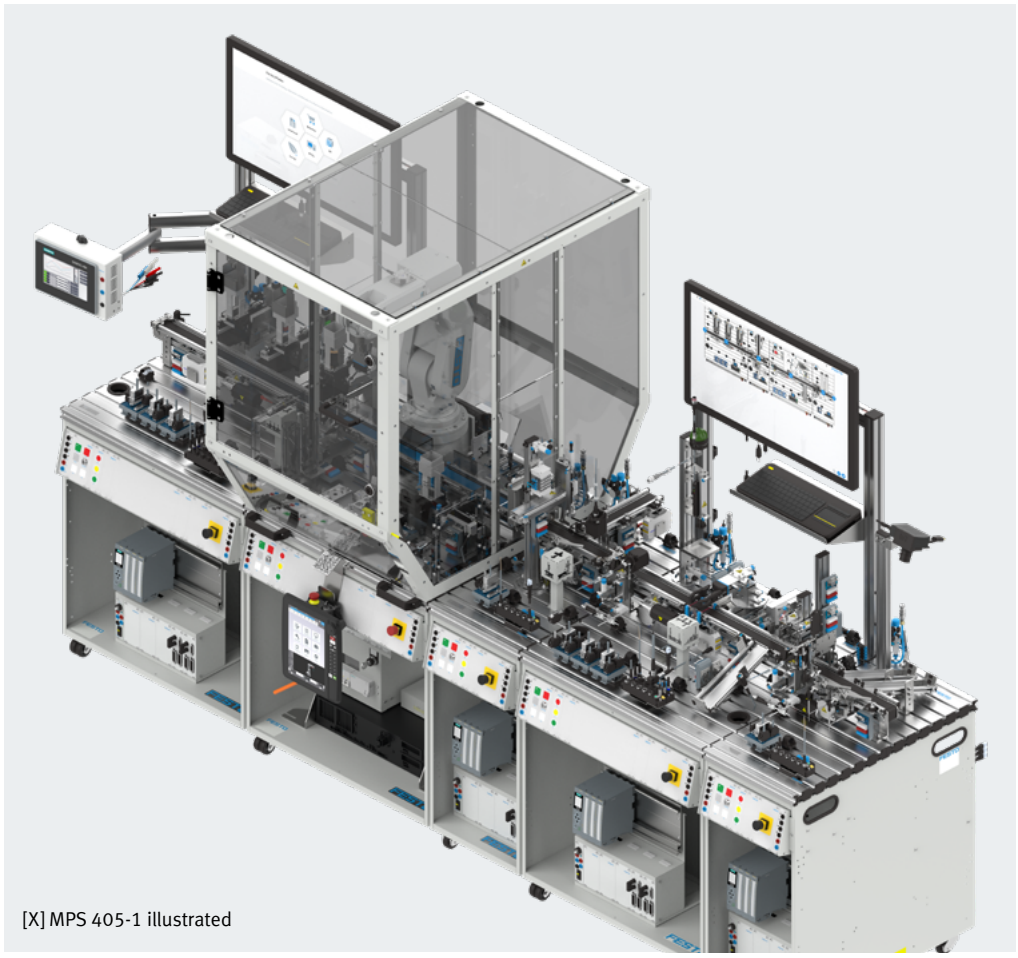
Evaluations
- Basics of PROFINET
- Basics of OPC UA
- Basics of MES
- Basisc of Energy Efficiency

User Guides
- Quick Start – MES
- Commissioning Energy Efficiency Package
- Integration of Vacuum Generator

MPS 405-1/MPS 405-1 R

Comprehensive Learning Factories with Industrial Robotics

New



[X] MPS 405-1 illustrated

Brief description
The MPS 405-1 learning factory consists of the MPS 400 system modules Distributor Pro, Robot, Joining, Measurement Pro and Sorting Inline. It is networked with an MES, equipped with RFID, HMI, IoT and IO-Link sensors, forming a self-sufficient system.

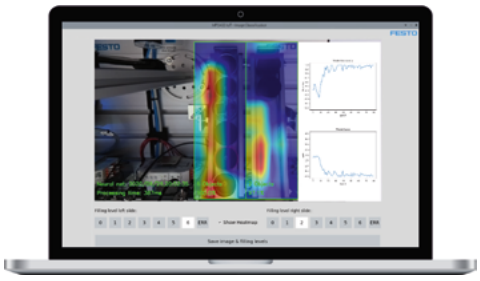
The MPS 405-1 R contains a Robotino in addition to the system modules mentioned, and therefore expands the learning topics to include the field of mobile robotics and related topics in production.

Process
Processing begins when a production order is entered through the intuitive MES interface. The first station separates workpieces from three stacking magazines with fill-level monitoring and writes the corresponding information to their RFID tags.

Next, the robot station selects – based on the order – one of three workpiece inserts and places up to two different inserts into the workpiece body. An optional top part can also be added. The joining station then reads the RFID tag and, according to the order, applies the required top part. It can either place a simple cover or, with the appropriate setup, mount an intelligent microcontroller onto the workpiece body.

The Measure Pro station captures key quality parameters: height or fill level and weight, using tactile measurement technology. A rotary stroke unit transfers the workpiece between the measuring modules and the conveyor. Depending on the results, workpieces can be discharged onto a separate chute. The sorting station distributes workpieces to two chutes according to order and quality criteria, or passes them on to additional downstream stations.

The training factory can also operate in modular sections. In this configuration, Robotino – a mobile robot – transports workpieces between production islands (MPS 405-1 R).





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MPS 405-1, 230 V	**8201028**
MPS 405-1 R, 230 V	**8206627**

Main components at a glance:

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MPS 400 MPS 400 Joining Station	8129125
MPS 400 Measuring Pro Station	8137077
MPS 400 Sorting Inline Station	8129438
MPS 400 Robot Station	8198501
MPS 400 Robotino Station (MPS 403-1 R), 230 V *	8159801

* Only included with the MPS 405-1 R

Recommended accessories:

1x IoT Gateway → Page 139
1x Networks and IT Security TP 1333 → Page 134
1x Machine Safety TP 1321 → Page 216
1x Machine Safety mounting kit for MPS TP 1321 → Page 217
1x Energy efficiency package for MPS 403 → Page 141

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Recommended learning material

Complete overview → Page 274

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– Smart Sensors for Smart Systems
– PLC Programming for Smart Systems
– Industrial Communication with PROFINET



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– Basisc of Energy Efficiency

User Guides
– Quick Start – MES
– Commissioning Energy Efficiency Package
– Integration of Vacuum Generator

Recommended Accessories



Simulation box, digital
The simulation box is used to display the input and output signals of a station or PLC.

Order no.	**170643**



Simulation box, digital/analog
In addition to digital signals, the simulation box, digital/analog also enables the simulation and display of analog signals (0 – 10 V).

Order no.	**526863**



Error simulation box
The error simulation box allows deliberate errors to be generated in the processes of stations or module applications. For example for training purposes, individual input or output signals can be interrupted or switched to continuous signal. This is used to locate and correct typical process errors in a hands-on training.

Order no.	**8074292**



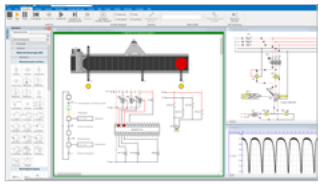
Lockout/tagout module
The module offers the option of a central shut-down device for voltage and compressed air supply of a station or of an entire system.
The main switch and on/off valve can each be secured with a padlock.

Order no.	**8064829**



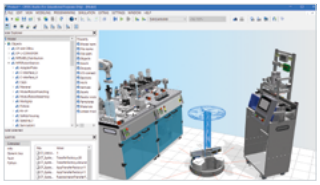
EasyPort USB
A USB interface connects the device to the PC. Connection to the automation technology is established via standard SysLink push-in connectors. Input and output signals can then be read into and out of the PC.

Order no.	**548687**



FluidSim
For more than 20 years, FluidSIM has been the world's leading circuit diagram design and simulation program for pneumatics, hydraulics and electrical engineering.

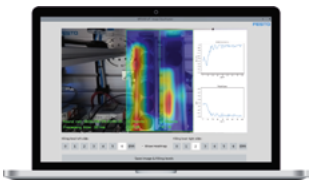
FluidSIM → Page 122



CIROS – the universal 3D Simulation system Made in Germany
CIROS is an industrially tested, extremely powerful platform for creating and using 3D Simulation models for automation technology.

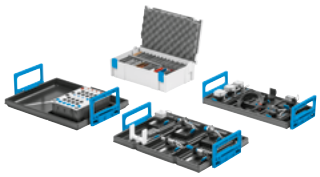
Extended by didactic mechanisms and materials, CIROS can be used in a variety of ways in the learning environment. Whether prefabricated models, industrial interfaces to robots and controllers or research approaches via Python.

Order no.	**8140772**



MPS IIoT kit Machine Learning
The package deals with machine learning based on neural networks ("deep learning"), one of the most prominent sub-disciplines of artificial intelligence. The hardware includes a single-board computer equipped with an HD camera to capture images that are then analyzed by a neural network.

IIoT kit	**8158958**
Classroom set (8 devices)	**8158957**



Sensors for object detection
Equipment set TP 1311
TP 1311 deals with sensors for object detection The focus is in particular on the design, function, range of applications and selection of sensors based on the requirements of the application. The equipment set contains sensors with analog and binary output signal, with the emphasis on binary output signals.

Order no.	**566918**



Smart sensors
Equipment set TP 1312
The TP 1312 equipment set combines industrial components and project-oriented learning to build profound knowledge in smart sensor technology for the Industrial Internet of Things. All smart sensors are equipped with IO Link.

Order no.	**566908**



Networks and IT Security
Equipment set TP 1333
Equipment set TP 1333 contains components for the setup of example networks that serve to communicate all important fundamentals of IT security. The equipment is configured for two workstations. The two EduTrainers with Siemens router and switch form the core of equipment set TP 1333 → Page 134.



Energy efficiency package for MPS 403
The package completes the MPS 403 with energy consumption metering, energy efficiency accessories and the matching Energy App for FactoryViews. Together with the eLab course “Energy Efficiency in Production”, you supplement the topic of energy in a holistic way.

Order no.	**8154889**



Tool set
The tool set contains basic tools for practical work on mechatronic systems such as MPS stations and modules.

Order no.	**539767**



Pipe and tubing cutter
For pneumatic tubing made of plastic and Perbunan with and without textile insert up to 20 mm outside diameter. Right-angled, burr-free cut due to positive support of the tubing in the cutter. It also has an integrated retaining clip to prevent unintentional opening. Delivery includes two replacement blades.

Order no.	**7658**



Compressor
Oil-lubricated, very quiet (45 dB (A)) compressor. This makes it ideal for use in classrooms. With pressure reducer and water separator.
– Pressure: 800 kPa (8 bar) P_{max}
– Suction capacity: 50 l/min
– Tank volume: 24 l
– Compressed air outlet: ¼“ or KD4
– Noise level: 45 dB (A)/1 m
– Duty cycle: max. 50%
– Pressure regulator with gauge

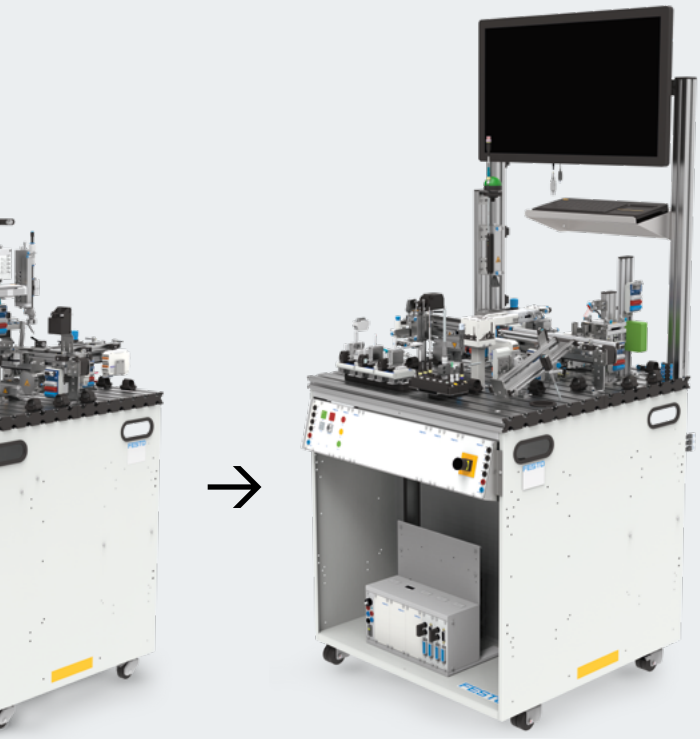
230 V	**91030**
100 V – 120 V	**565440**

Compressor accessories
(not illustrated)
Comprising:
– Coupling sockets (KD3-CK-4 and KD4-1/4-A)
– Quick coupling plug (KS4-CK-4)
– Tubing (6 x 1 silver 2.5 m)

Order no.	**102725**

Learning Factory Building Blocks

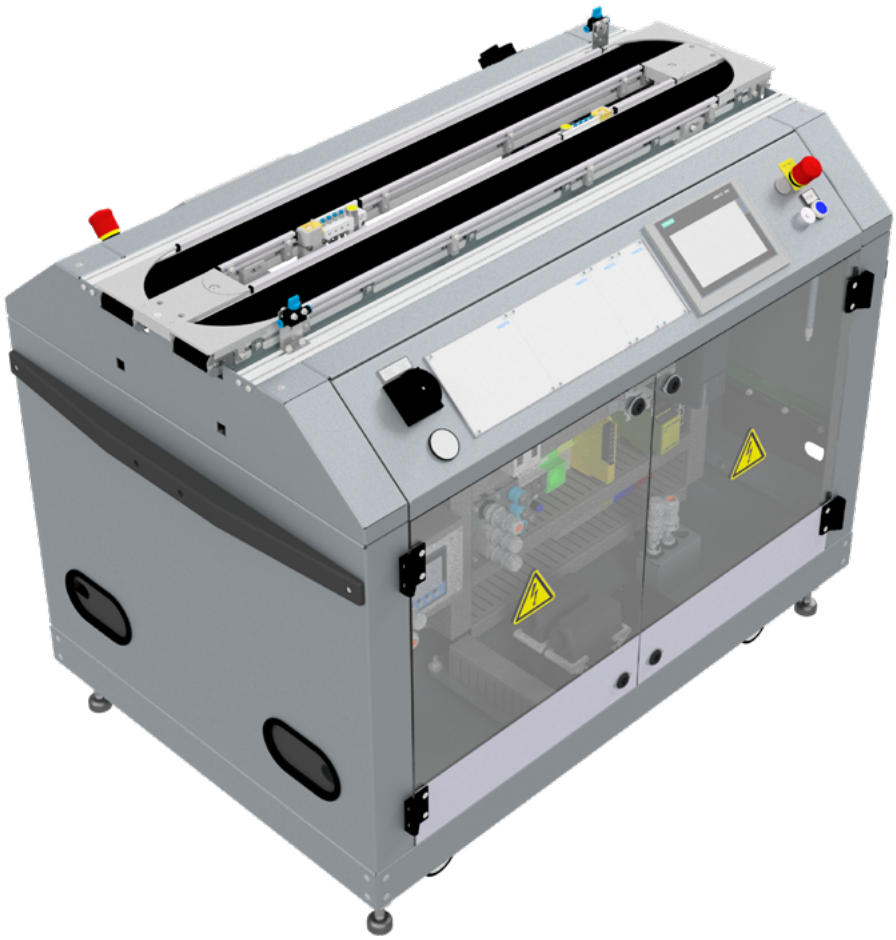




Learning Factory Pallet Circulation – Building Blocks
CP General Features 44
CP Basic Modules 46
CP Application Modules 54
CP Workpiece Carrier/Workpieces 58

Learning Factory Single Workpiece flow – Building Blocks
MPS 400 General Features 60
MPS 400 Stations 64
MPS Stations 76
MPS Modules 102
MPS Trolley 106
MPS Accessories 110

CP Factory – General Features



Operator panel
The operator panel consists of an industrial touch panel (HMI), an emergency stop mushroom actuator and a reset button. Furthermore, a pressure gauge for displaying the operating pressure and an RJ45 socket are embedded in the operator panel. The network interface is connected to an Ethernet switch in the control cabinet. The student thus has easy access to the network technology of the station or the entire system. Each learning station can be switched off separately via a lockable switch in the operator panel.

Control
The PLC program connects the station with the MES of the entire plant. The touch panel can be used to select between automatic mode with MES communication and a stand-alone set-up mode without MES connection. In addition to status and error messages, the student can call up current sensor and actuator values on the touch panel and control individual actuators. Furthermore application-specific process variants can be parameterized, selected and started.

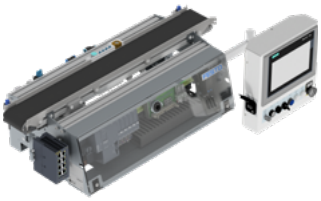
System connector
Each station is equipped with a standardized system connector that supplies the station with voltage, compressed air, emergency stop circuit and Ethernet. Subsequent stations can be easily connected via an additional system connector. This creates a linked system structure that does not require separate supplies for the individual stations. The emergency stop circuits of the respective stations are thus interconnected in the plant network.

Learning Factory Building Blocks

Configuration
All CP Factory stations are characterized by a robust, industrial design, which ensures maximum practical relevance in the learning and research environment. The CP Factory Station Straight consists of two pallet conveyors built into a carriage. In normal operation, these run in the opposite direction. In this way, a closed circulation of the workpiece carriers can be realized both in individual operation and in the plant network with the aid of passive ball returns. In the plant network, the passive ball return of the individual stations can be easily removed. The carriage is equipped with rollers and can be placed in a stable position by means of height-adjustable feet and aligned exactly to the neighboring station even if the floor is slightly uneven.

Learning stations
The station offers two separate learning stations, each with a conveyor and a stopper unit. The stopper unit consists of a pneumatic stopper and four inductive sensors for identifying BCD-coded workpiece carriers. Furthermore, an RFID read/write device is integrated into the stopper unit. This can read and write the digital product memory in the RFID tag of individual workpiece carriers. The production steps required in each case – with individual parameters if necessary – can thus be transferred for each individually identified workpiece from the MES to the PLC of the station. This teaches the student concepts such as variant diversity in production up to batch size 1.

CP Lab
The CP Lab is the tabletop version of the CP Factory. The CP Lab basic module offers the same basis for application modules and is also equipped with a stopper and four inductive sensors as well as an RFID read/write device and an S7-1500 controller. It has a full operator panel with integrated HMI. In contrast to the CP Factory, the CP Lab basic module contains only a single pallet conveyor. By combining with other CP Lab basic modules to form a carree, the closed pallet circulation is also produced in the CP Lab. CP Lab carts can be operated in a plant network with CP Factory via a deflector or Robotino.



Application modules
One application module can be operated on each learning station. Each application module location has its own control cabinet, an independent controller and an associated operator panel. The controller is mounted on a DIN mounting rail in the control cabinet. The inputs and outputs of the station are combined via fixed-position connection terminals and connected to the controller.



Essential components

Basic module with control cabinet and control
Pallet circulation belt
Control panel with HMI, emergency stop and main switch
Stopper unit with RFID and BCD

Recommended accessories

Networks and IT Security, Equipment set TP 1333 → Page 134	
Energy efficiency package	8154889
Simulation box, digital	170643
Simulation box, analog	526863
EasyPort	548687
CP-Syslink data line (only CP Lab)	8144925

Benefits
– Robust, industrial design of the learning factory for maximum practical relevance in the learning and research environment

– Simple linkage of adjacent stations via system plugs with power supply, compressed air, emergency stop circuit and Ethernet

– Modular basic stations with pallet circulation also enable non-linear system layouts with order-specific production sequence

– Complex logistics processes through connection of distributed production cells via mobile robots

– Software-supported fleet management for controlling multiple mobile robots in large plants

– Workpiece transport via clearly identifiable workpiece carriers and boxes with multiple nests possible

– Easy conversion of individual basic modules by simply changing different application modules

– Software and hardware integration of modern manufacturing processes by integrating industrial CNC machines and manual workstations with worker guidance

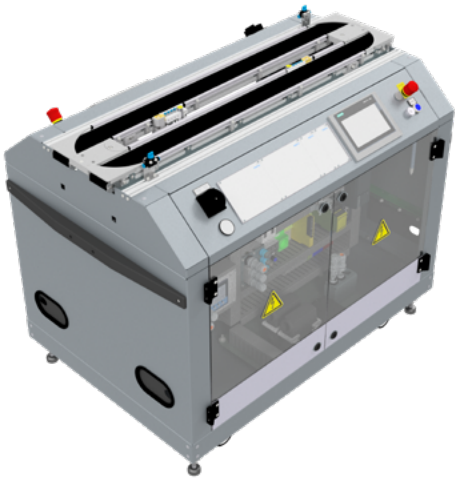
– Easy learning entry via tabletop basic module (CP Lab)

– Didactically prepared MES (Manufacturing Execution System) is excellently suited for the generation and acquisition of many different, machine-related (sensor) data in the production environment, also ideal for evaluation through data mining/big data applications

– The learning process is supported by modern media such as QR codes and AR-based provision of information

– Training material
Customized training documentation as eLab course and PDF files ensures an optimum learning experience. The specific learning path remains flexible and expandable through the modular approach. This makes it possible to divide up wide-ranging and complex topics into small learning units that are easy for students to understand.

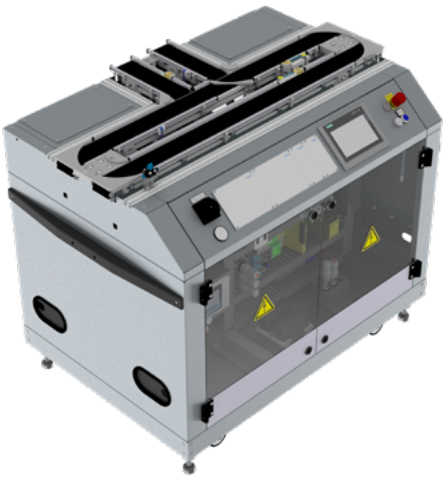
CP Factory Basic Modules



CP Factory Station Straight
The straight basic module has two independent controllers and therefore offers two opposite, independent learning stations. One application module can be mounted on each learning station. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs) to the next operating position.

The workpiece carriers are equipped with RFID tags for storing workpiece-specific data. With a passive ball return, a small circulation can be implemented.

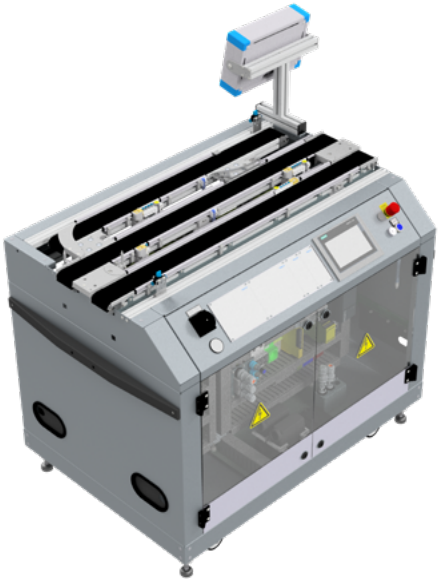
Order no.	**D12001**



CP Factory Station Deflector
The basic module deflector has a controller in the control cabinet and is used for branching off workpiece carriers and for holding an application module. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs). Two conveyors branching at right angles enable the branching of the workpiece carriers.

The workpiece carriers are equipped with RFID tags for storing workpiece-specific data. With a passive ball return, a small circulation can be implemented. The basic module deflector can be used as a docking module for the mobile robot.

Order no.	**D12004**



CP Factory Station Bypass
The basic module bypass is used to accommodate up to two application modules and thus provides two opposite, independent learning stations. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs). Workpiece carriers can be discharged via an additional bypass conveyor and transported to the next working position.

The workpiece carriers are equipped with RFID tags for storing workpiece-specific data. With a passive ball return, a small.

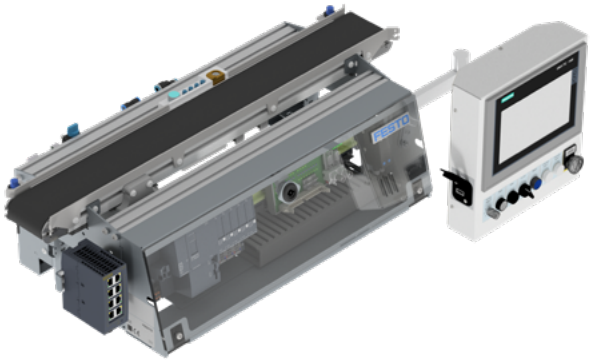
Order no.	**D14008**

CP Lab Basic Modules

CP Lab basic module
The belt is the main component of CP Lab and is used to transport the workpiece carriers (WT) to the next working position. The workpiece carriers are detected by capacitive sensors at the start and end of the belt. The workpiece carriers are equipped with RFID tags for storing workpiece-specific data.

An RFID read/write system that communicates with the controller via an IO Link interface is responsible for exchanging data with the workpiece carrier. The CP Lab basic module is equipped with a PLC and all the necessary interfaces to be supplemented by application modules and to communicate with the MES.

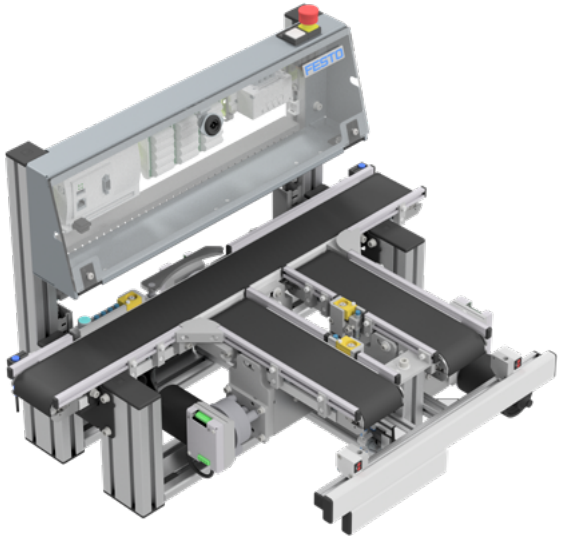
Order no.	**D12501**



CP Lab Deflector
The CP Lab Deflector is used as an additional module to the CP Lab basic module and serves to transport the workpiece carriers (WT) to the next working position. Two conveyors branching at right angles enable the branching of the workpiece carriers. The workpiece carriers are equipped with RFID tags for storing workpiece-specific data.

Based on the RFID data of the workpiece carrier, the integrated PLC controls the deflector according to the pending order. The CP Lab Deflector is the main interface for transferring workpiece carriers to the Robotino mobile robot system or the CP Factory modules.

Order no.	**D12520**

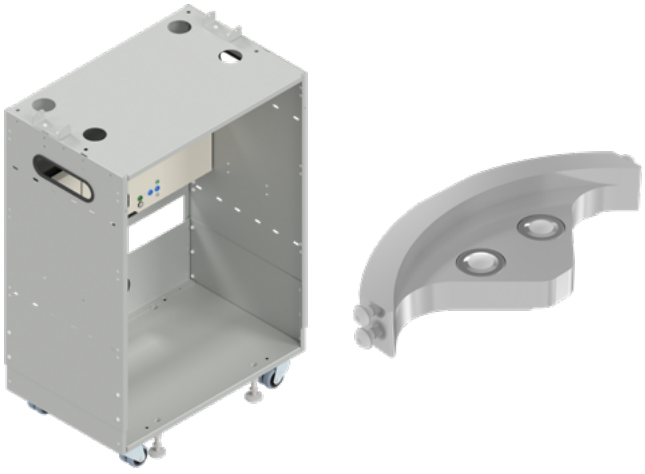


CP Lab Carriage and ball return
The CP Lab Carriage turns a CP Lab basic module or a CP Lab Deflector into a compact and mobile unit. The CP Lab basic module or a CP Lab Deflector can be easily mounted on the carriage. The trolley is suitable for the combination of CP Lab with CP Factory.

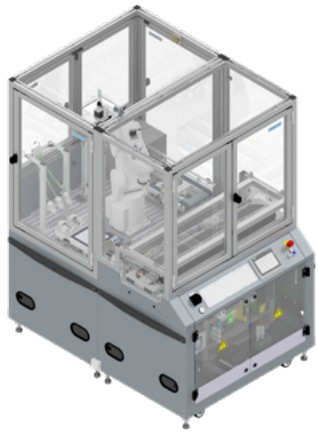
The CP Lab carriage is supplied with rollers and adjustable feet.

With the CP Lab passive ball return, CP Lab basic modules and/or CP Lab turnouts can be connected at right angles.

CP Lab Carriage	**D12720**
CP Lab passive ball return	**D12702**
E/A adapter for CP Lab	**D12726**



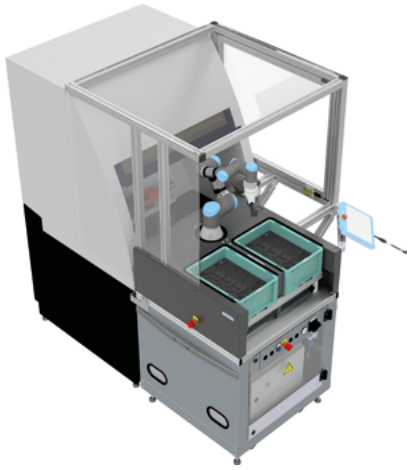
Robot and CNC Stations



CP Factory Station robot assembly
The robot assembly cell is used for the assembly of workpieces by means of a 6-axis industrial robot. The robot installs the printed circuit board into the housing and equips it with fuses. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs). A third conveyor forms a bypass for the workpiece carrier, fed to the robot as an assembly order.

The workpiece carriers are equipped with RFID tags for storing workpiece-specific data. With a passive ball return, a small circulation can be implemented. The workpieces (PCBs) are supplied manually or with a mobile robot.

Order no.	**D12006**



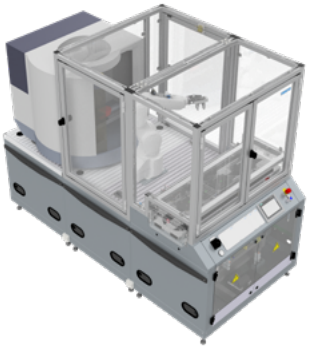
Collaborative robot station loading station with UR3e for handling and loading workpieces on a CNC machine
The learning system illustrates the linking of robotics and CNC technology and can be learned using a practical example. New communication methods such as OPC UA make it easy to link the two topics. The modular system enables learning at the individual stations and can be combined into a complete system in just a few simple steps. The cell is loaded with boxes using a mobile robot or manually. The order-related data is provided via FactoryViews MES4 V3. The robot then inserts the raw part into the CNC machine and the production process begins. The robot then picks up the finished part from the CNC machine and places it in the corresponding position. Once the order has been completed on the cell, either a Robotino or a worker can remove the box from the cell and forward it to the next work step.

Order no.	**D12018**

Robot and CNC Stations

CP Factory Station robot loading station for CNC
The robot loading cell is used in conjunction with a CNC milling machine and serves to load workpieces into the CNC milling machine via a 6-axis industrial robot. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs).

A third conveyor forms a bypass for the workpiece carrier, fed to the robot as a CNC order. The workpiece carriers are equipped with RFID tags for storing workpiece-specific data. With a passive ball return, a small circulation can be implemented.

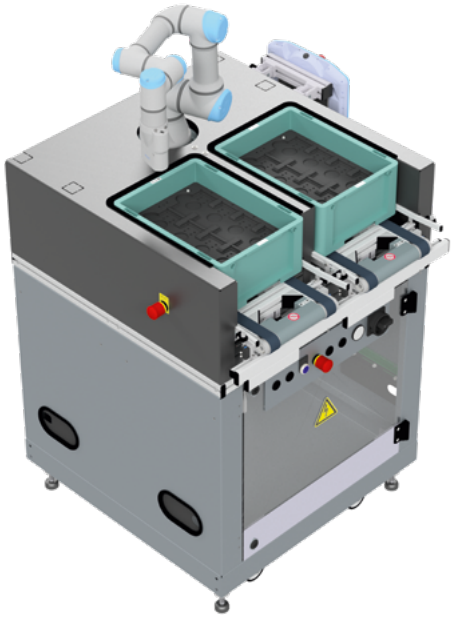


Order no.	**D12011**

CP System Cobot, collaborative robot
Collaborative robot station for handling and palletizing workpieces and for partial assembly of simple housings. The station is equipped with the collaborative robot UR3e. The application can be used as a free-standing robot training cell and also next to a CP Lab or a CP Factory Station Bypass.

In the free-standing application, up to 2 transport crates KTB 300 x 400 mm with inlays suitable for the CP workpieces can be placed manually in the working area of the robot. The robot is equipped with a specially shaped suction gripper for safe operation. In this operating mode, the station can be used for programming exercises in handling and palletizing.

If the CP System Cobot is used next to a CP Lab or next to a CP Factory Station Bypass, the following function is added: the robot can access pallets that arrive via the transport system and place or remove housing parts or printed circuit boards. Rear shells can also be placed loosely on front shells, which corresponds to an assembly step. In this operating mode, the robot communicates with the PLC of the transport system via PROFINET IO. The PLC programs required to control the robot and read out the RFID sensors via PROFINET IO are included in the scope of delivery of this station.



Station CP Robot Assistant UR3 EM, without Robotino Docking	**D12014**
Station CP Robot Assistant UR3 ED, with Robotino Docking (picture)	**D12015**

Machine Learning Worker Collaboration option package CP UR3E
With the “AI/ML Worker Collaboration” option package, the Cobot UR3e station is capable of delivering workpieces picked up by the robot to the operator’s hand with camera support and pinpoint accuracy. For example, to have workpieces handed to you to inspect or manually insert into a larger product.

In this scenario, the robot’s gripper follows the human hand until it is held still. Only then is the component transferred. The recognition of the hand and its movement as well as the necessary calculation of the corresponding path planning of the robot is carried out using means of artificial intelligence or machine learning. By means of an integrated 3D Simulation, the robot’s movements can be tracked on the monitor as the hand is followed.



Machine Learning Worker Collaboration option package CP UR3E	**D13030**

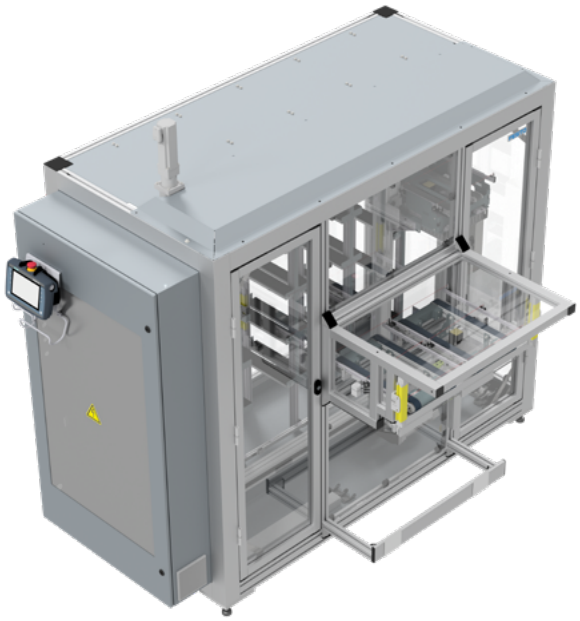
Automatic Warehouse



CP Factory Station automatic warehouse for pallets
The automatic warehouse has a Cartesian robot for putting away and retrieving pallets. Up to 32 pallets can be put away and removed. Two conveyors run simultaneously in different directions and transport workpiece carriers (WCs) to the next operating position. The workpiece carriers are equipped with RFID tags for storing workpiece-specific data.

With a passive ball return, a small circulation can be implemented. Stock administration is implemented in the higher-level MES.

Order no.	**D12002**



Automatic warehouse CP system for shipping crates
The automatic warehouse for shipping crates has a docking device, both on the receiving lane and on the output lane, for docking by the Robotino mobile robot (MR) and serves as a logistics hub for all finished parts, semi-finished products and assemblies within flexible production.

Up to 20 shipping crates can be stored in 4 rows of shelves with 5 storage spaces each. A 3-axis Cartesian robot takes over the storage and retrieval of the shipping crates. The storage and retrieval unit is controlled by a PLC.

Order no.	**D14002**

Manual Interaction

Manual workstation CP system for shipping crate content
Mobile workstation logistics with table and tablet PC.

Order no.	**D14027**



Manual storage and retrieval station CP system
The manual storage and retrieval station includes a manually loaded shelf storage system with space for up to 20 CP Factory shipping crates excluding the delivery area. The delivery area is located in the front zone of the modular racking storage system. The Robotino mobile robot delivers individual CP Factory shipping crates to or removes them from the delivery area.

For this purpose, it stops in the delivery area at a defined point without physical docking. The warehouse operator receives his/her instructions via the tablet pc, e.g. takes the CP Factory shipping crate manually from the Robotino and stores it in the warehouse at the specified compartment position (example shows manual put-away). The booking of the buffer locations in the MES4 system is carried out automatically.

Order no.	**D14028**



Mobile Robotics



Robotino CP system for workpiece carriers
The Robotino mobile robot (MR) is used to transport goods carriers. Robotino is the mobile robot platform for research and education. Equipped with a laser scanner and transport device, it functions as an autonomous guided vehicle system (AGV system) in mobile robotics.

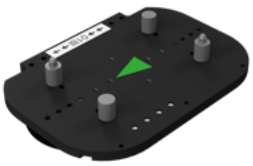
Order no.	**D14016**

Recommended accessories:

Workpiece carrier
The workpiece carrier (WC) is used for controlled and accurate transport of workpieces or pallets with workpieces. For identification, the WC has an RFID tag and a 4-bit code.

Technical Data
– Structure: polymer, glass-fiber-reinforced plastic
– Dimensions: 100 x 160 x 15 mm
– BCD code: codeable, 4 screws
– Track width: 80 mm
– Transport weight: max. 3 kg

Order no.	**D12703**



Mobile Robotics

Robotino CP system for shipping crates
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Order no.	**D14000**



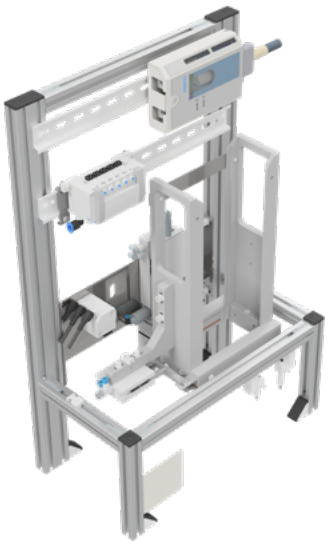
Recommended accessories:

Transport crate
Transport crate with RFID tag for CP system. The inlay is universally applicable. Front and rear shells, PCBs and a round material with D = 40 mm can be transported.

Order no.	**D14020**



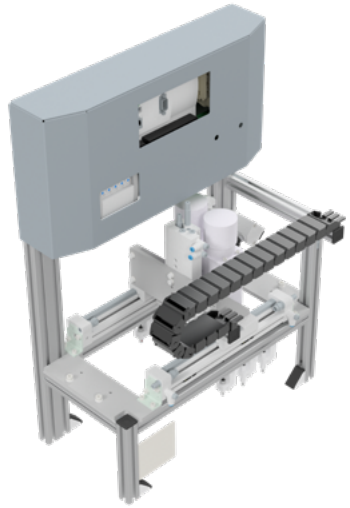
Application Modules
CP Lab and CP Factory



Magazine application module
The magazine application module can be mounted on both CP Factory basic modules and CP Lab belts. The magazine application module is suitable for magazining and separating cubic workpieces. The workpieces are stored in a magazine stack. If there is a pallet below the stacking magazine, the workpiece is separated corresponding to the order and placed onto the pallet.

All sensors and actuators are mounted on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO). The application module is completely built and tested.

Magazine application module	**D13007**

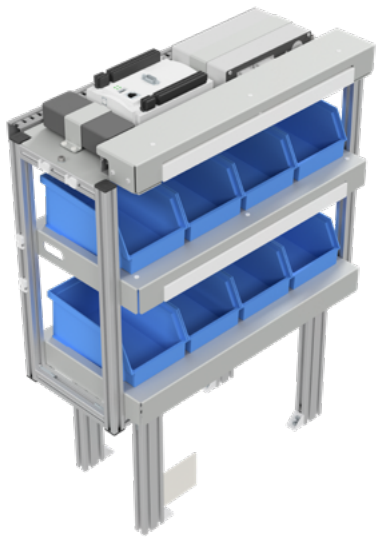


Drilling and iDrilling application module
The drilling application module can be mounted on both CP Factory basic modules and CP Lab pallet transfer systems. The drilling application module is designed for handling cube-shaped workpieces. If a workpiece is to be drilled, the dual drill head is moved to the desired position (left or right) by means of a pneumatic linear drive and the drill head is fed in the feed direction by means of a pneumatic Z-axis. This enables 2 (simulated) pairs of holes to be drilled into a workpiece.

All sensors and actuators are mounted on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO).

Only for iDrilling:
All sensors and actuators are mounted on an integrated controller with web interface and Ethernet interface. This turns the module into an intelligent module with CPS functionality.

Drilling application module	**D13001**
iDrilling application module	**D13013**



Pick-by-Light application module
The Pick-by-Light application module can be mounted on CP Factory base modules as well as CP Lab belts and is used for manual assembly of various products. The module consists of a shelf with 8 handle bowls for different mounting parts. Each bowl is equipped with a light indicator and a sensor for reaching into the bowl. As soon as a workpiece on the pallet transfer system arrives at the stopper of the Pick-by-Light workstation, the indicator light on the handle bowl from which the first assembly part is to be removed lights up.

A sensor on each handle bowl detects whether the worker has removed the correct part. If this is the case, the next handle bowl will light up. In the event of incorrect picks, an error message is displayed on the HMI, which must be acknowledged before the sequence can be processed further. When assembly is complete, the worker logs off the assembly job on the HMI, the stopper is opened, and the pallet leaves the station.

Pick-by-Light application module	**D13022**

Measuring application module
The measuring application module can be mounted on both CP Factory basic modules and CP Lab belts. Two laser distance sensors are mounted above the workpiece on an adjustable measuring tripod and can be directed to 2 measuring points for specific parts.

The sensors are placed on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO). The application module is completely built and tested.

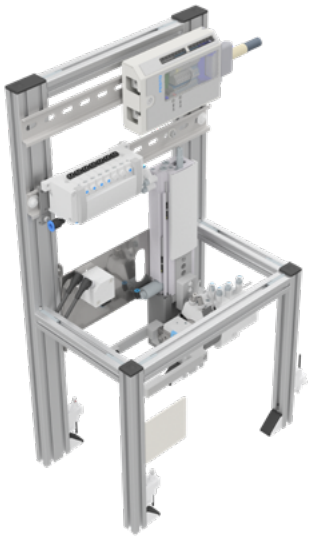
Measuring application module	**D13019**



Turning application module
The turning application module can be mounted on both CP Factory basic modules and CP Lab belts. Workpieces are turned to order by means of pneumatic handling. The turning application module is designed for handling cube-shaped workpieces. To avoid collisions when the pallets are discharged, the accumulation area behind the application module is monitored by a light barrier sensor.

Further sensors monitor the presence of the workpiece as well as all end positions of the pneumatic actuators. All sensors and actuators are mounted on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO). The application module is completely built and tested.

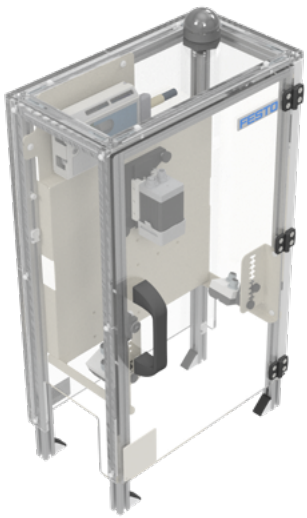
Turning application module	**D13002**



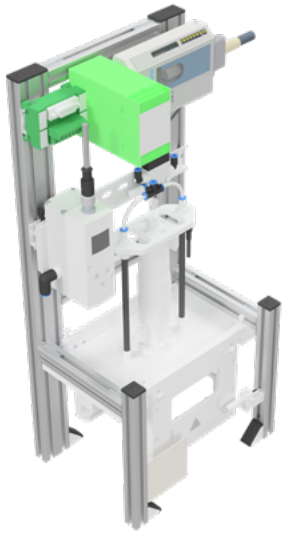
Camera inspection application module
The camera inspection application module can be mounted on both CP Factory basic modules and CP Lab pallet transfer systems. The camera can be freely positioned within the module and serves in the process as an intelligent and universal sensor with integrated control for optical quality assurance. In addition to the LED integrated in the camera, two separate area lights are available for illuminating the workpiece to be evaluated; the position of these lights is also variable and they can be switched on in different modes depending on the scenario.

In particular, the freely positionable camera position allows numerous different teaching and learning situations, whether focusing on an entire workpiece or highlighting individual sub-areas. In combination with the basic package “Machine Learning Vision”, the module serves as a real application scenario for a practically oriented introduction to machine learning (ML), with which corresponding ML techniques and paradigms are directly transferred into an industry-oriented application.

Camera inspection application module	**D13029**
Machine learning option package for camera inspection	**D13028**



Application Modules
CP Lab and CP Factory

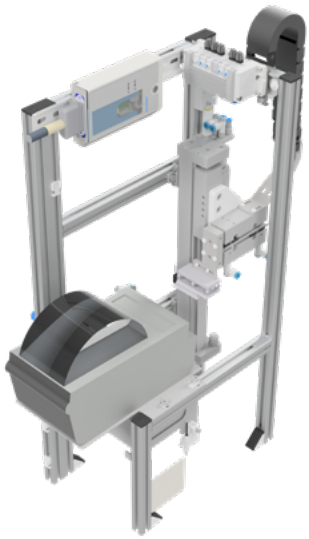


Muscle press application module
The muscle press application module can be mounted on both CP Factory basic modules and CP Lab belts. The muscle press application module is suitable for pressing cube-shaped workpieces. The pressing process is implemented via proportional pressure regulation. The force generated is precisely measured with a dynamometer. The pressing-in force is absorbed and dissipated by an additional guide and doesn't affect the conveyor belt.

All sensors and actuators are mounted on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO). The application module is completely built and tested.

Press application module
Workpiece housings (rear shells) are pressed onto the front shells by means of a pneumatic press. The application module is completely built and tested.

Muscle press application module	**D13015**
Press application module	**D13008**



Labelling application module
The Labelling application module can be mounted on both CP Factory basic modules and CP Lab basic modules. The application module automatically applies a freely printable, self-adhesive label to the offered model workpiece. The print data is loaded individually into the printer on a job-by-job basis. The label is printed immediately before application.

The scope of the Labelling application module includes the corresponding control software in the form of program modules. Program modules are also supplied to ensure that the print data can be loaded from the MES offered.

Labelling application module	**D13024**



Tunnel furnace application module
The tunnel furnace application module can be mounted on both CP Factory basic modules and CP Lab belts. It is used to control the temperature of workpieces up to a temperature of 80 °C.

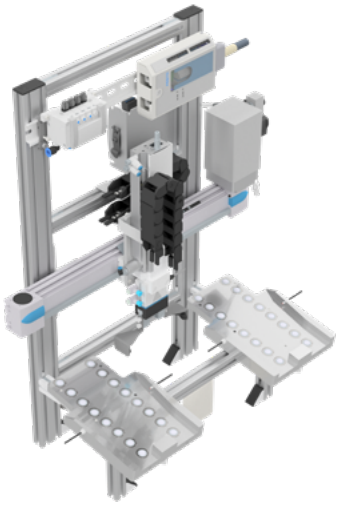
As a temperature control loop, the tunnel furnace exhibits the typical properties of a PTn line with a small time delay. The application module is completely built and tested.

Tunnel furnace application module	**D13012**

Output application module
The output application module can be mounted on both CP Factory basic modules and CP Lab belts. The application module is equipped with a two-axis handling system and is used to output cubic workpieces on two roller conveyors.

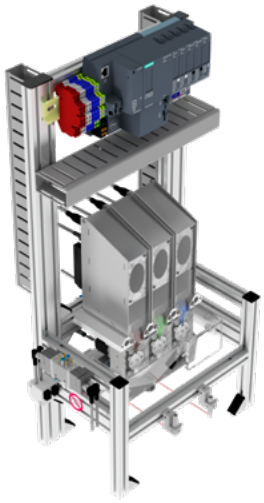
All sensors and actuators are mounted on an I/O terminal, which can optionally be exchanged for fieldbus nodes (PROFINET IO). The output application module can be used as a manual work station for goods withdrawal.

Output application module	**D13018**



Dispensing application module
The application module separates balls of three different colors and diameters and dispenses these in controlled quantities into a workpiece. The three magazines are outfitted with one pneumatic separator each. A pneumatically actuated funnel moves along the x-axis to fill the balls into one of three bins in the workpiece.

Dispensing application module	**D13025**



Application module automatic warehouse for workpieces
The automatic warehouse for workpieces can be placed on CP Factory basic modules, each above a free working position with RFID sensor and stopper. It offers 12 storage spaces on top of each other for CP Factory's housing workpieces. Front trays can be retrieved, rear trays can be placed on a front tray and finished or semi-finished modules can be put away and retrieved. The storage and retrieval unit consists of a Z-axis drive with toothed belt as well as a pneumatic linear drive and a gripper. To ensure safety, the warehouse is enclosed with transparent panels, with a front service door for loading and adjustment purposes. The positioning of the Z-axis is freely programmable by means of positioning control. To control the warehouse, the corresponding control module is loaded into a basic module of a CP Factory. The warehouse can be taught and operated via its HMI.

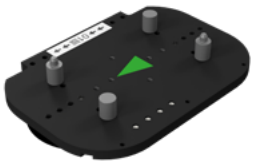
Warehouse management is carried out via a higher-level MES system (Festo MES4). This supports random access, chaotic storage and zoning.

Application module automatic warehouse for workpieces	**D13027**



Workpiece Carrier

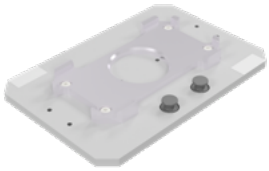
For CP Lab and CP Factory



Workpiece carrier
The workpiece carrier (WC) is used for controlled and accurate transport of workpieces or pallets with workpieces. For identification, the WC has an RFID tag and a 4-bit code.

Technical Data
– Structure: polymer, glass-fiber-reinforced plastic
– Dimensions: 100 x 160 x 15 mm
– BCD code: codeable, 4 screws
– Track width: 80 mm
– Transport weight: max. 3 kg

Order no.	**D12703**



Pallet
The pallet is used for controlled and accurate transport and storage of workpieces.

Technical Data
– Structure: aluminum
– Dimensions: 100 x 160 x 5 mm
– Workpiece nest: changeable, screw-mounted

Order no.	**D12704**



Transport crate
Transport crate with RFID tag for CP system. The inlay is universally applicable. Front and rear shells, PCBs and a round material with D = 40 mm can be transported.

Order no.	**D14020**

Workpieces

For CP Lab and CP Factory



Workpiece set
The entire workpiece set comprises the rear shell, PCB, electronic component (fuse) and front shell. It is used to represent many relevant process steps such as milling, drilling, marking, tempering, checking, turning, mounting, fitting, pressing and others.

Workpiece "front shell"
The front shell is part of the workpiece set.

Technical Data
– Material: polymer
– Dimensions: 110 x 60 x 10 mm

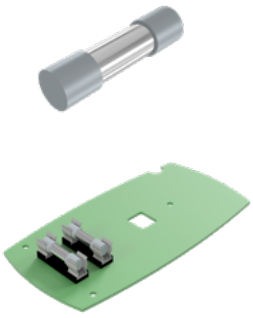
black	**D12705**
grey	**D12709**
blue	**D12711**
red	**D12713**



Workpiece "rear shell"
The rear shell is part of the workpiece set.

Technical Data
– Material: polymer
– Dimensions: 110 x 60 x 10 mm

black	**D12706**
grey	**D12710**
blue	**D12712**
red	**D12714**



Workpiece "Fuse"
A fuse set, comprising 10 fuses, is part of the workpiece set.

Technical Data
– Structure: micro fuse

Order no.	**D12708**

Workpiece "PCB"
The PCB is part of the workpiece set.

Technical Data
– Structure: PCB
– Dimensions: 100 x 55 mm

Order no.	**D12707**

MPS 400 Stations – General Features



Batch size 1
Every MPS 400 system module is equipped with an Ethernet switch and a PLC. The PLC program connects the system building block to the MES of the complete system. The PLC is connected to an RFID reading and writing device via an RFID controller. This enables the transfer of digital product memory from and to RFID tags of individual workpieces. The production steps required in each case – with individual parameters if necessary – are communicated individually for each workpiece from the MES to the PLC of the system building block. This makes it possible to learn concepts for variant diversity in production up to batch size 1.

Basic structure of station/system building block
An MPS 400 system building block consists of one station on an MPS trolley. The trolleys have an operator panel with buttons for basic control or for aligning the station. The current status of the station is indicated by a status indicator. A stop button stops all of the actuators within the system module. Some of the input and output signals as well as 24 V and GND can be accessed via 4 mm safety sockets on the left and right of the operator panel.

Digital learning support
The learning process is supported by augmented reality (AR) and QR codes. QR codes on the individual components of the learning system allows for rapid and targeted retrieval of relevant technical information.

Benefits

– The extensive modularity makes it possible to use the MPS 400 system building blocks within the context of a wide range of project work.

– An MPS 400 system building block can be used individually as well as in combination with other MPS 400 system building blocks as a system network.

– Comprehensive training documentation breaks down complex topics into small steps and learning units, allowing teaching to be designed in a structured yet flexible manner.

– The learning process is supported by modern media such as augmented reality (AR) and QR codes for provision of information as well as interaction with the learning system based on augmented reality.

Extension options

By integrating additional MPS 400 system building blocks, the learning system can be expanded into a larger system network. This allows learning content to be expanded extensively and for more complex production processes to be mapped at the same time.

Learning material

Customized training documentation as eLab course and PDF files ensures an optimum learning experience. The specific learning path remains flexible and expandable through the modular approach. This makes it possible to divide up wide-ranging and complex topics into small learning units that are easy for students to understand.

Festo Learning Experience

The digital learning portal for customized learning experiences

learning.experience@festo.com

Create your free test account!
→ https://lx.festo.com/en

Information for commissioning and troubleshooting the MPS 400 is available here:

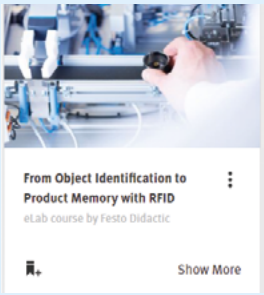
Essential components at all stations

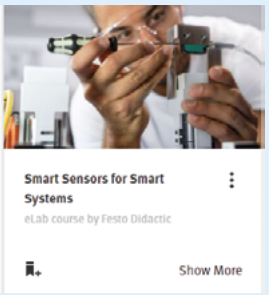
MPS trolley	
MPS operator panel with emergency stop button and status indicator	
S7-1500 Control	
Ethernet Switch	
RFID read/write device and RFID-Controller	
AR Marker for Augmented Reality Application	

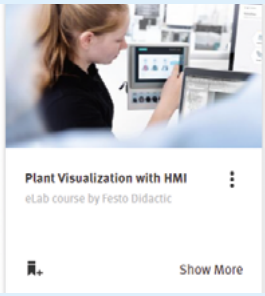
Recommended accessories for all stations

1x Simulation box, digital	170643
1x Simulation box, analog	526863
2x EasyPort	548687
1x Error simulation box	8074292
1x Lockout-tagout module	8064829







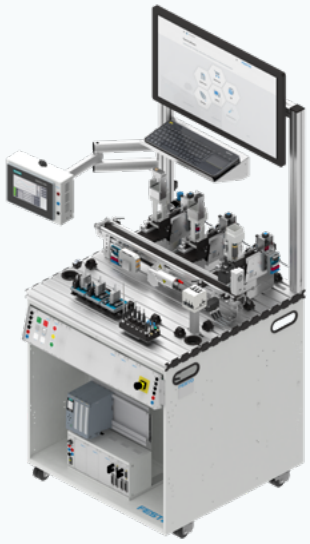


MPS 400 Stations at a Glance

Topic-Oriented Learning Modules

MPS 400 Distribution Pro

Industrial HMI and smart sensors



The MPS 400 Distribution Pro system building block pushes workpieces from three stacking magazines individually onto the conveyor belt using double-acting cylinders.

Learning topics
- Fundamentals of mechatronic sub-systems/complete systems
- Digital sensors and actuators
- Intelligent sensors with IO Link
- Object identification with RFID
- Visualisation with HMI
- Plant control with MES
- Programming and graphic representation of simple control sequences
- Data protection and security
- Commissioning and troubleshooting
- Recycling and economic aspects

MPS 400 Joining

Industrial Ethernet, vacuum and parallel gripper technology



The MPS 400 Joining system building block checks the position of the workpieces with a laser sensor and mounts various attachments if the position is correct.

Learning topics
- Fundamentals of mechatronic sub-systems/complete systems
- Optical sensors and actuators
- Machine safety and occupational health and safety
- Pneumatics and vacuum technology
- Intelligent maintenance with AR
- Condition monitoring
- Industrial communication with OPC-UA and PROFINET
- Programming and graphic representation of simple control sequences
- Commissioning and troubleshooting
- Energy efficiency and environmental protection

MPS 400 Measuring Pro

Industrial measurement technology and analogue value processing



The MPS 400 Measuring Pro system building block measures height and fill level as well as the weight of the workpieces. Defective parts are ejected on a chute.

Learning topics
- Basics of mechatronic sub-systems/total systems
- Tactile sensors
- Pneumatics and electropneumatics
- Measurement technology with strain gauges and measurement amplifiers
- Data acquisition and quality assurance
- Statistical process control (SPC)
- Production transparency and operating cost reduction

MPS 400 Sorting Inline

IIoT retrofitting and machine learning



The MPS 400 Sorting Inline system building block sorts the workpieces according to detected color and material or passes them on in the process.

Learning topics
- Basics of mechatronic sub-systems/ complete systems
- PLC programming advanced
- PLC programming in the context of I4.0 (HMI I RFID)
- Artificial intelligence (AI/ML)
- New business models through retrofitting (IoT)
- Data and information security
- Commissioning troubleshooting strategies
- Ecological and economic

MPS 400 Robotino

Flexible manufacturing through mobile robotics

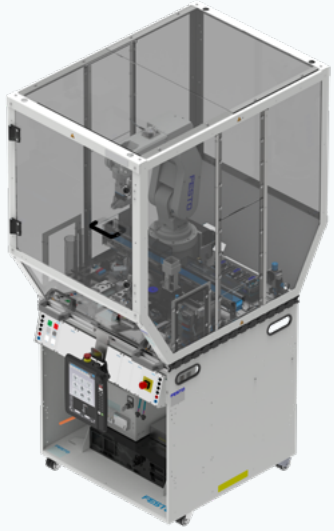


The MPS 400 Robotino system building block grips workpieces with a parallel gripper and transports them from one MPS 400 system building block to the next.

Learning topics
- Analyzing electronic systems and testing functions
- Analyzing and adapting controls
- Programming and implementing controls according to IEC 61131
- Getting to know the omnidirectional drive concept
- Integrating control and communication systems
- Mapping and autonomous navigation
- Motor control

MPS 400 Robot Assembly

Industrial robot applications for automated assembly



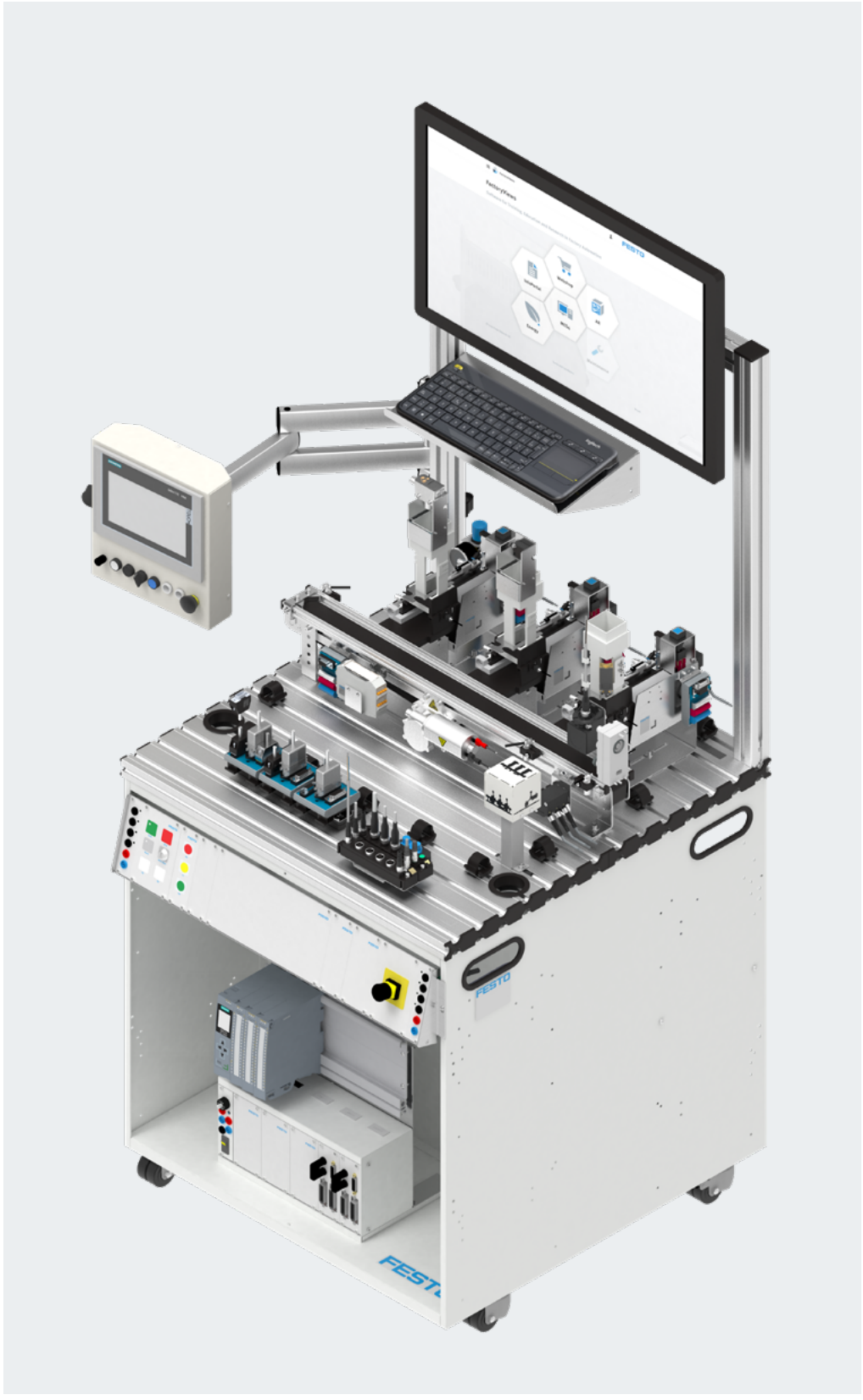
The MPS 400 Robot Assembly assembles workpieces, which are fed in via a conveyor, into a single-acting pneumatic cylinder.

Learning topics
- Fundamentals of industrial robotics
- Workpiece inspection and quality control using industrial robots
- Assembly of components using industrial robots
- Integration of industrial robots into a higher-level production process using MES software
- Workpiece identification using RFID technology

MPS 400 Distributing Pro

Industrial HMI and Smart Sensors

New



Brief description
The MPS 400 system module Distributing addresses – in addition to the basic principles of mechatronics – a number of topics such as the programming of industrial touch panels (HMI) as well as the integration and parameterization of smart sensors via IO Link. The simple design of the station with three integrated stacking magazines and a conveyor offers the opportunity to learn the basic principles of belt control and the corresponding material transport.

A computer with touch screen and a didactic MES (Manufacturing Execution System) provide the basic principles and software infrastructure for integrating additional MPS 400 system modules into a learning factory.

Process
The MPS 400 Distributing Pro system module distributes and conveys workpieces located in three stacking magazines. Each one has a double-acting cylinder that pushes the workpieces out one at a time. In stand-alone mode without an MES connection, the respective magazine is selected via a button. The Conveyor module transports the workpiece to the right or left, where sensors determine the qualities of the workpiece.

MPS 400 Distributing Pro	**8129394**

Essential components:

MPS Station Distributing Pro with 3 stacking magazines and one universal belt
Industrial touch panel (HMI) with additional controls
IO Link sensors and IO Link gateway
PC with 27 inch touch screen
Factory Views with didactic MES (Manufacturing Execution System) and webshop

Intuitive operation
Control and monitoring of the system is performed using a large touch screen and a keyboard. The core of the software environment is an educational web-based MES system, which can be expanded by adding further applications. The ergonomic design of the learning system ensures efficient and fatigue-free working and learning.

MES with online shop
– System configuration
– Product configuration
– Order entry and management
– Order tracking
– Order data storage
– Role-based information

Flexible actuator technology
The conveyor is equipped with a DC motor and a corresponding motor controller. AC motors can also be connected via a universal flange.

IO Link sensors
The monitoring of the stacking magazine fill level is performed using three different IO Link-based sensors. The students learn all about intelligent IO Link-based laser, ultrasound and capacitive sensors, recognize their advantages when compared with conventional sensors, and are then able to address, interpret, and service them and integrate them into production systems.

Touch panel
An industrial touch panel can be used to control parts of the station and to parameterize and monitor the three IO Link based sensors. The learning system teaches how to program touch panels with a structured display of all relevant information. This involves not only the visual preparation of live data from the system, but also ways of controlling and interacting with the system.

Training content
– Learning about and commissioning a mechatronic system with different modules (here: Stacking Magazine module and Conveyor module) and RFID
– Introduction to MES (Manufacturing Execution System) and online shop
– Acquisition and consolidation of PLC programming skills
– Programming and integration industrial touch panels (HMI)
– Integrating, parameterizing and operating smart IO Link-based sensors

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– Sensors for Object Sensing
– Electric Drives 1
– Actuators – DC Motor

eTheory courses
– CIROS – First steps

eLab courses
– Basics of Sensors and Actuators



– From Object Identification to Product Memory with RFID
– Basics of Plant Visualization with HMI



– Smart Sensors for Smart Systems
– CIROS – Basics of 3D Simulation

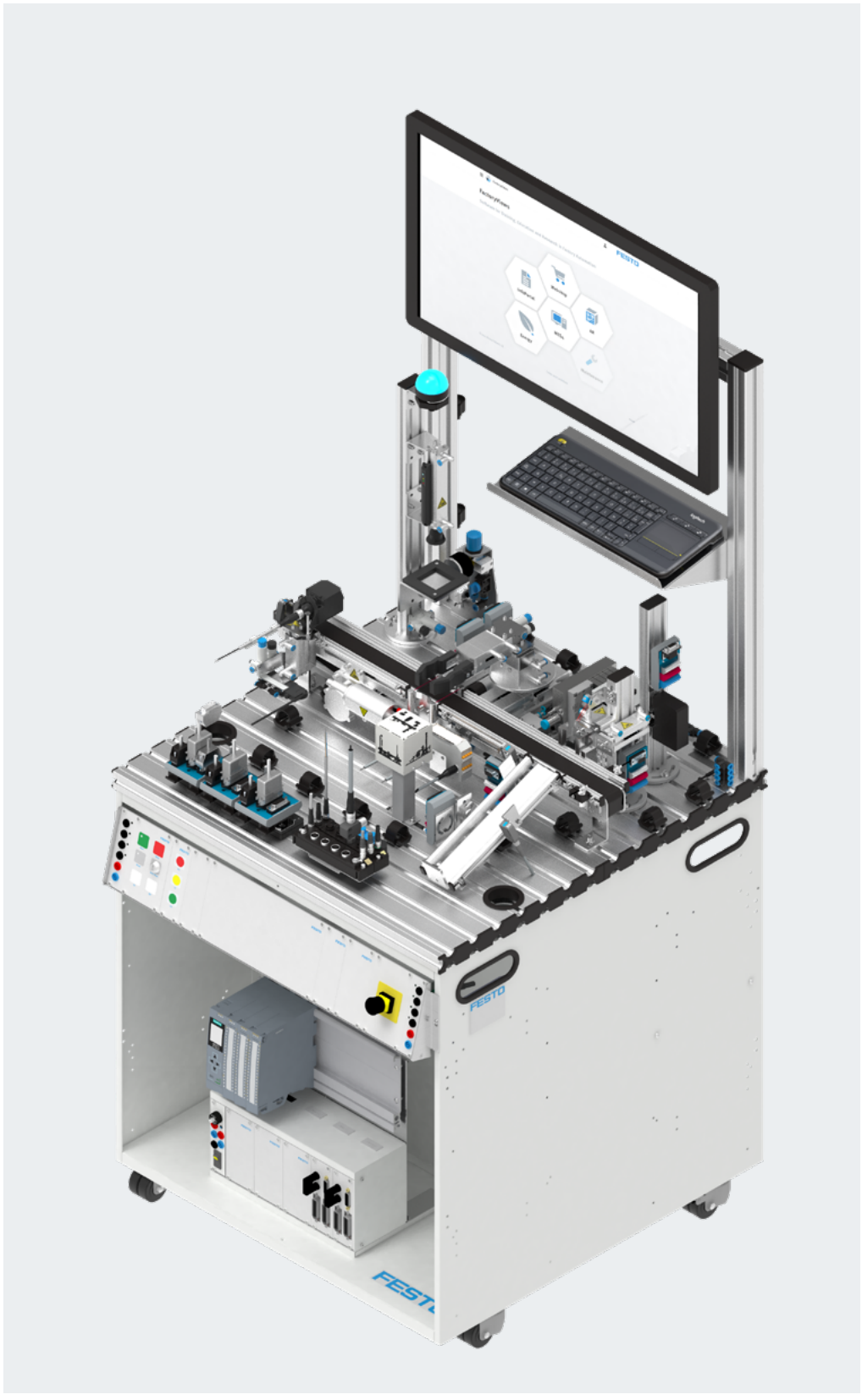
Evaluations
– Basics of Plant Visualization with HMI
– Smart Sensors – First Steps

User Guides
– Smart Sensors – First Steps
– CIROS – Installation Instructions

MPS 400 Measuring Pro

Industrial Measurement Technology and Analog Value Processing

New



Brief description
The MPS 400 system station Measuring Pro addresses, among other things, workpiece quality assurance in the automated production process. The learning system offers a versatile learning environment with a focus on measuring technology as well as complex process sequences and control patterns.

Process
The MPS 400 system station Measuring Pro measures both the height and the fill level of a workpiece as well as its weight. The Rotary/lifting module moves the workpiece between the Measuring modules and the belt. Depending on the results of the measurement, the workpieces are then discharged from the process on a separate slide or transferred to another station.

MPS 400 Measuring Pro	**8137077**

Essential components:

MPS Station Measuring Pro with Conveyor belt module and Rotary Lifting module
Weighing and tactile height measurement modules
Slide with pusher for square and round workpieces and level sensors
IO Link gateway, valve terminal and signal light

Workpiece handling
The system module receives the target values for the height of the workpiece or its fill level as well as the target value for the weight of the workpiece individually for each order via the MES. A pneumatically driven Rotary/lifting module takes the workpiece out of the process and conveys it to the two Measuring modules. The Rotary/lifting module is actuated via IO Link.

Weighing technology with strain gauges
The Weighing module measures the weight of the workpiece and compares it with the target value. A strain gauge with a corresponding measuring amplifier is used for this.

Tactile height measurement
The Height Measurement module consists of a measuring table and a measuring unit. The measuring unit works with a tactile measuring tip that is lowered onto the workpiece from above. The measuring tip is designed to detect the height of workpieces with different geometries. Likewise, the measuring tip can detect the fill level of open workpieces.

Visualization
The results of the measurement are visualized qualitatively via an IO Link controlled signal light. A computer with at least a 27 inch touch screen and a web-based user interface with attractive visualization make it easier to understand the measurement processes and results.

Rejects
A separate ejector unit can selectively eject workpieces of different geometries from the process – depending on the measurement results. In the process, the workpieces are pushed out onto a separate slide. The detection of the slide fill level is performed using sensors.

Complex process
The complex design and sequence of the station provides a challenging environment for learning advanced PLC programming skills. In the process, the topic of sensor technology is covered in greater depth using a variety of industrial sensors from the field of measuring technology. In conjunction with the control of the Rotary/lifting module and the other actuators, the system module is ideally suited for advanced project work in the field of mechatronics.

Training content
– Workpiece quality assurance using industrial measuring technology
– Capturing source data for statistical process control (SPC)
– Tactile height and fill level measurements
– Weighing technology with strain gauges and measurement amplifiers
– Electropneumatic circuitry and control of different pneumatic actuators

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0



– Sensors for Object Sensing

eTheory courses
– CIROS – First steps
– From Maintenance to Smart Maintenance



eLab courses
– CIROS – Basics of 3D Simulation

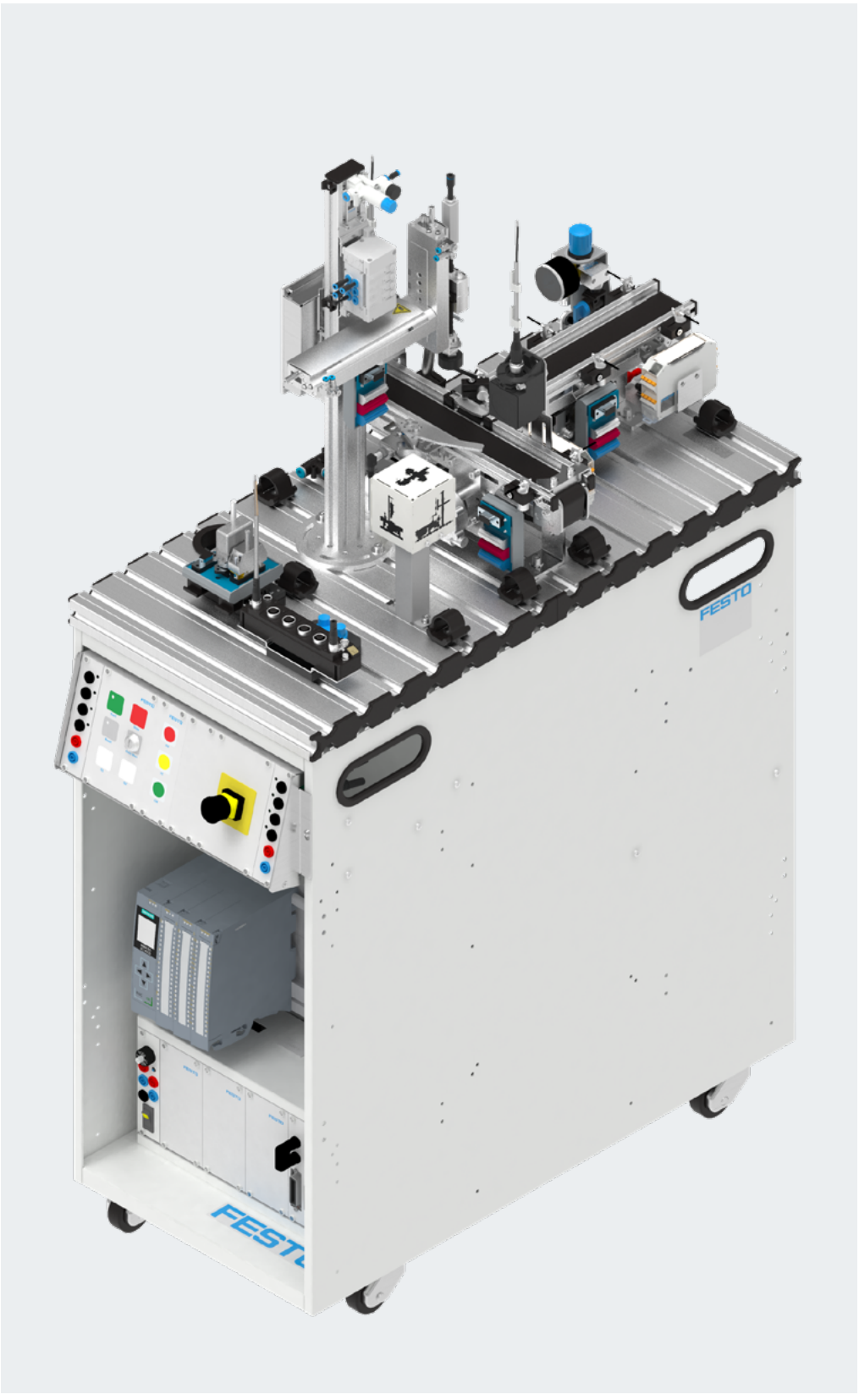
Evaluations
– From Maintenance to Smart Maintenance

User Guides
– CIROS – Installation Instructions

MPS 400 Joining

Industrial Ethernet, Vacuum and Parallel Gripper Technology

New



Brief description
The MPS 400 Joining system station covers a number of topics, including checking the orientation of workpieces using sensors, automated assembly and monitoring downstream transport.

Process
The MPS 400 Joining system station checks the orientation of the workpiece and, if it is positioned correctly, affixes a cover/top part to it. Workpieces placed on the conveyor are then transported to the depth measurement point. An analog diffuse sensor checks the position of the workpiece. In stand-alone mode without MES connection, workpieces with an orifice at the top are stopped in the assembly position by an electric stopper with a quarter turn actuator. There, the Pick&Place module mounts a cover or a top part. Afterwards, the workpiece is then transported further to the end of the belt.

Workpieces that are not positioned correctly are transported straight to the end of the belt without stopping, and the PLC can generate an error message. When connected to the MES of the complete system, the decision as to whether a top part is to be placed on the workpiece is made individually for each order.

MPS 400 Joining	**8129125**

Essential components:

MPS Station Joining with one Conveyor module and two Pick&Place modules
Parallel gripper and vacuum gripper kit for Pick&Place module
Industrial bus coupler (IO Link) with PROFINET bus header

Recommended accessories:

Machine Safety equipment set TP 1321 → Page 216
Machine Safety mounting kit for MPS → Page 217

Vacuum and parallel grippers
The Pick&Place module can be equipped with both the vacuum gripper and the parallel gripper. Different workpiece top parts are placed on the workpiece depending on the mounted gripper. The inputs and outputs of the Pick&Place module are connected to the PLC via a bus coupler.

Material flow
Light guides/through-beam sensors with opto sensors monitor the material flow on the conveyors. The Joining station can be supplemented with other stations from three different directions. The conveyors can be moved in both directions.

Training content
– Learning about and commissioning a mechatronic system with different modules (here: Pick&Place module and Conveyor module) and RFID
– Becoming familiar with optical and digital sensors as well as distance sensors and actuators
– Acquisition and consolidation of PLC programming skills
– Getting started in pneumatics, and vacuum technology in particular
– Handling and converting a Pick&Place module from vacuum gripper to parallel gripper

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– Pneumatic Fundamentals

eTheory courses
– CIROS – First steps
– From Maintenance to Smart Maintenance

eLab courses
– Basics of Pneumatics



– CIROS – Basics of 3D Simulation

Evaluations
– Basics of Pneumatics
– From Maintenance to Smart Maintenance

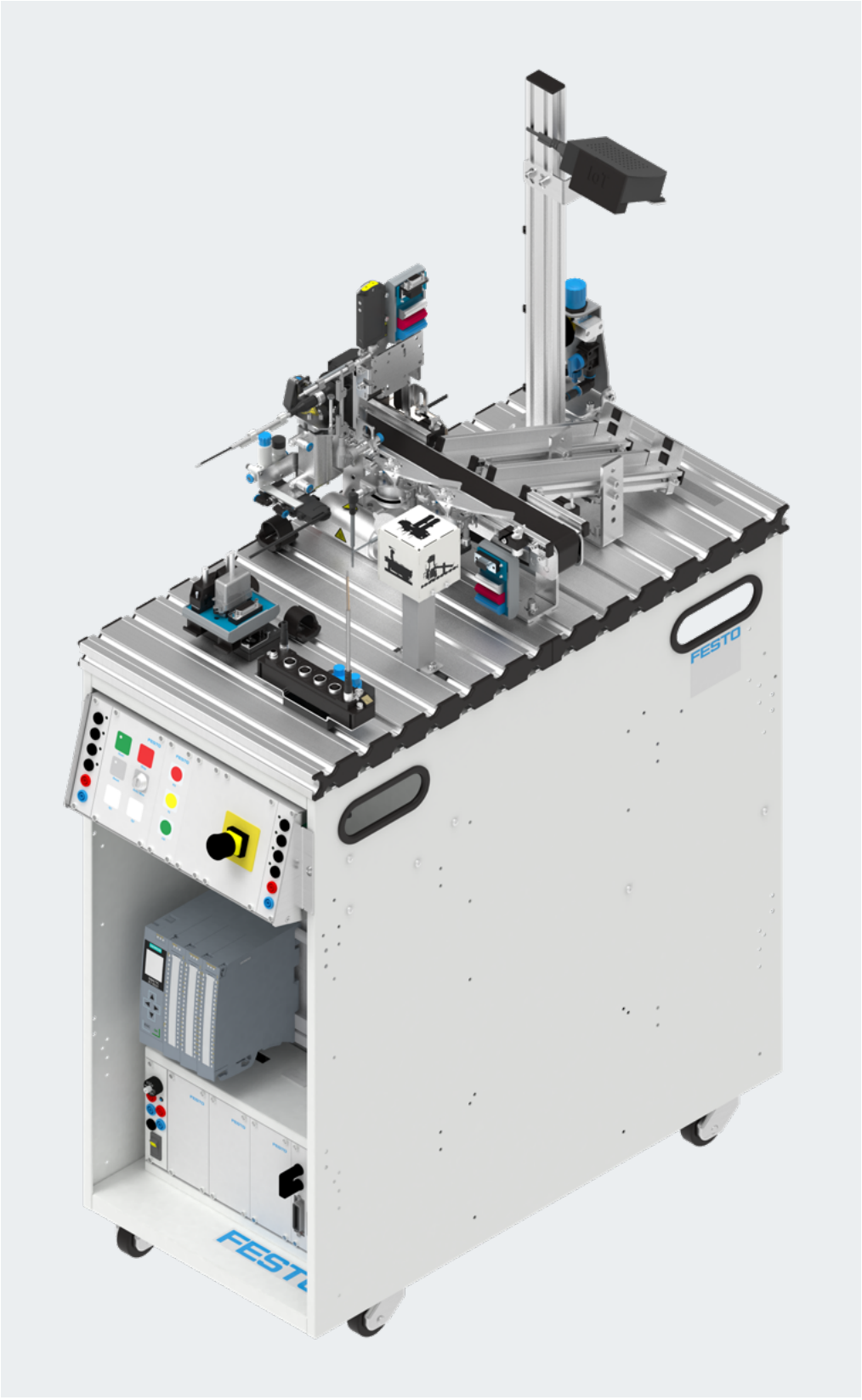


User Guides
– CIROS – Installation Instructions

MPS 400 Sorting Inline

Sensor Combinatorics and Machine Learning

New



Brief description
The MPS 400 Sorting Inline system station covers a number of topics including differentiating between different workpieces through combining a variety of sensor types. The use of algorithms from the field of machine learning in small computers equipped with a camera provides students with a simple introduction to the practical application of artificial intelligence in production. At the same time, students acquire a good understanding of the advantages and challenges of retrofitting existing systems with IIoT and the related development of potential new business models

Process
An RFID reading/writing device with height adjustment adapts to incoming workpieces and reads their product memory. Afterwards, the color and material of the workpiece are detected. By comparing the measured values with data from RFID or a connected MES, errors in the color and material of the workpiece can be detected. The workpieces are then either sorted onto one of two slides or passed on to downstream stations. Using a camera, an IIoT device monitors the two slides. A machine learning algorithm on a small computer analyzes the images of the camera and in doing so detects the number of workpieces on each slide.

MPS 400 Sorting Inline	**8129438**

Essential components:

MPS Station Sorting Inline with one Conveyor belt module and two Slide modules
Module detection with diffuse sensor, light barrier and inductive sensor
IIoT retrofitting module with camera and machine learning algorithm

Sensor combinations
Students explore the combination and evaluation of different types of sensors, in this case diffuse sensors, light barriers and inductive sensors. In this way, they recognize how the combined use of sensors can provide information that no sensor could capture individually.

Machine learning
Students gain an easy introduction to the complex field of artificial intelligence and its practical application in the production environment. The advantages and disadvantages as well as the typical steps and challenges involved in retrofitting existing production facilities (IIoT retrofitting) can also be conveyed here. The additionally obtained data within the scope of IIoT retrofitting increase the quality of the decisions made. These improvements gained through machine learning also demonstrate the opportunities for new business models.

Training content
– Detecting different workpieces through the combination of different sensor types
– IIoT retrofitting of existing industrial systems
– Practical application of artificial intelligence (AI) and machine learning (ML) in production
– AI/ML supported evaluation of camera images in an automated environment
– Development of new business models through IIoT retrofitting

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– PLC Programming

eTheory courses
– CIROS – First steps

eLab courses
– Basics of PLC Programming



– PLC Programming for Smart Systems
– CIROS – Basics of 3D Simulation

Evaluations
– Basics of PLC Programming
– PLC Programming for Smart Systems

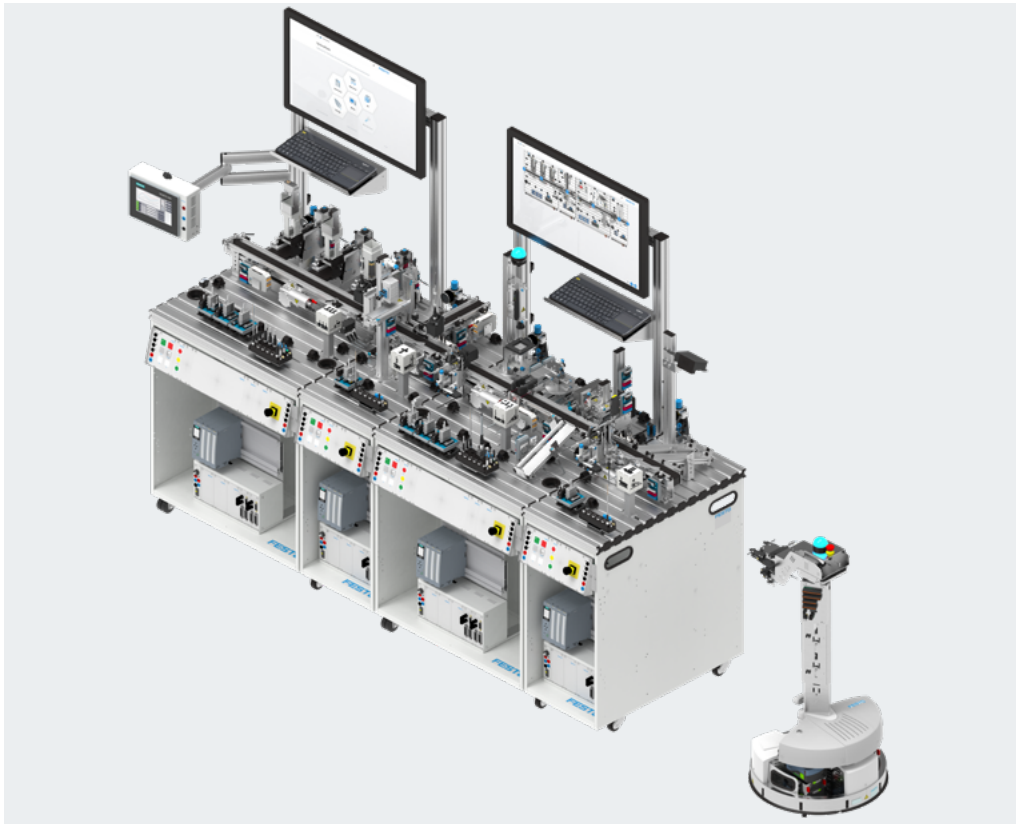


User Guides
– CIROS – Installation Instructions

MPS 400 Mobile Robotics

Flexible Material Flow Through Autonomous Mobile Robot





Mobile robots in production
Small batch sizes increase the competitiveness of production lines. At least this was the theory. Because even with individually trackable workpieces, production lines remain rigid and fail to build on the competitive advantages of flexible production.

Only flexible material flows with adaptable work schedules and flexible capacity control can leverage this potential. To enable production in production islands, it must be possible to redirect material flows flexibly without production sequences and their throughput times becoming unreliable.

To meet this challenge, a deep understanding of mobile robotics is a prerequisite.

The strengths and weaknesses of driverless transport systems (DTS) versus autonomous mobile robot systems (AMR), for example: While established DTS score in robustness and throughput, AMR are masters of dynamic route planning and can thus be used more flexibly. Whether working side by side or planning – for successful production according to the Industrial Internet of Things, it is important to internalize the modes of operation and limitations of mobile robot systems.

MPS 400 mobile robotics 120 V	**8159799**
MPS 400 mobile robotics 230 V	**8159801**

Essential components:

Robotino	8101344
Electric Gripper kit	8127981
MPS Handshake Kit for Robotino Integration	8124921

Recommended accessories for more than two production cells:

1x MPS Handshake Kit for Robotino Integration	8124921

Use in the MPS
With the mobile robotics platform Robotino, we provide you with the appropriate building blocks to flexibly expand the MPS learning fields with the topic of mobile robotics. With the electric gripper package, the transport of workpieces between the stations of the MPS 400 series can be realized on three levels:

Level 1
With our prepared sensor kit, Robotino inserts itself between two stations in a sensor-based way and transports workpieces, without the need for any further communication.

Level 2
By communicating via OPC UA, Robotino can supply several stations with workpieces, starting from the sender station.

Level 3
Fully integrated into MES4 V3, Robotino is ready for flexible transport scenarios and can move workpieces back and forth between any number of stations.

For each level, we give a suggested solution. For the vast majority of behavioral routines and procedures, however, there are alternative solutions that you can replace, modify, or reprogram accordingly in the training.

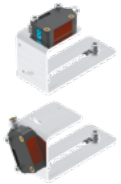
Robotino
Robotino 4 conveys topics such as mechatronics, programming, sensor technology, motor and drive technology, control technology and image processing in a simple and straightforward manner.
→ Pages 152 – 157



Electric gripper package
Accessories kit for installing and commissioning an electric gripper system. The system can be installed on the Robotino as of generation 3. It contains all the hardware components and sample programs for Robotino required for operation between current MPS stations.
→ Page 158



MPS Handshake Kit for Robotino Integration
The combination of optical transmitters and receivers at MPS stations enables 1-bit communication with the Robotino. The Handshake Kit is mounted directly under existing conveyors and replaces the usual communication between current MPS stations. The counterpart to this communication interface is included in the Robotino 4 gripper package.
→ Page 158



Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– PLC Programming

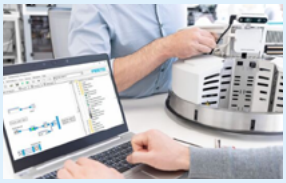
eTheory courses
– Introduction to Robotics



– CIROS – First steps



eLab courses
– Autonomous Mobile Robotics with Robotino 4



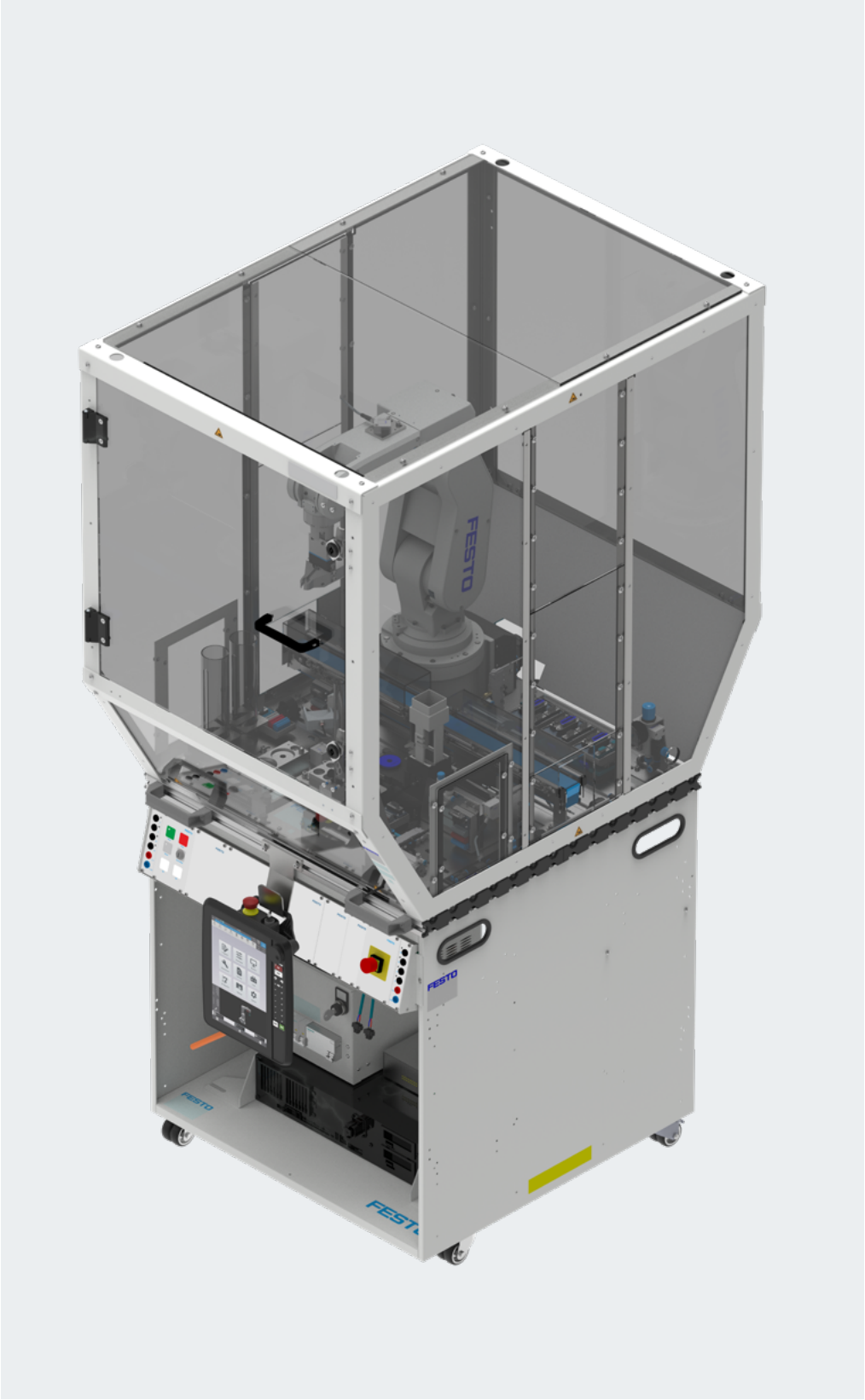
– CIROS – Basics of 3D Simulation

Evaluations
– Basics of Robotics

User Guides
– CIROS – Installation Instructions

MPS 400 Robot Assembly New

Industrial Robot Applications for Automated Assembly



Brief description
The MPS 400 Assembly Robot covers core robot application tasks, supported by integrated courseware. Learners gain practical skills in installation, commissioning, programming, operation, maintenance, troubleshooting, and system optimization.

Process
The station can assemble workpieces, which are fed in via a conveyor, into a single-acting pneumatic cylinder.

The robot picks up the bottom part from the conveyor and places it in the test device in an orientated position. If the operator cannot determine the position, the operator places the reject part in the reject magazine provided for this purpose. The color of the workpiece is then detected with the aid of a reflected light sensor and the component is placed in the assembly device.

Now the assembly of the component begins. The robot removes one piston and one spring from the magazine provided and mounts them. Finally, the cover is removed from a magazine, checked for correct positioning and mounted on the workpiece. If the position of the cover cannot be identified, the robot also places the part recognized as a reject in a magazine provided for this purpose.

Once the assembly process is complete, the fully assembled component is transferred back to the conveyor and transported to the end of the station.

MPS 400 Assembly Robot	**8198501**

Main components at a glance:

Robot Mitsubishi RV-2FRB with a pneumatic multifunctional gripper
Robot controller CR800 and Teachbox R86 TB
MPS robot handling module and MPS robot assembly module
Safety housing with safety door switch

Topic: Industrial robotics
The station and its equipment levels make processes and tasks possible which are required in industrial production for commissioning and adjustment of robot-based work cells. It includes a 6-axis articulated arm robot that combines a sturdy engineering design and construction with a large working range and a high movement speed. The station is equipped with a robot controller, a Teach Box, a safety housing, service unit and pneumatic multifunction gripper.

Training content
– Fundamentals of industrial robotics
– Workpiece inspection and quality control using industrial robots
– Assembly of components using industrial robots
– Integration of industrial robots into a higher-level production process using MES software
– Workpiece identification using RFID technology

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eLearning courses
– Introduction to Industry 4.0
– Introduction to Robotics

eTheory courses
– CIROS – First steps

eLab courses
– Introduction to Robotics with 3D Simulation



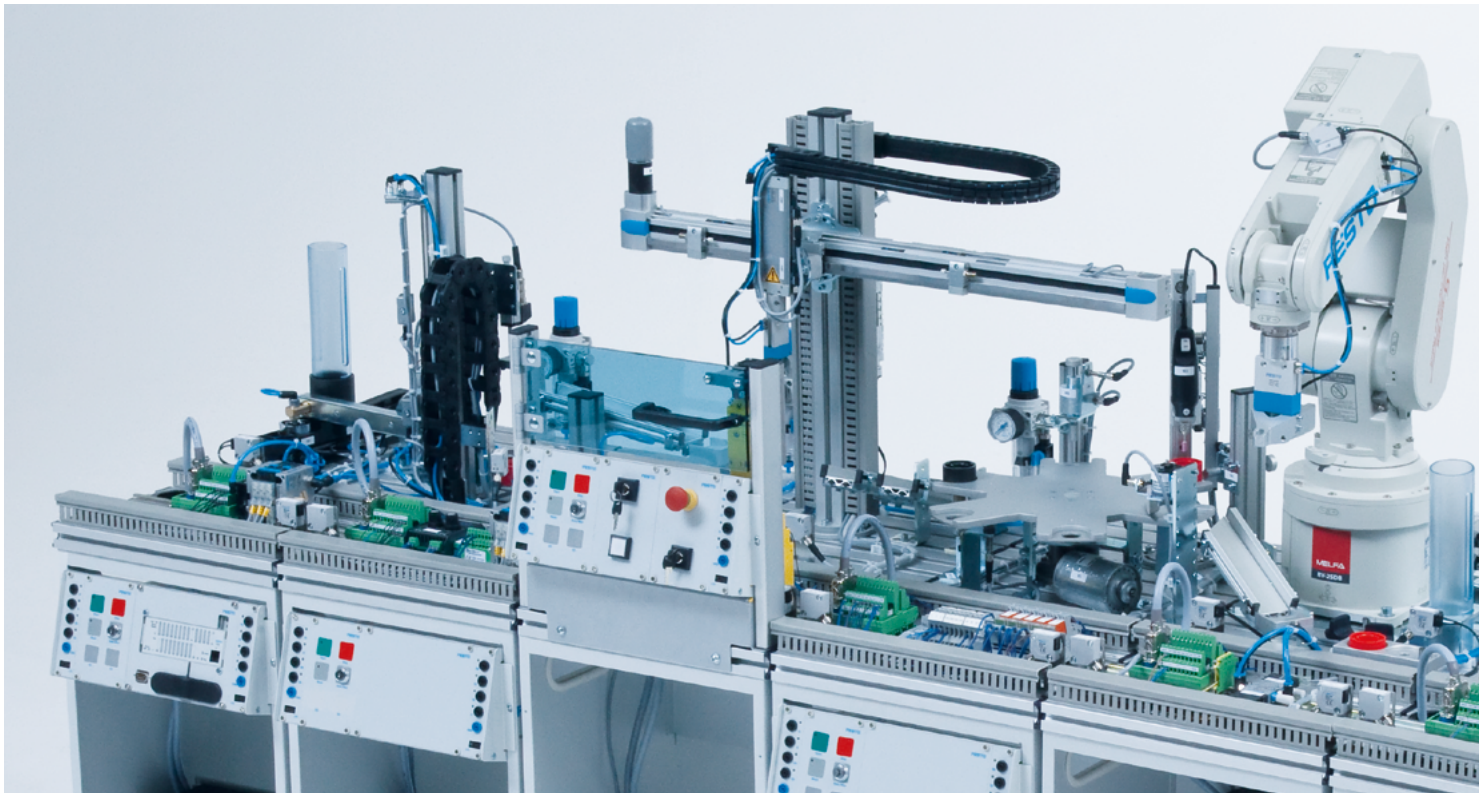
– CIROS – Basics of 3D Simulation

Evaluations
– Basics of PLC Programming
– PLC Programming for Smart Systems

User Guides
– CIROS – Installation Instructions

MPS Stations

Mechatronic Systems for World Champions

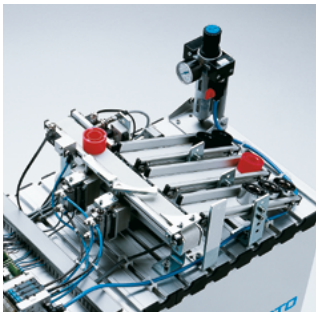


The MPS makes history

Since 1991, the stations from the modular production system MPS have been the “sporting equipment” at the mechatronics world championships. In national and international competitions, MPS has demonstrated that its concept, the stations and control systems and its functionality involved provide exactly those features that characterize automated production throughout the world: integrating mechanical systems, electrical engineering and IT to form mechatronics.

Anyone who trains using MPS can be confident that numerous companies, schools and universities all over the world are doing exactly the same. The stations in the modular production system are the origin and role model for almost all mechatronic training systems.

The MPS is the original.



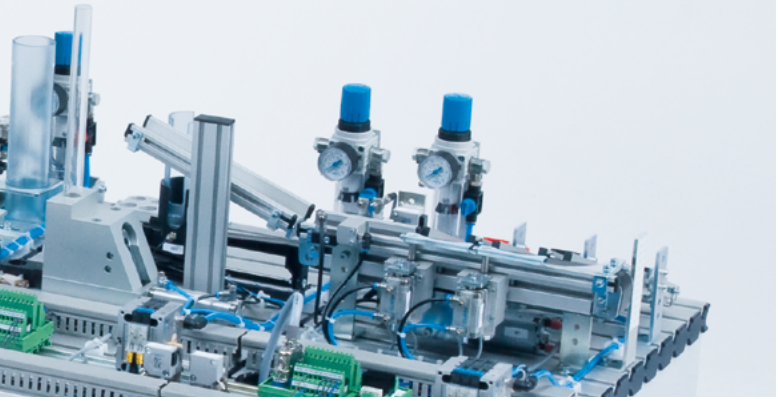
Each station has its own focus
Two stations are sufficient to represent a simple, industry like process for basic training in automation technology: distributing and sorting.

This simplest of all combinations provides numerous basic functions of automated production: separating, feeding, identifying, sorting. Each additional station adds new learning objectives and each station can be used to achieve a particular objective. This means that the transfer of knowledge to the actual operation of modern automated production is as efficient as possible.



Combine: As you like it!
All stations can be combined with others to create systems. This adds learning content and increases the flow of material and information. It is up to you whether you network the stations or operate them in stand-alone mode with a separate PLC.

Combination with other processes is also possible, e.g. with the MPS transfer system or the MPS PA stations.

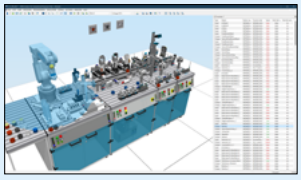


3D: Like real life

The MPS stations provide plenty of material for varied training. But in practice not every station is always available.

That's why all MPS stations are also available as a simulation. The virtual stations in CIROS behave just like the real stations. There is no difference in commissioning and troubleshooting. The same PLC can be used for control.

The virtual CIROS stations enable you to:
– add more functions of an automated system to your learning scenario
– provide multiple learners with the same stations at the same time
– design more individual training without having access to all real stations



CIROS → Pages 124 – 129



Sensitive: Safety modules
Hardly any issue affects so many employees in a company as health and safety. Emergency stop, safety curtains, safety doors and failsafe control are all part of a system made up of MPS stations.



Manufacturing and assembly
What is important? If simple handling tasks are sufficient for your learning scenario, the workpiece set with bodies of various materials can be used. If you want handling to involve simple assembly, the bodies with measuring instruments or containers with covers are ideal. For complex assembly with robots, a symbolic single-acting cylinder provides just the right challenges. If you want to program a microcontroller system, MPS offers the EasyKit as the perfect starter package.



Choice of PLC
The PLC normally controls the individual stations, unless you are using the virtual mini control system in FluidSIM for example.

As for the PLC, we recommend an EduTrainer Universal. We will fit the PLC of your choice, as well as fieldbus components if required. The advantage of the EduTrainers in the MPS Station is clear: you can remove the control and use it for other processes or in a workbench.

worldskills

Since 1991, the modular production system MPS has been the competition platform for the mechatronics world championships.

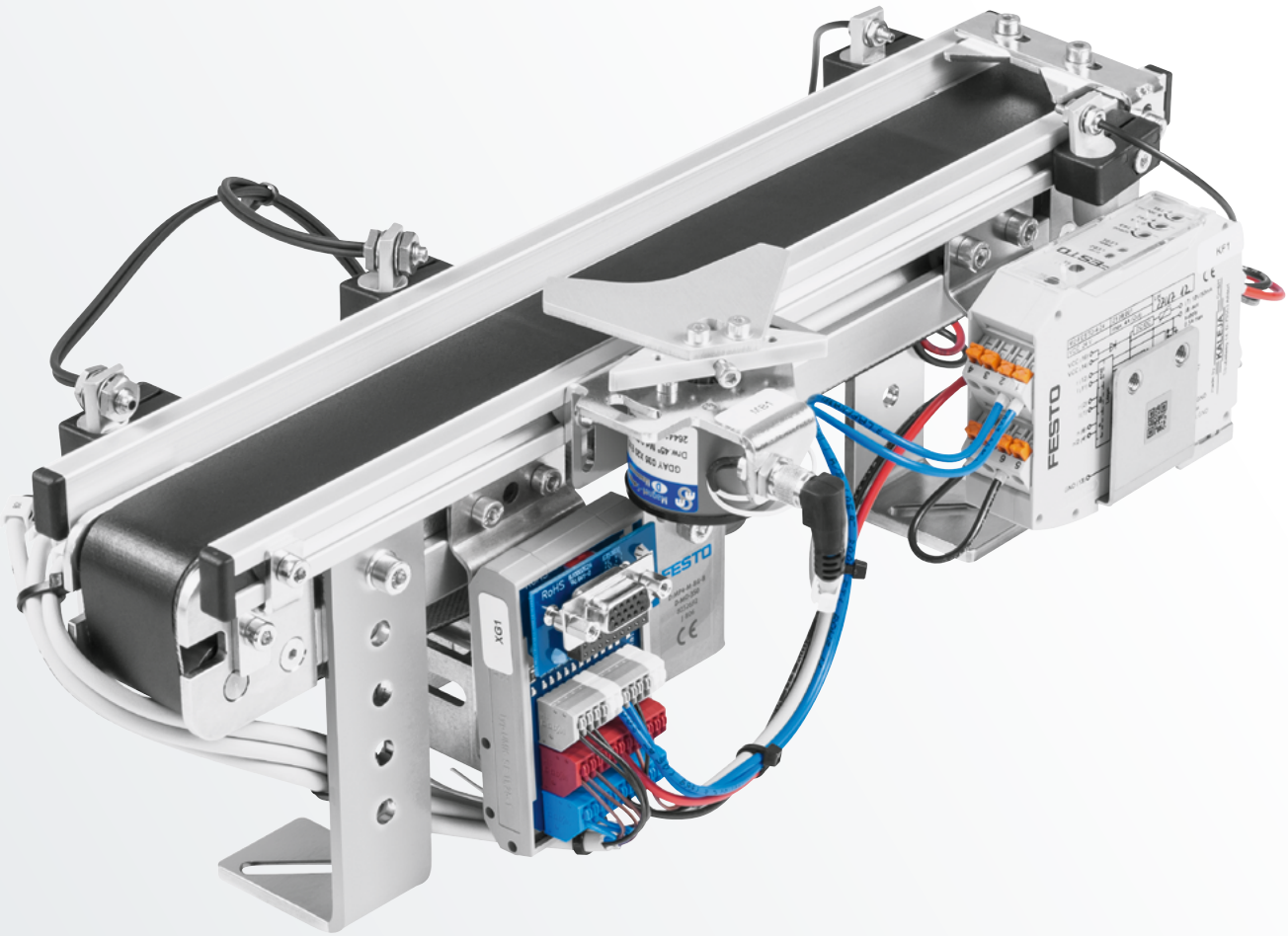
The Modular Basis
Connectivity in all Directions

One module – Many options!

Thanks to the great modularity and the defined interfaces, different learning scenarios can be designed on one module by using additional components.

– Get to know one module and connect to a control with 4 mm safety plugs.
– Connect this module to a control with open wiring and terminal block.
– Connect this module to a control with a plug connector and start programming immediately.
– Connect this module to a bus coupler with a plug connector and start with network technology immediately.

No matter where you start, the path is always right.



Well connected with the bus node CTEU for valve terminals and the IO Link DA Interface

The fieldbus node supports fieldbus-capable modules. The bus node module is therefore a low-cost means of exploring the extensive world of fieldbus protocols, including CANopen, PROFIBUS and DeviceNet. This communication interface is based on the Festo “I-Port” as a universal M12 connection. It can be equipped with the new bus modules CTEU or configured with IO Link.



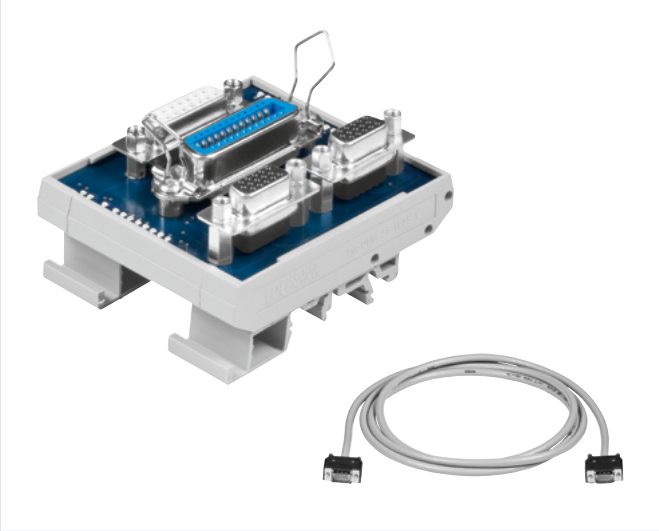
The interface box allows safe wiring using 4 mm safety plugs

The wired sensors and actuators in the module are connected to a defined interface. These are connected via the interface box to 4 mm safety socket contacts. This applies both to digital and analog signals and the power supply.



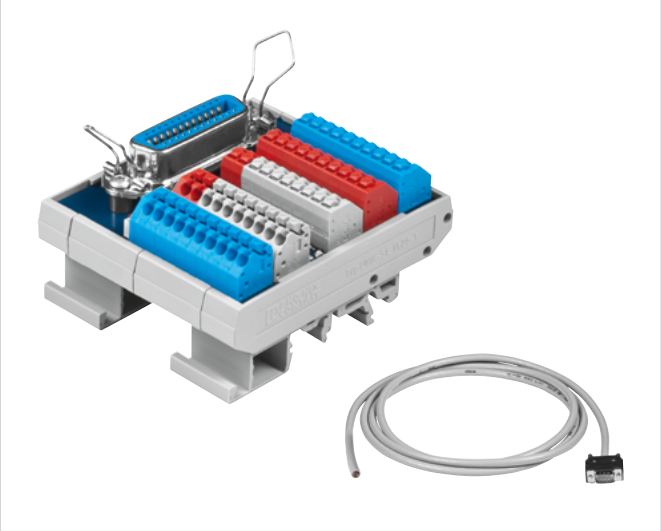
Fast commissioning thanks to a uniform interface

A uniform interface allows all modules and components to be connected to the modular system. The defined interface (I/O interface) helps ensure fast system commissioning.



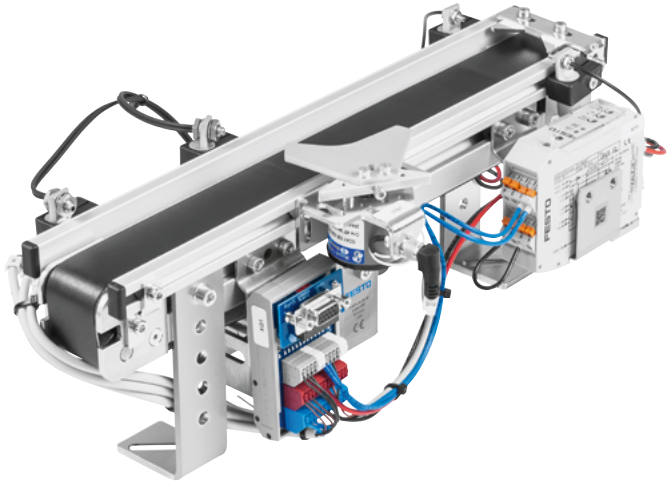
The I/O terminal – The central unit of the MPS SysLink concept

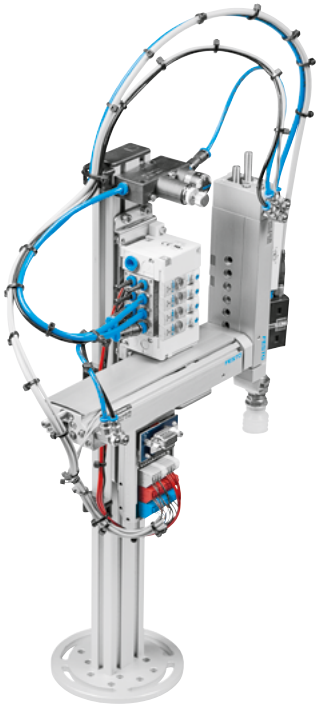
It is used to wire eight digital inputs and eight digital outputs which are connected to a socket contact. Contact is established via spring-loaded terminals. LEDs are included on the input and output terminals which make it easy to monitor the switching status and enable systematic troubleshooting. The interface can be mounted on an H-rail.



From Modules to Systems

The Right Combination for Successful Learning



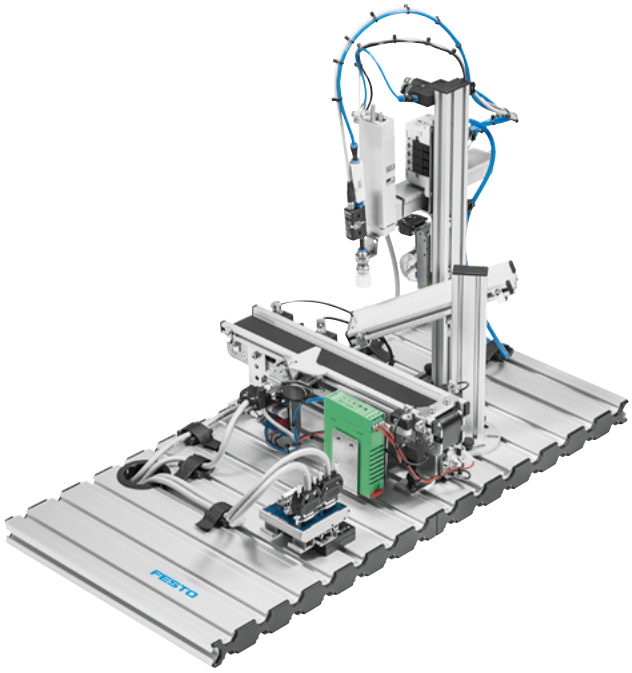


Conveyor module

The Conveyor module is intended for mounting on a profile plate, profile foot or slotted mounting plate with freely positionable DC motor. It is suitable for transporting and separating workpieces with a diameter of 40 mm (e.g. “Cylinder bodies” or “Cylinder for assembly” workpiece sets). The module is supplied fully assembled.

Pick&Place module

The Pick&Place module is a universal, 2-axis handling device for Pick&Place tasks. The position of the limit switches, as well as their mounting position and height, can be adjusted on this module. The module is supplied complete with a vacuum generator, pressure switch, vacuum filter and suction cup, valve terminal, pressure regulator and electrical interface. In another version, a parallel gripper is fitted instead of vacuum technology.





Pick&Place station

The Pick&Place station is equipped with a two-axis Pick&Place module and a Conveyor module. Optical diffuse sensors or light barriers detect the workpiece housing placed onto the conveyor. The conveyor transports the workpiece to the electric feed separator. The Pick&Place module picks up a workpiece insert from the slide and places it on the workpiece housing. The complete workpiece (housing and insert) is released by the feed separator and transported to the end of the conveyor.

Pick&Place station including trolley

Compact and mobile – the station is easy to mount on the trolley. Appropriate passages in the side walls and backwalls enable orderly routing of cables. The symmetrical design of the trolley means that there are mounting options on both sides for the control panel, the intermediate bottom and for drawers. A lifting column can be integrated in the center of the trolley to facilitate ergonomic work on the profile plate. There is space for the assembly board for the electrical connections and the PLC rack on both sides of the trolley. The profiles for A4 mounting allow additional EduTrainer units to be used on the trolley. An optional attachable door protects the equipment inside.

The Stations in the Modular Production System at a Glance

A production line in a factory can be made up of individual production cells. Each cell has a specific function in the process (distribution, testing, processing, handling, assembly, storage). You can select an application or process that meets your requirements from a range of individual stations.

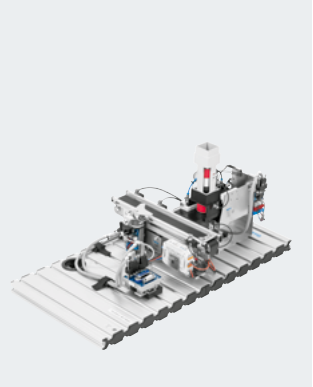
By effectively combining individual stations, you can assemble your production system.

Learn about the functions and training aims of the individual stations as well as their possible combinations on the following pages.

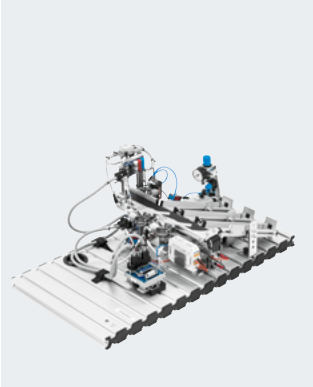
Make more of your potential

Either:
Simple to set up/commission yourself:
– Mount control console to the trolley with 2 screws
– Place EduTrainer Universal in trolley
– Connect the EduTrainer Universal to the control console and the station using our universal SysLink plug connector
– ... finished!

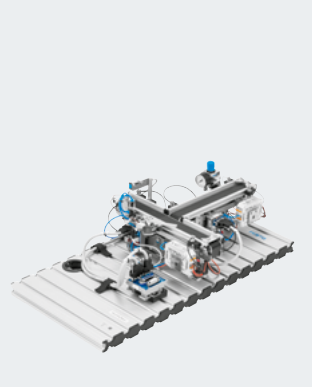
Or:
MPS commissioning service
On request, we can also commission systems for you – particularly in the case of larger systems – to ensure that your training projects run smoothly right from the start.



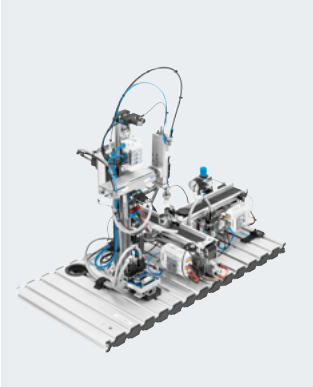
Distributing station D



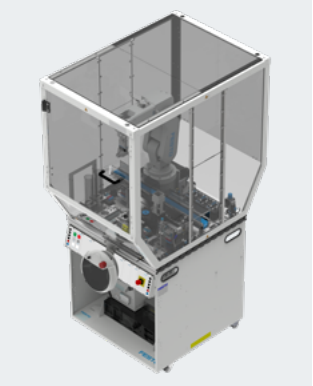
Sorting station D



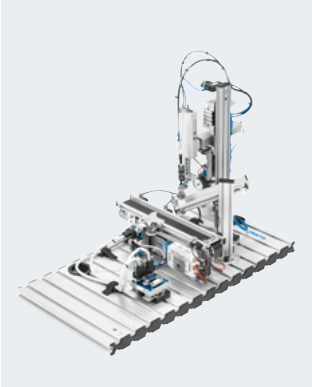
Separating station D



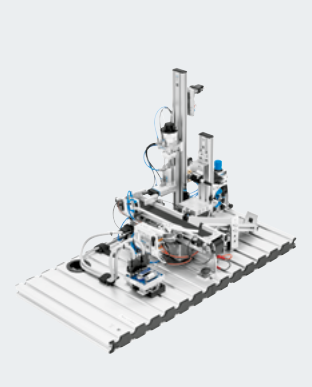
Joining station D



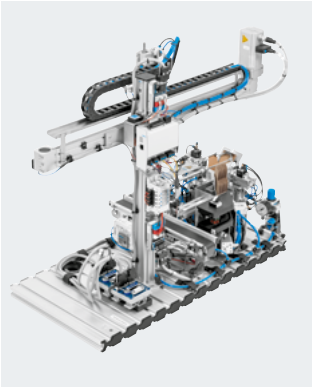
Robot station with MPS modules D



Pick&Place station D



Measuring station D



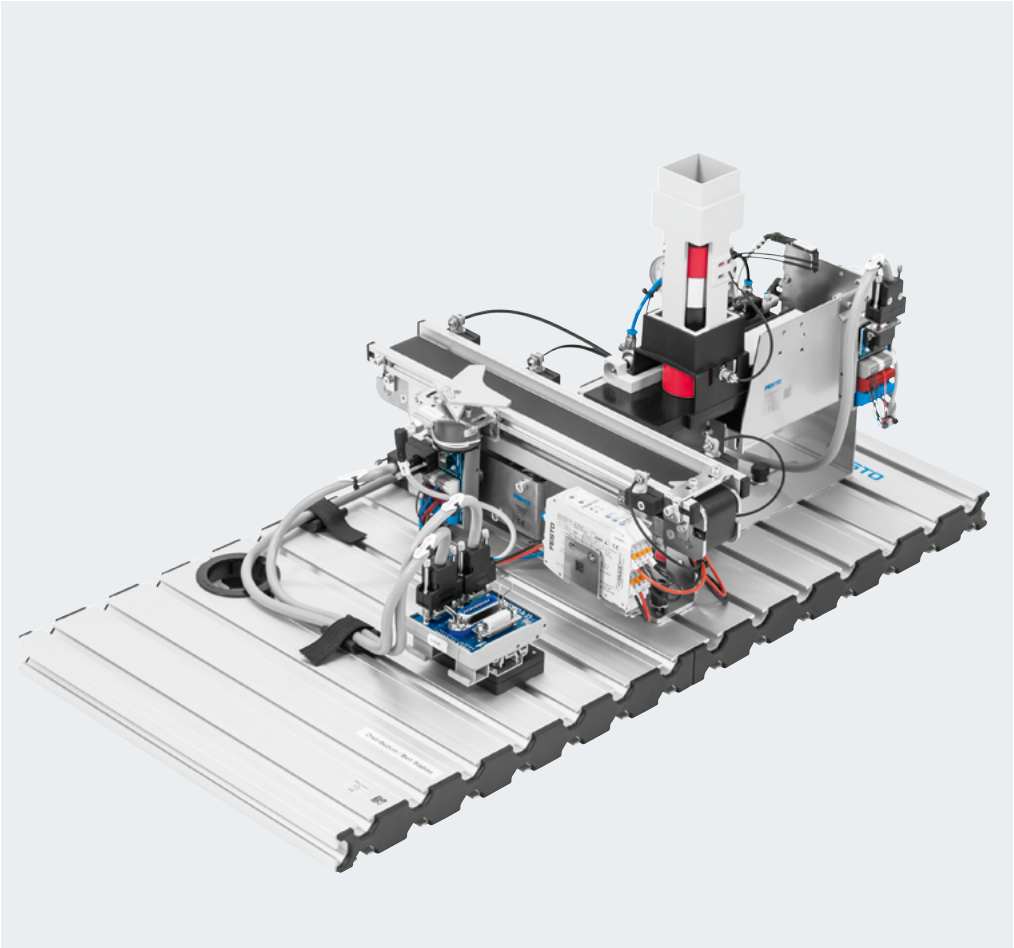
Packaging station D



Storing station v3 D

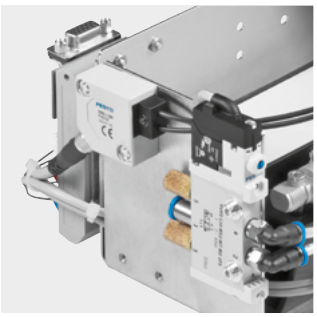
Distributing Station

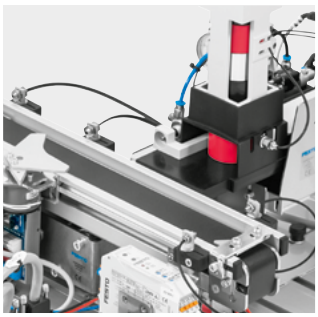
Basic Principles of Mechatronic Systems

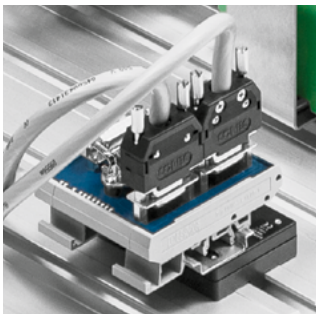


The MPS distributing station D tackles a number of topics, including the basic principles of PLC programming and sensor technology. In addition to this, the station provides an introduction to conveyor control using motor controllers and the associated transport of materials.

The station separates individual workpieces in a stacking magazine. A double-acting cylinder pushes the workpieces out one at a time. The conveyor module transports the workpiece to the right or left. The conveyor can be stopped in order to separate the workpiece. The simple setup process for the MPS Station makes it easy to create a workflow program for the handling process. Different workpieces can be used in the stacking magazine module.







Distributing/Conveyor station, mounted	**8034566**

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal ➔ Pages 168 – 169	
2x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Stacking magazine module, without workpiece holder	8032172
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– Square/round workpiece dimensions: max. 40 mm
– 6 digital sensors
– 4 digital actuators



Distributing station with additional equipment

Training content
– Familiarization with the stacking magazine and conveyor belt modules
– Gaining insight into common separation and distribution processes
– Introduction to pneumatic control systems
– Acquisition of basic PLC programming skills
– Introduction to how sensors and actuators work and are used
– Controlling a DC motor using a motor controller
– Preparation and commissioning of a mechatronic system

Benefits
– The highly modular nature of the station makes it incredibly versatile and allows it to be used for many different types of project work.
– The station can be used individually or together with other stations at various points in a system or process.
– With the aid of this station, students will develop basic knowledge of common separation and distribution processes and of how to control a conveyor.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
– Sensors for Object Sensing



– Electric drives 1
– Actuators – DC motor
– GRAFCET

eTheory course
– CIROS – First steps

eLab course
– Basics of Sensors and Actuators



– CIROS – Basics of 3D Simulation

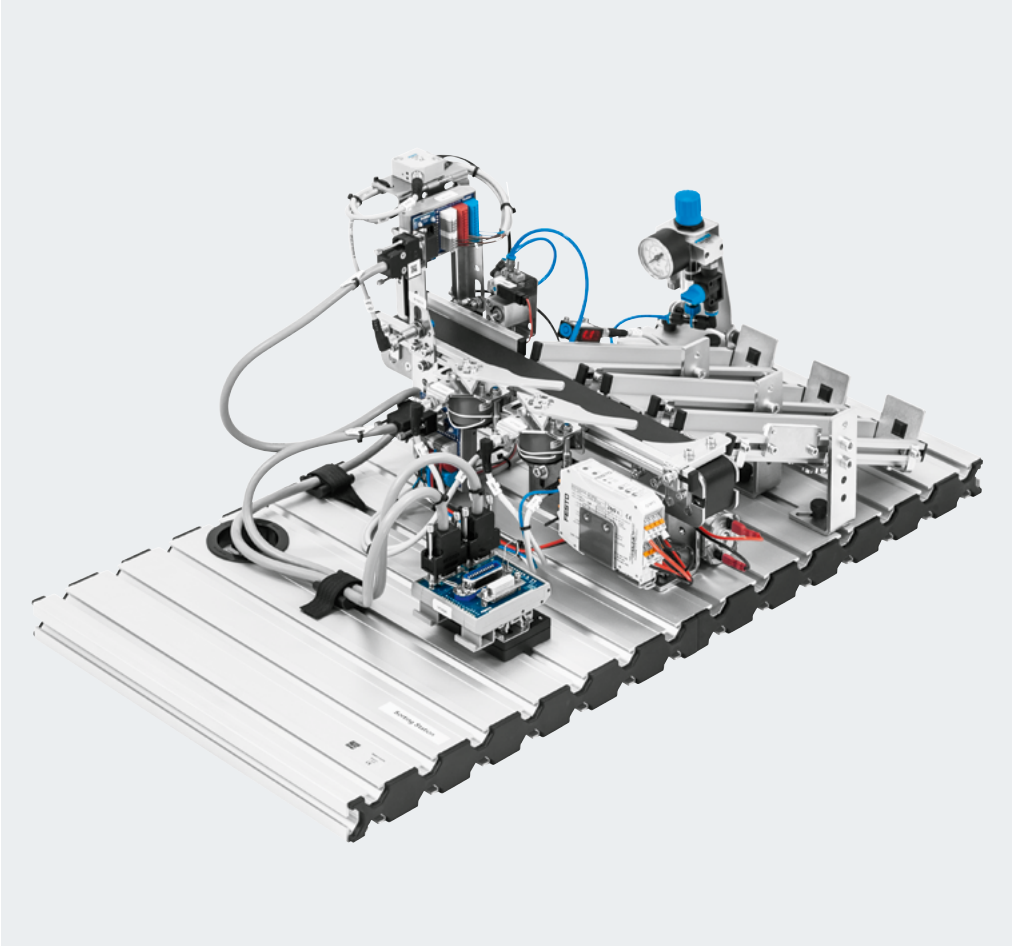
Workbook
– MPS Distributing station D

Evaluation
– Basics of GRAFCET Programming

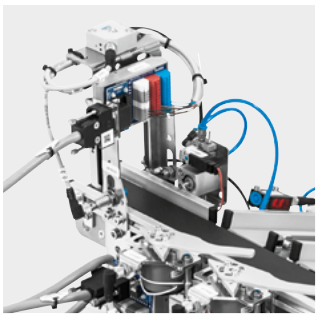
User Guides
– CIROS – Installation Instructions

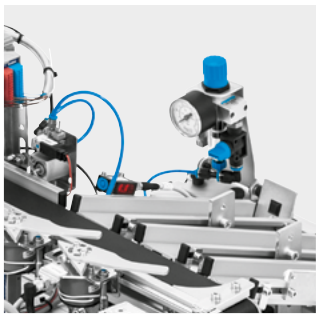
Sorting Station

Combining Opto and Inductive Sensors









The MPS sorting station D tackles a number of topics, including combining different types of sensor to detect materials. The station controls a sorting process based on workpiece properties.

The station sorts workpieces onto three material slides. A diffuse sensor detects when a workpiece is placed in the station and triggers transportation of the workpiece to the sorting point: A pneumatic stopper (short-stroke cylinder) stops the workpiece while the conveyor keeps running, and passes it on for sorting onto one of three material slides. Opto and inductive sensors detect the workpiece properties and distinguish between workpieces based on their color and material. A electric deflector sorts the workpiece onto the correct material slide. A retro-reflective sensor monitors the fill levels of the material slides.

Sorting station D, mounted	**8046325**

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal ➔ Pages 168 – 169	
2x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x End curve	On request
1x Detection module	8044527
3x Slide module	653393
1x Separator module, electrical	532952
1x Stopper, simple, with valve	8046324
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327
1x Kit for Sorting inline	8083826

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– Square/round workpiece dimensions: max. 40 mm
– 8 digital sensors
– 4 digital actuators



Sorting station with additional equipment

Training content
– Familiarization with the various functions of the MPS sorting station D
– Gaining insight into handling technology and common sorting processes
– Acquisition of basic PLC programming skills
– Introduction to pneumatic control systems
– Introduction to how sensors and actuators work and are used, in particular diffuse sensors, fiber-optic through-beam sensors, fork light barriers and inductive proximity sensors
– Executing processes based on measurements recorded by sensors
– Controlling a DC motor using a motor controller
– Preparation and commissioning of a mechatronic system

Benefits
– The highly modular nature of the station makes it incredibly versatile and allows it to be used for many different types of project work.
– The station can be used individually or together with other stations at various points in a system or process.
– With the aid of this station, students will acquire specialist skills in the fields of materials detection, combining sensors, and programming sorting functions.
– Kit for Sorting inline is included.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
– PLC Programming



– GRAFCET

eTheory course
– CIROS – First steps

eLab course
– Basics of PLC Programming



– CIROS – Basics of 3D Simulation

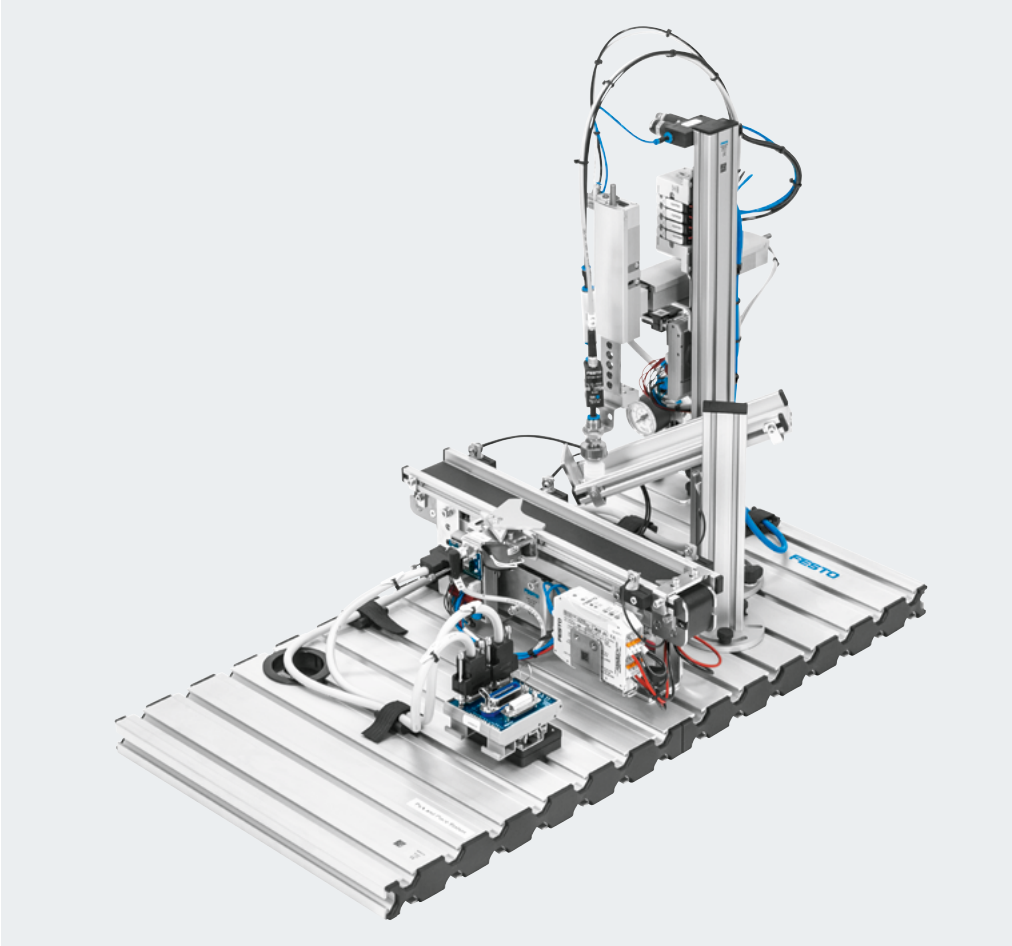
Workbook
– MPS Sorting station D

Evaluation
– Basics of PLC Programming
– Basics of GRAFCET Programming

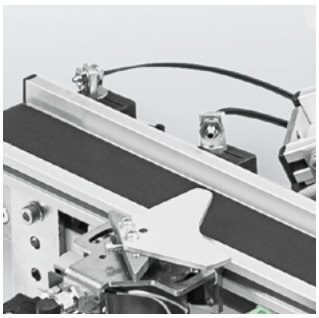
User Guides
– CIROS – Installation Instructions

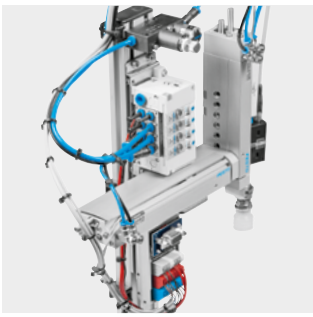
Pick&Place Station

Vacuum Technology in Automated Processes









The MPS Pick&Place station D tackles a number of topics, including the basic principles of vacuum technology and how to use it in an automated process. A pneumatic gripper and the conveyor module are used to transport workpieces.

The station has a two-axis Pick&Place module and a conveyor module. Opto sensors, diffuse sensors or light barriers detect a workpiece housings when it is on the conveyor. The conveyor transports the workpiece to the electric feed separator. The Pick&Place module picks up a workpiece insert from the material supply slide and places it in the workpiece housing. The complete workpiece (housing and insert) is passed on by the feed separator. The conveyor module transports the workpiece to the end position.

The MPS Pick&Place station D can be used to perform a number of different handling tasks:
– Feeding workpieces (housings or basic bodies)
– Rejection of workpieces (housing or basic bodies)

It can also be used to perform custom handling tasks. The Festo slide units in the station facilitate the use of variable stops and cushioning mechanisms, as well as mountings that can be adjusted in every direction.

The MPS station provides a clear overview of the main components for the vacuum application: the vacuum generator, the pressure switches, the vacuum filters and the suction cups with connections are harmonized for optimum performance.

Pick&Place station D, mounted	**8034567**

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal ➔ Pages 168 – 169	
2x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Pick&Place module, With vacuum	8031659
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– Square/round workpiece dimensions: max. 40 mm
– 7 digital sensors
– 6 digital actuators



Station Pick&Place with additional equipment

Training content
– Familiarization with the various functions of the MPS Pick&Place station D
– Gaining insight into common handling processes
– Familiarization with the key components of a mechatronic system
– Acquisition of fundamental knowledge on vacuum technology and pneumatic grippers
– Acquisition of basic PLC programming skills
– Introduction to pneumatic control systems
– Introduction to how sensors and actuators work and are used
– Controlling a DC motor using a motor controller
– Preparation and commissioning of a mechatronic system

Benefits
– The highly modular nature of the station makes it incredibly versatile and allows it to be used for many different types of project work.
– The station can be used individually or together with other stations at various points in a system or process.
– This station will help students to acquire a basic understanding of vacuum technology and pneumatics in automation processes.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
– Pneumatic Fundamentals
– GRAFCET

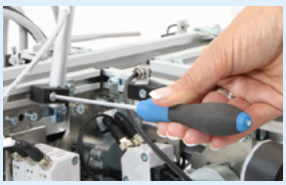
eTheory course
– CIROS – First steps

eLab course
– CIROS – Basics of 3D Simulation

Workbook
– MPS Pick&Place station D



Evaluation
– Basics of Pneumatics

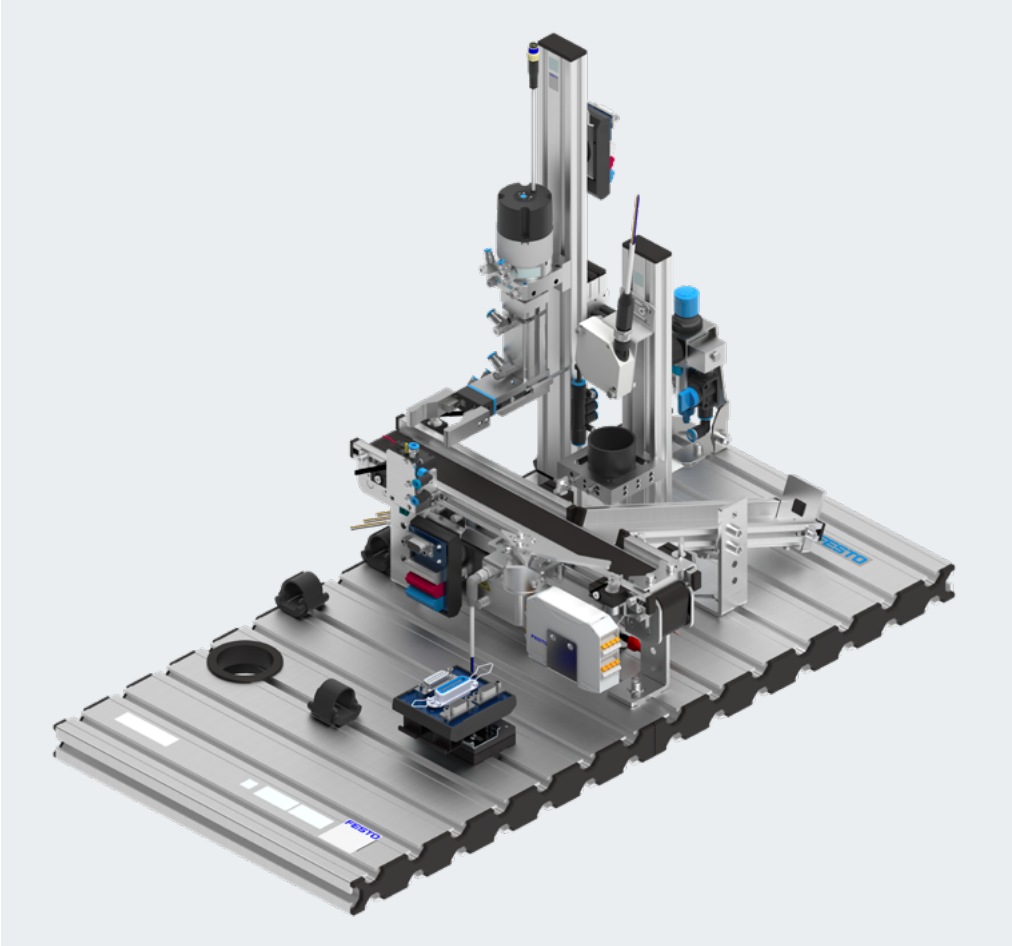


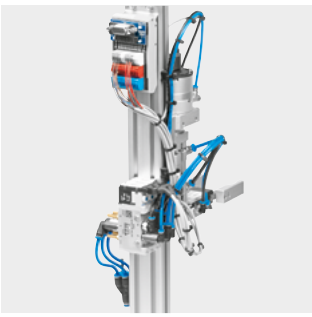
– Basics of GRAFCET Programming

User Guides
– CIROS – Installation Instructions

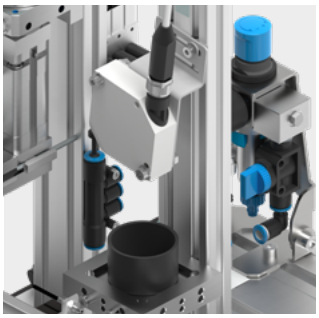
Measuring station

Analog Measurement Technology in Quality Processes









The MPS measuring station D tackles a number of topics, including how to record and process analog and digital signals. The station also provides insight into how pneumatic actuators work and are used, and how actuators are calibrated.

The station takes workpieces out of the ongoing process in order to place them on a measuring table and measure their height. The conveyor module transports the workpieces to the measurement point. The rotary lifting module moves a workpiece into the measuring position. The diffuse sensor measures the height of the workpiece. Depending on the result of the measurement, an electric quarter-turn actuator either moves the workpiece onto a material slide or places in on the conveyor.

Fiber-optic through-beam sensors and opto sensors monitor the material flow on the conveyor. The conveyor can be used in both directions.

The diffuse sensor supplies either an analog or a digital output signal, as required. The module can thus be used for various levels of training. The binary switching output can be adapted to the measurement requirement and the signal type by means of teach-in programming.

The rotary lifting module uses an electric quarter turn actuator and a pneumatic gripper to automate the measurement task and take random samples from the process.

Measuring station, mounted	8038623

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal ➔ Pages 168 – 169	
2x I/O data cable with SysLink connectors IEEE 488	34031

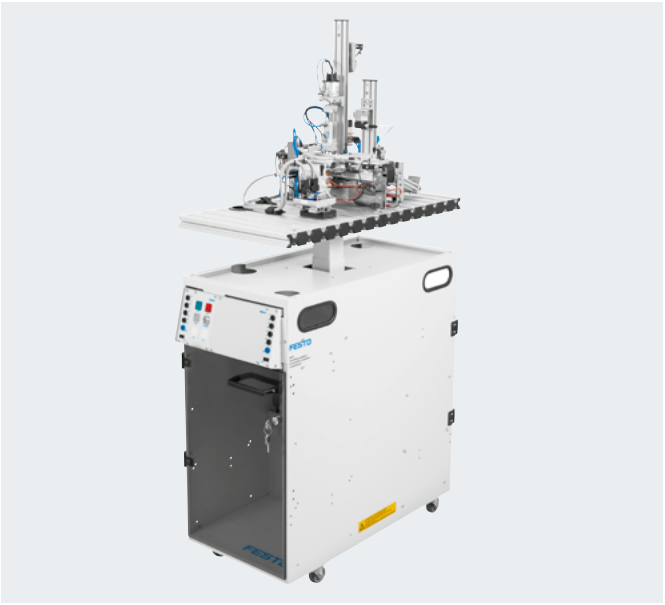
Recommended accessories:

Simulation box, digital	170643
Simulation box, digital/analog	526863
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
Analog cable, crossover	533039
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Rotary/lifting module	8035936
1x Slide module	653393
1x Measuring table	8040204
1x Stopper, simple, with valve	8046324
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– Round workpiece dimensions: max. 40 mm
– 8 digital sensors
– 7 digital actuators
– 1 analog input



Measuring station with additional equipment

Training content
– Familiarization with the various functions of the MPS measuring station D
– Gaining insight into common measurement and sorting processes
– Acquisition of basic PLC programming skills
– Introduction to pneumatic control systems
– Introduction to how sensors and actuators work and are used
– Executing processes based on measurements recorded by sensors
– Controlling a DC motor using a motor controller
– Controlling a conveyor; programming and processing standardizations
– Calibration of actuators
– Preparation and commissioning of a mechatronic system

Benefits
– The highly modular nature of the station makes it incredibly versatile and allows it to be used for many different types of project work.
– The station can be used individually or together with other stations at various points in a system or process.
– With the aid of this station, students will develop basic knowledge of measurement and sorting processes and of how to control a conveyor.
– The students will also learn the basics of sensor signal recording and processing and how to program standardizations for the calibration of actuators.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
– PLC Programming
– GRAFCET

eTheory course
– CIROS – First steps



eLab course
– CIROS – Basics of 3D Simulation

Workbook
– Basic level PLC programming
– Advanced level PLC programming

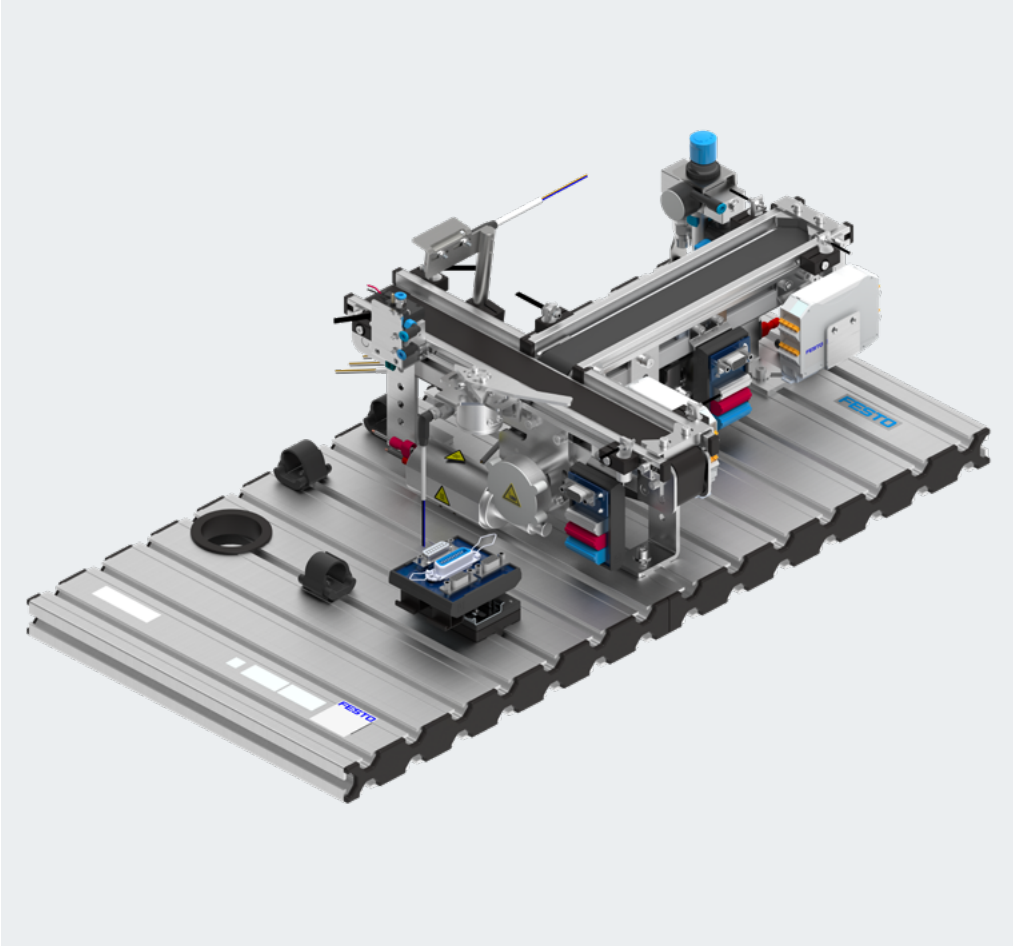


Evaluation
– Basics of PLC Programming
– Basics of GRAFCET Programming

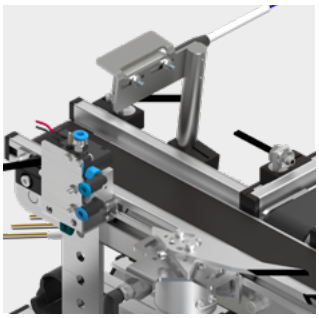
User Guides
– CIROS – Installation Instructions

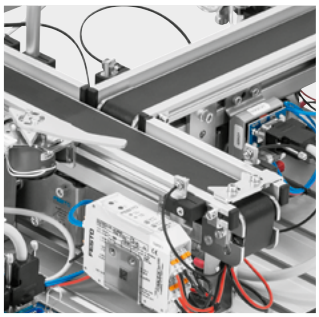
Separating Station

Basic Principles of Mechatronic Systems









The MPS separating station D tackles a number of topics, including the use of digital sensors and actuators. The station controls a distribution process based on workpiece properties. The workpiece dimensions measured by the sensors are used to determine the subsequent process.

The workpieces on the conveyor are transported to the depth measurement point. An analog diffuse sensor checks the depth of a drilled hole. If the hole is deep enough, the conveyor carries the workpieces to the end position. An electric deflector with a quarter turn actuator guides workpieces that are skewed or do not have sufficient hole depth to a collection point via the second conveyor.

Fiber-optic through-beam sensors and opto sensors monitor the material flow on both conveyors. The workpieces on the conveyors can transport workpieces in both directions.

The diffuse sensor supplies either an analog or a digital output signal, as required. The module can thus be used for various levels of training. The binary switching output can be adapted to the measurement requirement and the signal type by means of teach-in programming.

The MPS separating station D enables users to set up flexible assembly lines using a variety of stations. Downstream stations can be added to the station in two directions. Combined assembly processes such as cylinder assembly and installation of workpiece inserts in housings can be performed using the separating station.

Separating station, mounted	**8038802**

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal ➔ Pages 168 – 169	
2x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 300 x 40 mm, DC motor	8033135
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Diffuse sensor, analog	541120
1x Stopper, simple, with valve	8046324
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– Round workpiece dimensions: max. 40 mm
– 6 digital sensors
– 4 digital actuators



Separating station with additional equipment

Training content
– Familiarization with the various functions of the MPS separating station D
– Gaining insight into common distribution processes
– Familiarization with the key components of a mechatronic system
– Acquisition of basic PLC programming skills
– Introduction to pneumatic control systems
– Introduction to how sensors and actuators work and are used
– Controlling a DC motor using a motor controller
– Preparation and commissioning of a mechatronic system

Benefits
– The highly modular nature of the station makes it incredibly versatile and allows it to be used for many different types of project work.
– The station can be used individually or together with other stations at various points in a system or process.
– With the aid of this station, students will develop basic knowledge of distribution processes and of how to control a conveyor.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
– PLC Programming
– GRAFCET

eTheory course
– CIROS – First steps



eLab course
– CIROS – Basics of 3D Simulation

Workbook
– Basic level PLC programming



– Advanced level PLC programming

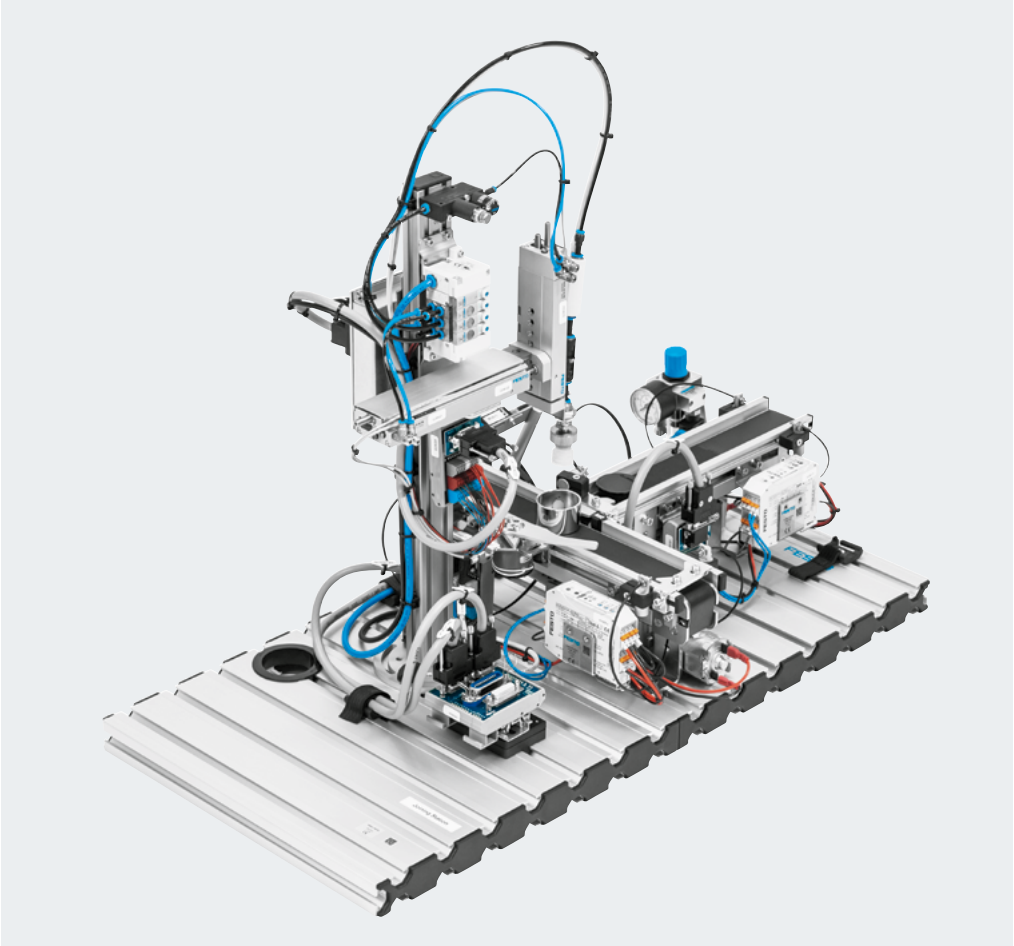
Evaluation
– Basics of PLC Programming
– Basics of GRAFCET Programming

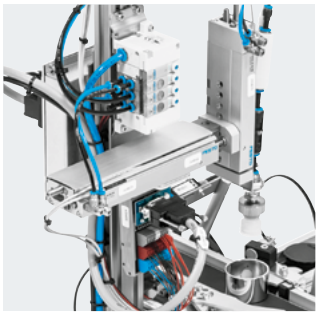
User Guides
– CIROS – Installation Instructions

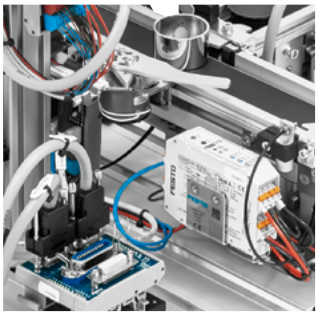
Joining Station

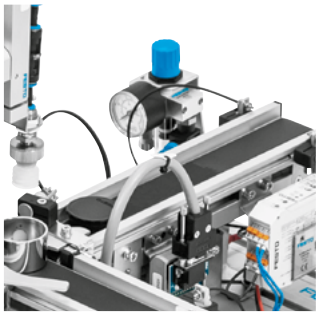
Industrial Ethernet and IO-Link Communication

New









The MPS joining station D covers a number of topics, including checking the orientation of workpieces using sensors, automated assembly and monitoring downstream transport.

The station checks the orientation of the workpiece and, if it is positioned correctly, affixes a cover/top part to it. A conveyor belt transports the workpieces to the depth measurement point. There, an analog diffuse sensor checks the position of the workpiece. Workpieces with an opening at the top are stopped in the assembly position by an electric stopper with a quarter-turn actuator and given a cover/top section by the pick & place module. The workpiece is then transported to the end of the belt. Workpieces that are not positioned correctly are transported straight to the end of the conveyor belt without stopping, and the PLC can generate an error message for them. Fiber-optic through beam sensors with Opto sensors monitor the material flow on the belts. The joining station can be supplemented with other stations from three different directions. The conveyor belts can transport workpieces in both directions.

Joining station	**8063910**

Additional equipment, also order:

1x MPS trolley 700 x 350	8033248
Control console, SysLink	8127608
EduTrainer Universal A4 Rack with SIMATIC S7-1512C-1PN	8065452
2x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
PA workpiece set	554301
Fieldbus node CTEU Profinet	2201471
Mounting Kit Parallel Gripper	8064882
EasyPort USB – interface for measuring, open/closed loop control ➔ Page 166	

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
2x Conveyor module, 300 x 40 mm, DC motor	8033135
1xPick&Place module	8031659
1x IO Link DA-Interface	8038559
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327

Technical data
- Operating pressure: 600 kPa (6 bar)
- Power supply: 24 V DC, 4.5 A
- Workpiece dimensions: 40 mm (round)
- 6 (5) digital input signals
- 6 digital output signals
- 1 analog input (alternative)
- IO Link with 2x 4DI/4DO/2AI/1AO interface (in use: 4DI/4DO)
- Dimensions (W x D x H): 350 x 700 x approx. 450 mm



Joining station with additional equipment

Training content
- You will understand how the joining station and its various components work
- You will have acquired basic PLC programming skills
- You will be familiar with optical, digital sensors, actuators and distance sensors
- You will be able to prepare and commission a mechatronic system
- You will understand the basics of IO Link, pneumatic control systems, analog signal processing and gripper technology

Benefits
- The highly modular nature of the station makes it suitable for use in various types of project work.
- The station can be used in systems either on its own or combination with other stations at various stages of the process.
- The station covers the following topics: vacuum technology, digital and analog sensors, and network-based communication protocols.

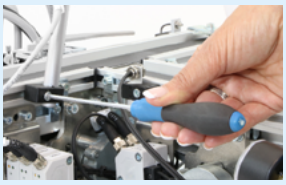
Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
- PLC Programming
- GRAFCET

eLab course
- Basics of Pneumatics



- CIROS – Basics of 3D Simulation

Workbook
- MPS Joining station D

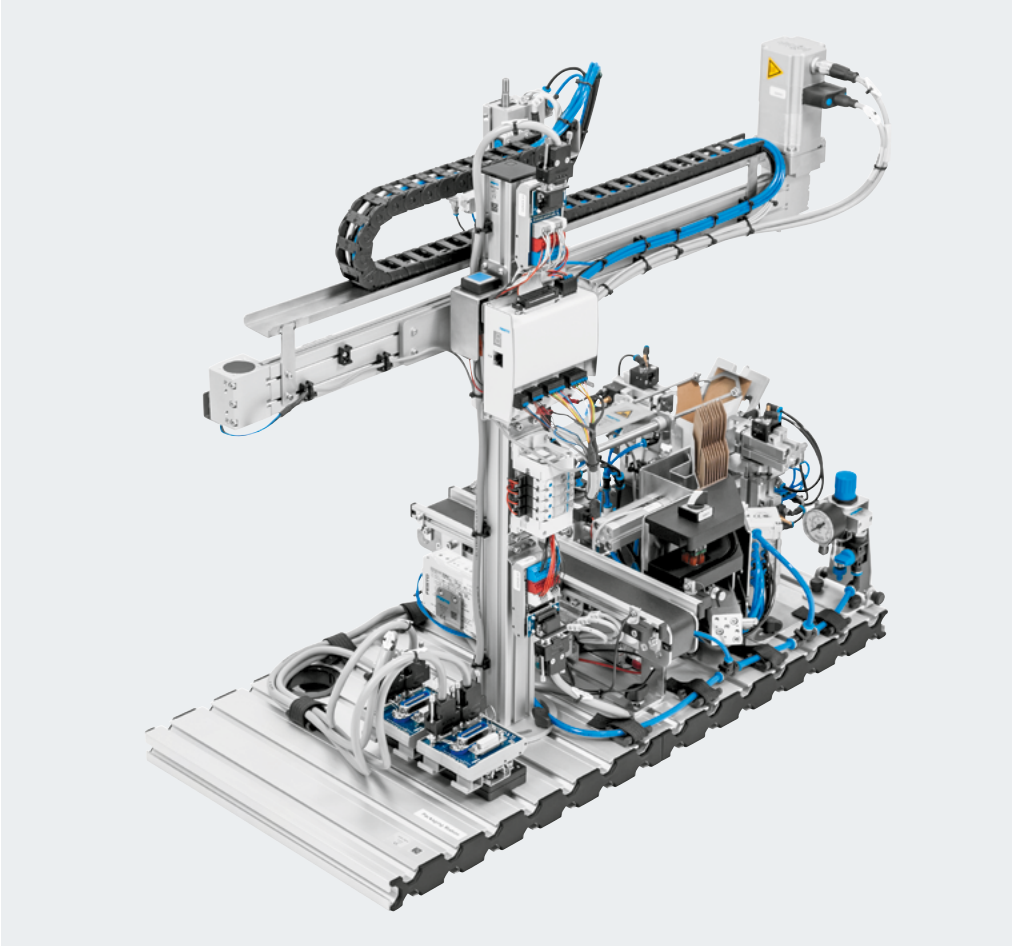


Evaluation
- Basics of Pneumatics
- Basics of GRAFCET Programming

User Guides
- CIROS – Installation Instructions

Packaging Station

Complex Mechanical Handling Processes

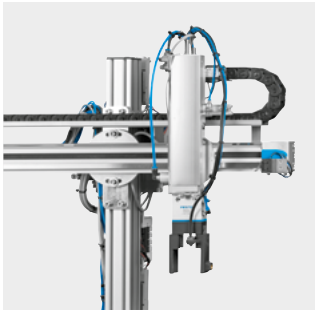


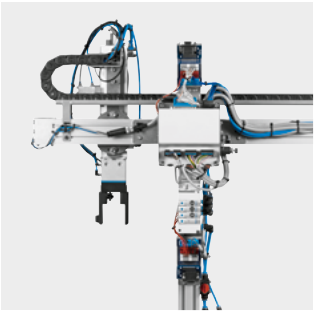
The MPS Packaging station D deals with the pneumatic control of a complex packaging process, and the control of stepper motors by motor controllers. The station also provides an introduction to the use of digital sensors.

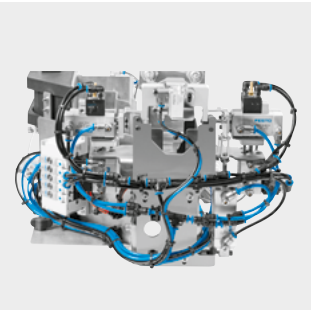
The station packs workpieces in an automated process. A conveyor carries the workpiece into the collecting position of the Two-Axis Handling module. The Packaging module takes a carton out, unfolds the carton, and prepares the carton for loading. The Two-Axis Handling module conveys the workpiece into the carton: this operation is carried out by a stepper motor in the X-axis and a precision-controlled cylinder in the Z-axis. The carton is closed and passed on to the Conveyor module. The Conveyor module transports the packed workpiece to the end position.

A stepper motor with controller moves the linear axis to particular positions with high positioning accuracy.

Pneumatic end position sensors detect the cylinder position and control the packaging mechanism.







Packaging station, mounted	**8062644**

Additional equipment, also order:

MPS trolley 700 x 350	8033590
Control console, SysLink	8127608
EduTrainer Universal A4 Rack with SIMATIC S7-1512C-1PN	8095754
3x I/O data cable with SysLink connectors IEEE 488	34031

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Two-axis handling module with a stepper motor	8049257
1x Packaging module	8043505
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x C interface	8025738
1x Quick-Fix clamping adapter	8026327
Box size 1 (50 piece) (L x W x H): 48 x 42 x 50	8064300
Box size 2 (50 piece) (L x W x H): 48 x 42 x 60	8064301

Technical data
- Operating pressure: 700 kPa (7 bar)
- Power supply: 24 V DC, 4.5 A
- Square/round workpiece dimensions: max. 40 mm
- 15 digital input signals
- 14 digital output signals
- Dimensions (W x D x H): 350 x 700 x approx. 900 mm



Packaging station with additional equipment

Training content
- Familiarity with the various functions of the MPS Packaging station D
- Understanding of common packaging processes
- Acquisition of basic PLC programming skills
- Introduction to pneumatic control systems
- Introduction to the functioning and use of sensors and actuators
- Control of stepper motors with a motor controller
- Conveyor belt control
- Adjustment of complex mechanical or pneumatic modules

Benefits
- The modularity of the Festo Didactic training systems makes it possible to use the MPS Packaging station D for a variety of different projects.
- The station can be used individually or together with other stations at various points in a system or process.
- With the aid of this station, the students develop basic knowledge of common packaging processes and of control of a stepper motor using a motor controller.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
- Sensoren zur Objekterkennung
- PLC Programming
- GRAFCET

eTheory course
- CIROS – First steps

eLab course
- CIROS – Basics of 3D Simulation

Workbook
- Basic level PLC programming



- Advanced level PLC programming

Evaluation
- Basics of PLC Programming



- Basics of GRAFCET Programming

User Guides
- CIROS – Installation Instructions

Storing station

Challenging, Up-to-Date, Mechatronic Overall System

New



The MPS storing station addresses, among other things, the topics of parameterization and commissioning of multi-axis controllers and advanced PLC programming. Workpieces can be stored on several high rack storage levels using a combination of sensors and actuators during the process sequence. A modern web interface serves as a state-of-the-art HMI.

The storing station can differentiate workpieces based on their colour and store up to 48 workpieces on six levels. It is also possible to additionally store cardboard boxes by adjusting the tray and the actuator. The workpiece or the cardboard box is identified on the conveyor module by a combination of sensors and the parameterization of the multi-axis controller. A pneumatic gripper fastened to a stepper motor with gear rack picks the workpiece or the cardboard box from the conveyor and places it in the storage area. The storage area can be located either at the beginning (removal from storage) or at the end (placement into storage) of a production line, or as a buffer station within a production line, by means of appropriate programming. The position of the gripper can be registered by means of the encoder on the motor. Position teaching is possible by means of password-protected user management. 3D simulation software with integrated simulated PLC and error simulation is available for the station. The control panel and a PLC turn the station into an automated system. The station can process different workpieces with a diameter/edge length of 40 mm.

Storing station with trolley	**8207351**

Additional equipment, also order:

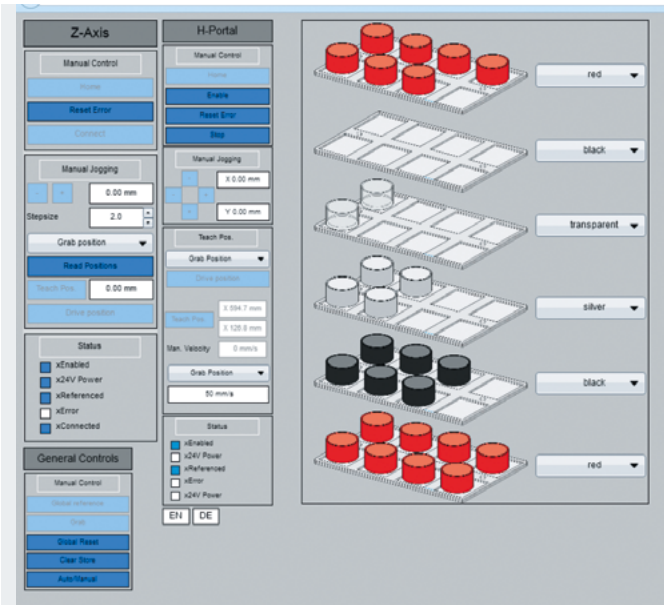
Control console, SysLink	8127608
EduTrainer Universal A4 Rack with SIMATIC S7-1512C-1PN	8095754
3x I/O data cable with SysLink connectors IEEE 488	34031
IEC power cable ➔ Page 199	

Recommended accessories:

Simulation box, digital	170643
I/O data cable with SysLink connectors (IEEE 488), crossover	167106
PA workpiece set	554301

The most important components at a glance:

1x MPS trolley 700 x 350	8033248
1x Aluminum profile plate, 700 x 350 mm, with cable guide	170395
1x H-portal with Z-axis and motor controller	On request
1x Conveyor module, 350 x 40 mm, DC motor	8032692
1x Workpiece holder	On request
1x Start-up valve with filter control valve	540691
1x Cable holder with hook-and-loop fastener (pack of 10)	8034300
1x I/O-Terminal	8025736
1x Festo CECC CODESYS V3 compact controller	8023951



Web interface

Training content
- Acquisition of advanced PLC programming skills
- Learning about and configuring digital sensors and actuators
- Learning about and actuating stepper motors
- Using web interfaces to control and monitor the processes

Benefits
- The distinct modularity allows the station to be used in connection with different types of project work.
- The station can be used individually as well as in combination with other stations in systems at various stages of the process.
- This station can help you to acquire specific skills regarding the topics of multi-axis controllers and advanced PLC programming.

Technical data
- Operating pressure: 600 kPa (6 bar)
- Power supply: 2x 24 V DC, 4.5 A
- Square/round workpiece dimensions: max. 40 mm
- Dimensions (W x D x H): 350 x 700 x 904 mm
- Overall height with carriage: 1654 mm

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eLearning course
- Sensors for Object Sensing
- Pneumatic Fundamentals
- PLC Programming
- GRAFCET



eTheory course
- CIROS – First steps

eLab course
- CIROS – Basics of 3D Simulation

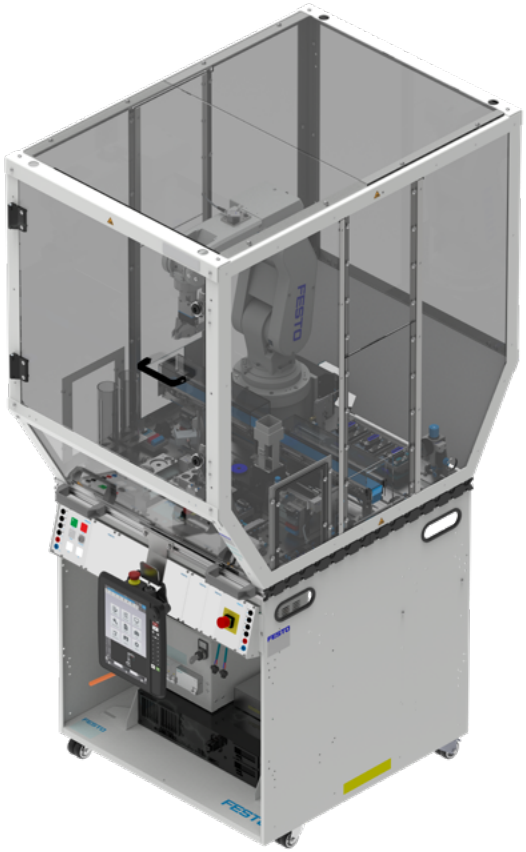


Evaluation
- Basics of Pneumatics
- Basics of PLC Programming
- Basics of GRAFCET Programming

User Guides
- CIROS – Installation Instructions

Robot station with MPS modules

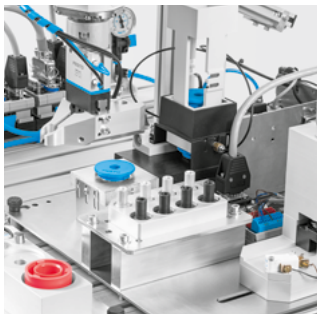
The Equipment Level as an Introduction to Industrial Robotics

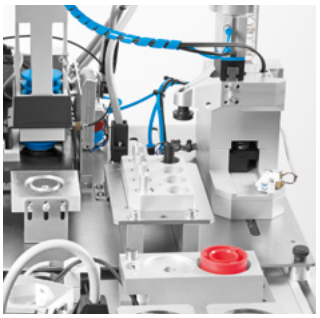


Function
This equipment level is created based on the basic design of the MPS robot station and the two robot handling and robot assembly modules as a introduction to industrial robotics. The upstream station feeds the bodies of the pneumatic cylinders to be assembled to the robot via a slide. The robot determines the orientation of the bodies and places them in the assembly holder in the correct orientation. It takes the piston from the pallet and assembles it in the body. Controlled magazines feed the piston springs and cylinder end caps to the robot. The fully assembled pneumatic cylinder is then placed on a slide.

Topic: Handling and assembly
In many industrial applications, robots handle and assemble workpieces and modules. Getting to know these areas of application is an essential part of an introduction to robotics.

Developed in accordance with the EU Machinery Directive 2006/42/EC in compliance with DIN EN 60204-1 and DIN EN ISO 12100.







Robot station with MPS modules, complete	**8169662**

Battery set for robot RV-2SDB/RV-2FB	572162

Note
The robot's batteries feature a buffer period of one year and must therefore be replaced every year.

Recommended accessories:

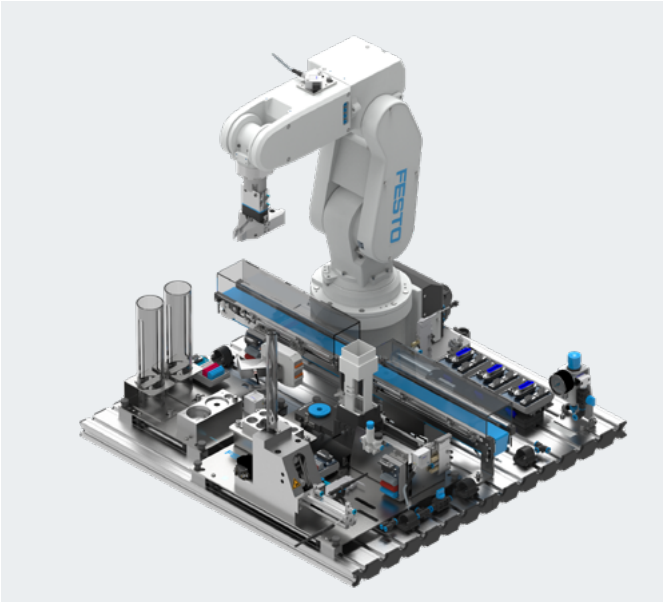
Workpiece set "For cylinder assembly"	162239
Programming instructions for Mitsubishi robot RV-2FB, en	8039315
Technical manual for Mitsubishi robot RV-2FB, en	8039316

The most important components at a glance:

MPS trolley, 700 x 700	541139
Aluminum profile plate 700 x 700	159410
Safety housing	8039314
Control console, SysLink, 700 mm	8039325
Tabletop power supply unit → Page 149	
Robot handling module → Page 148	
Robot assembly module → Page 148	
Robot interface box	8046131
Graphical operator terminal	8039317
Robot RV-2FB with Teachbox R32TB	3396765
Gripper, pneumatic	573859
Start-up valve with filter control valve	540691
CIROS, License package with 6x Education, 1x Studio → Pages 124 – 129	

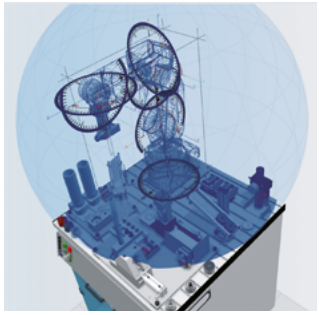
Technical data
– Power supply: 230 V AC
– Operating pressure: 600 kPa (6 bar)
– Maximum workpiece width: 40 mm
– 12 digital input
– 5 digital outputs

More learning and research systems for robotics:
– Robot Vision Cell → page 150
– Robotino → page 152



Robot station with MPS modules in detail

Training content
– Integration of an industrial robot in an assembly process
– Teaching of robots in complex assembly environments
– Commissioning of complex systems
– Maintenance, servicing and troubleshooting of complex systems
– Programming of industrial robots combined with the integration of sensors and additional actuators
– Programming of multitasking applications



Optimally coordinated:
The included CIROS package supports the tasks from the workbook

Recommended learning material

Complete overview Learning media MPS, see MPS D
→ page 110
For example:

eTheory courses
– Introduction to Robotics



– CIROS – First steps

eLab courses
– CIROS – Basics of 3D Simulation

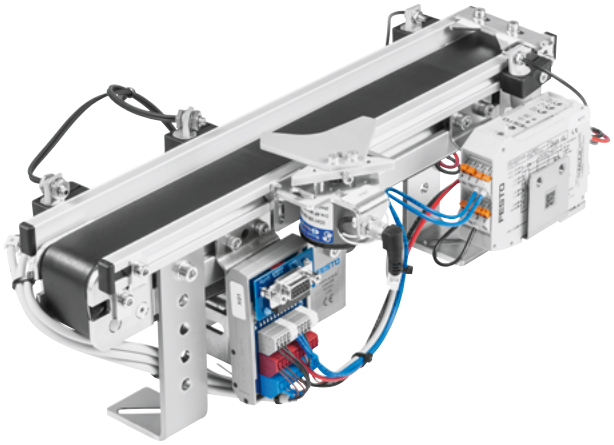
Workbook
– Handling with industrial robots



Evaluations
– Basics of Robotics

User Guides
– CIROS – Installation Instructions

Conveyor Module



The Conveyor module is intended for mounting on a profile plate, profile foot or slotted mounting frame with freely positionable DC motor. It is suitable for transporting and separating workpieces with a diameter of 40 mm (e.g. “Bodies” or “Cylinder for assembly” workpiece sets). The module is supplied fully assembled.

Training content
– Belt control system
– Sensors
– Reading circuit diagrams
– Buffering and separating

Technical data
– Power supply: 24 V DC
– Maximum workpiece width: 40 mm
– Length: 300, 350 or 700 mm
– Conveyor height above profile: approx. 117 mm
– 3 digital sensors
– 3 digital actuators

Scope of delivery
Conveyor module including:
– DC motor: 24 V DC, 1.5 A with motor controller right/left
– 2 diffuse sensors
– Light barrier
– Mini I/O terminal
– Mounting material for profile plate
– Feed separator/stopper, electric



Conveyor module, DC motor integrated:

300 x 40 mm	**8033135**
350 x 40 mm → see illustration	**8032692**

Conveyor module, with motor flange:

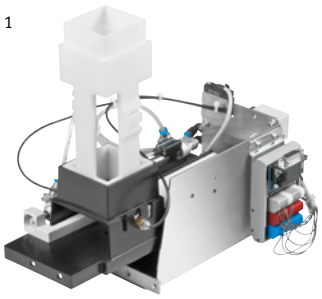
350 x 40 mm	**8037644**
700 x 40 mm	**8037645**

Recommended accessories for the conveyor module, with motor flange:

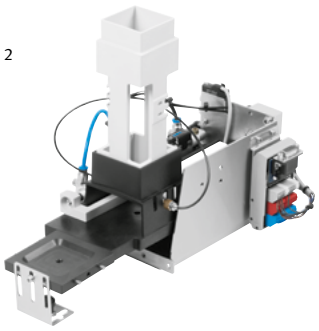
DC motor controller for clockwise/anti-clockwise rotation	567245
DC motor	532941
Mounting materials	On request
AC motor	On request

Stacking Magazine Module

1



2



The Stacking magazine module separates workpieces or end caps. A double-acting cylinder pushes the workpiece at the bottom out of the gravity-feed magazine. The cylinder position is detected electrically by magnetic three-wire sensors. The speed with which the cylinder extends and retracts can be infinitely adjusted via one-way flow control valves. Through-beam sensors or diffuse sensors can be attached to the magazine. The magazine offers mounting options for installation on a profile, profile plate or at conveyor height via an optional adapter. It is possible to eject products from three magazines at a common position. The module is supplied completely assembled.

Training content
– Basic principles of pneumatics
– Sensor technology: magnetic limit switches
– Sensor technology: opto-electrical sensors
– Connecting tubing and wiring
– Reading circuit diagrams

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– 3 digital sensors
– 1 digital actuator
– Length with workpiece holder: 310 mm
– Length without workpiece holder: 240 mm

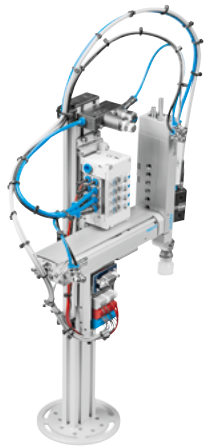
Scope of delivery
– Plastic injection-molded cylinder body and ejector
– Magazine tube for end caps and cylinder bodies with diameter/edge length = 40 mm
– Mini I/O terminal
– 5/2-way single solenoid valve
– Double-acting cylinder
– 2 magnetic limit switches
– Through-beam sensor
– Mounting accessories for profile plate
– Workpiece holder (only with order no. 8032171)

1 Without workpiece holder	**8032172**
2 With workpiece holder	**8032171**

Recommended accessories:

Adapter for Stacking magazine belt	8032173
MPS slotted mounting plate	8038504
PA workpiece set	554301
15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
15-pin D-sub cables: plug connector – open, 2.0 m	8033586
C Interface	8025738

Pick&Place Module



The Pick&Place module is a universal, 2-axis handling device for Pick&Place tasks. The position of the end-position switches, as well as mounting position and height, can be adjusted on this module. The module is supplied complete with vacuum generator, pressure switch, vacuum filter and suction gripper, valve terminal, pressure regulator and electrical interface. In another version, a parallel gripper is used instead of vacuum technology.

Training content
- Basic principles of pneumatics
- Sensor technology: magnetic limit switches
- Connecting tubing and wiring
- Reading circuit diagrams
- Getting to know handling systems
- Vacuum technology/gripper technology

Technical data
- Operating pressure: 600 kPa (6 bar)
- Power supply: 24 V DC
- 4 digital sensors
- 4 digital actuators
- Stroke length, X-axis: 80 mm
- Stroke length, Z-axis: 50 mm
- Pick&Place unit, height-adjustable
- Pressure setting along the Z-axis

Scope of delivery
- Mini I/O terminal
- Valve terminal with 2x 5/2-way single solenoid valves and 1x 5/2-way double solenoid valve
- 2 double-acting cylinders with guide
- 3 magnetic limit switches
- Mounting accessories for profile plate
- Vacuum switches, Venturi nozzle, soft and hard suction cups (only with order no. 8031659)
- Parallel gripper (only with order no. 8031660)

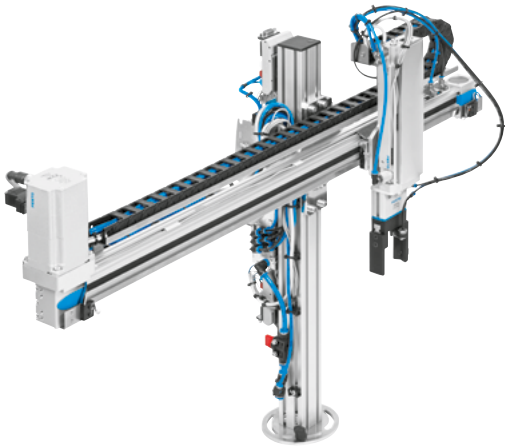


With vacuum technology → see illustration	**8031659**
With parallel gripper	**8031660**

Recommended accessories:

MPS slotted mounting plate	8038504
PA workpiece set	554301
15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
15-pin D-sub cables: plug connector – open, 2.0 m	8033586
C Interface	8025738

Two-Axis Handling Module With a Stepper Motor



The two-axis handling module with a stepper motor can be used to handle workpieces and boxes. The X-axis is implemented via an electromechanical drive. The stepper motor is actuated by a controller. This makes the positioning of the axis very precise and easy to configure. The Z-axis is implemented via a guided, pneumatic cylinder.

The integrated pneumatic mini stop allows the upper and lower end position and a mid-position to be approached. The electrical interfaces as well as the valve manifold and the stepper motor-controller are available on the module.

Technical data
- Power supply: 24 V DC
- Operating pressure: 600 kPa (6 bar)
- Square/round workpiece dimensions: max. 40 mm
- Stepper motor for motor controller
- X and Z-axis adjustable at an angle of 15°
- Stroke of the X-axis: 600 mm
- Stroke of the Z-axis: 100 mm
- Interfaces: 2x 15-pin D-Sub-HD
- 8 digital input signals
- 7 digital output signals

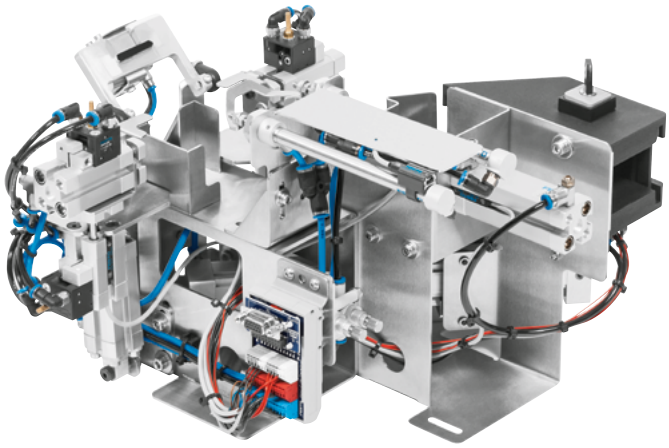
Scope of delivery
- X-axis with belt drive
- Z-axis with guided cylinder
- Stepper motor
- 2 roller lever switches for deactivating the X-axis
- Diffuse sensor
- Gripper jaws for the workpiece and box
- 2x mini I/O terminal
- Valve: 4x 5/2-way valve (monostable)
- Mounting material for profile plate
- Technical datasheet

Order no.	**8049257**

Recommended accessories:

MPS slotted mounting plate	8038504
2x 15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
2x 15-pin D-sub cables: plug connector – open, 2.0 m	8033586
C Interface	8025738

Packaging Module



The Packaging module is responsible for handling the boxes. The thrust cylinder separates and unfolds the boxes from the magazine. The guide cylinder unfolds the upper section of the box, pushes the closing flap and then fixes the box lid by advancing the stop cylinder to lower the workpiece into it afterwards. As soon as the provided box is filled and the guide cylinder is moved into the initial position, the box can be sealed with the folding mechanism. The sealed box can then be removed.

Technical data
– Power supply: 24 V DC
– Operating pressure: 600 kPa (6 bar)
– Square/round workpiece dimensions: max. 40 mm
– Box dimensions (L x W x H): 48 x 42 x 50 or 60 mm
– Interfaces: 15-pin D-Sub-HD
– 4 digital sensors
– 4 digital actuators

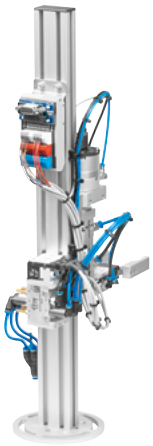
Scope of delivery
– Module fully assembled and set
– Sensors: 4x magnetic limit switch
– Valve: 4x 5/2-way solenoid valve
– Mounting material for profile plate
– 50x box size 1
– 50x box size 2

Order no.	**8043505**

Recommended accessories:

MPS slotted mounting plate	8038504
15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
15-pin D-sub cables: plug connector – open, 2.0 m	8033586
C Interface	8025738
Box size 1 (50 pieces) (L x W x H): 48 x 42 x 50 mm	8064300
Box size 2 (50 pieces) (L x W x H): 48 x 42 x 60 mm	8064301

Rotary/Lifting Module



The rotary/lifting module is a 2-axis handling unit for small lifting and swivelling tasks with a parallel gripper for transporting workpieces with a diameter/edge length of 40 mm (1.6“). The gripping position and the rotation angle can be adjusted. The module is supplied fully assembled with valve slices and an electrical interface.

Technical data
– Operating pressure: 600 kPa (6 bar)
– Power supply: 24 V DC
– 4 digital sensors
– 3 digital actuators
– Rotation angle, C-axis: 0 – 180°
– Stroke length, Z-axis: 20 mm (0.8 in)
– Swivel radius (axis center point to workpiece center point): 100 mm (4 in)
– Rotary/lifting unit, height-adjustable

Scope of delivery
– Mini I/O terminal
– Valve slices, 3x 5/2-way solenoid valve, monostable
– Double-acting cylinder with guide
– Swivel cylinder
– 4 magnetic limit switches
– Parallel gripper with gripper jaws
– Mounting accessories for profile plate

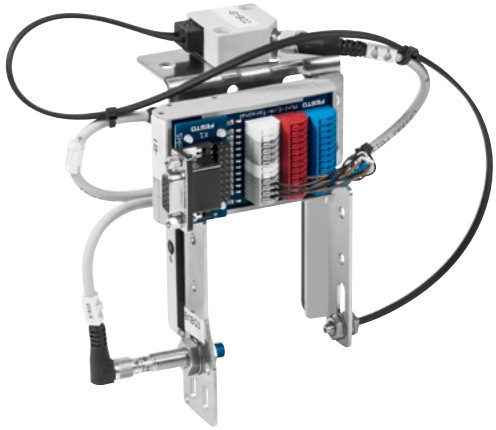
Training content
– Basic principles of pneumatics
– Sensor technology: magnetic limit switches
– Connecting tubing and wiring
– Reading circuit diagrams
– Learning about handling systems
– Semi-rotary drive
– Gripper technology

Order no.	**8035936**

Recommended accessories:

MPS slotted mounting plate	8038504
PA workpiece set	554301
15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
15-pin D-sub cables: plug connector – open, 2.0 m	8033586
MPS measuring table	8040204

Detection Module



The Detection module is mounted in an MPS station to a guide rail at the Conveyor or Slide module. The module can also be mounted on a profile plate with a simple conversion. Different workpieces are identified based on the sensor evaluation and combination (red, black, metal, transparent).

The module is equipped ready for use with three different sensors and an electrical interface. It is suitable for detecting workpieces with a diameter of up to 40 mm (1.6 mm).

Technical data
– Power supply: 24 V DC
– Square/round workpiece dimensions: max. 40 mm (1.6 mm)
– 3 digital sensors

Scope of delivery
– Sensor carrier with mini I/O terminal
– Diffuse sensor: PNP, N/O contact
– Fork light barrier: PNP, N/O contact
– Inductive sensor: Rated operating distance 2.5 mm, PNP, N/O contact
– Mounting accessories

Order no.	**8044527**

Recommended accessories:

15-pin D-sub cables: plug connector – plug connector, 2.0 m	8033584
15-pin D-sub cables: plug connector – open, 2.0 m	8033586

RFID Module



The RFID module is suitable for use in MPS conveyors or as an individual module for use of slot or profile plates.

RFID (identification using electromagnetic waves) refers to a technology for transmitter/receiver systems for automatic and touchless identification and localization of objects via radio waves.

The RFID system consists of a transponder/tag on or in an item, which contains an identification code, and a read/write device for reading or writing this identifier.

Technical data
– Power supply: 24 V DC
– Supported protocols: Modbus, EtherNet/IP, PROFINET
– H-rail mounting for basic functional module
– Sensor mounting to belt guide rail

Scope of delivery
– Network interface
– Basic functional module with extension module for 2 RFID write/read devices
– RFID write/read device including connecting cable (1 piece)
– Mounting material for basic functional module (QuickFix) and for sensor to profile plate and guide rail of MPS Conveyor
– 10x RFID tags with tool inserts for PA workpiece set
– Technical datasheet

Order no.	**8063388**

Recommended accessories:

MPS slotted mounting plate	8038504
RFID R/W head with foot mounting	8063437
RFID memory 128 bytes (10 piece) with insert	8063850

MPS trolley

Compact and Mobile – Thanks to the Trolley





The station is easy to mount on the trolley. Appropriate through-holes in the side and rear panels enable orderly routing of cables. The symmetrical design of the trolley means that there are mounting options on both sides for the control panel, the intermediate shelf and for drawers. A lifting column can be integrated in the center of the trolley to facilitate ergonomic work on the profile plate. There is space for the assembly board for the electrical connections and the PLC rack on both sides of the trolley. The profiles for A4 mounting allow additional EduTrainer units to be used on the trolley. An optional attachable door protects the equipment inside.

Technical data
– Dimensions (H = including castors to top edge of trolley x W x D): 750 x 350 x 700 mm

Scope of delivery
– Trolley including castors
– Intermediate shelf

MPS trolley 350 x 700	**8033248**
MPS trolley 350 x 700, with height adjustment	**8033590**
MPS trolley 700 x 700	**8106686**
MPS trolley 700 x 700, with height adjustment	**8106687**
MPS trolley 700 x 700 for robot	**8106688**

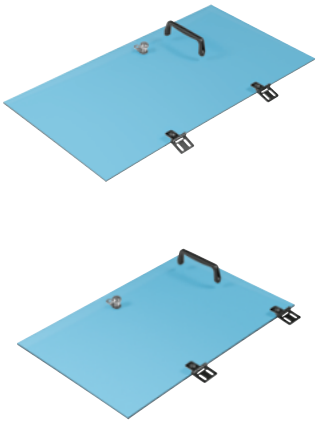
Expansion option:

MPS height adjustment	8033591
Grounding kit	8088988
MPS door for 350 trolley front	8033595
MPS door for 350 trolley rear	8033596
MPS Türset for 700 trolley front	8112136
MPS Türset for 700 trolley rear	8112134
MPS drawer set	8033593
Profile plate connector	162228

MPS Trolley Accessories



MPS height adjustment
Pure ergonomics. Students can adjust the height to a level that suits them when working with MPS stations. Simply raise the mounted profile plate, which is infinitely adjustable, upwards. The integrated Bowden cable is used for infinitely adjustable lowering.



MPS door
The safety door for the MPS trolley 700 x 350 is attached to the trolley from the outside. A lock prevents unauthorized opening of the door.



MPS drawer set
Order on the table. The drawer set expands the MPS trolley to provide additional storage space. The drawers can be stacked on top of one another or divided between both sides of the trolley. An intermediate shelf covers the drawer from above.



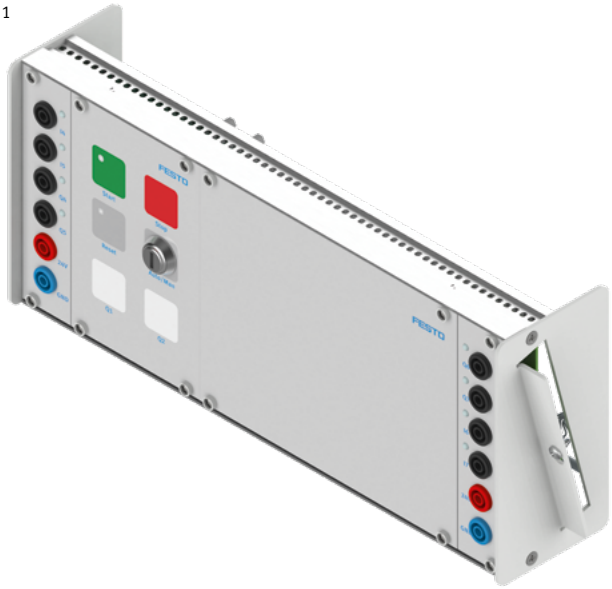
Profile plate connector
For connecting two profile plates (e.g. when combining two MPS stations to build a system).



Trolley with additional equipment

MPS Trolley Operator Panel

1



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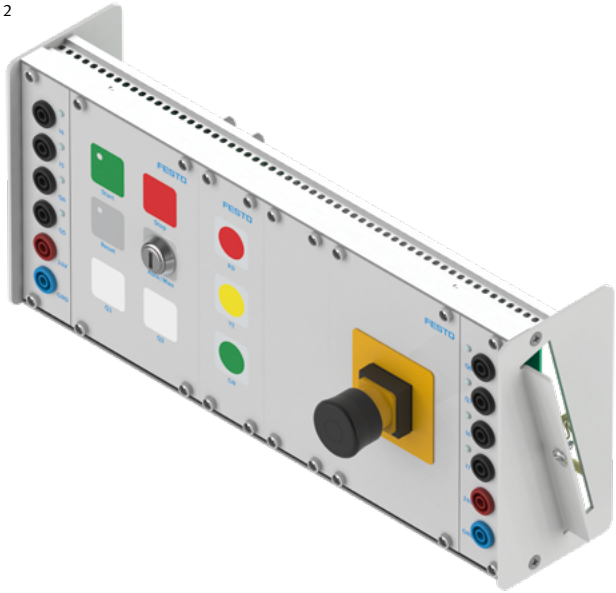


MPS operator panel
The MPS operator panel enables easy operation of MPS stations. The operator panel can be mounted on the MPS trolley and is connected to the control level via SysLink.

Control elements:
– START button with LED
– STOP button
– RESET button with LED
– AUTO/MAN key actuator
– 2 flexibly usable indicator lights

A black stop mushroom actuator is also integrated, which simulates the function of an emergency stop for didactic purposes.

The following signals are available on the left and right of the operator panel via 4 mm safety lab sockets:
– 2x digital inputs with LED
– 2x digital outputs with LED
– 24 V
– GND

Due to the modular design, the operator panel can be supplemented with additional front panel modules.

1 Operator panel 350 mm	**8127608**
2 Operator panel 350 mm with emergency stop button and status	**8137529**
Operator panel 700 mm	**8127609**
Operator panel 700 mm with emergency stop button and status indicator	**8137559**

Expansion option:

19“ module STOP button, detenting	8137306
19” blank panel (16 HP) for the control panel	534630
19” blank panel (32 HP) for the control panel	195765
19” control panel	195766
19” emergency stop module (9 HP)	573860
19” request module (3 HP)	573861
19” mounting frame	526206
MPS status indicator plate	8098009

MPS Trolley Operator Panel



19“ module STOP button, detenting
The 19“ module STOP button, detenting enables the integration of a purely didactic stop mushroom actuator – similar to a real emergency stop mushroom actuator – into an MPS operator panel. The connection to an EduTrainer or an emergency stop board is made via a 2.5 m long cable with a 2-pin screw clamp plug.

The 19“ module STOP button, detenting can be integrated into the MPS control console. A 19“ empty panel (order no. 534630) is required for installation in the control console. The 19“ empty panel is not included in the scope of delivery.

Order no. **8137306**



19” blank panel (16 HP) for the operator panel

Order no. **534630**

19” blank panel (32 HP) for the operator panel
To cover unoccupied module slots in the 19” frame of the MPS control panel.

Order no. **195765**



MPS status indicator plate
The MPS status indicator plate is a signal generator that lights up in the colors red, yellow, or green. The signal generator can be connected to an MPS station via SysLink. Depending on how the outputs are programmed, the MPS status indicator plate can be used to show the status of the process, for example.

Order no. **8098009**

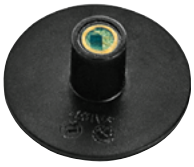
MPS D and MPS 400 Workpieces

1



2





1 **MPS workpiece set**
The workpieces are compatible with MPS stations. For example, the housing in the Pick&Place station can be closed with the cover.
The set comprises:
– 8 housings, black
– 8 housings, red
– 8 housings, silver
– Outside diameter D = 40 mm
– Height H = 25 mm
– Fill quantity V = 15 ml
– 24 covers, black

Order no. **8129188**

2 **PA workpiece set**
To fill liquids into the MPS PA Bottling station. The workpieces are compatible with the MPS stations. For example, the housing in the Pick&Place station can be closed with the cover.

The set comprises:
– 6 housings black
– 6 housings red
– 6 housings silver
– 6 housings transparent
– Diameter outside D = 40 mm
– Height H = 25 mm
– Volume V = 15 ml
– 24 lids black

Order no. **554301**

RFID insert MPS workpieces
RFID insert for MPS workpieces in MPS 400 training systems.

Set with 12 RFID inserts

Order no. **8128766**

MPS Robot Assembly Workpieces

1



2



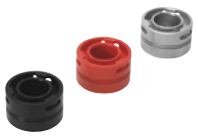
1 Workpiece set "For cylinder assembly"
The workpiece set consisting of cylinder components for full assembly (body, piston, spring, cover). The cylinders can be assembled and dismantled many times. This kit allows for the complete assembly of 7 black and 7 red plastic cylinders and 7 aluminum cylinders.
– External diameter: 40 mm
– Height (black): 22.5 mm
– Height (red and aluminum): 25 mm

Order no. **162239**

2 Workpiece set "Cylinder end caps"
Workpiece set consisting of 50 end caps for cylinder assembly. The end caps do not yet have a hole for the cylinder piston rod. This hole is punched by the hydraulic press station. However, the hydraulic press station can also be operated with end caps that already have a hole.
Number of end caps: 50

Order no. **162240**

1



2



1 **Workpiece set "Reject bodies"**
Simulates a faulty workpiece.

The workpiece set comprises 2 black and 2 red plastic cylinder bodies and 2 aluminum cylinder bodies.
– External diameter: 40 mm
– Height: Each color:
1x 23 mm and 1x 24 mm

Order no. **534368**

2 **Workpiece set "Cylinder bodies"**
The workpiece set comprises 4 black and 4 red plastic cylinder bodies and 4 aluminum cylinder bodies.
– External diameter: 40 mm
– Height (black): 22.5 mm
– Height (red and aluminum): 25 mm

Order no. **167021**

EasyKit IoT Tracker

Microcontroller system



EasyKit, the compact 32-bit microcontroller

The EasyKit microcontroller system has a diameter of 40 mm (1.6 mm) and is pre-equipped with the high-performance 32-bit microcontroller, a monochrome display, a three-axis acceleration sensor, a temperature sensor, LEDs, and a joystick as standard.

The EasyKit workpiece is loaded and programmed via a USB port. An extension plug is used to connect the battery board or other extensions.

The microcontroller board is protected by a transparent housing. The battery board with lithium polymer battery is mounted in a protective housing with an outside diameter of just 40 mm (1.6 in).

Extensions such as an I/O board with six digital and analog input and output channels can be connected instead of or in addition to the battery. The open system concept also permits custom enhancements.

EasyKit is the smart workpiece for the new MPS generation. The microcontroller system can be reprogrammed to assume a number of functions. This can be a video game, a watch, a pedometer, and much more, depending entirely on the programming.

EasyKit is also prepared for the integration of an RFID tag.

Technical data

EasyKit microcontroller board:
- 32-bit microcontroller, 80 MHz cycle rate, 256 kB of program memory, 64 kB of RAM
- Monochrome display (resolution 64 x 48 pixels)
- 2x LED
- Acceleration sensor
- Temperature sensor
- Humidity Sensor
- Air preasure Sensor
- Joystick
- USB: Micro B port

EasyKit battery board:
- Lithium polymer battery
- Battery life: 2 to 4 hours, depending on the application

EasyKit overall dimensions:
- Outside diameter: 40 mm (1.6 in)
- Height with carrier housing: 41.5 mm (1.63 in)

Scope of delivery
- Microcontroller board, extension connector, display, acceleration sensor, temperature sensor, joystick, and USB port in the housing
- Battery board with lithium polymer battery, charging electronics, and housing
- USB connecting cable, 0.6 m (23.6 in)
- Carrier housing
- Data sheet
- Programming software and full documentation available to download

Order no.	**8163034**

Accessories

1
2



1 **MPS A4 mounting frame**
The A4 mounting frame expands the MPS station to provide space for an EduTrainer in A4 format above the profile plate. Because the EduTrainer is mounted on the profile plate, it is always at eye level. There is thus space for the PLC in the trolley and for the touch panel in the A4 mounting frame, for example.

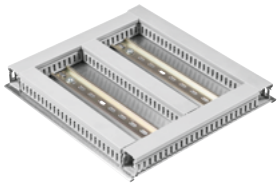
Technical data
– Dimensions (H x W outside x D): 626 x 342 x 84 mm

Scope of delivery
– Holder for profiles
– 2x A4 mounting profiles
– Mounting accessories for profile and profile plate

Order no. **8033592**

2 **MPS mounting profile**
The MPS A4 mounting profile expands the MPS trolley 700 x 350 to include a space in A4 format. The PLC or assembly board can therefore be hung in the A4 mounting frame.

Order no. **8033594**



MPS A4 assembly board
The assembly board is used to mount the various terminals or other components that can be mounted on the H-rail. There are two levels with a height of approx. 95 mm available. The board can be installed in any A4 mounting frame in the MPS trolley or in the lab table. The board can also be hung in the trolley or attached to the profile plate or the intermediate shelf in the MPS trolley. The board is fully assembled.

Technical data
Dimensions (H x W x D):
279 x 314 x 40 mm

Scope of delivery
– Assembly plate
– 2 H-rails, 240 mm long
– Cable ducts

Order no. **8035612**



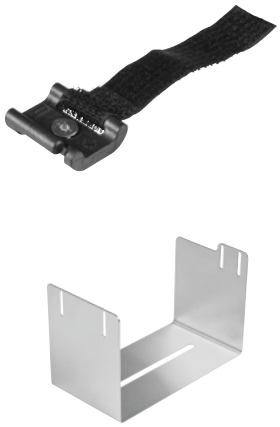
MPS slotted mounting plate
For mounting the MPS modules in order to learn about a particular workplace before it is integrated into an MPS station. The modules can also be stored safely on the plate.

Technical data
Dimensions (H x W):
297 x 310 mm

Scope of delivery
– Slotted plate
– 4 plastic feet

Order no. **8038504**

1
2



1 **Cable holder with hook-and-loop fastener (pack of 10)**
Reliable and stable fastener for guiding cables and tubing in electrical and pneumatic installations of plants.

Technical data
– Overall length: 122.5 mm
– Band width: 20 mm
– Contact width: 30 mm
– Contact length: 34 mm

Scope of delivery
– 10 cable holders
– 10 M 15 screws
– 10 T-head nuts for profile plate slot

Order no. **8034300**

2 **Adapter for Stacking magazine module**
Adapter for mounting the magazine at MPS conveyor height. Stainless steel sheet bending parts including mounting screws.

Order no. **8032173**

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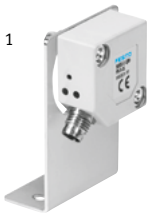

2


1 **IR receiver**
The IR transmitter and IR receiver for the perfect pairing for wireless, invisible, 1-bit communication, e.g. 1-bit communication between 2 MPS Stations. The receiver and transmitter are each supplied with a retainer and a connecting cable.

Order no.	**196964**

2 **IR transmitter**
The IR transmitter and IR receiver for the perfect pairing for wireless, invisible, 1-bit communication, e.g. 1-bit communication between 2 MPS Stations. The receiver and transmitter are each supplied with a retainer and a connecting cable.

Order no.	**196963**

1


2


1 **Connecting cable, stations C and D**
This cable is used for connection and communication between stations of generation C and stations of generation D.

For one-bit communication between two generation C stations, one-way light barrier transmitters and receivers were used. With generation D, the signal is transmitted directly via a 4 mm lab cable. The connecting cable is used for communication between stations of generation C (up to 2013) and stations of generation D (as of 2014).

Technical data
– Operating voltage 24 V
– Electrical connection:
  M8 plug (3-pin)
– Length: 1.0 m

Order no.	**8079890**

2 **Rubber feet**
For non-slip, protective mounting of profile plates on tabletops of any type. Set (4 pieces).

Order no.	**158343**



MPS measuring table
This measuring table fits the MPS rotary/linear module. The measuring table and analog sensor are height-adjustable. The diffuse sensor supplies both an analog and a binary output signal. This facilitates different training levels. The binary switching output can be adapted to the measurement requirement via a simple teach-in process. The mounting bracket can be used to attach different sensors.

The measuring table is fully assembled and is also suitable for project exercises with other handling devices or a robots.

Technical data
– Height: 665 mm
– 1 digital/analog signal (teach-in)
– Height-adjustable
– Workholder for square/round workpieces: maximum 40 mm

Scope of delivery
– Diffuse sensor
– Profile
– Connecting cable
– Mounting accessories for profile plate

Order no.	**8040204**



Slide 250
The slide is used for feeding or sorting out workpieces.

Technical data
– Length: 250 mm
– Height adjustable: 20 – 117 mm
– High end stop
– Sample application: Sorting station
– Includes mounting accessories for construction on a profile plate

Order no.	**8046639**

Accessories Electrical Connection Technology

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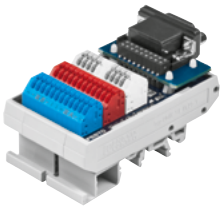

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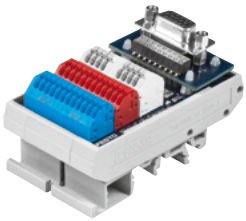
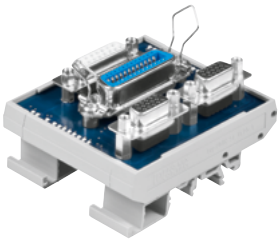
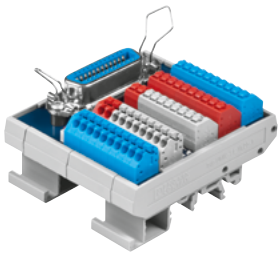
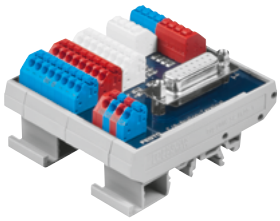








Mini I/O terminal
The mini I/O terminal is the central unit of the MPS modules. It is used to wire four digital inputs, four digital outputs, two analog inputs and one analog output which are connected to a socket. Contact is established via spring-loaded terminals. LEDs are fitted on the input and output terminals which make it easy to monitor the switching status and enable systematic troubleshooting. The terminal can be mounted on an H-rail.

The terminal is available in two variants:
– 15-pin Sub-D HD socket, straight
– 15-pin Sub-D socket, 90° to the PCB

Technical data
– 24 V/0 V terminals
– Digital inputs: 4
– Digital outputs: 4
– Analog inputs: 2
– Analog output: 1
– Spring-loaded terminal: 0.2 – 0.5 mm²
– 15-pin Sub-D HD socket
– Status LEDs
– Dimensions (W x D): 45 x 77 mm

Scope of delivery
Terminal with H-rail mounting

1 Straight	**8025740**
2 90° to the PCB	**8025739**

C Interface
Simple Plug and Learn – intelligent connection technology. The design of the system connection enables two modules to be easily connected to a PLC via SysLink. If the module is to be equipped with analog signals, these can be picked off via the 15-pin Sub-D socket.

Technical data
– 24-pin IEEE socket (SysLink)
– 15-pin Sub-D socket
– 2x 15-pin Sub-D HD sockets
– Status LEDs
– Dimensions (W x D): 68 x 77 mm

Scope of delivery
Terminal with H-rail mounting

Order no.	**8025738**

Digital I/O terminal (SysLink)
The I/O terminal is the central unit of the MPS SysLink concept. It is used to wire eight digital inputs and eight digital outputs which are connected to a socket. Contact is established via spring-loaded terminals. LEDs are fitted on the input and output terminals which make it easy to monitor the switching status and enable systematic troubleshooting. The terminal can be mounted on an H-rail.

Technical data
– 24 V/0 V terminals
– Inputs: 8
– Outputs: 8
– Spring-loaded terminal: 0.2 – 1.5 mm²
– 24-pin IEEE socket (SysLink)
– Status LEDs
– Dimensions (W x D): 68 x 77 mm

Scope of delivery
Terminal with H-rail mounting

Order no.	**8025736**

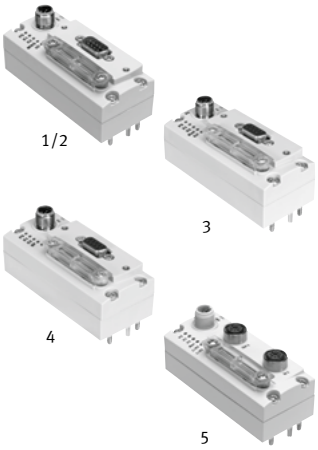
Analog I/O terminal
Analog signals are routed to a special analog terminal with a 15-pin Sub-D socket. It is used to wire four analog inputs and two analog outputs which are connected to a socket. Contact is established via spring-loaded terminals. LEDs are included on the input and output terminals which make it easy to monitor the status and enable systematic troubleshooting. The terminal can be mounted on an H-rail.

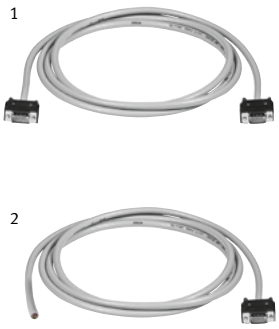
Technical data
– 24 V/0 V terminals
– Current inputs: 4
– Current outputs: 2
– Voltage inputs: 4
– Voltage outputs: 2
– Spring-loaded terminal: 0.2 – 1.5 mm²
– 15-pin Sub-D socket
– Status LEDs
– Dimensions (W x D): 68 x 77 mm

Scope of delivery
Terminal with H-rail mounting

Order no.	**8025737**









IO Link DA interface

The IO Link DA interface is the universal interface from modules to different communication/bus systems. An MPS module is connected via each of the two 15-pin Sub-D HD sockets. The M12 I-Port connection provides communication via IO Link. Bus coupling modules (CTEU) expand the I-Port interface to include various bus systems. The following modules are currently available: CANopen, DeviceNet, CC-Link, PROFIBUS, EtherCAT. LEDs display the status of the interface. The interface can be mounted in a 19" frame, bolted or on an H-rail.

Technical data
- M12 I-Port IO Link interface with 24 V/0 V
- 2x 15-pin Sub-D HD sockets (each 4DI/4DO; 2AI/1AO, 24 V/0 V)
- 2 LEDs
- Dimensions (H x W x D): approx. 128 mm x 18 HP x 28 mm

Scope of delivery

Interface with cover, A-coded connecting cable and H-rail mounting

Order no.	**8038559**

Fieldbus node CTEU

Well connected with the fieldbus node CTEU for valve terminals and the "IO Link DA Interface". The fieldbus node supports fieldbus-capable modules. The bus node module is therefore a low-cost means of exploring the extensive world of fieldbus protocols, including CANopen, PROFIBUS and DeviceNet. This communication interface is based on the Festo I-Port as a universal M12 connection. It can be equipped with the new bus modules CTEU or configured with IO Link.

Bus node:

1 CANopen	**8039079**
2 DeviceNet	**8039078**
3 CC-Link	**1544198**
4 PROFIBUS DP	**570040**
5 EtherCat	**572556**
PROFINET	**2201471**
ASi	**572555**

15-pin Sub-D HD cables

1 **Connector – connector**

For the connection of MPS modules to the C interface via the mini I/O terminal. The I/O data cable is used to connect 24 V/0 V, four digital inputs and outputs as well as two analog inputs and one analog output in parallel.

Technical data
- Wires: 16 x 0.25 mm²
- 15-pin Sub-D HD plug connector

0.5 m	**8033582**
1.0 m	**8033583**
1.5 m	**8042954**
2.0 m	**8033584**

2 **Connector – open**

For the connection of MPS modules to the digital or analog I/O terminal via the mini I/O terminal. The I/O data cable is used to connect 24 V/0 V, four digital inputs and outputs as well as two analog inputs and one analog output.

Technical data
- Wires: 16 x 0.25 mm²
- 15-pin Sub-D HD plug connector

2.0 m	**8033586**

19" mini I/O 4 mm module

The 19" mini I/O 4 mm module is used for wiring the digital and analog inputs and outputs of an MPS module using 4 mm safety cables. The MPS module is connected to the 15-pin Sub-D HD socket. Mounting on an H-rail, a mounting plate included in the scope of delivery, or in a 19" mounting frame is possible.

Technical data
- 4x 4 mm socket for digital inputs
- 4x 4 mm socket for digital outputs with LED indicator
- 2x 4 mm socket for analog inputs
- 1x 4 mm socket for analog outputs
- 2x 4 mm socket for 24 V
- 2x 4 mm socket for 0 V
- 15-pin Sub-D HD socket
- Dimensions (H x W x D): 128.3 mm x 12 HP x 27.7 mm (5 in x 12 HP x 1 in)

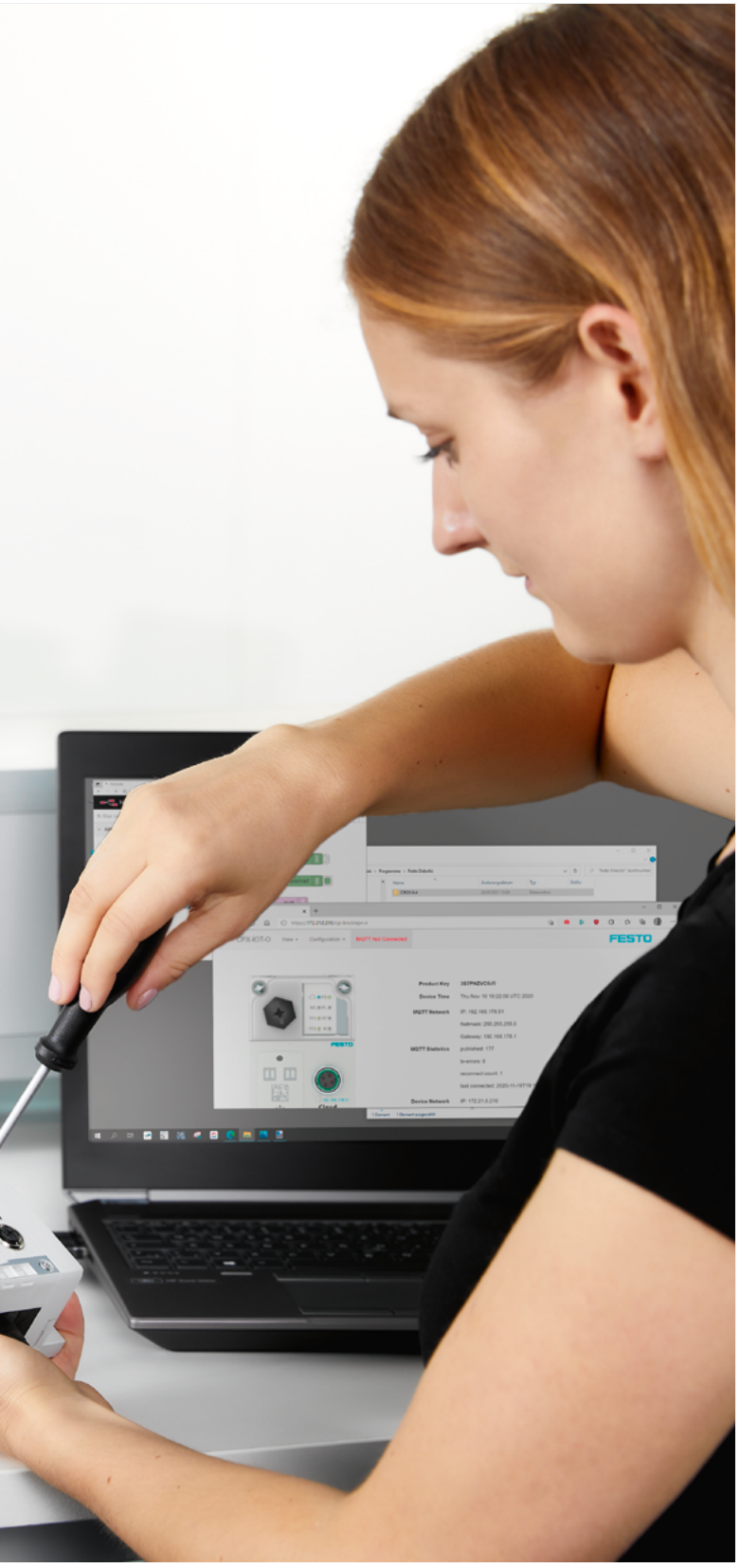
Scope of delivery

Interface with cover and H-rail mounting

Order no.	**8040895**

Focus and Trending Topics I4.0





Overview 118

The Digital Factory

Factory Simulation
EasyPort 120
FluidSIM 122
CIROS 124

Factory Management
FactoryViews 130
MES4 131

Networks and IT Security 134

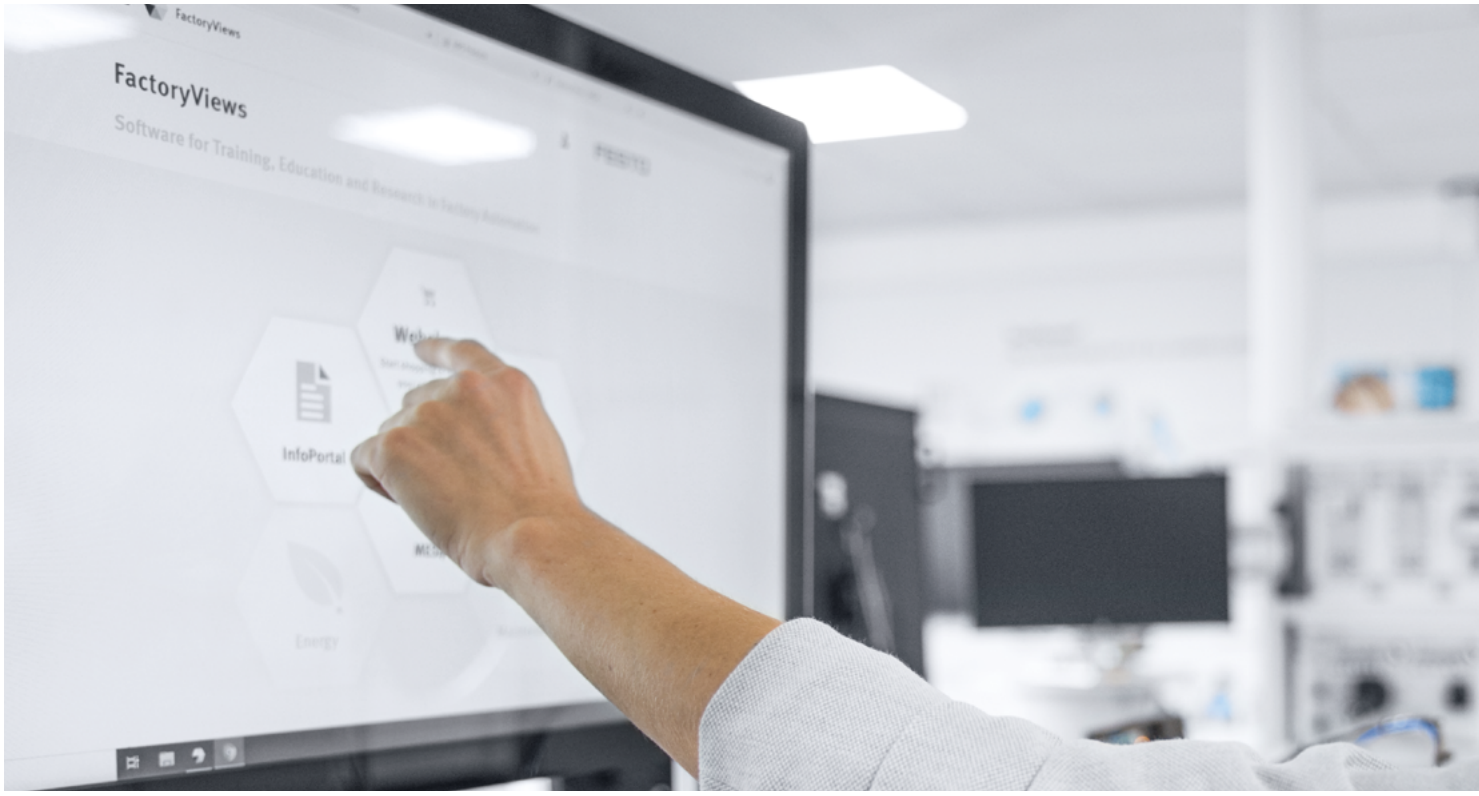
Artificial Intelligence in Application 136

Energy Management 140

Industrial Robotics 142

Mobile Robotics 152

Focus and Trending Topics I4.0





Factory simulation
Simulation and virtual commissioning save time and money in mechanical engineering and provide a clear and effective training and research tool.

It is possible to switch between a real system and a simulation in order to use the appropriate perspective for each purpose.



Factory management
In a modern, networked factory, machines and workpieces communicate with each other as well as with ERP (Enterprise Resource Resource Planning) systems and MES (Manufacturing Execution Systems), both inside and outside the factory, up to the cloud level. MES4 is the didactic MES for Festo for an intelligent factory with open interfaces.



Network and IT security
Machines and systems have to be protected against unauthorized access. Since attackers are also using increasingly sophisticated methods with increasing digitalization, the security mechanisms and employee expertise in place have to keep pace.



Artificial Intelligence in Application
Machine learning, or deep learning, based on neural networks has shown particular promise for automated data analysis. Increasing computing power makes it possible to analyze and classify huge amounts of data which can be used to draw profitable conclusions. This is why flexible and exciting data analysis based on machine learning is also making its way into our learning factories.





The digitalization of production allows people, products and production facilities to be intelligently networked. This creates potential for increasing the quality, efficiency and transparency of production.

In a variety of application areas, from simulation and secure networking to AI-based analytics and energy efficiency measures, the following focus and trending topics can be integrated into the learning system in a modular fashion.



Smart maintenance
Servicing machines and equipment is facilitated and accelerated by digitalization in the factory. Machines can independently order upcoming servicing, and the automated evaluation of downtimes enables the continuous improvement of processes.



Energy management
Integrated energy monitoring with web-based visualizations allows easy analysis of electrical consumption and compressed air as well as monitoring of the correct functioning of the modules. Consumption can also be controlled in a targeted manner, meaning that in addition to energy efficiency issues, energy flexibility is also increasingly coming into focus.



Industrial robotics
Industrial robots truly come into their own when it comes to the automated and efficient assembly of products and variants. For this reason, robotic cells usually constitute an essential core of the overall system in our CP Factory.



Mobile robotics
An intelligent flow of materials and networked logistics are important drivers for Industry 4.0. The CP Factory offers a versatile teaching and research platform for a wide range of logistics problems, including the integration of the latest version of the proven mobile robot.

EasyPort USB

Interface for Measuring, Open and Closed-Loop Control



Connection of software/simulation with actual training equipment/ all PLCs

The principle is simple: the USB interface is connected to the PC. The connection to the automation equipment is via standard SysLink connectors. Therefore input and output signals can be read into and output from a PC. To ensure that EasyPort is adaptable to different situations, we have developed software for the device drivers with a graphical user interface, via which connections can be made.

Technical data

- 24 V power supply via separate screw terminals or via SysLink connectors
- Interface to PC (galvanically isolated): USB 2.0, RS 232. Up to 4 modules can be connected via a USB hub. Transmission speed: 115 kbaud
- Analog interface: sub-D 15-pin socket, 12 bit resolution, 4 analog inputs, 2 analog outputs, sample frequency 0.5 kHz
- Digital interface: 16 digital inputs, 16 digital outputs on 2x 24-pin Centronics sockets with 8 digital inputs each (24 V), 8 digital outputs (24 V). 24 V power supply. Digital signals represented by LEDs
- Large LCD display, display of channel, unit, trend, and measured value (4 digits). Selection of the channel to be displayed and the units via keys.
- Controllable via ActiveX Control from LabVIEW, C++, or Visual Basic

EasyPort USB 19”

- Technical data as with EasyPort USB , but for installation in a 19” support system
- Front plate: 19” plate with 36 HP

Connects the Simulation to the Real World

Example applications	**Measuring**	**Control (open loop)**	**Closed-loop control**	**Controlling a simulation**
PC: **Software and simulations**	– FluidLab-PA – FluidLab-P – FluidLab-H – LabVIEW – C++ – Visual Basic	– FluidSIM (only digital) – S7-PLCSIM – CODESYS Soft-SPS – LabVIEW – C++ – Visual Basic	– FluidLab-PA – FluidLab-P from version 2.0 – LabVIEW – C++ – Visual Basic	– FluidSIM – CIROS – LabVIEW – C++ – Visual Basic
Interface: **EasyPort USB**	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital
Real training equipment	– Simulation box, digital/analog – MPS PA – TP 210 – TP 610 EasyPort USB is the PC interface for receiving analog measurements and digital signals. Measurement data logged via: – FluidLab-PA – FluidLab-P – FluidLab-H	– Simulation box, digital/analog – MPS PA – MPS – TP 301 EasyPort USB is the PC interface to control actual processes or simulations on a PC via an actual PLC. Actual process, controlled via: – S7-PLCSIM – FluidSIM – CODESYS	– Simulation box, digital/analog – MPS PA – TP 210 – TP 610 EasyPort USB is the PC interface to control an actual closed-loop controlled system. Closed-loop controlled system, controlled via: – FluidLab-PA – FluidLab-P from version 2.0	– Any PLC – Simulation box, digital – EduTrainer Recommendation: The Codesys starter kit with CECC-LK and EasyPort USB contains everything that is needed to start on the subject of control Simulated process, displayed via: – CIROS – FluidSIM

EasyPort USB	**548687**



EasyPort USB 19“	**8021637**



Scope of delivery
– EasyPort USB/EasyPort USB 19“
– 24 V connecting cable on 4 mm safety plugs
– USB cable
– Data carrier: EasyOPC driver, datasheet, Activ-X control, examples of control using LabVIEW

Also order:

For EasyPort with a real process or Simulation box:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analog cable, parallel, 2 m	529141

For EasyPort with a real PLC:

I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106

For EasyPort, freely wirable, with any PLC:

I/O data cable with SysLink connector IEEE 488 and bare cable-end sleeves	167122

For EasyPort with an EduTrainer:

I/O data cable, crossover, with terminal socket, 0.3 m	167197

For EasyPort with a real PLC or Simulation box:

Analog cable, crossover, 2 m	533039

CODESYS starter kit with CECC-LK and EasyPort USB	8024001
Universal connection unit, digital (SysLink)	162231
Quick-Fix screw adapter	549806

FluidSIM

Interactive Pneumatic, Hydraulic, and Electrical Circuit Simulations



FluidSIM at a glance

- Convenient creation of circuit diagrams and their interactive simulation
- Content tailored to Festo Didactic learning systems
- Various usage options: web, Windows, and via the Festo LX digital learning portal
- Can be used online and offline
- Fast learning preparation and individual learning
- Learn what effects changes in a technical set-up have and observe the immediate consequences by running real-time simulations
- Extensive library of pneumatic, hydraulic, control, electronic and digital components
- Virtual and real measuring devices
- Fault models for developing skills in troubleshooting and preventing errors

For more than 25 years, FluidSIM has been the world's leading simulation software for creating and simulating circuit diagrams in pneumatics, hydraulics, and electrical engineering.

FluidSIM enables valuable technical skills to be acquired by designing circuits, bringing them to life through simulation, and optimizing them through interaction. The simulation of control systems and processes has long been an industrial standard that ensures errors are prevented, and efficiency and quality are increased.

Objectives
FluidSIM provides a practical way for students to develop their skills in automation technology and to master complex tasks.

The learning objectives of FluidSIM include:
- Creating circuit diagrams
- Identifying and preventing errors
- Optimizing solution circuit diagrams through interactive simulations
- Understanding how solutions are developed
- Observing effects through real-time simulations

Component library
FluidSIM also has component libraries for pneumatics, hydraulics, and electrical engineering that can be used either separately or in combination. The component libraries include hundreds of pneumatic, hydraulic, electrotechnical, electric, and digital components, and are constantly expanded and revised.

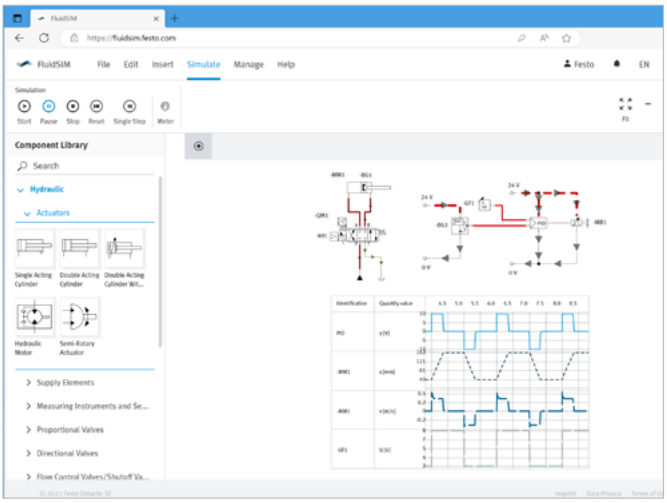
GRAFCET
GRAFCET diagrams can be created and included in simulations in FluidSIM. These simulations comprise:
- GrafEdit: Standard-compliant creation of GRAFCETs
- GrafView: Visualization of the control sequence mapped as GRAFCET
- GrafControl: Controlling the process with GRAFCET, including fault simulation and process monitoring
- GrafPLC: Manufacturer-independent control of all fluid and electrical engineering systems

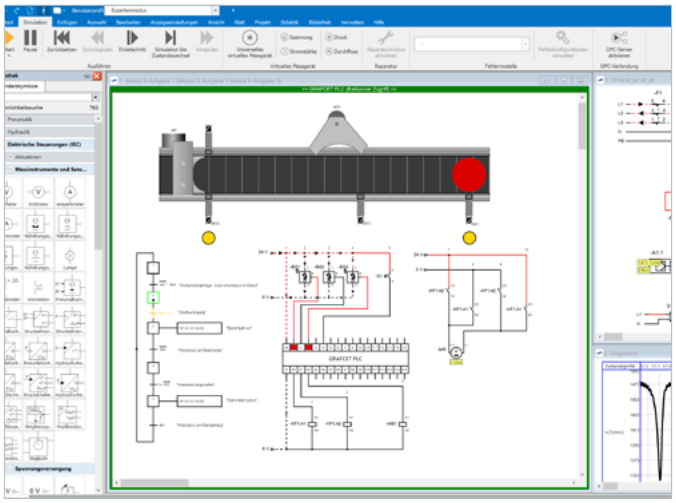
Virtual and real measuring devices
FluidSIM offers both real and virtual measuring devices that can be integrated into circuits. Before the simulation, real measuring devices are installed, while virtual measuring devices are used during or before the simulation to display the simulated values of the circuit. In contrast to real measuring devices, virtual measuring devices do not influence the circuits. They therefore show the pure values of the circuit simulated by FluidSIM. Virtual measuring devices can be used in electrical as well as pneumatic and hydraulic circuits.

Fault models and diagnostics
FluidSIM has an innovative diagnostic concept, which enables the readily available fault models for various components to be compiled. Before a simulation, a specific error configuration can be selected; this then has an impact on the subsequent simulation. During this simulation, defective components are identified with the help of virtual measuring devices and then virtually repaired.

Lesson preparation and learning materials
With the expert mode of FluidSIM, profiles can be created and lessons can be organized and then assigned to students. The profiles enable the functions, components, and error models to be narrowed down, for example so that students only deal with the functions and tasks that are relevant to them. Multimedia training content is also available on FluidSIM so that variety and interest can be added to the lessons.

→ Video





Interfaces to practical applications
With FluidSIM, students put the knowledge they have learned into practice straight away. Signals are transmitted either via the connected hardware or via interfaces from other programs. All parameters are identical to those of the training packages from Festo Didactic and additionally, they can be fully adapted to the characteristics of other components. The EasyPort hardware enables FluidSIM to be used both as a controller for real systems and as a replacement for them. The industry standard OPC-UA is also supported, bringing FluidSIM even closer to industrial applications.

Licenses and use variants
FluidSIM can be accessed in different ways. Depending on the license, users can choose to learn within
– the web version (fluidsim.festo.com),
– the Windows version,
– or they can use FluidSIM directly in courses in our digital learning portal Festo LX.

Web version
The web version of FluidSIM is a device-independent user application. It can be accessed anytime, anywhere, and from any device (e.g., iPad) and without the need for installation. The web version includes approximately 80% of the functionality of the Windows version, covering all the most important and frequently used features. It is continuously developed and enhanced, also with additional functions available exclusively on the web.

Windows version
The Windows version includes all functionalities and content of FluidSIM and can also be used completely offline. Please note that this version can only be run on devices with a Windows operating system.

Integration in Festo LX
By integrating FluidSIM in Festo LX, simulation tasks can be conducted directly in Festo LX courses. You can create simulation tasks within LX yourself or use already available courses from Festo Didactic.
By using this functionality users no longer have to switch between LX and FluidSIM, enabling a seamless user experience.

Our licensing options
FluidSIM 365 and FluidSIM 6 are the two license versions available for FluidSIM.

The FluidSIM 365 license version gives users access to all use variants available:
– the web version (fluidsim.festo.com),
– the Windows version,
– Integration in Festo LX.

All updates and upgrades are included in the FluidSIM 365 license. The 365 license provides users with maximum flexibility.
As a result, some of the licenses can be used for the web version, some for the Windows version, and the rest for using FluidSIM in Festo LX.
The floating principle applies: As soon as a user no longer actively uses a license, it is available for the next user in the organization.

A pure FluidSIM 6 license gives users access to the Windows version only. Upgrades to any higher version are not included, nor is the use of the web version and the use of FluidSIM within Festo LX.

FluidSIM 365 – Annual Subscription

Pneumatics	**8253110**
Hydraulics	**8253114**
Electrical Engineering	**8253118**

FluidSIM 365 – 1 year (non-renewing)

Pneumatics	**8253111**
Hydraulics	**8253115**
Electrical Engineering	**8253119**

FluidSIM 365 - 3 years (non-renewing)

Pneumatics	**8253112**
Hydraulics	**8253116**
Electrical Engineering	**8253120**

FluidSIM 365 - 5 years (non-renewing)

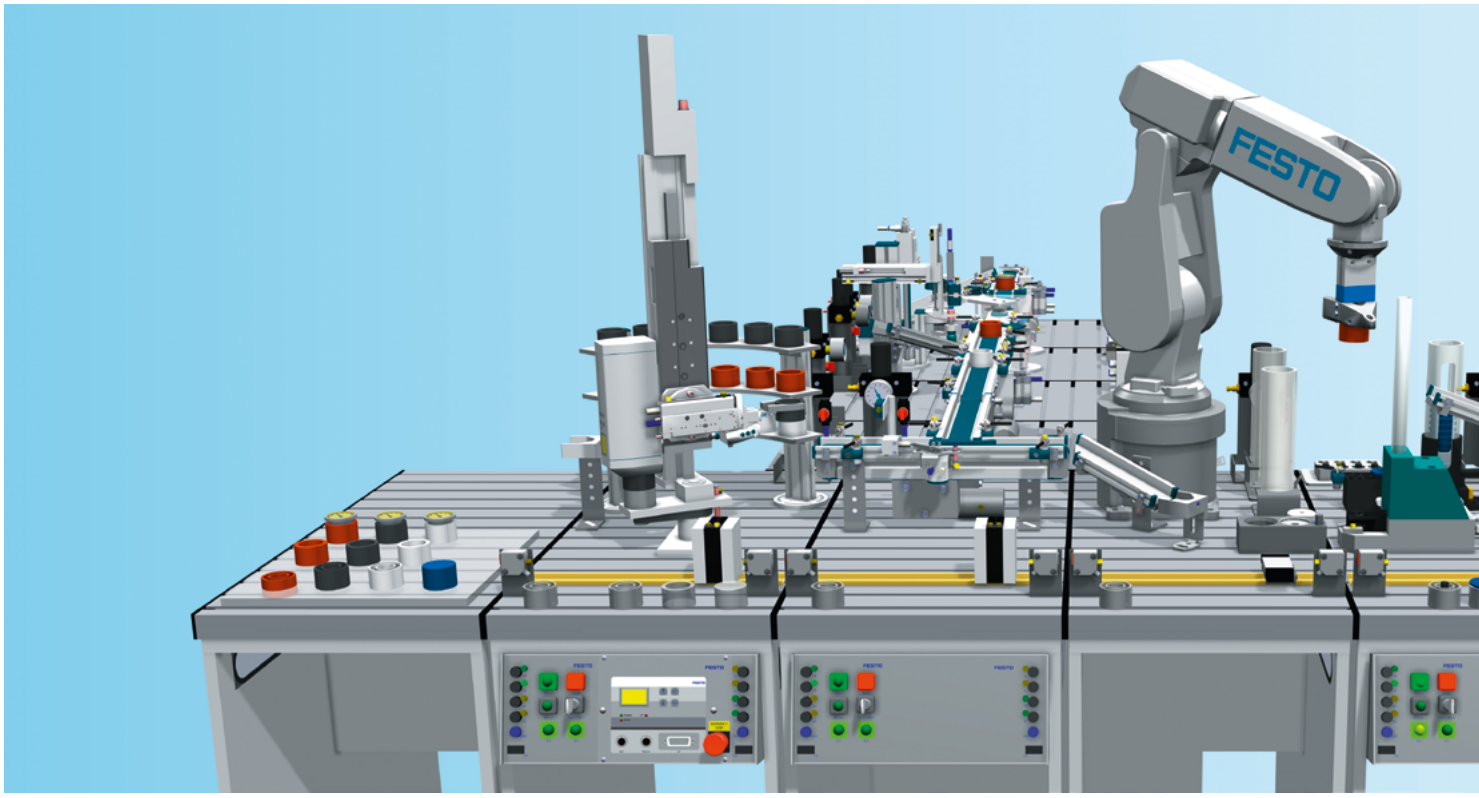
Pneumatics	**8253113**
Hydraulics	**8253117**
Electrical Engineering	**8253121**

FluidSIM 6 (perpetual)

Pneumatics	**8243501**
Hydraulics	**8243502**
Electrical Engineering	**8243503**

CIROS

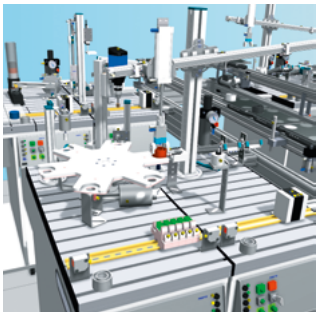
Professional Training in Virtual Learning Environments



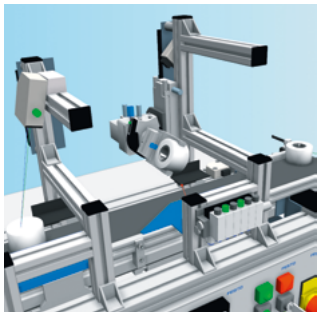
The fascination of 3D Simulation

Modern PC technology allows us to create realistic 3D simulations even for the most complex automation systems. Participants discover the kinetic dynamism of mechatronic systems using virtual reality – without any risk to human or machine. This allows users to take a step into automation technology without any worries, providing a great motivational boost.

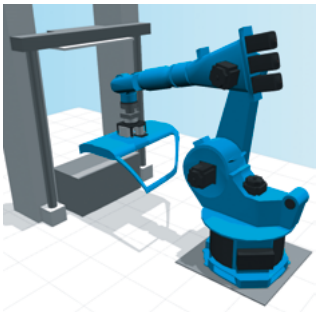
Working and learning methods have changed – and CIROS supports these new methods. With a focus on visual learning, the appealing virtual representations encourage and motivate the full learning process.



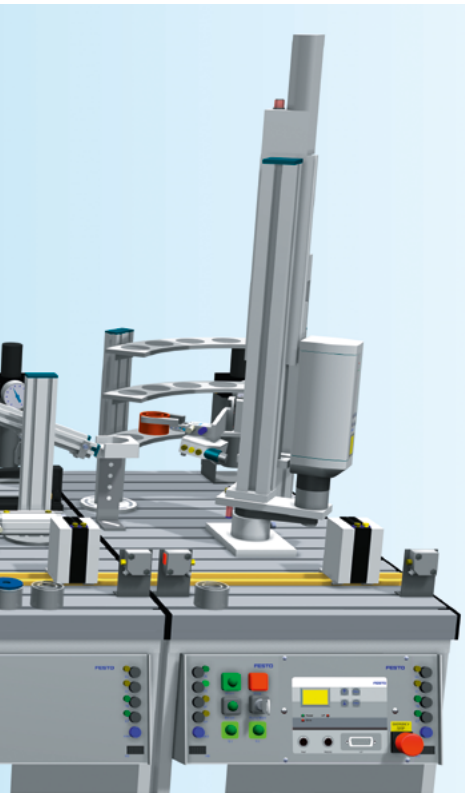
Industrial practice
Today, simulation represents an important tool in production and product development in order to quickly and cost-effectively analyze new solutions, methods, and processes. Depending on the task in question, the simulation systems used differ from each other in terms of the level of detail of the information to be obtained and the way in which it is calculated.



Flexible learning
Realistic, simulated learning systems expand the training possibilities where real automation systems might reach their limits, allowing new training content and scenarios to be covered through simulation.



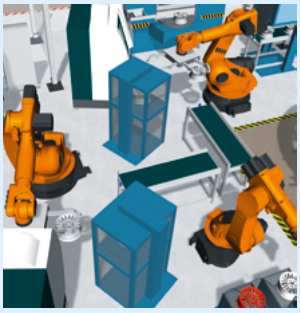
Safe commissioning
Large, fast, and cost-intensive equipment is used in mechatronic systems. Training on this equipment risks the high cost of repair as well as the safety of students. However, the learning and commissioning of robots, linear axes, and transport systems within the simulated production environment is completely without risk for both students and equipment.



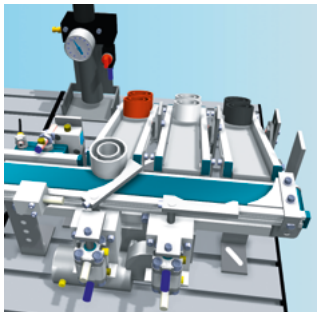
CIROS – the universal 3D Simulation system, made in Germany

The flexibility provided by CIROS makes it suitable for many different fields of application. It is available in a variety of price ranges with different options and configurations, and is efficient and convenient to use on a daily basis.

CIROS covers a great number of applications, ranging from the use of 3D Simulation in basic and further training, to the implementation of the digital factory in industrial companies, and right up to real-time simulations of complex virtual worlds



Latest information at any time at:



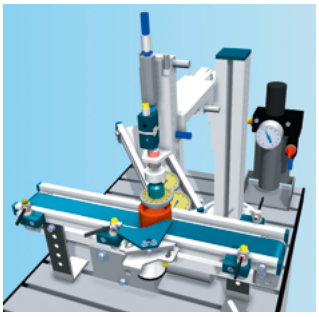
Easy fault-insertion
A simple click of the mouse in the simulation is all that is needed to put a pneumatic cylinder or an inductive sensor into a fault state. This opens up new learning situations in which students can be trained in systematically searching for faults



Putting simulation to use
While virtually commissioning industry control systems and robots, students can use the system simulation to develop sequencing and motion programs, which can then be transferred to the control systems already in place.



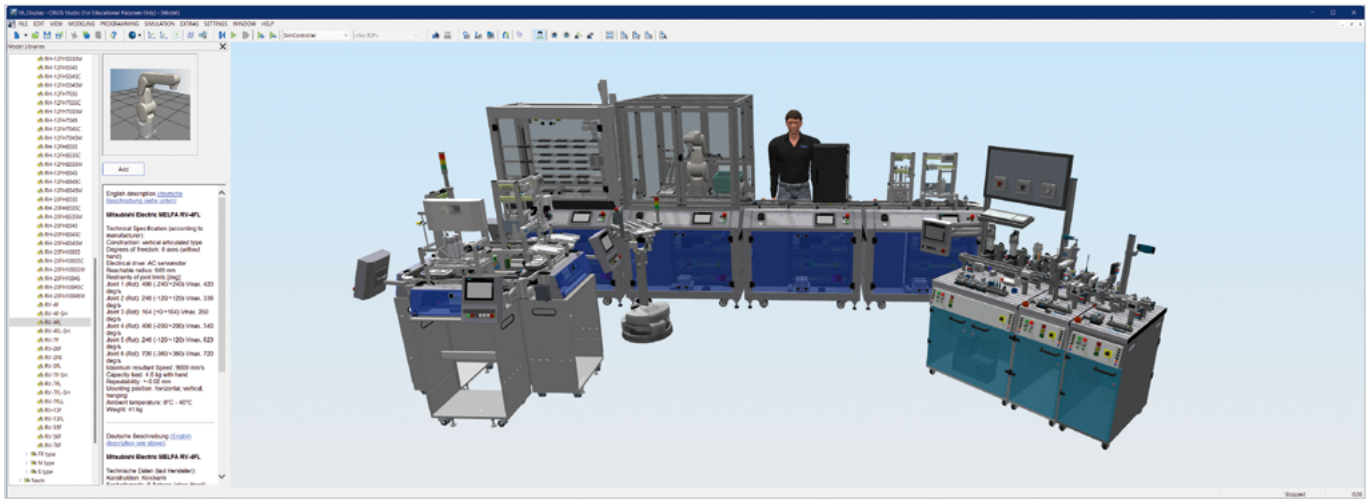
Use beyond the boundaries
With the connection to industry and research interfaces, countless scenarios can be realized. Intelligent modules and hybrid systems can be networked with each other in a comprehensible way.



Ready to use immediately
Once CIROS has been installed, over 150 simulation models from the factory and process automation sector are included and available for immediate pedagogical use. Extensive model documentation is also available on demand.

CIROS 7

Creating Virtual Learning Environments



CIROS is an industrially tested, extremely powerful platform for creating and using 3D Simulation models for automation technology.

It combines the following functions into a single common interface:

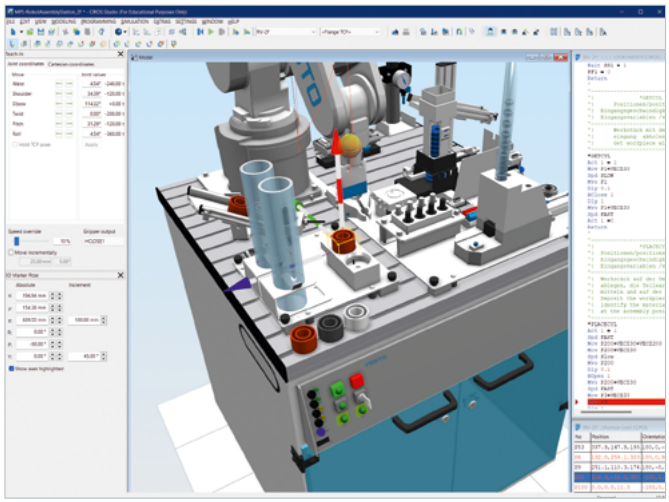
- Discrete time 3D simulations with modelling mechanisms
- CAD import filters for STEP, IGES, STL, VRML, Collada and export filter for conventional formats
- Layout of systems and production lines based on model libraries and application modules
- Access to more than 1100 robot models included
- Robot programming in the following programming languages, among others:
  - Industrial Robot Language (IRL)
  - Mitsubishi MELFA BASIC V
  - Kuka Robot Language (KRL)
  - ABB Rapid
- Connection to the Manufacturing Execution System MES4 for operating learning factories as a didactic digital twin.
- Virtual human with 30 independent degrees of freedom
- The extensive model library contains
  - Beginner models for an introduction to basic topics
  - Further course documents in Festo LX (free registration required)
  - Virtual illustrations from the Festo Didactic learning systems such as MPS and Robotino for transferring learning performance between simulated and physical devices
  - Prepared examples on industrial interfaces such as PLC SIM Advanced
- The model is either controlled via the integrated STEP7 PLC control, through the use of other interpreters such as IRL or via external interfaces to PLCSIM and PLCSIM Advanced
- Using OPC UA or EzOPC, it is also possible to establish connections to other OPC-based interfaces such as Codesys
- When using EasyPort, up to four external hardware PLCs can be used simultaneously for simulation control (hardware-in-the-loop)
- Matlab, Python and EtherCat can be used to connect external simulation controllers and to model system behavior.
- Expandable behaviors for detecting and correcting faults can be logged in the fault simulation mode. Evaluation of the outcomes enable effective training to be designed for systematic commissioning and repairs in the event of malfunctions in the simulation environment.
- In order to process the results of exercises and projects as effectively as possible, extensive camera paths and modes are provided that can be exported as a video or HTML5 container for device-independent display.

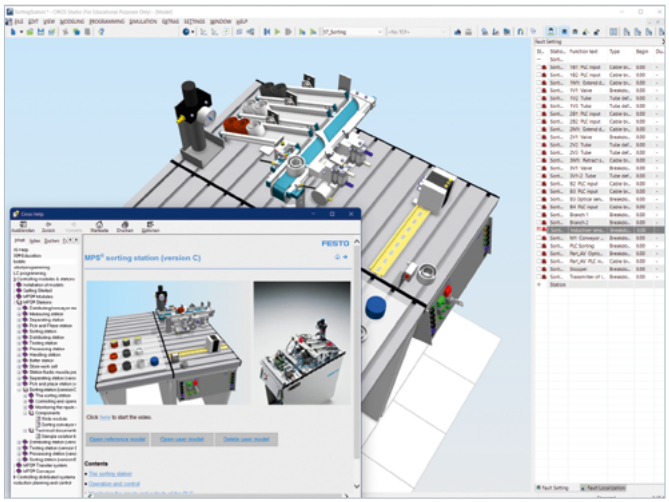
System requirements

- Intel Core i5 (7th generation) or equivalent
- 8 GB RAM, at least 200 GB HDD/SSD
- Windows 10 1709 64-bit or later
- Graphics card
  - Individual models: Intel HD 530 or better
  - Systems or for displaying large models and virtual reality: NVIDIA GeForce GTX 1070 or better
- CIROS supports OpenVR. A free Steam account is required in order to use the virtual reality feature

The purchase of a license provides the rights to continuously operate the version including two subsequent years of updates.

Using Virtual Learning Environments





CIROS adapts to learning situations. From a single workstation at a station to a classroom for virtual learning factories.

The following features help with the adjustment:

CIROS Studio
Contains the license for teachers and researchers. In CIROS Studio, new learning scenarios can be created and prepared for the prepare them for the classroom. Prefabricated projects, stored error behavior and configurations for use in distributed work are some examples of possible adaptations. In addition, this license can be used to connect to selected physical robot controllers.

CIROS Education
Includes learner and student license. CIROS Education users work in ready-made or provided models and can produce results in the form of programs or simulation videos.

CIROS Cyber-Physical Library (CP-L)
Activating this license unlocks the extensive library from the CP Factory and CP Lab environment.

Manufacturing Execution System 4
By activating this license, the stand-alone program MES4 V1 can be fully put into operation. This is necessary for operation as a didactic twin of a learning factory comprising CP Factory, CP Lab, and MPS 400.

Customized activation
All licenses described are delivered digitally as standard. If desired, digital delivery can be completed in a few days upon request.

Activation can take place either on USB dongle, local machine or as a lecturer licence. With the activation as a lecturer licence, independently expiring sub-licenses can be generated.

Ideal for use in the training company and independent of the place of use.

CIROS 7	**8140772**
CIROS Update	**8140773**
CodeMeter dongle	**8156609**

CIROS 7
Robotics Applications



What do you need?
Ideally, for a robotics laboratory, we recommend actual robot work cells, for example the MPS Robot station with optional equipment levels, along with CIROS Education and CIROS Studio as a virtual learning environment for simulating a wide range of applications in industrial robotics.

Generally, a CIROS Education license, available at the relevant workstations, is set up for all users training in the laboratory at the same time. A CIROS Studio license is also required for the connection of real controllers for robots from Mitsubishi Electric.

Industrial robotics for everyone
The more than 25 ready-made simulation models of robot work cells in CIROS Education are executable immediately after installation. The entry-level models, which represent simple Pick&Place tasks, are suitable for robot-programming beginners and provide users with a safe, hands-on environment for learning about the fundamentals of robotics.

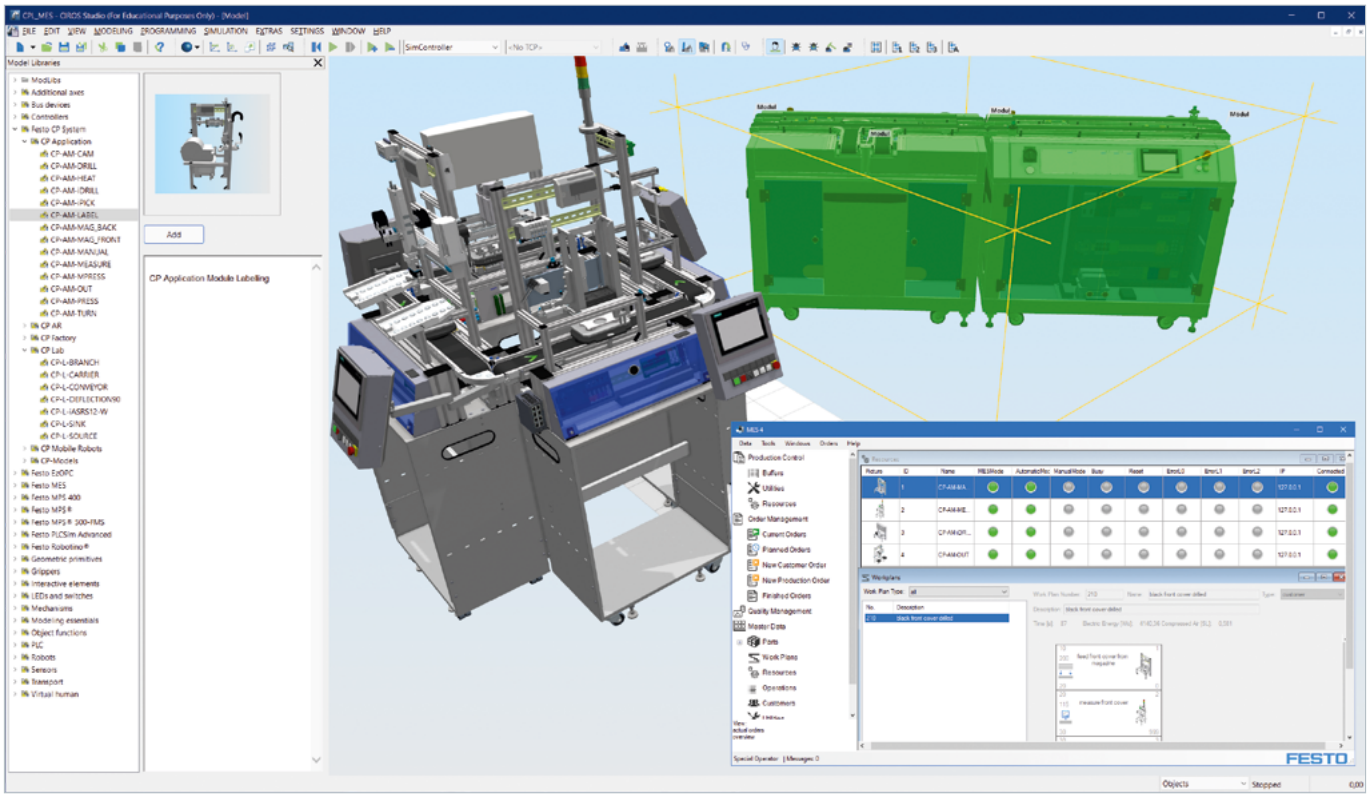
The models from various other manufacturers include applications for industrial robots in the areas of dismantling, laboratory automation, packaging, and welding. Programming languages for each model can be set separately.

Quick commissioning
Anyone who uses an MPS Robot station in the laboratory will be able to find a suitable simulation model in CIROS Education. CIROS Education can be used to develop and optimize programs for the actual station, e.g., cycle time.

Ideally, the actual robot controller should be linked to the simulation and control computer via an Ethernet connection at the robot workstation. CIROS Studio uses that connection to the robot controller to transfer the program created using CIROS Education. The user then checks the robot positions in the actual station, adapts them if necessary, and runs the program, initially with the robot at controlled speed.

Individual expansion
All of the simulation models supplied provide a template for building a virtual learning environment with CIROS Studio. Even an existing robot work cell can be remodeled using the available robot libraries along with the CIROS Studio CAD import and modeling functions.

Automation Technology Applications



From hardware-in-the-loop to completely virtual
CIROS supports various scenarios for PLC simulation, as well as offline programming for PLC-controlled automation technology installations. A real PLC can be coupled with CIROS via EasyPort. In this type of scenario, CIROS receives the PLC initial values, simulates the controlled process, and transfers the current sensor values back to the PLC inputs via EasyPort. Alternatively, various software controllers, such as the S7-PLCSIM or a Codesys SoftPLC, can be used to control the simulated sequence without any hardware. CIROS also supports the connection of controllers via an OPC server.

The entire world of automation technology
In the collection of CIROS models supplied you will find suitable simulation models that can be used immediately for virtually all Festo Didactic learning systems in the area of factory and process automation. The range of models includes the components, modules and stations of the Modular Production System MPS. With CIROS Studio you can also create your own process models or build your own systems based on the available models of the MPS stations.

Which PLC should you use for your application?
Given the wide range of options for connecting a PLC to CIROS, it is generally possible to use any PLC to control the simulated model. Select the PLC manufacturer and type and we will recommend the best means of connecting it to the virtual learning environment.

Introduction to the operation of learning factories
Equipped with models and interfaces to MES4, CIROS permits the operation of extensive training factories based on the CP Factory, CP Lab and MPS 400 learning factories. The virtual image of the learning factories can be used in various scenarios to facilitate the introduction to the topics in the field of factory automation. The operation is rounded off as a digital twin of the learning factories with the possibility of layouts of the virtual learning factories in various configurations.

FactoryViews – Software for Training, Education and Research in Industrial Automation





Modern, centrally available apps
FactoryViews is the future central software portal to access our educational apps for your learning factory.

Thanks to the FactoryViews apps, your learning factory will become even more transparent, easier to use and experience .

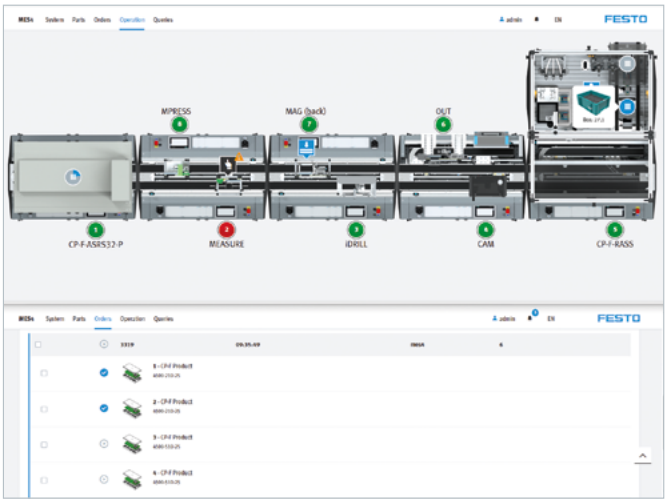
All apps interact smoothly and can be operated via a browser. This allows for flexible use, e.g. via a laptop or a tablet directly on the hardware.

Snapshot function:
Restore with just one click
The software and configuration state can be backed up, saved and transferred to a single file in an easy, cross-app way. Work statuses, tasks, demo scenarios or the initial state of the system can all be restored with just one click.

FactoryViews is already available for the following learning solutions:
– MPS 400, with the apps MES4 V3, Webshop, InfoPortal, AR, Machine Learning
– CP Lab WorldSkills I4.0 preparation pack, with the apps MES4 V3, Webshop, InfoPortal, AR, Energy
– Standalone training software MES4 V3 Lite

FactoryViews MES4 V3 – The Intuitive Control System for Your Learning Factory

For MPS 400 and CP Systems





Manufacturing Execution System Modern Architecture
FactoryViews MES4 V3 controls the production orders of the learning factory in real time.

The software combines classic MES functionalities with the new possibilities arising from increasing networking in the digitalised factory. FactoryViews MES4 V3 supports the CP Lab, CP Factory and MPS 400 systems.

Learning Goals
– Production planning and production control
– Understanding communication between the MES and the production level
– Monitoring orders, managing inventory and recording and analysing processing and transport times
– Analysing reference data such as OEE, quality, efficiency, availability
– Carrying out database analyses

Benefits
– Browser-based user interface for platform-independent, intuitive operation of all relevant functions
– Seamless interaction with other applications thanks to integration in FactoryViews
– Snapshot function for saving and restoring complete work statuses in just one file, e.g. for preparing training scenarios
– Integrated help and documentation

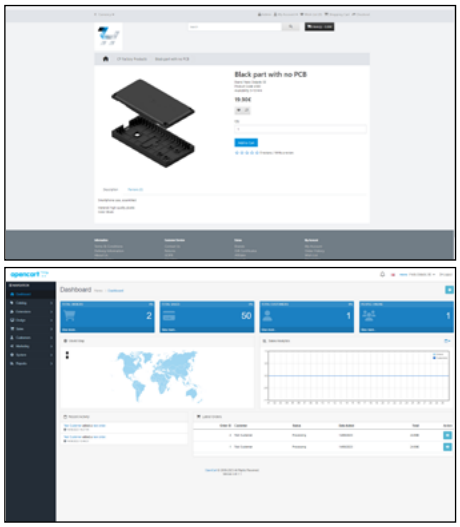
Further Information
Specific features
– Asset management: The production resources and their capabilities are stored in a library and can be graphically configured into production systems. Systems can be saved and loaded and exported to CIROS for simulation.
– Routing management: Routings can be configured graphically, also with branches as well as processing times and energy consumption per step. Production parameters can be set statically, on the basis of other parameters and at production time.
– Order management: Orders can be created, saved, loaded, planned and activated directly in MES4 and all steps can be tracked live
– Storage management: All storage and buffer positions are visualised graphically as well as live and can be edited, restricted or blocked.
– Monitoring and control in real time: The MES4 communicates continuously with the production resources in order to transmit work orders, record work steps and results and monitor the machine status and error messages. PLC errors are displayed graphically in the system overview and contain the PLC error message.
– Reports and analyses: Based on database queries, MES4 displays live analyses with tables and graphs on key performance indicators (KPIs) such as quality, availability and efficiency. You can create your own queries.
– Interfaces: The MES4 enables integration into your own applications thanks to the open TCP/IP, REST and SQL interfaces. System definitions, routings, orders, storage statuses and database queries can be exported and imported in CSV and JSON formats.
– Multilingual: The application language can be switched between DE, EN, FR, ES, ZH, HU, PT.

System requirements
– Intel Core i3 (10th generation) or later
– At least 8 GB RAM, 200 GB SSD
– Windows 10 Pro 64-bit or later
– Current web browser

FactoryViews MES4 V3 full version	**8225463**
Upgrade from MES4 V1/V2 to FactoryViews MES4 V3*	**8225464**
Additional licence for FactoryViews MES4 V3**	**8225467**

* An MES4 V1 or V2 licence must already be available.
** A FactoryViews MES4 V3 licence must already be available.

FactoryViews Webshop



The FactoryViews webshop combines the possibilities of e-commerce with the MES software and the learning factory.

The webshop offers a customer area for configuring products and creating and tracking orders, as well as an administration area for customizing all products, orders, customer data and the website.

Learning Goals
– Applying e-commerce options
– Using ERP functions
– Creating products and prices in the webshop
– Customizing and optimizing the webshop appearance
– Creation of marketing measures and customer communication

Specific features
– Front-end with search, filter and complete guided ordering process for customized orders of configurable and non-configurable products, with descriptions, images, prices, availability and ratings, as well as customer login with order history
– Administration area
– Connector for automatic synchronization of customer orders from the web store with production orders in MES4, with clear display of the order assignment and processing status
– Email notifications with status updates for order tracking
– Possibility of connecting several suppliers to a web store for distributed production
– The software can be run as a component of FactoryViews in the local network. Porting to customer cloud storage is possible on request.

FactoryViews Webshop, Full version	**8225465**
FactoryViews Webshop, Additional licence*	**8225468**

* A FactoryViews Webshop App license must already be available.

FactoryViews Energy App



Energy monitoring is the basis for understanding, controlling and optimizing energy flows in the factory.

The software contains all the necessary tools for the communication, storage, visualization and analysis of energy consumption data from the learning factory.

Learning goals
– Industrial energy monitoring with OPC UA
– Measuring and evaluating electricity and compressed air consumption
– Quantifying energy efficiency measures
– Determining costs and emissions
– Creating dashboards

Specific features
– The signals are received via OPC UA or via MQTT.
– The monitoring dashboard provides a graphical visualization of all signals, both as a real-time graphic and as historical values.
– The analysis dashboard allows you to graphically analyze the electricity and compressed air consumption of process steps.
– The footprint dashboard visualizes the current consumption with the costs and environmental impact.
– The factory dashboard enables the CP systems learning factory to be started and stopped, total consumption to be monitored, load peaks to be reduced and energy-efficient operation to be parameterized.
– Station-specific dashboards are available for the CP Factory Robot Assembly station and the Heat tunnel application module
– In simulation mode, recorded data or random values can be streamed instead of real measurements.

FactoryViews Energy App, Full version	**8225466**
FactoryViews Energy App, Additional license*	**8225469**

* A FactoryViews Energy App license must already be available.

Festo AX for Learning Factories



Capture, visualise, gather and analyse process data using Festo AX and machine learning

ML models are trained based on the training data gathered during error-free operation. The ML models then analyse the system data during runtime and detect and visualise anomalies using 'health scores'.

Learning Goals
– Using AI/ML software for anomaly detection
– Connection of PLC data to the software
– Training ML models with machine data
– Interpreting results and taking action
– Creating and implementing your own use cases

Further Information
The package includes the software that is also used in the industry as well as a licence that is valid for an unlimited period. The software must be downloaded and installed on the MES PC of a CP Lab or MPS 400 learning factory according to the instruction manual. The learning factories are already prepared to detect anomalies with Festo AX.

The application can be accessed on several devices at the same time via web browsers on the system network. All recorded data and trained models are visible to all users.

There is no complex modelling or specific prediction of failure for individual components. Instead, the anomaly detection – which is easy to implement – provides results for typical uses cases for carrying out preventive maintenance and avoiding production downtimes at an early stage.

The user manual 'Quick Start: Festo AX for Learning Factories' on Festo LX (no subscription required) helps users to get started quickly with operation.

The eLab course 'Anomaly detection in maintenance with Festo AX' (separate Festo LX subscription required) provides a systematic, multimedia guide for all the steps, from data acquisition and model training to maintenance measures. It also contains instructions for connecting other typical learning factory components.

Software Festo AX for learning factories	**8225462**

Festo AX Smartenance for Education



Efficient, transparent maintenance

Festo AX Smartenance Education is a CMMS (Computerized Maintenance Management System) software that combines maintenance and asset management with a machine logbook in a single solution.

The web application is designed for maintenance or production managers, while the mobile app is tailored for maintenance technicians and machine operators. This allows all relevant information about a machine to be accessed anytime and anywhere.

– Fewer unplanned downtimes through optimized maintenance
– All data available via mobile and web
– Increased team efficiency and improved collaboration
– Reduced administrative workload
– Interface with SAP Maintenance Management (S/4HANA)

Improve your maintenance and asset management and benefit from increased transparency about your equipment.

Advantages
– Manufacturer-independent applicability
– Mobile app for smartphone & tablet
– Web application for an overview of all maintenance activities and management of fault tickets
– High acceptance due to user-friendly interface
– Efficient work with minimized travel distances
– Comprehensive documentation of all equipment activities
– No training required
– Customizable dashboards for individual user needs

Use cases
– Maintenance of teaching and learning equipment
– Monitoring of safety equipment
– Keeping complex systems operational
– Handling of malfunctions
– Preventing future malfunctions through documented lessons learned
– Spare parts management for individual machines or entire systems

→ Sign up for a free trial

Festo AX Smartenance Education

Subscription, 10 users, 1 year *	**8210610**
Subscription, 10 users, 3 years *	**8210611**

* Each license corresponds to one user of the web application or one access for a mobile device.

Industrial Networks and IT Security

TP 1333

Flexible learning system for modern networking with Siemens routers and switches, plus a separately available download package featuring configuration software and a practical workbook. Ideal for IT security and industrial communication labs.

With the TP 1333, learners receive practical and future-oriented training in networking and security technologies. The training system is designed for up to two workstations and can be seamlessly adapted to different teaching and laboratory environments thanks to its modular components. Whether placed on a workbench or mounted in an A4 frame, the modules can be positioned flexibly to support a wide variety of learning scenarios.

At the core of the system are two EduTrainers, each equipped with a Siemens S615 router and an XC208 switch. Combined with an Ethernet cable set and Siemens PST software, the hardware is ready for immediate operation.

To use the TP 1333 as a complete learning system, two PLCs, two PCs, and a separately available download package containing the Festo NetLab Toolkit configuration software and the accompanying workbook are required. The PLC used must support external IP address assignment – for example, a Siemens S7-1512C, either as an EduTrainer or integrated into another training system.

The configuration software in the download package includes the Festo NetLab Toolkit and prepared configuration files. The toolkit enables easy configuration of network and security functions – from IP addressing and certificate management to system diagnostics. After a one-time login, all functions remain accessible without repeated password entry.

The workbook included in the download package combines theory with practical exercises. Industry-relevant tasks, prepared setups, and sample solutions support efficient and realistic instruction. While the first four exercises are completed individually, exercises five and six promote collaboration between neighboring workstations.

Learning goals
- Master networking fundamentals: Understand IP/MAC addressing, switching, routing, and data packet flows
- Configure industrial networks: routers, switches, PLCs, addressing, VLANs, NAT, and firewall rules
- Apply security measures: Implement port security, firewall rules, access control, and logging
- Analyze network traffic: Capture data packets, evaluate them, and diagnose errors
- Establish secure communication: Set up IPsec VPNs and manage certificates

Benefits
- Industry-ready from day one: Hands-on practice with the same Siemens industrial components used in modern factories
- Comprehensive IT security topics: Coverage of the most important networking and cybersecurity focus areas in industry
- Flexible in use: A modular design for classrooms, labs, or project-based learning scenarios
- -fficient teachware: Practical exercises, fundamentals, and sample solutions for fast learning success
- Future-proof skills: Ideal for modern training programs focused on networking and cybersecurity

Technical data
- Includes two EduTrainers, each equipped with a Siemens S615 router and an XC208 switch, an Ethernet cable set, and Siemens PST software
- Operating voltage: 24 V DC
- Dimensions of one EduTrainer (H x W x D): 335 mm x 315 mm x 240 mm
- Mounting options: tabletop device, A4 mounting frame

Technical specifications subject to change.



Equipment Set TP 1333	**8106066**

Also required, please order:

Download package with configuration software and workbook, de	8075235
Download package with configuration software and workbook, en	8084440
Download package with configuration software and workbook, es	8107694
Download package with configuration software and workbook, fr	8106097

Also required: Two PLCs and two PCs

Special license rules apply for schools and educational institutes in the commercial sector.

TP 1333 accessories

Touch panel KTP700 EduTrainer

Training device for an A4 mounting frame or as a desktop device. The communication connections for 1x PROFINET and 1x USB are accessible at the front via robust plug connectors.



1x Touch Panel KTP700 EduTrainer*	**8022731**
6x Touch Panel KTP700 EduTrainer*	**8041505**

Ethernet Switch XB005 EduTrainer

Training device for an A4 mounting frame or as a desktop device. The universal Siemens Ethernet switch Scalance XB005 allows you to set up small star and linear structures and provides a simple way of showing how PLCs, touch panels (HMI) and other components are networked.



Ethernet Switch Scalance XB005	**4473300**

Available as a package: Touch panel KTP700 EduTrainer + Ethernet switch XB005 EduTrainer*

1x Touch panel KTP700 EduTrainer + 1x Ethernet switch XB005 EduTrainer*	**8062740**
6x Touch panel KTP700 EduTrainer + 6x Ethernet switch XB005 EduTrainer*	**8062741**

Touch panel KTP400 EduTrainer Compact

Training device for an ER mounting frame (pneumatics/hydraulics). The communication connections for 1x PROFINET and 1x USB are accessible at the front via sturdy plug connectors.



Touch Panel KTP400 EduTrainer Compact*	**8041758**

Ethernet Switch XB005 EduTrainer Compact

Training device for an ER mounting frame (pneumatics/hydraulics). The universal Ethernet switch Siemens Scalance XB005 allows you to set up small star and linear structures and provides a simple way of showing how PLCs, touch panels (HMI) and other components are networked.



Ethernet Switch XB005 EduTrainer Compact	**8041755**

Available as a package: Touch panel KTP400 EduTrainer Compact + Ethernet switch XB005 EduTrainer Compact*

1x Touch panel KTP400 EduTrainer Compact + 1x Ethernet switch XB005 EduTrainer Compact*	**8022734**
6x Touch panel KTP400 EduTrainer Compact + 6x Ethernet switch XB005 EduTrainer Compact*	**8022735**

Ethernet Switch US5T EduTrainer

Training device for an A4 mounting frame or as a desktop device. The universal Allen-Bradley Ethernet switch US5T allows you to set up small network structures and provides a simply way of showing how PLCs, touch panels (HMI) and other components are networked.



Ethernet Switch US5T EduTrainer	**4994634**

* Special license rules apply for schools and educational institutes in the commercial sector.

Artificial Intelligence in Application
Machine Learning Vision



Machine Learning Vision
The Machine Learning Vision package extends the CP Camera Inspection application module with machine learning functions and learning options. It thus offers a practically oriented introduction to the highly topical subject of machine learning (ML). The application scenario here is optical quality inspection, as used in numerous production companies. Be it for component recognition, for distinguishing good parts from bad parts, for identifying anomalies or generally for determining the quality of a manufactured component.

The package contains the didactic machine learning software, a powerful PC and the necessary accessories and training documentation. It complements the CP Camera Inspection application module, which is already perfectly prepared with the industrial camera module and the integrated variable-position illumination. As a result, the solution offers challenging test and experiment situations with regard to camera angle, field of view and illumination, to which corresponding machine learning algorithms must be adapted.

The included software guides the user through the typical processing steps, starting with the acquisition, storage and pre-processing of the relevant data, the selection and training of a suitable ML procedure and ending with its use in the actual application. The training documentation addresses various tasks of increasing complexity from different areas of optical quality assurance on the basis of machine learning.

The software offers a wide range of customization options, in which case all experiments can be carried out even without programming and ML knowledge. The user interface is browser-based and can thus be operated from various devices in the local network. Communication with a Siemens PLC – provided that the CP Camera Inspection application module is integrated in a CP Lab/ Factory system application module takes place via OPC UA interface.

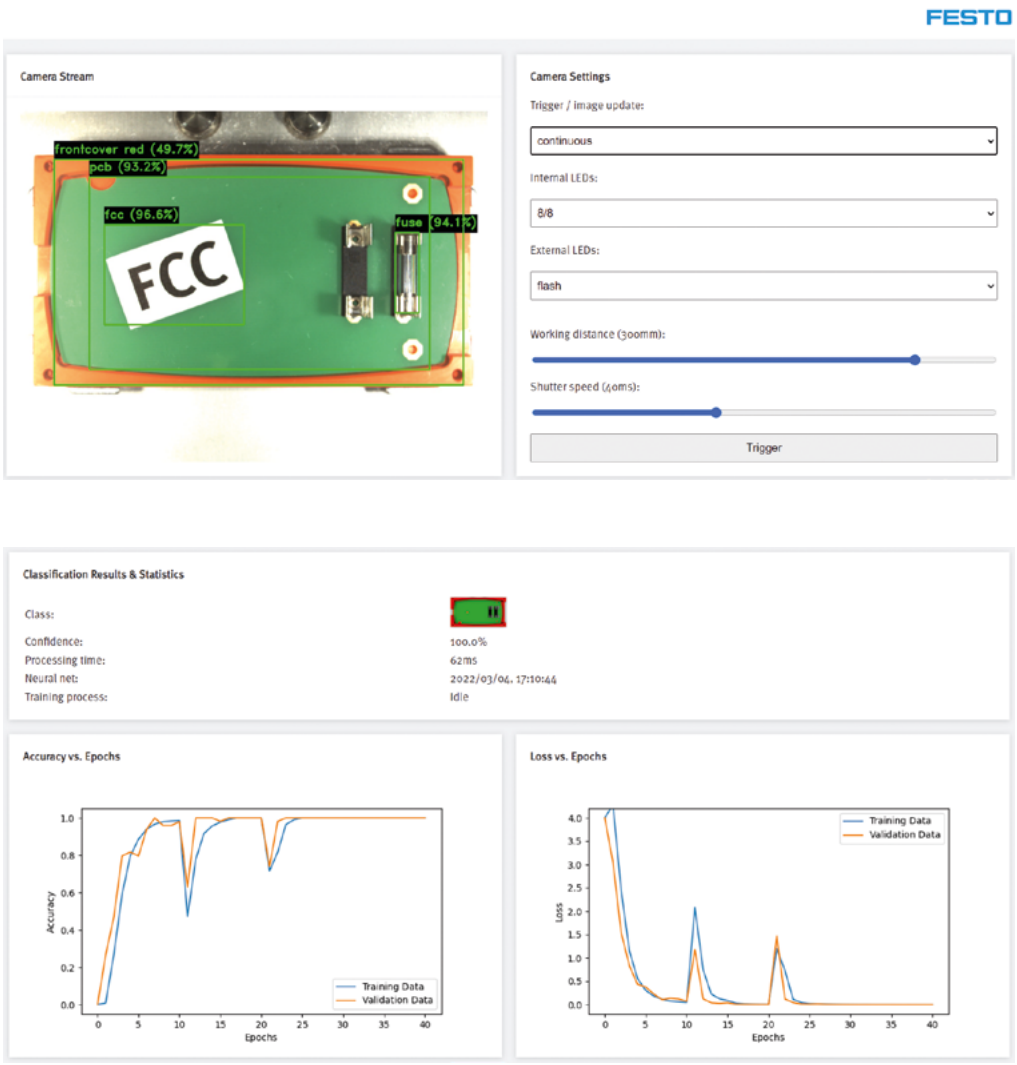
Training content
– Machine learning and artificial intelligence
– Basics of supervised, unsupervised, reinforcement learning
– Introduction to neural networks
– Introduction to Python and Google Tensorflow
– Conduct, analysis, optimization of machine learning procedures with the help of the algorithms and tools included in the package, using optical quality inspection as an example
– Transferring the knowledge gained to other ML application areas

Scope of delivery
– High-performance computer
– Workpiece carrier including pallet
– Front and rear shells in black, blue, red, grey
– 4 PCBs
– 1 set of fuses
– Training documentation
– Pre-trained neural networks for all experiments

Additionally required components
– USB keyboard and mouse*
– Monitor with HDMI or DisplayPort connection*

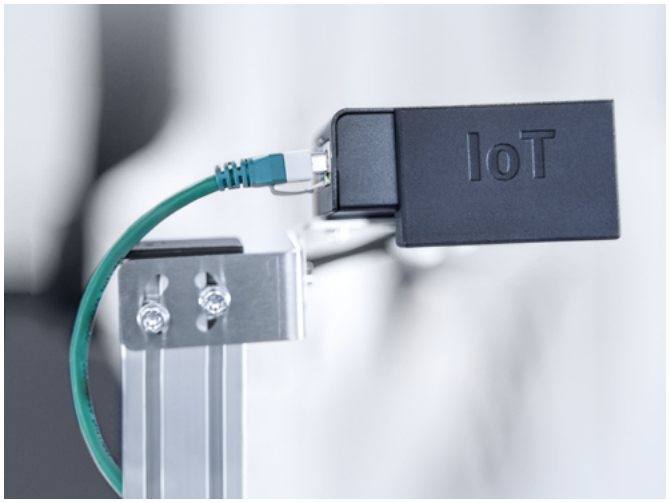
* Not necessary when accessing via a remote connection.

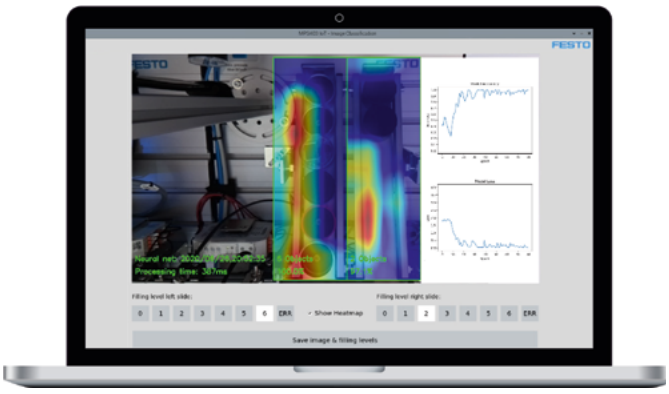
Machine Learning Vision	On request



Artificial Intelligence in Application

MPS IoT kit Machine Learning





Machine learning in image processing

The “MPS IoT Retrofit” package deals with machine learning based on neural nets (also referred to as “deep learning”), one of the most prominent sub-disciplines of artificial intelligence. As the underlying application scenario “computer vision” has been selected, therefore the hardware contains a single-board computer equipped with a HD camera to record images to be analyzed by a neural net afterwards.

With respect to the software, a variety of python programs are available. The frontends of almost all tools are web-based, allowing for an access via mobile devices like smart phones, tablets, laptops, etc. Due to the Wi-Fi hotspot the device offers a wireless remote access. The system comes ready to run so students can start first experiments right away.

The key feature of the “MPS IoT Retrofit” package is the fact, that students learn the most important topics in the domain of image processing with machine learning in an easy way. Not only the main learning schemes like supervised/unsupervised learning are discussed, but also the most prominent applications in the computer vision domain – i.e., image classification, object localization, and multi-object detection – are introduced and discussed by means of a series of practical experiments.

Students can distinguish apples from lemons or tools from shoes etc. One potential task when integrated in a learning factory is to check the filling level of slides containing workpieces by applying machine learning techniques. Otherwise, all kind of objects can be detected and localized. Furthermore, powerful neural net architectures like so-called convolutional neural nets are being used.

The entire software is well-documented and allows students to perform their own computer vision experiments outside the learning factory. Prior programming knowledge is not required. The Courseware encourages students to transfer their knowledge to new applications.

Learning contents
- Artificial Intelligence/Machine learning based image processing
- Practical application of (convolutional) neural nets/deep learning
- Supervised and unsupervised learning
- Computer vision (image classification, object localization, multi-object-detection)
- IoT Retrofitting of legacy systems

Benefits
- The device can either be used stand-alone or be integrated in an existing learning factory
- Students have the option to apply the algorithms to new objects and images
- Focus on practical application of AI/ML solving real-world challenges

Main components
- Single-board computer with HD camera
- Ethernet cable
- HDMI cable
- Power supply

Technical data
- Power supply: AC 110/230 V, 1 A
- Dimensions (W x D x H): approx. 200 x 200 x 600 mm

MPS IoT kit Machine Learning	**8158958**
MPS IoT kit Machine Learning (Classroom set = 8 devices)	**8158957**

IIoT and Retrofitting

IoT Gateway





The connection of components at the production level with servers at the IT level of a company or with the cloud offers a wide range of new usage possibilities, e.g. monitoring production with a smartphone via the internet. Gateways play an important role in interoperable communication via standardized data exchange protocols and also frequently offer functions for decentralized data management.

The IoT Gateway connects production level devices to the Industrial Internet of Things (IIoT). It has a network connection for the device side, one for the cloud side and a hardware switch to control read and write authorization.

The gateway offers a web interface with configuration options, including
– Network configuration including DHCP client
– NTP client for time synchronization
– Device management
– MQTT broker settings

The gateway is able automatically to find known device types such as the Festo Didactic energy measurement box in the network. The information for pairing the devices is stored in a signature file. After the devices have been paired, referred to as onboarding, the data is automatically retrieved cyclically and forwarded to an MQTT broker.

Your own signature files can be created and imported, meaning that your own device types can be found, coupled and read out via OPC UA.

The graphical development environment installed on the gateway, Node-RED, enables edge computing functionalities, i.e. data processing at the boundary between the local network and the cloud.

A wide range of signal sources can be integrated using library elements, e.g. via the protocols OPC UA, Modbus TCP or REST API, signals can be pre-processed using function blocks or JavaScript code, dashboards can be set up for visualization and signals can be output to server services such as MQTT, MySQL or cloud services such as Siemens MindSphere or Microsoft Azure.

The gateway can be installed with the supplied accessories e.g. in CP Lab carriage or on the NetLab EduTrainer and connected.

Scope of delivery
– IoT Gateway
– Connection cable 24 VDC to 4 mm safety plug
– 2x network cable
– Mounting accessories
– Training documents with example scenario

IoT Gateway	**8172682**

Energy Management

Energy Measurement Box for Pallet Circulation Systems (CP Lab and CP Factory)

1



2



The topic of energy and CO_2 efficiency is taking on an increasingly important role in the industrial environment. Systematic measurement of the power consumption of production systems forms the basis for all energy-related considerations within a factory. For example, energy monitoring promotes understanding of energy flows, enables systems to be monitored, the industrial energy efficiency of processes to be analyzed and efficiency measures to be monitored. The energy measurement boxes from Festo Didactic are used for this purpose. They measure consumption precisely, process signals and forward them on for data storage and data analysis.

The energy measurement boxes expand learning factories by measuring the consumption of electrical energy and compressed air as well as other variables such as currents, voltages, active and reactive power, processing the data and communicating via the network. In addition to the possibility for energetic analyses and optimizations, this provides a data source for a continuous stream of live data from the production plant.

The energy measurement boxes can be placed both on the table or in a laboratory trolley, or hung in an A4 mounting frame by removing the feet. This means that the energy measurement boxes can be operated flexibly both at various training factory modules as well as at laboratory workstations or other consumption points.

The single-phase energy measurement box is used for learning factories with single-phase consumers (e.g. CP Lab). There are 3 measuring channels to measure the electrical power consumption and the pneumatic air consumption. Thus, up to 3 different loads can be evaluated at the same time, e.g. three CP Lab belts each with 24 V power pack. Power is supplied via an IEC C14 male connector.

The three-phase energy measurement box is used for learning factories with three-phase loads (e.g. CP Factory modules). There is a separate measuring channel for each phase to measure the electrical power consumption.

The compressed air consumption is measured by a common measuring channel. Power is supplied via the 5-pole connecting cable with Wieland plugs supplied to match the connections of the CP Factory modules.

Both energy measurement boxes contain the following components:

Electrical power measurement:
– Siemens SENTRON PAC3220 power analyzer for 3 measuring channels
– 3x current transformer

Compressed air measurement:
– Festo SFAH IO Link flow sensor
– Festo SPAU IO Link pressure sensor
– Push-in connectors for 6 mm tubing

Control and communication:
– Festo CPX-E PLC with IO Link master, web server, OPC UA server
– RJ45 LAN connection

Communication to the sensors is implemented via Modbus TCP and IO Link, communication to the energy data management is provided via a documented OPC UA interface.

Scope of delivery
– The corresponding energy measurement box
– Network cable
– Connecting cables, electrical
– Connections, pneumatic
– Operating instructions with connection examples

1 Single-phase energy measurement box	**8129208**
2 Three-phase energy measurement box	**8130678**

Also order:

Energy monitoring package for CP systems, including PC and software	D35002
IoT-Gateway	8172682

Energy Efficiency Package for MPS 400









The topic of energy efficiency is finding its way into many technical curricula and is an important factor in the design of sustainable and competitive production plants of tomorrow. The energy efficiency package for the MPS System 403-1 offers a holistic training approach from awareness raising and consumption analysis to planning and implementation of optimization measures, as well as cost effectiveness, so as to prepare students for these changes.

The energy efficiency package adds to the MPS System 403-1 the ability to measure and analyze power consumption, quantify waste and increase plant efficiency. The expansion is installed once and can also remain in the system for regular operation of the MPS System 403-1.

Hardware
The energy measurement box with industrial components measures the electricity and compressed air consumption of three stations independently of one another, and provides measurement and metadata via OPC UA. With the components supplied for compressed air-saving vacuum generation and the leakage simulators, the respective training tasks can be carried out in practice. All connecting cables and tubing are included in the scope of delivery.

Software
The Energy app for FactoryViews takes over communication via OPC UA with the energy measurement box, data recording in an open MariaDB database as well as visualization and analysis on didactically prepared dashboards. The dashboards make it possible to visualize the recorded measured values, analyze consumption over selected time intervals, display costs and emissions, parameterize settings as well as export measured values as CSV data. Dashboards can be accessed via web browsers, e.g. with the tablet.

Scope of delivery
– Single-phase energy measurement box
– Vacuum generator with air-saving function
– Leakage simulator with fixed leakage rate
– Leakage simulator with adjustable leakage rate
– Tubing 6 mm
– Vacuum generator pilot line
– Electrical and pneumatic connectors
– Energy app license for FactoryViews
– Software download

Energy efficiency package for MPS 403-1	**8154889**

Recommended learning material

Complete overview → page 274

For example:

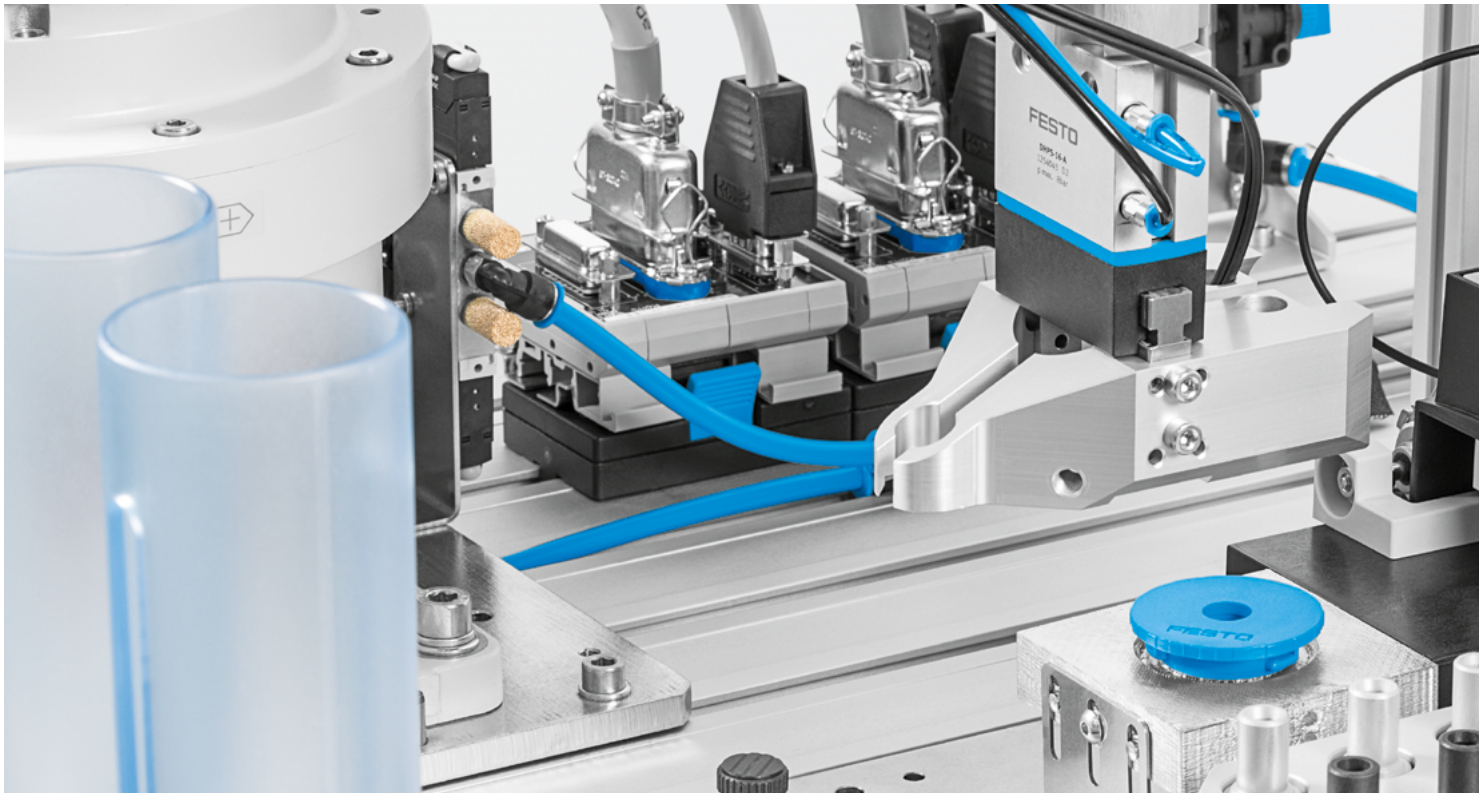
eLab courses
– Energy Efficiency in Production



Evaluations
– Basics of Energy Efficiency

User Guides
– Commissioning Energy Efficiency Package
– Integration of the Vacuum Generator
– Integration of the Air-Saving Circuit

Robotics for Training and Research



An important role for Industry 4.0

Industry 4.0 changes the world of production by merging modern information and communication technologies with classic industrial processes, making them more flexible and efficient.

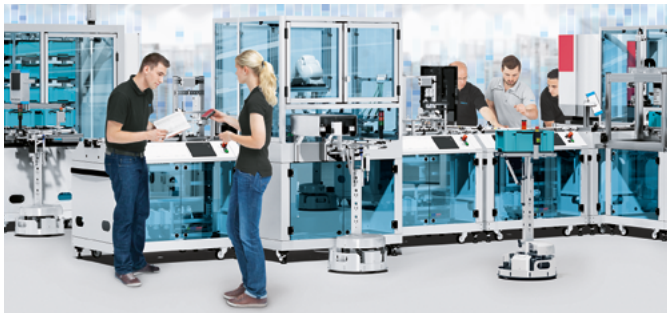
Robotics is an important topic for this new industrial model. Technology developments in this field open the door to new applications and configurations, as well as human-robot interactions.

This is why robots are an integral part of the Industry 4.0 learning solutions offered by Festo Didactic.



Robotics learning solutions
Industry needs knowledgeable, skilled robotics engineers, technicians, and operators. To enable trainers to successfully integrate robotics into programs and lab facilities, Festo Didactic offers holistic approaches to integrate industrial stationary, mobile and service robots into your learning environment.

Hardware equipment is supported by multimedia and paper-based training tools, creating a blended learning environment.



Integration into manufacturing systems
Robots can be integrated into cyber-physical systems and the modular production system MPS for customized set-ups and complete coverage of automation.

The robot stations and modules can also be tailored to specific requirements.

Flexibility and expandability
Mobile robots from Festo Didactic are based on an open source concept. Users have full access to the entire source code for the implementation of robot applications with common programming languages and systems.

In addition, state-of-the-art functions ensure the greatest possible system expandability and compatibility.



A key component of industrial automation

The number of robot installations is rapidly increasing all around the world, driven by greater demands for industrial productivity and efficiency. The majority of manufacturers has already integrated robotics technology, to different degrees, in their operations.

Robotics is now a key component of automation and a competitive advantage for companies. Today, robotics is paving the way for new technologies and capabilities, creating job opportunities and posing important challenges for the workforce.





Robotino 4 in the classroom
Our autonomous mobile platform is open to common programming languages and can be combined with a variety of external devices and media. This flexibility makes Robotino 4 an ideal learning system for mobile robotics in the vocational training of mechatronics technicians and computer scientists.

Robotino 4 ensures straightforward entry into mobile robotics as well as integration into advanced learning systems in the smart factory environment.



Virtual training
CIROS offers professional robotics training in a virtual environment. Students can simulate a wide range of applications in industrial robotics.

Ready-made simulation models provide users with a safe, hands-on environment for learning the basics or more advanced subjects.

The software can also be connected to real robot controllers for practical selected training.

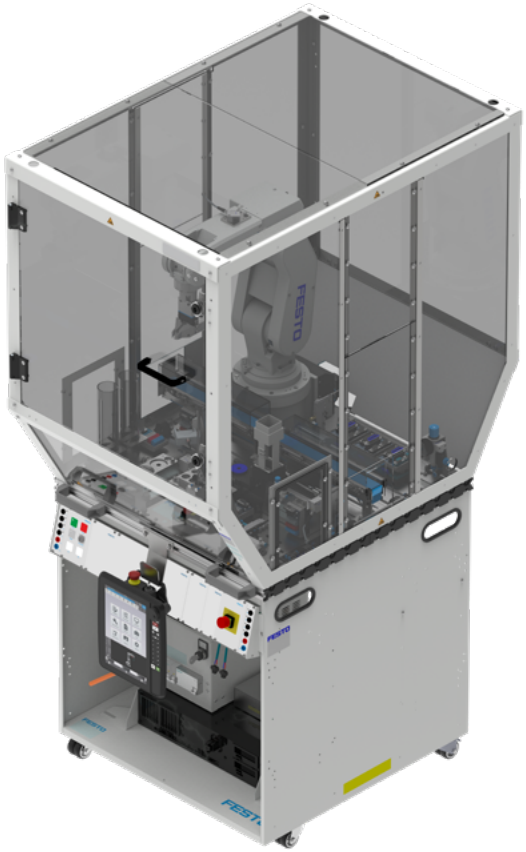


Research projects
Festo is proud of its cooperation with the scientific community. Our solutions and expertise help researchers to push boundaries by developing alongside or deploying ready-made technology.

RoboCup develops agent-based automated guided vehicles (AGV) to help leverage the benefits of Industry 4.0 compliant factories.

Robot Station with MPS Modules

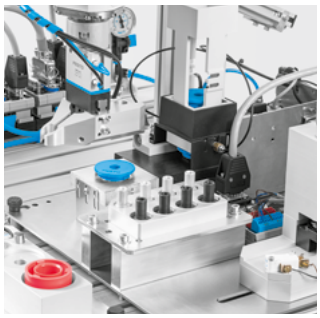
The Equipment Level as an Introduction to Industrial Robotics

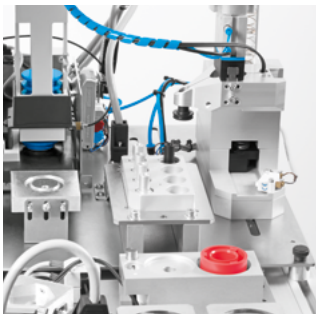


Function
This equipment level is created based on the basic design of the MPS robot station and the two robot handling and robot assembly modules as a introduction to industrial robotics. The upstream station feeds the bodies of the pneumatic cylinders to be assembled to the robot via a slide. The robot determines the orientation of the bodies and places them in the assembly holder in the correct orientation. It takes the piston from the pallet and assembles it in the body. Controlled magazines feed the piston springs and cylinder end caps to the robot. The fully assembled pneumatic cylinder is then placed on a slide.

Topic: Handling and assembly
In many industrial applications, robots handle and assemble workpieces and modules. Getting to know these areas of application is an essential part of an introduction to robotics.

Developed in accordance with the EU Machinery Directive 2006/42/EC in compliance with DIN EN 60204-1 and DIN EN ISO 12100.







Robot station with MPS modules, complete	**8169662**

Battery set for robot RV-2SDB/RV-2FB	572162

Note
The robot's batteries feature a buffer period of one year and must therefore be replaced every year.

Recommended accessories:

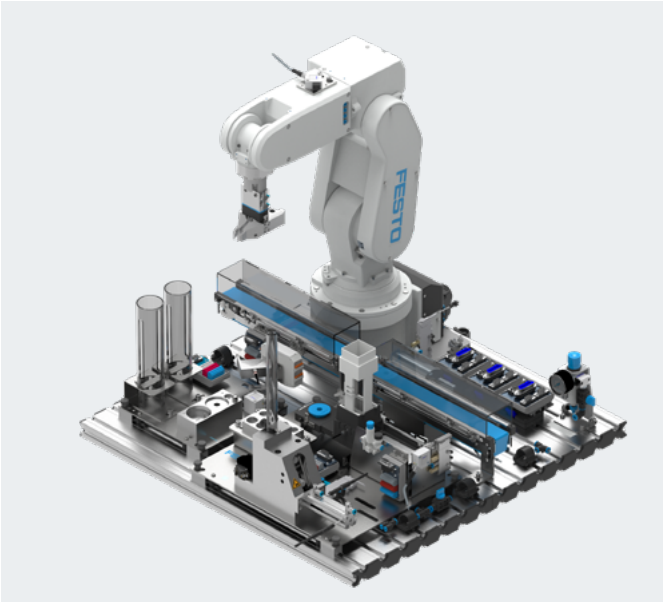
Workpiece set "For cylinder assembly"	162239
Programming instructions for Mitsubishi robot RV-2FB, en	8039315
Technical manual for Mitsubishi robot RV-2FB, en	8039316

The most important components at a glance:

MPS trolley, 700 x 700	541139
Aluminum profile plate 700 x 700	159410
Safety housing	8039314
Control console, SysLink, 700 mm	8039325
Tabletop power supply unit ➔ Page 149	
Robot handling module ➔ Page 148	
Robot assembly module ➔ Page 148	
Robot interface box	8046131
Graphical operator terminal	8039317
Robot RV-2FB with Teachbox R32TB	3396765
Gripper, pneumatic	573859
Start-up valve with filter control valve	540691
CIROS, License package with 6x Education, 1x Studio ➔ Pages 124 – 129	

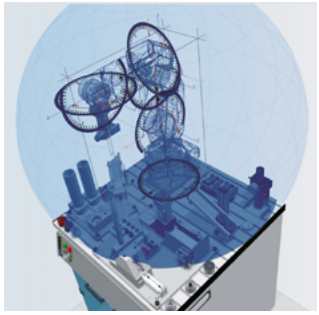
Technical data
– Power supply: 230 V AC
– Operating pressure: 600 kPa (6 bar)
– Maximum workpiece width: 40 mm
– 12 digital input
– 5 digital outputs

More learning and research systems for robotics:
– Robot Vision Cell ➔ page 150
– Robotino ➔ page 152



Robot station with MPS modules in detail

Training content
– Integration of an industrial robot in an assembly process
– Teaching of robots in complex assembly environments
– Commissioning of complex systems
– Maintenance, servicing and troubleshooting of complex systems
– Programming of industrial robots combined with the integration of sensors and additional actuators
– Programming of multitasking applications



Optimally coordinated:
The included CIROS package supports the tasks from the workbook

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eTheory courses
– Introduction to Robotics



– CIROS – First steps

eLab courses
– CIROS – Basics of 3D Simulation

Workbook
– Handling with industrial robots

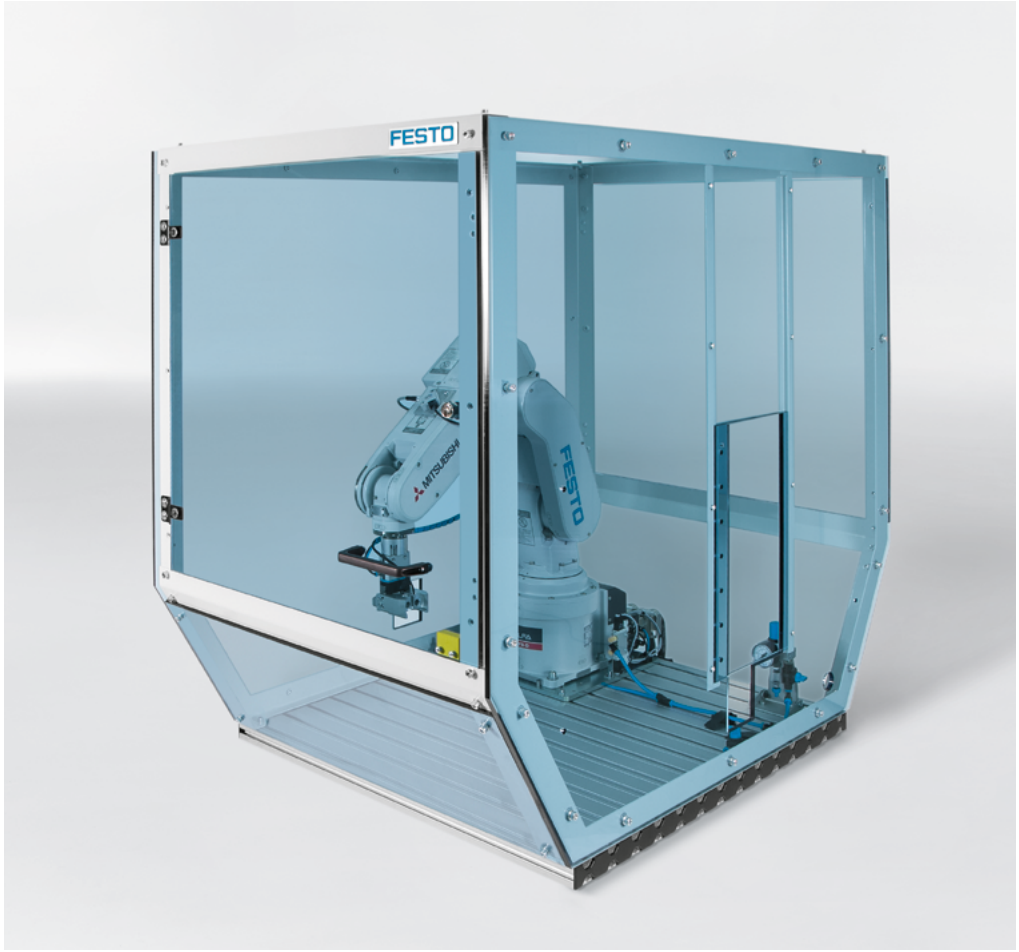


Evaluations
– Basics of Robotics

User Guides
– CIROS – Installation Instructions

Robot Station

Base for the Robot Applications









Function
The robot station includes the new 6-axis articulated arm robot RV-2FB by Mitsubishi Electric. This industrial robot combines a sturdy engineering design and construction with a large working range and a high movement speed.

In the basic design, the station is equipped with a robot controller, Teachbox, safety housing, service unit and pneumatic multifunction gripper. Additional MPS modules are available for your individual robot applications.

Topic: Industrial robotics
In flexible automation, industrial robots are among the most important components. They allow automated processes to be adjusted rapidly. The MPS robot station and its equipment levels make processes and tasks possible which are required in industrial production for commissioning and adjustment of robot-based work cells.

Fit for research: the real-time interface
The robot's controller is able to adopt setpoint values for the axes via a network connection. This allows you to develop your own robot controller.

Robot station	**8169662**

Additional equipment, also order:

MPS trolley, 700 x 350	541139
Tabletop power supply unit ➔ Page 149	
Robot handling module ➔ Page 148	
Robot assembly module ➔ Page 148	
Robot interface box	8046131
Graphical operator terminal	8039317
Workpiece set “For cylinder assembly”	162239
Programming instructions for Mitsubishi robot RV-2FB, en	8039315
Technical manual for Mitsubishi robot RV-2FB, en	8039316
CIROS ➔ Pages 124 – 129	
C interface	8025738
15-pin Sub-D HD cables: connector – connector, 1.0 m	8033583
I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031

Note

Each Application module requires 1x C interface (order no. 8025738), 1x 15-pin Sub-D HD cable (order no. 8033583) and 1x I/O data cable with SysLink connectors (order no. 34031).

The most important components at a glance:

1x Aluminum profile plate 700 x 700	159410
1x Gripper, pneumatic	573859
1x Safety housing	8039314
1x Start-up valve with filter control valve	540691



Robot station with additional equipment

Training content
- Mechanical structure of a robot station
- Mode of operation and applications of optical sensors
- Use of safety switches
- Areas of application of industrial robots
- Terminology in robot technology
- Teaching robots in different coordinate systems
- Moving robots in object coordinate system

Technical data
- Power supply: 230 V AC
- Operating pressure: 600 kPa (6 bar)
- Maximum workpiece width: 40 mm
- 1 digital input
- 2 digital outputs



Robot RV-2FB with R56TB touch panel
High-precision, 6-axis articulated arm robot with gear units by Harmonic Drive AG and brakes on all axes. Complete with control unit, programming cable, battery set and handheld terminal R56TB, which conveniently provides all programming functions via a 6.5” graphical touchscreen.

Recommended learning material

Courseware
Complete overview ➔ page 274

For example:

eTheory courses
- Introduction to Robotics



- Introduction to Collaborative Robotic
- CIROS – First steps

eLab courses
- CIROS – Basics of 3D Simulation

Workbook
- Handling with Industrial Robots

Evaluations
- Basics of Robotics
- Basics of Collaborative Robotics

User Guides
- CIROS – Installation Instructions

Robot Handling Module



The robot handling module extends the MPS robot station by adding the workpiece handling application. This module supplies workpieces to the station via a slide, which the robot transports to the assembly retainer. The sensor in the gripper enables the robot to differentiate workpieces by color (black/non-black). The sensor in the assembly retainer also monitors the orientation of the workpiece. From the assembly retainer, the robot sorts the workpieces into various magazines or passes them on to a downstream station. The combination with the robot assembly module also allows workpieces to be assembled.

The two pipe magazines and the assembly retainer are mounted on a mounting plate which can be mounted on the base plate of the MPS robot station with the supplied mounting material. That allows the overall module to be removed from the station and remounted later in the identical position if required, without adjusting the relevant robot positions for this module.

Scope of delivery
– Slide module
– Retainer module with reflection light sensor
– Assembly retainer module with reflection light sensor
– 2 pipe magazines
– Mounting plate
– Mounting material for profile plate

Technical data
– Power supply: 24 V DC
– Maximum workpiece width: 40 mm
– 2 digital inputs
– Overall height/width/length: 245/220/245 mm
– Weight: 5 kg

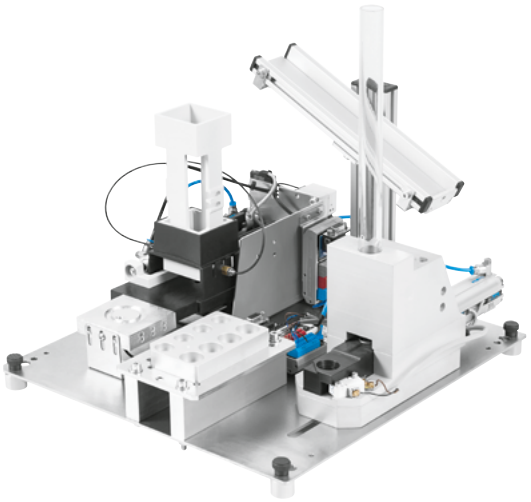
Training content
– Workpiece handling with industrial robots
– Robot programming using I/O communication

Order no.	**8038620**

Recommended accessories:

Workpiece set “Cylinder bodies”	167021
Workpiece set “For cylinder assembly”	162239
C interface	8025738
15-pin Sub-D HD cables: connector – connector, 1.0 m	8033583
I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031

Robot Assembly Module



The robot assembly module is used to mount assemblies in the MPS robot station. The module supplies the individual components for the assembly process of the pneumatic cylinder: A double-acting cylinder pushes the cylinder end cap out of the stacking magazine. The pistons are stored on a pallet. A double-acting cylinder pushes the springs out of a slim magazine.

All components of the robot assembly module are fastened to a mounting plate which can be mounted repeatedly with positional accuracy on the station’s profile plate. This guarantees a rapid conversion of the station.

The robot handling module with the assembly retainer are required to assemble the pneumatic cylinder. In order to control the modules with the robot control system, the robot interface unit (Order no. 534364) is required.

Scope of delivery
– Stacking magazine module (end caps)
– Piston pallet
– Separating module (springs)
– Output slide module
– Mounting plate
– Mounting material for profile plate

Technical data
– Operating pressure max: 600 kPa (6 bar)
– Power supply: 24 V DC
– 8 digital inputs
– 3 digital outputs
– Overall height/width/length: 370/325/370 mm
– Weight: 8 kg

Training content
– Introduction to and application of automated assembly systems
– Planning an assembly station
– Correct usage of limit switches
– Robot programming using I/O communication
– Commissioning of the entire process

Order no.	**8038740**

Recommended accessories:

Workpiece set “For cylinder assembly”	162239
Simulation box, digital	170643
C interface	8025738
15-pin Sub-D HD cables: connector – connector, 1.0 m	8033583
I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031

Gripper System FlexShape Kit for Mitsubishi Robots



Leap into the thrilling world of bionics with the FlexShape kit! The patented gripper system offers positive-locking gripping thanks to a variable gripping surface for a range of different materials and contours, and can be used for different workpieces without spending time on retooling or external sensors. Taking its inspiration from the natural world, the gripper slides over an object like the tongue of a chameleon, enveloping it for a secure grip.

The assembly kit contains all the necessary components and the corresponding setup instructions for operation on CR800 and CR750/CR751 controllers and with connected RV-2FRB, RV-2FB or RV-2SDB from Mitsubishi Electric. Providing the connection requirements are met, the kit can also be used together with other robot models. The system also covers CR2-B and CR1 generation controllers, providing they meet the technical requirements.

Scope of delivery
- FlexShape gripper DHEF-20-A with adapter flange and mounting accessories
- Proportional valve for setting the operating pressure of the inverting cap of the gripper DHEF
- 5/3-way valve module for controlling the gripper DHEF
- Holder for the workpieces that need to be gripped
- Mounting accessories and workpieces
- Commissioning instructions

Technical data
- Actuator operating pressure: 600 kPa (6 bar)
- Gripper stroke: 66 mm
- Object size for secure gripping: gripping surface circumference up to approx. 100 mm
- Operating voltage: 24 V DC 4 A, ≤ 100 W output power, SELV/PELV, limited power source (LPS)
- Proportional valve input pressure: 600 – 800 kPa (6 – 8 bar)
- Proportional valve setpoint specification: 0 – 10 V DC
- Inverting cap operating pressure: 7 – 10 kPa (0.07 – 0.1 bar)

Order no.	**8116512**

Accessories



Tabletop power supply unit
- Input voltage: 85 – 265 V AC (47 – 63 Hz)
- Output voltage: 24 V DC, short-circuit-proof
- Output current: max. 4.5 A
- Dimensions: 75 x 155 x 235 mm

Without power cable

Order no.	**8049633**

With IEC power cable, 1.3 m

Connector as per CEE 7/VII for DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID

Order no.	**162417**

Connector as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

Order no.	**162418**

Connector as per BS 1363 for GB, IE, MY, SG, UA, HK, AE

Order no.	**162419**

Connector as per AS 3112 for AU, NZ, CN, AR

Order no.	**162380**

Connector as per SEV 1011 for CH

Order no.	**162381**

Connector as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)

Order no.	**162382**

Robot Vision Cell

Robotics Trends in Focus



Robot with eye contact

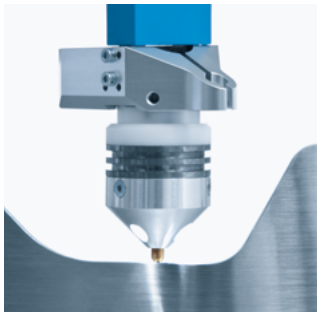
Walking through the leading handling technology fairs or taking a look at market leaders' catalogs clearly shows that without a camera, a modern robot cell is worthless when it comes to future production. The camera is the basic prerequisite for one of the elementary forms of work in the future: collaboration between humans and robots.

In this context, the Robot Vision Cell is an extremely innovative learning environment in contemporary robotics training. It enables the potential of current robot applications and the trends in future applications to be outlined in a clear and practical way.

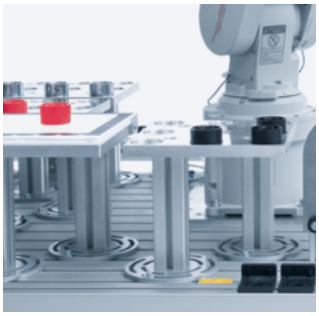


Priority 1: Safety
Robots operate quickly, powerfully and dynamically. Safety cages are therefore used to protect operating and maintenance personnel.

Safety must be the top priority and is an essential part of any training content. Thus, it is only logical that we have completely enclosed the Robot Vision Cell and fitted it with safety doors.



Welding simulation
Welding is a typical example of a robot application that demands precision path control. In the Robot Vision Cell, appropriate tools and suitably shaped parts enable path welding tasks to be simulated.



Palletizing and assembly
Fast and precise assembly of part-finished or end products and removal or loading of pallets are standard tasks for most robotics applications. The workpieces from the modular production system and the appropriate pallets are therefore included.

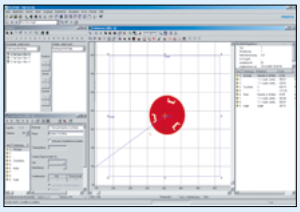


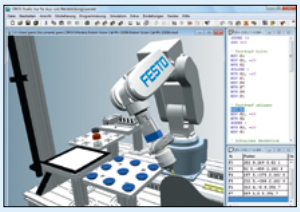
Configuration, programming and simulation

No learning system is complete without the necessary supporting software.

Therefore, the cell includes configuration and image processing software that can be used to set up and perform even complicated measuring and testing tasks.

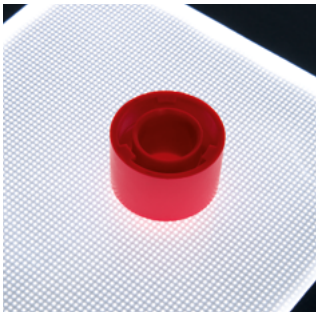
The CIROS cells simulated in 3D make a major contribution to efficient and varied training. Simulation also provides a high level of safety at the start of robotics training.







Industrial design camera
The industrial camera communicates directly with the robot controller via Ethernet and can thus easily be integrated into the process as an additional unit – for position detection, color identification, for checking dimensions or, for example, for monitoring assembly processes.



Calibration and transmitted light unit
The calibration and transmitted light unit supports the camera in its quality assurance tasks. For example, it increases the accuracy of the tool positions and helps to detect the position of workpieces.

Robotino 4

The Flexible Mobile Robotics Platform for Vocational Training



Here we go!
Robotino 4 conveys topics such as mechatronics, programming, sensors, motor and drive technology, closed-loop control technology and image processing in a simple and straightforward manner.

Plug-and-learn
Robotino 4 offers various interfaces for many external devices and media. This extendibility enables interesting learning scenarios. The integrated learning system consists of hardware, software and courseware.



Industrial Internet of Things
For easy integration into an Industrial Internet of Things environment, the Robotino 4 offers a Wi-Fi access point with 2.4 and 5 GHZ, allowing fast switching between operating modes



Powerful innovation
Powerful latest-generation lithium-ion battery packs with a running time of up to 10 hours guarantee uninterrupted use in teaching. Robotino 4 remains mobile at all times due to rapid replacement of battery packs, even during operation. This enables ongoing project work and focused learning.



RGBD sensor
Robotino 4 particularly demonstrates its performance by traveling individual or custom-defined routes as required. It is possible to program journeys in a real and virtual environment using the new stereo camera system. The RGBD sensor depth provides an excellent spatial image for laboratory environments.



Robotino 4 and Industrial Internet of Things

Mobile robots are becoming increasingly important in automation technology alongside industrial robots. They are used as logistics experts for simple material transport, however flexible production processes in smart factories are imposing increasingly complex requirements on mobile robot systems. With Robotino 4, the new competencies in the Industrial Internet of Things environment are quick and easy to learn.



Gefördert durch:
Bundesministerium für Wirtschaft und Technologie
aufgrund eines Beschlusses des Deutschen Bundestages



Electric gripper
Robotino 4 offers a wide range of accessories. Laser scanners, electric grippers, forklifts or towers are available for further tasks. The practical relevance of the tasks in the courseware will motivate pupils and trainees. The solutions proposed facilitate understanding, thereby ensuring learning success.



Get started easily
Robotino 4 can be programmed with all common programming languages such as JAVA, Matlab, C/C++ or LabVIEW. The integrated RESTful API will comply with your wishes in just a few minutes. Thus, Robotino makes it easy for pupils and trainees to get started. They will be able to configure tasks easily without taking much time.



Versatile learning scenarios
When experimenting with the Robotino SIM simulation software, students work creatively but without entering a real danger situation.



Powerful actuator
Robotino 4 particularly demonstrates its performance by traveling individual or custom-defined routes as required. With its ESD-optimized wheels, Robotino also moves safely and reliably on demanding surfaces. Controlled by its omni-directional actuator, it rotates on the spot or travels in all directions.

Robotino 4

For Research and Education



[X]

With Robotino to the Industrial Internet of Things
Our learning system for the entry into mobile robotics is suitable both for teaching basic topics in mechatronics and information technology, and for use in advanced applications in the areas of autonomous mobile robot systems (AMR), as well as automated guided vehicles (AFTS/AGV). With its open interfaces, it enables rapid access to the teaching of tomorrow's logistics topics.

Omnidirectional actuator
The three drive modules of the Robotino are integrated in a stable stainless steel frame. Using an omni-directional actuator, Robotino moves quickly forwards, backwards and sideways and also turns on the spot. Three sturdy industrial DC motors with optical rotary encoders permit speeds of up to 10 km/h with high reliability.

Everything at a glance
The frame contains nine infrared distance sensors and numerous prepared mounting options. An analogue inductive sensor and two optical sensors are addition-ally included, enabling the Robotino to recognize and follow predefined paths. Robotino is delivered with an extended image processing system, which uses a stereo/RGBD camera unit to independently perceive the environment, and can navigate freely in it. These autonomous functions can be seamlessly integrated into workflow-based programs.

 [X] Figure contains additional equipment

Robotino 4	**8101344**

The most important components at a glance:

Battery	8100249
RealSense Camera	8094015
Access Point	8089372
Charger 110 V	8102393
Charger 220 V	8102392
IO-Connector (left/right) 16X	8028360
IO-Connector (left/right) 12X	8028361
Omniwheel	8098079
Assembly Segment	8029513
Assembly Tower	8029514

Uninterrupted use
Power is supplied via up to four 18 V lithium-ion rechargeable batteries, each of which permits a running time of two and a half hours. "Hot-Swap" ensures an exchange during ongoing operation. The system switches itself off in time if the state of charge is too low. The rechargeable batteries can be charged in less than an hour when detached. This means that Robotino can maintain its mobility for the duration of the experiment and does not have to be restarted.

Controller
At the heart of Robotino is a robust embedded PC to the COM Express specification. This is how the scalability of the computing power is achieved. Robotino uses a powerful 4-core processor with hyper-threading. The operating system and all user data are stored on a replaceable solid state disk (SSD) with 64 GB. All data is freely accessible and unencrypted. Data and commands can be conveniently transferred via the connected access point in 2.4 and 5 GHz. A switch can be used to set up your own network or to connect to an existing network. A 32-bit microcontroller that directly generates the PWM signals for actuating up to four electric DC motors is responsible for the motor control.

Expandability
Additional components can be connected to the robot controller via standard interfaces such as USB (4x USB 3, 2x USB 2) and Ethernet. For subsequent expansion, the controller also provides analogue and digital inputs/outputs and relay outputs for additional actuator technology.
In order to support interfaces such as RS422, EIA-485 and IEEE 1394 that are not available in the standard versions, there are two PCI Express slots for interface cards.
Additional electric axes and grippers, for example, can be connected to an additional motor output and encoder input and controlled via pulse-width modulation.

Open programming environment
The programming interface (API) of Robotino establishes the prerequisites for using various programming languages and systems to develop a control program. The API supports the following languages and systems:
– C/C++, JAVA, .Net
– LabVIEW and MATLAB/Simulink with prepared toolbox
– Robot Operating System (ROSV1)
– RESTful API: HTTP-based interface ready for retrieval and transmission of information at runtime

Graphical programming
Robotino View is the interactive, graphical programming and learning environment for Robotino. It communicates directly with the robot system via wireless LAN and can be run locally on Robotino. The programming system combines modern operating concepts for an easy introduction to robot programming without source code. Via various prepared function blocks not only permit access to sensors and battery data but also neutral blocks such as function generators or logic operators can be added with a click. In addition to this interface for sequence-based programs, we offer the free tool Robotino Factory, which orchestrates the mapping and navigation used for autonomous functions. In the laboratory environment, paths and target positions can be registered in minutes and made available for programming.

Hardware-in-the-loop scenario
With our software controller, you can directly access the Robotino motors. Create your own motor controller, e.g. in MATLAB, and adapt its control loop.

Tailored to your requirements
We deliver Robotino with your desired scope of delivery. In addition to the basic equipment consisting of 2 optical sensors, one analog sensor and the jacking device for table experiments, the number of batteries (2 or more are recommended), power supply units, attachment towers and segments can be freely selected and thus adapted to your learning situation.

Scan the QR Code and find current accessories and technical documentation for the Robotino on our info portal.

Recommended learning material

Courseware
Complete overview → Page 274

For example:

eTheory courses
– Introduction to Robotics



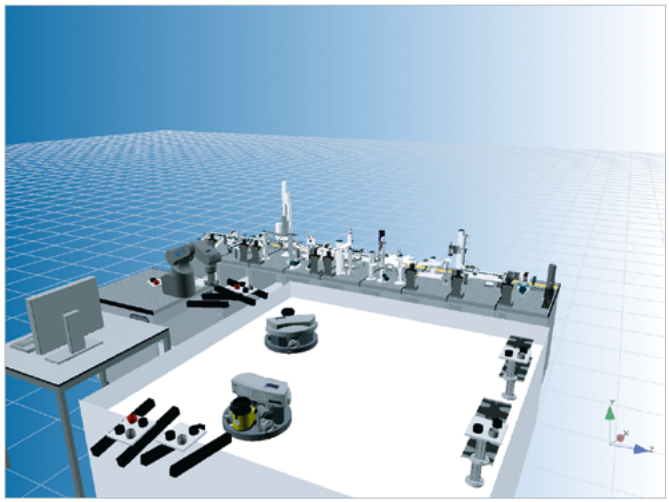
– CIROS – First steps

eLab courses
– CIROS – Basics of 3D Simulation
– Autonomous Mobile Robotics with Robotino 4

Evaluations
– Basics of Robotics

User Guides
– CIROS – Installation Instructions

Robotino SIM Professional



Robotino SIM Professional is an ideal virtual learning environment for working with Robotino. Identifying differences based on actual behavior is the key to grasping, analyzing and understanding new physical and technical phenomena. The software enables you to create any virtual 3D working environments for Robotino and then to simulate the program created. The software is available in four languages (de/en/es/fr) and the language selection can be changed online.

The Robotino simulation model comprises the geometric model with
– three omnidirectional drives
– two inductive analog sensors
– two digital optical sensors
– nine distances sensors
– a camera
– sensor in the chassis protection strip

The Robotino library includes additional components such as grippers, slides, laser scanners and workpieces. You are notified of new components in the library via the Internet.

The editor and the complete model library in LabCreator provide you with an outstanding working environment for quickly and easily creating attractive virtual scenarios for Robotino.

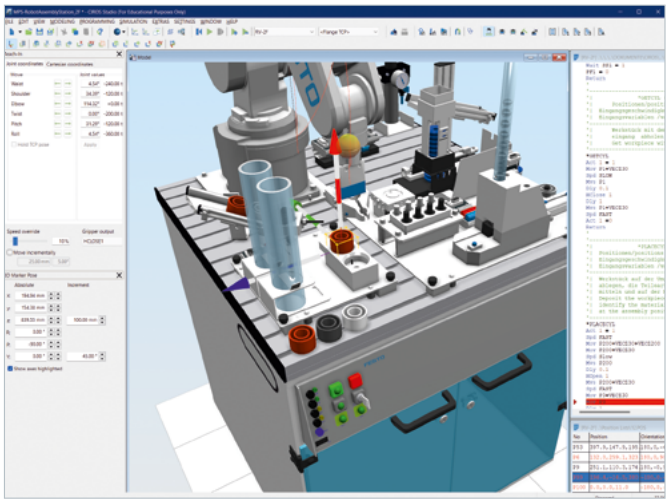
Robotino can be programmed using Robotino View or in one of the high-level languages C, C++, C# or Java. To do this, you require the corresponding API interface.

To use the software, you require a Windows 2000, XP, VISTA or Windows 7 operating system. For 3D visualisation, a graphics card with at least 128 MB RAM and OpenGL support is required.

Scope of delivery
– CD with software in de/en/es/fr
– Manual in de/en/es/fr
– 2 dongle with individual licenses
– Network dongle with 25 licenses

Order no.	**567230**

Simulation in CIROS

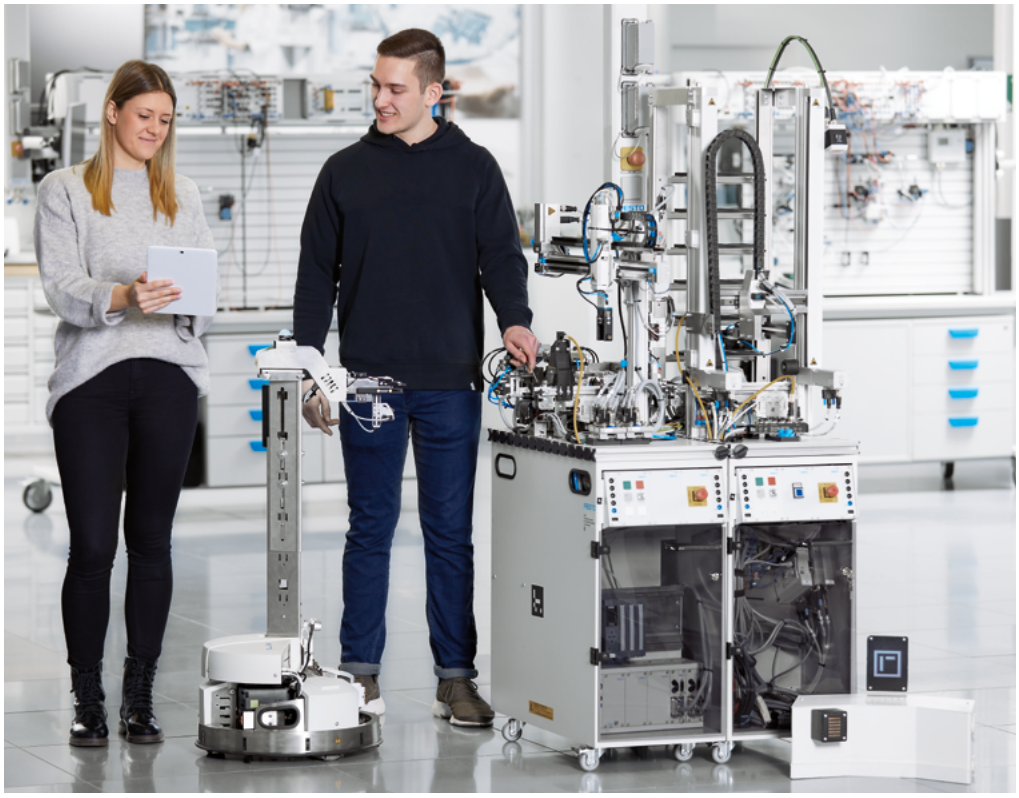


CIROS is the industrially proven, extremely powerful platform for the creation and application of 3D simulation models for automation technology.

In addition to the automation technology and industrial robotics-focused content, CIROS is prepared for use in conjunction with Robotino. Several application scenarios are available to choose from.

– With the Robotino simulation controller, Robotino View can be connected directly to CIROS. In combination with other control systems such as PLCs, robotics or hardware-in-the-loop scenarios, completely new learning scenarios can be trained and realized.
– As a predefined resource in training factories. Thanks to integration in MES4, Robotino fulfills material flow branching and transport tasks in the MPS 400, CP Lab and CP Factory learning systems.
– In addition to prepared scenarios, Robotino can be connected to CIROS via OPC UA, Python and other interfaces.

Implementing Your Own Applications with Robotino



With Robotino, you can implement your own applications in the fields of mobile robotics and service robotics. The mounting tower allows you to attach standard components or extensions developed by you to Robotino at any height and to connect them to the control system via the provided interfaces. This means you can convert Robotino quickly and easily from a forklift truck to a service robot, for example.



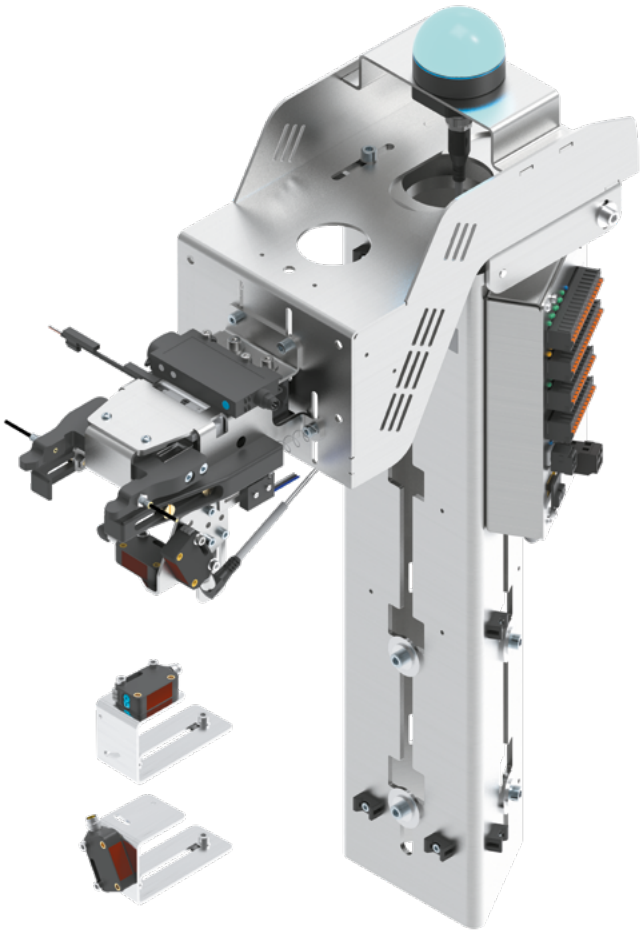






RoboCup
Carry out relevant research and measure yourself against the world's elite researchers – in the RoboCup Industrial Logistics League, researchers from around the world test what production logistics 4.0 can offer. In a smart factory, you carry out research into concepts and solutions for the challenges of the automated guided vehicle system of the future and perform tasks with a large number of variants. The multi-stage production process can be planned using up to three Robotinos per team with a free choice of sensors, and handling and software approach to fulfil the MES tasks. Every year, fascinating new challenges are created to ensure a demanding competitive atmosphere for everyone from beginners in robotics-related areas, right up to doctoral candidates and professors.
→ ll.robocup.org

Electric Gripper Kit



Accessory kit for the installation and commissioning of an electric gripper. The gripper package is designed to be mounted on Robotino generation 3 or later. It contains all hardware components necessary for operation in between current MPS stations and sample programs for Robotino.

The package includes:

- Electrical gripper system based on EHPS with sensor package (Order no. 8125328)
- LED signal for RGB display of states (Order no. 8125007)
- Connection box with all Robotino connections (Order no. 8126834)
- Height-adjustable tower top (Order no. 8124635)
- Sensor package for commissioning on MPS stations (Order no. 8124921)
- Technical documentation enclosed in each case
- Mounting aid for MPS systems and example programs
- All accessories comply with the RoHS directive according to CE marking

Technical data

Electrical connections provided as replication of the Robotino system:
- Digital inputs/outputs: 8 (24 V DC, 2 A), of which 5 inputs and 6 outputs are preassigned by the gripper package
- Analogue inputs: 8 (0 – 10 V DC)
- Relay changeover switch: 2
- Supply connections:
  - 13x 24 V DC
  - 1x 12 V DC
  - 3x 5 V DC
  - 4th motor output consisting of 6-pin connector for encoder and 2-pole power output (PWM)

Extract of performance data EHPS gripper package:
- EHPS-16-A parallel gripper integrated
- Digital inputs/outputs: 4/2
- Gripper jaw stroke 10 mm (x2)
- Jaw gripping weight 100g (x2)
- Max. clock frequency 2.2 Hz
- Repeat accuracy better than or equal to 0.03 mm
- Maximum gripping width: 53.8 mm
- Min. gripping width: 33.8 mm
- Gripping force approx. 65N (in relation to center of MPS workpieces)

→ Pages 72 – 73

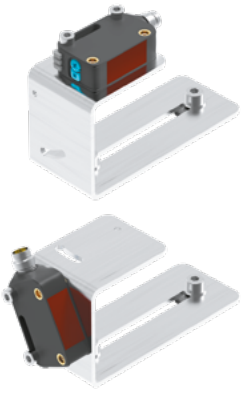
Further information on:
→ Festo Didactic Info Portal

Order no.	**8127981**

Components included:

MPS Handshake Kit for Robotino Integration	8124921

Recommended accessories for more than two production cells:



MPS Handshake Kit for Robotino Integration

The combination of optical transmitters and receivers for MPS stations enables the characteristic 1-bit communication with Robotino. The Handshake Kit is mounted below existing conveyor belts and replaces the usual communication between recent MPS units. Due to the uncomplicated integration a multitude of scenarios can be realised. The counterpart to this communication interface is included in the Robotino 4 gripper package.

Scope of delivery
- 1x set of input sensor with adapter and cable set
- 1x set of output sensor with adapter and cable set
- Technical documentation

Order no.	**8124921**

Mobile Manipulator Integration Package



[X]

The integration package mobile manipulator marries the mobile learning system Robotino to the collaborative robot Cobotta into a mobile manipulator. It contains all necessary components consisting of software and hardware for the integration. The package is completed by comprehensive support materials.

Scope of delivery
– Height adjustment for assembly tower
– Robotino safety box
– Robotino connection box
– Cobotta kit
– Commissioning documentation

Further information including commissioning video in the
→ Festo Didactic Info Portal

The following requirements for operation are provided by Robotino:
– Voltage of 24V provided for operation of Cobotta and voltage converter

Technical data integration package
– Weight of installation set approx. 2.5 kg
– Provides COBOTTA power consumption of 180 W; 24 V DC; 7.5 A
– Provides 5 Ethernet ports incl. 48 V PoE (3 of which are occupied)

Dimensions of the entire system including Robotino and Cobotta components which are not included in this product:
– Diameter retracted 470 mm
– Diameter extended max. 900 mm
– Height retracted 1250 mm
– Height extended max. 1425 mm
– Total weight of system approx. 30 kg

Requires Robotino and Cobotta for successful integration.



[X]

Mobile Manipulator Integration Package	**8153902**

[X] Figure contains additional equipment

Accessory Package Charging Station for Robotino 4



This accessory pack increases the range of the Robotino. The station can be approached in three different and combinable ways: Via optical sensors, by means of image processing of the 2D marker, or using a laser scanner. The different approach options can be used manually or in automatic mode. The charging station is directly compatible with the charging points used by Robotino Factory.

The charging station is intended for use with the Robotino 4 mobile learning system. The package creates the technical prerequisite for docking Robotino 4 without further handling and sequentially charging the battery packs. During the charging process, Robotino 4 remains in operation and is operated with mains voltage to avoid battery drainage.

Scope of Delivery
– Charging station with 6-pin contact
– Reflector marker for laser scanner
– Illuminated marker for image processing
– Charging contact with 6 contact pins
– Installation and commissioning instructions

Technical Data
– Operating voltage according to selected version
– Power consumption: max. 240 W
– Dimensions: 535 mm x 212 mm x 152 mm
– Weight: approx. 14 kg
– Protection class IP20

Requires country-specific power supply cable for non-heating appliances.

The package consists of a charging station and a charging contact. One charging contact is required per Robotino. There is no special coupling between contact and charging station.

Charging station and contact for Robotino 120 V	**8134658**
Charging station and contact for Robotino 230 V	**8134659**

Components included:

1x Charging contact	8131075

Individually reorderable:

Charging station 120 V (without Charging contact)	8131016
Charging station 230 V (without Charging contact)	8131017

Industrial Control Technology





Overview of EduTrainer Universal 162
Overview of EduTrainer Compact 163
How to Select the Right EduTrainer 164

Interfaces to the Process 165
EasyPort USB 166

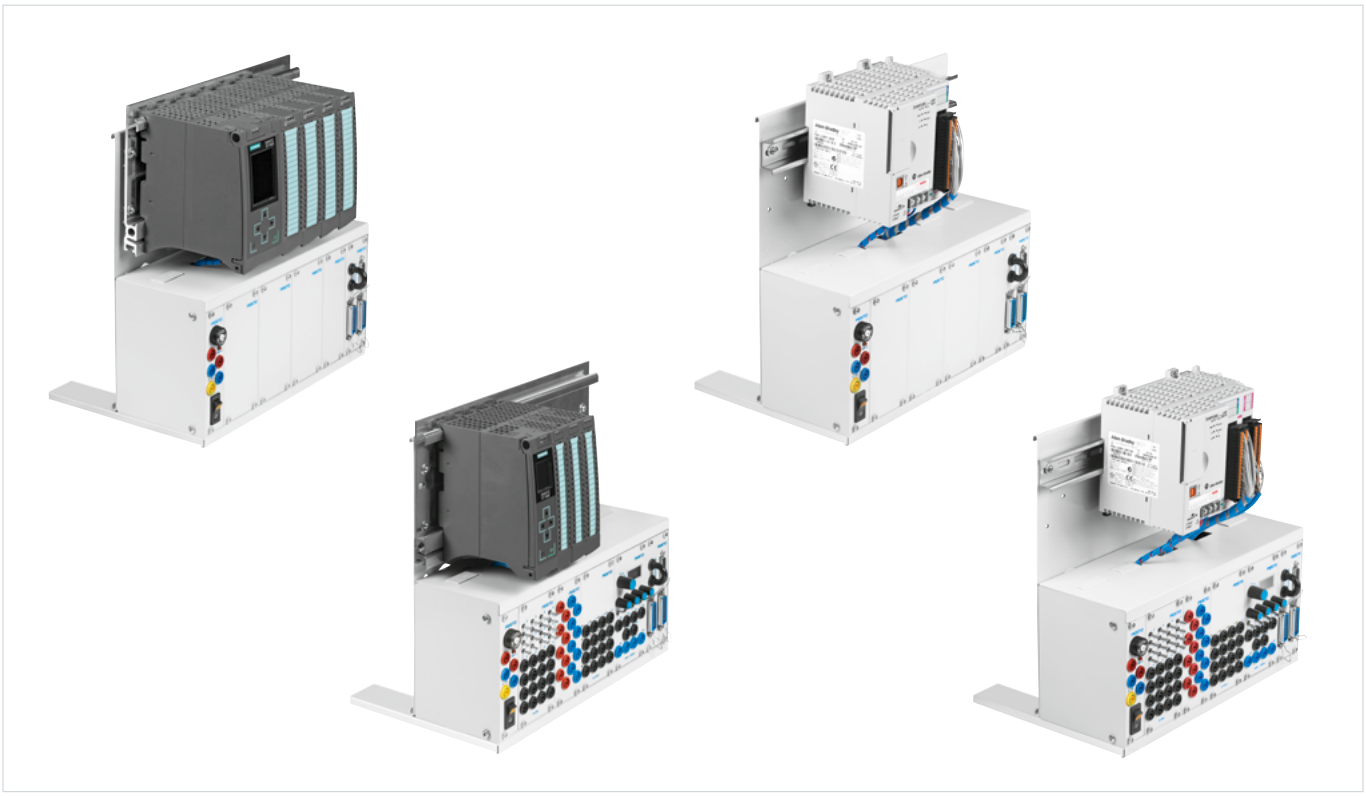
EduTrainer with Siemens Controllers 168
EduTrainer with CODESYS Controllers 174
EduTrainer with Allen-Bradley Controllers 178

Simulation Modules for EduTrainer Universal and Compact 182
EduTrainer for Mini Control Systems 184
Operation and Networking in Basic Training 188
Control Panels (HMI) and Switches 189

TP 301 Basic PLC Programming 194

Accessories and Optional Components 196

Overview of EduTrainer Universal



The EduTrainer Universal
Do you use PLCs from global market leaders or less well-known but innovative control concepts? Does your training tend to focus on mastering processes and technologies rather than safe handling of wires and screwdrivers?

If so, the EduTrainer Universal is the right solution for you!

No matter what is most important to you, you can get exactly the EduTrainer Universal that you need:
– Fully set up and configured or your own design (online configurator)
– With PLCs from Siemens, Allen-Bradley, Festo and other manufacturers
– With or without
  – Power supply unit
  – 4 mm safety sockets
  – SysLink system interface



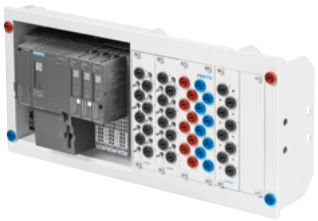
Universal shape and size
The EduTrainer Universal deserves its name:
– It fits in A4 mounting frames.
– It fits in an MPS station.
– However, it can also stand on a table or lie flat.
– It comes as a fully configured standard Preferred version – or you can customize it yourself.
– Available in narrow and wide versions.



Universal design
There are many more than just 5 or 6 manufacturers of programmable logic controllers worldwide. The EduTrainer Universal is designed for different H-rails so that it can be fitted with any PLC. Below the PLC, the 19” plug-in format ensures that the EduTrainer can be equipped with any conceivable combination of connecting plates and simulation modules. A range of simulation modules allows for many different processes to be connected and simulated during the training.

Overview of EduTrainer Compact



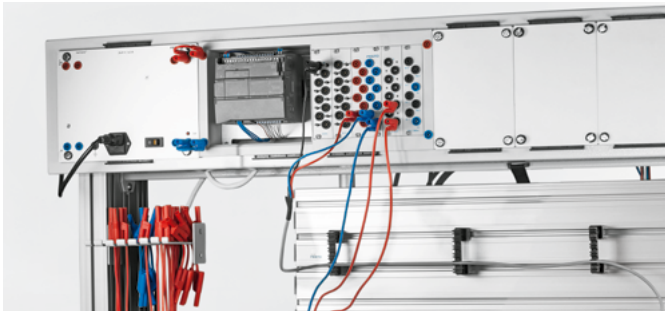






The EduTrainer Compact
Do you want to teach PLC programming in addition to relay circuits at your pneumatic or hydraulic laboratory? Do you want a device that suits your workbench? Does your training tend to focus on mastering processes and technologies rather than safe handling of wires and screwdrivers?

The EduTrainer Compact is the ideal control system for pneumatics and hydraulics and has proven itself worldwide.



The EduTrainer Compact can be integrated into the ER mounting frames of various laboratory systems or used as stand-alone desktop devices. The sensors and actuators are connected to the inputs/outputs of the PLC via 4 mm safety sockets. The inputs can be simulated with switches or potentiometers. Depending on the configuration, 4 mm safety sockets or SysLink universal I/O interface sockets are available. This provides many different options for connecting to all Festo Didactic equipment sets.

- The heavy-duty PLC for pneumatics or hydraulics laboratories
- Suitable for an ER mounting frame
- Fully set up and configured or your own design (online configurator)
- With PLCs from Siemens, Festo and other leading manufacturers
- External voltage supply via 4 mm safety sockets
- With or without 4 mm safety sockets for PLC inputs and outputs
- With or without SysLink system interface for PLC inputs and outputs

Recommended learning material for all EduTrainer

eLearning course
– PLC Programming



– GRAFCET

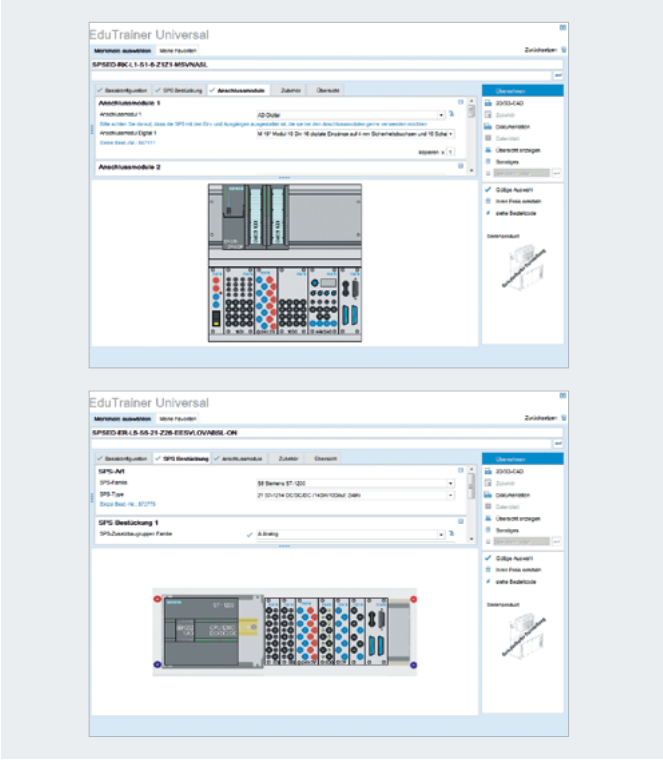


How to Select the Right EduTrainer



We recommend the
Preferred version from the catalog
Simply select an EduTrainer from the following pages or from the website.

The benefits to you:
– Cost-effective solution
– Completely harmonized technology
– Quick delivery



Online configuration with listed PLCs
If you cannot find a suitable Preferred version, an EduTrainer can be configured with one of the PLCs offered in our online configurator (➔ www.festo.com/didactic). You can configure the required EduTrainer yourself and order it from us.

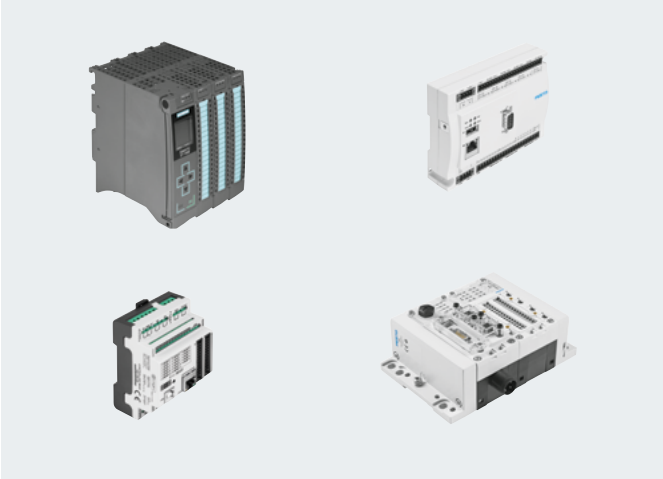
The benefits to you:
– Customized solution
– Easy to select from listed components

Online configuration with other PLCs
If the desired PLC is not listed in the online configurator, an EduTrainer can be configured with the required PLC as an EduTrainer “with special PLC.”

The benefits to you:
– Customized solution
– Any PLC available on the market (as long as external dimensions and connections are compatible)

Online configuration for self-installation of PLC
You can configure an EduTrainer “without PLC” if you already own the PLC and would like to install it yourself or if you want to make your own changes and modifications to the EduTrainer.

The benefits to you:
– Maximum flexibility in designing the device
– Any PLC available on the market (as long as external dimensions and connections are compatible)

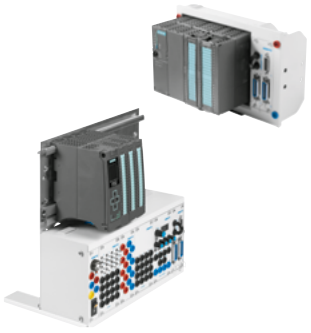
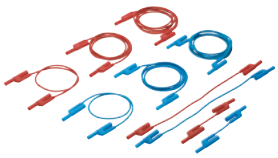
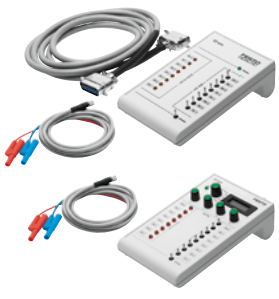
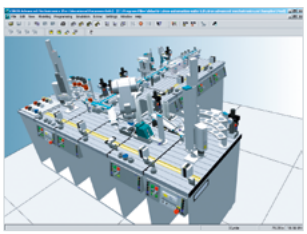
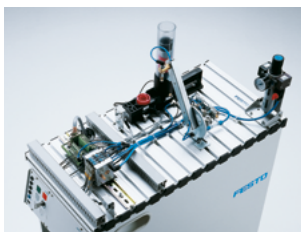


Control systems and PLC modules
In addition to EduTrainers, we also offer you individual controllers or controller components:
– All Siemens trainer packages and individual controllers
– Festo components
– Allen-Bradley components
– Controllino (Arduino-based compact controller)
– And others

Note: If you do not have the controller or Siemens Trainer Package you need, please visit our website or request the controller directly from us.

More controllers that suit your requirements can be found at ➔ www.festo.com/didactic. See “online configurator”

Interfaces to the Process

With an EduTrainer or any PLC, you can control the process of your choice. The programmer (PC), controller and processes are connected via various interfaces	**1. Simulation of the PLC inputs and display of the PLC outputs** Testing a PLC program using the simulation box	**2. Control of virtual processes** Industry-oriented, cost-effective PLC training by means of simulation software, e.g. CIROS	**3. Control of real processes** Using equipment sets and MPS stations **Cable set**
EduTrainer or PLC of your choice			
I/O Data cable I/O data cable with SysLink connectors for EduTrainer at both ends (order no. 034031/167197) or with SysLink connector at one end and open ends for any PLC (order no. 167122)			
Interface EasyPort USB (order no. 548687)			
Cable set with safety plugs (order no. 0892666)			
Process model – Digital simulation box (order no. 170643) or simulation box digital/analog (order no. 526863) – Simulation software CIROS FluidSIM – Equipment sets and MPS stations			

EasyPort USB

Interface for Measuring, Open- and Closed-Loop Control



Connection of software/simulation with actual training equipment/ all PLCs

The principle is simple: the USB interface is connected to the PC. The connection to the automation equipment is via standard SysLink connectors. Therefore input and output signals can be read into and output from a PC. To ensure that EasyPort is adaptable to different situations, we have developed software for the device drivers with a graphical user interface, via which connections can be made.

Technical data

- 24 V power supply via separate screw terminals or via SysLink connectors
- Interface to PC (galvanically isolated): USB 2.0, RS 232. Up to 4 modules can be connected via a USB hub. Transmission speed: 115 kbaud
- Analog interface: sub-D 15-pin socket, 12 bit resolution, 4 analog inputs, 2 analog outputs, sample frequency 0.5 kHz
- Digital interface: 16 digital inputs, 16 digital outputs on 2x 24-pin Centronics sockets with 8 digital inputs each (24 V), 8 digital outputs (24 V). 24 V power supply. Digital signals represented by LEDs
- Large LCD display, display of channel, unit, trend, and measured value (4 digits). Selection of the channel to be displayed and the units via keys.
- Controllable via ActiveX Control from LabVIEW, C++, or Visual Basic

EasyPort USB 19”

- Technical data as with EasyPort USB , but for installation in a 19” support system
- Front plate: 19” plate with 36 HP

Connects the Simulation to the Real World

Example applications	**Measuring**	**Control (open loop)**	**Closed-loop control**	**Controlling a simulation**
PC: **Software and simulations**	– FluidLab-PA – FluidLab-P – FluidLab-H – LabVIEW – C++ – Visual Basic	– FluidSIM (only digital) – S7-PLCSIM – CODESYS Soft-SPS – LabVIEW – C++ – Visual Basic	– FluidLab-PA – FluidLab-P from version 2.0 – LabVIEW – C++ – Visual Basic	– FluidSIM – CIROS – LabVIEW – C++ – Visual Basic
Interface: **EasyPort USB**	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital/analog	Interface: USB  Interface: digital
Real training equipment	– Simulation box, digital/analog – MPS PA – TP 210 – TP 610 EasyPort USB is the PC interface for receiving analog measurements and digital signals. Measurement data logged via: – FluidLab-PA – FluidLab-P – FluidLab-H	– Simulation box, digital/analog – MPS PA – MPS – TP 301 EasyPort USB is the PC interface to control actual processes or simulations on a PC via an actual PLC. Actual process, controlled via: – S7-PLCSIM – FluidSIM – CODESYS	– Simulation box, digital/analog – MPS PA – TP 210 – TP 610 EasyPort USB is the PC interface to control an actual closed-loop controlled system. Closed-loop controlled system, controlled via: – FluidLab-PA – FluidLab-P from version 2.0	– Any PLC – Simulation box, digital – EduTrainer Recommendation: The Codesys starter kit with CECC-LK and EasyPort USB contains everything that is needed to start on the subject of control Simulated process, displayed via: – CIROS – FluidSIM

EasyPort USB	**548687**



EasyPort USB 19“	**8021637**



Scope of delivery
– EasyPort USB/EasyPort USB 19“
– 24 V connecting cable on 4 mm safety plugs
– USB cable
– CD-ROM: EasyOPC driver, datasheet, Activ-X control, examples of control using LabVIEW

Also order:

For EasyPort with a real process or SimuBox:

I/O data cable with SysLink connectors (IEEE 488) at both ends, 2.5 m	34031
Analog cable, parallel, 2 m	529141

For EasyPort with a real PLC:

I/O data cable with SysLink connectors (IEEE 488) on both ends, crossover	167106

For EasyPort, freely wirable, with any PLC:

I/O data cable with SysLink connector IEEE 488 and open ends	167122

For EasyPort with an EduTrainer:

I/O data cable, crossover, with plug and socket, 0.3 m	167197

For EasyPort with a real PLC or SimuBox:

Analog cable, crossover, 2 m	533039

CODESYS starter kit with CECC-LK and EasyPort USB	8024001
Universal connection unit, digital (SysLink)	162231
Quick-Fix screw adapter	549806

EduTrainer Universal Preferred Versions Laboratory

SIMATIC S7-1500

1



1 S7-1512C-1PN	**8065595**
2 S7-1516-3PN/DP	**8042524**
3 S7-1516F-3PN/DP	**8034574**

Notes

Order no. 8065595, 8042524 and 8034574 are based on Siemens SCE Trainer Packages and each one contains one EduTrainer including programming cable (Ethernet cable) and programming software STEP 7 TIA portal. When Siemens updates these Trainer Packages, the controllers are replaced by successor models. Subject to technical implementation.

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analog cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	

Other accessories:

Analog cable, crossover, 2 m	533039

2



3



The ultimate in power and efficiency

The SIMATIC S7-1500 controller family represents the new controller generation in the TIA portal and a milestone in automation. It delivers maximum performance and user-friendliness for medium and high-end applications in machine and plant automation.

EduTrainer Universal with:

CPU S7-1512C-1PN
- Main memory: 250 kB for program and 1 MB for data
- Memory card included
- Interface: PROFINET IRT with 2-port switch

Inputs/outputs:
- 32 digital inputs (24 V DC)
- 32 digital outputs (24 V DC, 0.5 A)
- 5x analog inputs, 4x U/I, 1x R/RTD, 16-bit resolution
- 2x analog outputs, 2x U/I, 16-bit resolution

CPU S7-1516-3PN/DP
- Main memory: 1 MB for program and 5 MB for data
- Memory card included
- Interface 1: PROFINET IRT with 2-port switch
- Interface 2: Ethernet
- Interface 3: PROFIBUS, 10 ns bit performance

Inputs/outputs:
- 32 digital inputs (24 V DC)
- 32 digital outputs (24 V DC, 0.5 A)
- 8x analog inputs, 8x U/I/RTD/TC, 16-bit resolution
- 4x analog outputs, 4x U/I, 16-bit resolution

CPU S7-1516F-3PN/DP
- Main memory: 1.5 MB for program and 5 MB for data
- Memory card included
- Interface 1: PROFINET IRT with 2 port switch
- Interface 2: Ethernet
- Interface 3: PROFIBUS, 10 ns bit performance

Inputs/outputs:
- 32 digital inputs (24 V DC)
- 32 digital outputs (24 V DC, 0.5 A)
- 8x analog inputs, 8x U/I/RTD/TC, 16-bit resolution
- 4x analog outputs, 4x U/I, 16-bit resolution

The mounting system
- EduTrainer Universal, size 1 (W x H) 305 x 297 mm
- Can be placed on a desk or in an MPS station
- Stable, powder-coated, sheet-steel mounting system
- Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
- 19" module 16DIN (12 HP), 16 digital inputs on 4 mm safety sockets and 16 switches/push buttons for signal simulation
- 19" module 16DOUT (12 HP), 16 digital outputs on 4 mm safety sockets
- 19" module 4AIN/2AOUT (12 HP), analog processing 4 analog inputs on 4 mm safety sockets can be switched to simulation via potentiometer and 2 analog outputs on 4 mm safety sockets
- 19" module 24 V/0 V (9 HP), 8x 4 mm safety sockets, red for 24 V distribution, 8x 4 mm safety sockets, blue for 0 V distribution
- 19" module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connector with 4 analog inputs and 2 analog outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.

Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Universal Preferred Versions MPS

SIMATIC S7-1500

The ultimate in power and efficiency

The controller family SIMATIC S7-1500 is a new controller generation in the TIA portal and a milestone in automation. It delivers maximum performance and user-friendliness for medium and high-end applications in machine and plant automation.

EduTrainer Universal with:

CPU S7-1512C-1PN (MPS)
- Main memory: 250 kB for programs and 1 MB for data
- Memory card included
- Interface: PROFINET IRT with 2-port switch

Inputs/outputs:
- 32 digital inputs (24 V DC)
- 32 digital outputs (24 V DC, 0.5 A)
- 5x analog inputs, 4x U/I, 1x R/RTD, 16-bit resolution
- 2x analog outputs, 2x U/I, 16-bit resolution

CPU S7-1516-3PN/DP (MPS)
- Main memory: 1 MB for program and 5 MB for data
- Memory card included
- Interface 1: PROFINET IRT with 2-port switch
- Interface 2: Ethernet
- Interface 3: PROFIBUS, 10 ns bit performance

Inputs/outputs:
- 32 digital inputs (24 V DC)
- 32 digital outputs (24 V DC, 0.5 A)
- 8x analog inputs, 8x U/I/RTD/TC, 16-bit resolution
- 4x analog outputs, 4x U/I, 16-bit resolution

The mounting system
- EduTrainer Universal, size 1 (W x H) 305 x 297 mm
- Can be placed in a A4 mounting frame
- Can be placed on a desk or in an MPS station
- Stable, powder-coated, sheet-steel mounting system
- Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
- 19" module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connection with 4 analog inputs and 2 analog outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.

1



1 S7-1512C-1PN (MPS)	**8065452**
2 S7-1516-3PN/DP (MPS)	**8065594**

Notes

Order no. 8065452 and 8065594 are based on Siemens SCE Trainer Packages and each one contains one EduTrainer including programming cable (Ethernet cable) and programming software STEP 7 TIA portal. When Siemens updates these Trainer Packages, the controllers are replaced by successor models. Subject to technical implementation.

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analog cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	

Other accessories:

Analog cable, crossover, 2 m	533039

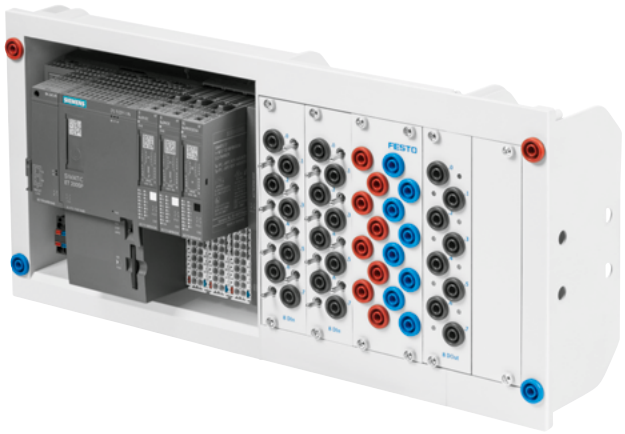
2



Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Compact Preferred Version

SIMATIC S7-1500



1512SP F-1 PN	**8065601**

Notes

Order no. 8065601 is based on a Siemens SCE Trainer Package and contains one EduTrainer including programming cable and programming software Step 7 TIA-Portal. When Siemens updates these Trainer Packages, the controllers are replaced by successor models. Subject to technical implementation.

Recommended accessories:

Power supply unit for mounting frame ➔ Page 199
4 mm Safety laboratory cables ➔ Page 199
Ethernet cable ➔ Page 198

The ultimate in power and efficiency

The controller family SIMATIC S7-1500 represents the new controller generation in the TIA portal and a milestone in automation. It delivers maximum performance and user-friendliness for medium and high-end applications in machine and plant automation.

EduTrainer Compact with:

CPU 1512SP F-1 PN
- Main memory: 300 kB for program and 1 MB for data
- Interface: PROFINET IRT with 3-port switch
- Memory card included
- Ethernet cable included
- Programming software included

Inputs/outputs:
- 16 digital inputs (24 V DC)
- 8 digital outputs (24 V DC, 0.5 A)

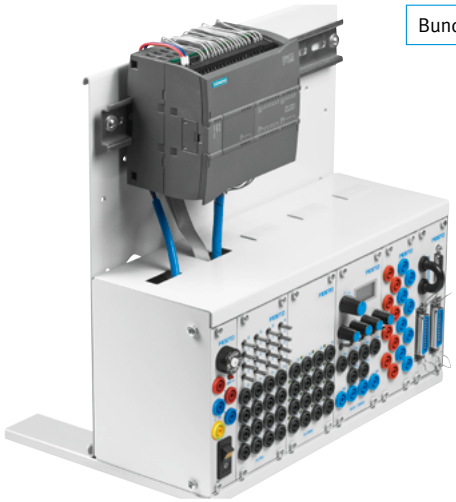
The mounting system
- EduTrainer Compact for ER mounting frame, size 2 (W x H x D) approx. 364 x approx. 170 x approx. 80 mm
- 19” modules with 4 mm safety plugs, SysLink system connector or 24 V/0 V
- Suitable for ER mounting frame or freestanding on the table
- Lightweight injection-molded housing
- The units are supplied fully assembled
- Other combinations are possible via the online configurator

Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Universal Preferred Versions Laboratory

SIMATIC S7-1200

1



Bundle of 6

1	6x S7-1215C-TP (RK1/DIO-A-24/0V-SL)	**8096453**
2	6x S7-1215C-TP (RK1/SL)	**8096454**

Notes

Order nos. 8096453 and 8096454 are based on Siemens SCE Trainer Packages and contain six EduTrainers each, including programming cable (Ethernet cable) and programming software STEP 7 Basic. When Siemens updates these Trainer Packages, the controllers are replaced by successor models. Subject to technical implementation.

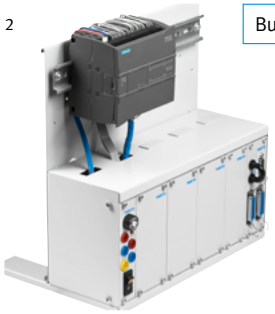
Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analog cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	

Recommended accessories:

Analog cable, crossover, 2 m	533039

2



Bundle of 6

Special license rules apply for schools and educational institutes in the commercial sector.

The modular mini control system from Siemens

For solutions in discrete and stand-alone automation applications in the lower performance range. The family of SIMATIC S7-1200 controllers is equipped with an integrated engineering system: SIMATIC STEP 7 Basic for controller and HMI.

EduTrainer Universal with CPU S7-1215C (order no. 8096453)

– Digital inputs on 4 mm safety sockets and switches/buttons for signal simulation
– Voltage distribution each with 8x 24 V/0 V on 4 mm safety sockets
– Digital outputs on 4 mm safety sockets
– Analog inputs on 4 mm safety socket switchable to simulation via potentiometer
– Analog output on 4 mm safety sockets
– Simulation module with 2x SysLink push-in connectors with digital inputs and outputs and Sub-D, 15-pin push-in connectors with analog inputs and outputs; 4 mm safety sockets for emergency stop bridge to connect a safety circuit for digital outputs. The controller can use it to connect to stations, operator panels, applications and, with the external PC interface Easy-Port, to visualizations on the PC.
– 125 kB RAM, 4 MB loading buffer
– Interface: PROFINET (2x RJ45)
– 14 digital inputs (24 V DC)
– 10 digital outputs (24 V DC, 0.5 A)
– 2 analog inputs: 2 (0 – 10 V DC)
– 1 analog output (±10 V DC, 0 – 20 mA)

EduTrainer Universal with CPU S7-1215C (order no. 8096454)

– Simulation module with 2x SysLink push-in connectors with digital inputs and outputs and Sub-D, 15-pin push-in connectors with analog inputs and outputs; 4 mm safety sockets for emergency stop bridge to connect a safety circuit for digital outputs. The controller can use it to connect to stations, operator panels, applications and, with the external PC interface Easy-Port, to visualizations on the PC.
– 125 kB RAM, 4 MB loading buffer
– Interface: PROFINET (2x RJ45)
– 14 digital inputs (24 V DC)
– 10 digital outputs (24 V DC, 0.5 A)
– 2 analog inputs: 2 (0 – 10 V DC)
– 1 analog output (±10 V DC, 0 – 20 mA)

The mounting system

– EduTrainer Universal
– Dimensions (W x H): approx. 305 mm x 297 mm
– Stable, powder-coated, sheet-steel mounting system
– Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
– The carrier sits securely on a desk or in an MPS and can be integrated into an A4 frame, or placed at an angle on the desk, by simply removing the leveling feet and following a few more simple steps
– The units are supplied fully assembled

System requirements

– Windows 10 (64 Bit) Home & Professional & Enterprise 1909, 2004, 20H2 / IoT Enterprise 2016 LTSB / 2019 LTSC

EduTrainer Compact Preferred Versions

SIMATIC S7-1200

Bundle of 6



1

1	6x S7-1215C-TP (ER2/DIO-A-24V/0V)*	**8096455**
2	6x S7-1215C-TP (ER2/DIO-A-SL)*	**8096456**
3	1x S7-1215C-TP (ER2/DIO-A-24V/0V)**	**8096457**
4	1x S7-1215C-TP (ER2/DIO-A-SL)**	**8096458**
5	1x S7-1214C-TP (ER2/DIO-A-SL)**	**8115009**

Notes

*Order nos. 8096455 and 8096456 are based on Siemens SCE Trainer Packages and contain six EduTrainers each, including programming cable (Ethernet cable) and programming software STEP 7 Basic. When Siemens updates these Trainer Packages, the controllers will be promptly replaced by successor models. Subject to technical implementation.

**Order nos. 8096457, 8096458 and 8115009 contain one EduTrainer without programming cable (Ethernet cable) and programming software. The programming software Step 7 can be ordered in different packages at www.festo.com/didactic

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analog cable, parallel, 2 m	529141
Power supply unit for mounting frame → Page 199	
4 mm Safety laboratory cables → Page 199	
Ethernet cable → Page 198	
Programming software STEP 7 → www.festo.com/didactic	

Bundle of 6



2



4



3



5

The modular mini control system from Siemens

For solutions in discrete and stand-alone automation applications in the lower performance range. The family of SIMATIC S7-1200 controllers is equipped with an integrated engineering system: SIMATIC STEP 7 Basic for controller and HMI.

EduTrainer Compact with CPU S7-1215C (order no. 8096455, 8096457)

– Digital inputs on 4 mm safety sockets and switches/pushbuttons for signal simulation
– Voltage distribution, each with 8x 24 V/0 V on 4 mm safety plugs
– Digital outputs on 4 mm safety sockets
– Analog inputs and outputs on 4 mm safety sockets
– 75 kB RAM, 4 MB loading buffer
– Interface: 2x RJ45
– 14 digital inputs (24 V DC)
– 8 digital outputs (24 V DC, 0.5 A)
– 2 analog inputs (0 – 10 V)
– 1 analog output (±10 V DC, 0 – 20 mA)

EduTrainer Compact with CPU S7-1215C (order no. 8096456, 8096458)

– Digital inputs on 4 mm safety sockets and switches/pushbuttons for signal simulation
– Digital outputs on 4 mm safety sockets
– Analog inputs and outputs on 4 mm safety sockets
– Simulation module with 2x SysLink plug connectors for MPS stations and control panel with digital inputs and outputs and Sub-D, 15-pin plug connection with analog inputs and outputs; 4 mm safety sockets for emergency stop jumper to connect a safety circuit for digital outputs
– 75 kB RAM, 4 MB loading buffer
– Interface: 2x RJ45
– 14 digital inputs (24 V DC)
– 10 digital outputs (24 V DC, 0.5 A)
– 2 analog inputs (0 – 10 V)
– 1 analog output (±10 V DC, 0 – 20 mA)

EduTrainer Compact with CPU S7-1214C (order no. 8115009)

– Digital inputs on 4 mm safety sockets and switches/pushbuttons for signal simulation
– Digital outputs on 4 mm safety sockets
– Analog inputs and outputs on 4 mm safety sockets
– Simulation module with 2x SysLink plug connectors for MPS stations and control panel with digital inputs and outputs and Sub-D, 15-pin plug connection with analog inputs and outputs; 4 mm safety sockets for emergency stop jumper to connect a safety circuit for digital outputs
– 50 kB RAM, 2 MB loading buffer
– Interface: 1x RJ45
– 14 digital inputs (24 V DC)
– 10 digital outputs (24 V DC, 0.5 A)
– 4 analog inputs (±10 V DC, 0 – 20 mA)
– 2 analog outputs (±10 V DC, 0 – 20 mA)

The mounting system

– EduTrainer Compact for ER mounting frame
– Height x depth x width approx.: 170 x 80 x 364 mm
– Suitable for ER mounting frame or tabletop stand-alone
– Lightweight, injection-molded housing
– The units are shipped fully assembled

Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Compact Preferred Versions
LOGO! 8

LOGO! EduTrainer Compact

Compact trainer devices that provide users with an introduction to logical signal processing within a mini control system.

Features of LOGO! modules:

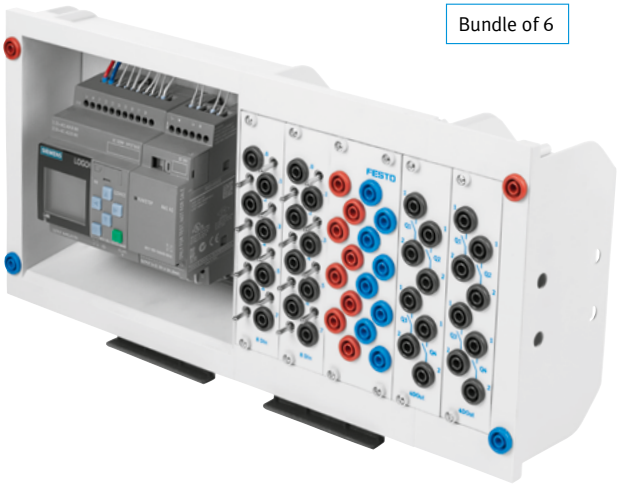
LOGO! 12/24 RCE (V8)
With LOGO! 8 the successful Siemens logic module enters the next generation.
– New logic module generation
– Display with new look and feel
– Ethernet communication
– Integrated web server
– New software in new design

EduTrainer Compact with:

LOGO! 8
– Basic functional module 12/24 RCE
  8 digital inputs
  4 relay outputs
– DM8 extension module:
  4 digital inputs
  4 relay outputs

The mounting system
– EduTrainer Compact for ER mounting frame, size 2 (W x H x D) approx. 364 mm x approx. 170 mm x approx. 80 mm
– 19" modules with 4 mm safety plugs, SysLink system connector
– Suitable for ER mounting frame or freestanding on the table
– Lightweight injection-molded housing
– Expandable to some extent with 19" simulation modules
– The units are supplied fully assembled
– Other combinations are possible via the online configurator

Bundle of 6



1

1	6x LOGO! 8 TP*	**8041132**
2	1x LOGO! 8**	**8041133**

Notes
*Order no. 8041132 is based on a Siemens SCE Trainer Package and contains six EduTrainers including programming software LOGO! Soft Comfort V8.
**Order no. 8041133 contains one EduTrainer without programming software. The matching programming software LOGO! can be ordered separately, if necessary.

Recommended accessories:

Power supply unit for mounting frame → Page 199	
4 mm Safety laboratory cables → Page 199	
Ethernet cable → Page 198	
Programming software LOGO! Soft Comfort V8	8040050



2

Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Universal Preferred Version MPS

Festo CECC-LK CODESYS V3.5



CECC-LK (MPS)	**8043320**

Notes

The Codesys V3.5 programming software can be downloaded for free on the Festo website.

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	

World language IEC 61131-3

The CECC controllers are the latest generation of compact controllers from Festo. A CECC controller can be programmed for IL, LD, FBD, ST, SFC and CFC with Codesys provided by Festo in accordance with IEC 61131-3.

EduTrainer Universal with:

Festo CECC-LK (MPS)

Interfaces:
– 4x IO-Link master
– 1x IO-Link device
– Ethernet connection
– USB connection
– CANopen

Inputs/outputs:
– 12 digital inputs (24 V DC)
– 8 digital outputs (24 V DC, 0.5 A)

IO-Link extension module:
– 8 digital inputs (24 V DC)
– 8 digital outputs (24 V DC, 0.5 A)

CODESYS

Codesys is a development environment for programmable logic controllers (PLC) in accordance with the IEC 61131-3 standard for application development in industrial automation.

The point-to-point communication of the IO Link interface enables a simple and safe three-conductor wiring between the controller, sensors or actuators, and also makes remote parameterization possible. A wide variety of IO-Link devices are available on the market. They are mostly sensors, actuators or a combination of these as well as special IO Link nodes to increase the number of inputs/outputs or to use standard sensors and actuators.

The mounting system

– EduTrainer A4 rack, desktop variant, size 1, W x H 305 x 297 mm
– 19” module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connection with 4 analog inputs and 2 analog outputs, emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
– Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
– Can be placed on a desk or in an MPS station.
– Stable, powder-coated, sheet-steel mounting system

EduTrainer Universal Preferred Versions MPS

Festo CPX-CEC CODESYS V3.5

World language IEC 61131-3

Benefit from automation programming in a world language, based on IEC 61131-3.

Increased performance

CPX-CEC means improved cycle times and more connectable actuators. The modular I/O system offers complete flexibility. Intelligent pneumatic and electric axes can be activated via fieldbus. The extensive Codesys function library provides diagnostics and condition monitoring options. Open- and closed-loop control – the solution for efficient automation of workstations or via remote control.

EduTrainer Universal with:

CPX-CEC CODESYS 3.5 (MPS)
- 800 MHz processor
- Data memory 32 MB flash/ 256 MB RAM
- Integrated web server
- Master CANopen fieldbus
- Communication via Ethernet (Modbus/TCP, EasyIP, TCP/IP)
- Process visualization using operator unit CDPX or OPC server

Inputs/outputs:
- 16 digital inputs (24 V DC)
- 16 digital outputs (24 V DC, 0.5 A)

The mounting system
- EduTrainer A4 rack, desktop variant, size 1, W x H 305 x 297 mm
- 19" module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connection with 4 analog inputs and 2 analog outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.
- Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
- The size 1 rack can be placed on a table or in an MPS station.
- Stable, powder-coated, sheet-steel holder system

1



1	CPX-CEC CODESYS 3.5 (MPS)	**8065602**

Notes

Includes Ethernet cable for programming the CPX-CEC.

The Codesys programming software can be downloaded for free on the Festo website.

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	

EduTrainer Compact Preferred Versions

Festo CECC CODESYS V3.5



1

1	CECC-LK	**577602**

Note

The free Codesys V3.5 programming software is available for download on the Festo homepage.

Recommended accessories:

Power supply unit for mounting frame → Page 199
4 mm Safety laboratory cables → Page 199
Ethernet cable → Page 198

The compact controller from Festo

The CECC controllers are the latest generation of compact controllers from Festo. A CECC controller can be programmed for IL, LDR, FCH, ST, SFC and CFC with Codesys provided by Festo in accordance with IEC 61131-3.

EduTrainer Compact with:

Festo CECC-LK

Festo CECC-LK is a compact and powerful PLC. The industrial design controller has 12 digital inputs, 8 digital outputs, and 2 fast digital inputs. In addition, a wide variety of interfaces
are available as standard features on board:

– 4x IO-Link Master
– 1x IO-Link Device
– Ethernet connection
– USB connection
– CANopen

CODESYS

Codesys is a development environment for programmable logic controllers (PLC) in accordance with the IEC 61131-3 standard for application development in industrial automation.

The point-to-point communication of the IO Link interface enables a simple and safe three-conductor wiring between the controller, sensors or actuators, and also makes remote parameterization possible. A wide variety of IO Link devices are available on the market. They are mostly sensors, actuators or a combination of these as well as special IO Link nodes to increase the number of inputs/outputs or to use standard sensors and actuators.

The mounting system

– EduTrainer Compact for ER mounting frame, size 2 (W x H x D) approx. 364 mm x approx. 170 mm x approx. 80 mm
– 19” modules with 4 mm safety plugs
– Suitable for ER mounting frame or freestanding on the table
– Lightweight injection-molded housing
– The unit is supplied fully assembled
– Other combinations are possible via the online configurator

CODESYS starter kit with CECC-LK and EasyPort USB



An ideal tool for newcomers to PLC technology.

With the compact and powerful PLC CECC-LK, a 24 volt PC interface (EasyPort USB) and the necessary software and hardware.

The PLC is programmed from your PC using Codesys provided by Festo, in accordance with IEC 61131, and information is exchanged with the visualization program via the PC interface. The visualization software provides various process models from the world of technology and everyday situations, such as level crossings, multi-storey car parks, sorting systems, washing machines, garage doors, wind generators, lifting luggage and more. A Getting Started kit is provided to explain how to use the hardware and software.

All the necessary accessories such as cables, 100 – 240 V/24 V power supply unit and screwdriver are included. All that is needed is a PC and a country-specific IEC power cable for the power supply unit (e.g. order no. 247661 for de, fr, es, etc.) – then you're off!.

System requirements
- PC with Win 2000 SP4/XP SP2/ Vista
- At least Pentium200 MHz
- 32 MB RAM
- 10 MB free space on hard disk
- CD-ROM drive
- Internet Explorer 5.0 or Netscape 4.0 or higher
- 1 free Ethernet and USB port

Order no.	**8024001**

Festo CECC CODESYS V3 compact controller



Codesys is a development environment for programmable logic controllers (PLC) in accordance with the IEC 61131-3 standard for application development in industrial automation. The free Codesys programming software is available for download on the Festo homepage.

The point-to-point communication of the **IO-Link interface** enables a simple and safe 3-conductor wiring between the controller, sensors or actuators, and also makes remote parameterization possible. There is a variety of IO Link devices on the market. They are mostly sensors, actuators or a combination of these as well as special IO Link nodes to increase the number of inputs/ outputs or to use standard sensors and actuators.

For industrial use, quick and easy to install.

Festo CECC-LK is a compact and powerful PLC. The industrial design controller has 12 digital inputs, 8 digital outputs, and 2 fast digital inputs.

In addition, there is a wide variety of interfaces available as standard features on board:
- 4x IO Link master
- 1x IO Link device
- Ethernet connection
- USB connection
- CANopen

A comprehensive Codesys function library enables stand-alone open and closed-loop control and efficient automation of, for example, manual workstations to IEC 61131.

- Individual device or integratable via Codesys V3.
- Simple programming and navigation to IEC 61131-3.
- Hybrid: use CANopen Master and integrated IO Link to directly activate electric and pneumatic drives and connect valve terminals.
- Ethernet 10/100 Mbit/s, Modbus TCP Client/Server, EasyIP, TCP/IP

Festo CECC-D, like CECC-LK, but without IO-Link.

Festo CECC-LK → see figure	**8023951**
Festo CECC-D	**8023952**

Recommended accessories:

I/O data cable with one SysLink connector as per IEEE 488 and open ends	167122

EduTrainer Universal Preferred Versions Laboratory

Allen-Bradley CompactLogix

1



1 AB CL 1769-L24ER-QB1B (digital)	**8022737**
2 AB CL 1769-L24ER-QBFC1B (digital/analog)	**8022848**

Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Analog cable, parallel, 2 m	529141
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	
Programming software RSLogix	8034585

Other accessories:

Analog cable, crossover, 2 m	533039

2



The standard in North America

Allen-Bradley CompactLogix controllers of the series 1769 are ideal for small to compact control applications that do not require axis control or safety functions. These controllers offer integrated serial EtherNet/IP or ControlNet channels and modular DeviceNet communications.

EduTrainer Universal with:

AB CL 1769-L24ER-QB1B (digital)
– Main memory: 0.75 MB
– 1 GB SD memory card included
– Interfaces: 2x EtherNet/IP, 1x USB
Inputs/outputs:
– 16 digital inputs (24 V DC)
– 16 digital outputs (24 V DC, 0.5 A)

AB CL 1769-L24ER-QBFC1B (digital/analog)
– Main memory: 0.75 MB
– 1 GB SD memory card included
– Interfaces: 2x EtherNet/IP, 1x USB
Inputs/outputs:
– 16 digital inputs (24 V DC)
– 16 digital outputs (24 V DC)
– 4 universal analog inputs
– 2 universal analog outputs
– 4 high-speed counters

The mounting system
– EduTrainer Universal, size 1 (W x H) 305 x 297 mm
– Can be placed on a desk or in an MPS station
– Stable, powder-coated, sheet-steel mounting system
– Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A

All EduTrainer systems include all the required equipment with simulation modules:
– 19" module 16IN (12 HP), 16 digital inputs on 4 mm safety sockets and 16 switches/pushbuttons for signal simulation
– 19" module 16OUT (12 HP), 16 digital outputs on 4 mm safety sockets
– 19" module 4AIN/2AOUT (12 HP), analog processing 4 analog inputs on 4 mm safety sockets can be switched to simulation via potentiometer and 2 analog outputs on 4 mm safety sockets (not with order no. 8022737)
– 19" module 24 V/0 V (9 HP), 8x 4 mm safety sockets, red for 24 V distribution, 8x 4 mm safety sockets, blue for 0 V distribution
– 19" module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connector with 4 analog inputs and 2 analog outputs; emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs

Special license rules apply for schools and educational institutes in the commercial sector.

EduTrainer Universal Preferred Version MPS

Allen-Bradley CompactLogix

The standard in North America

Allen-Bradley CompactLogix controllers of the series 1769 are ideal for small to compact control applications that do not require axis control or safety functions. These controllers offer integrated serial EtherNet/IP or ControlNet channels and modular DeviceNet communications.

EduTrainer Universal with:

AB CL 1769-L24ER-QB1B (MPS)
– Main memory: 0.75 MB
– 1 GB SD memory card included
– Interfaces: 2x EtherNet/IP, 1x USB
Inputs/outputs:
– 16 digital inputs (24 V DC)
– 16 digital outputs (24 V DC, 0.5 A)

The mounting system
– EduTrainer Universal, size 1 (W x H) 305 x 297 mm
– Can be placed on a desk or in an MPS station
– Stable, powder-coated, sheet-steel mounting system
– Integrated power supply unit, AC 110/230 V, DC 24 V, 4 A
– 19" module system connector SysLink (9 HP), with 2x SysLink plug connector for MPS station and control panel, each with 8 digital inputs and 8 digital outputs and 1x Sub-D 15-pin plug connection with 4 analog inputs and 2 analog outputs, emergency stop jumper to connect a safety circuit for disconnecting 8 digital outputs.



AB CL 1769-L24ER-QB1B (MPS)	**8034582**

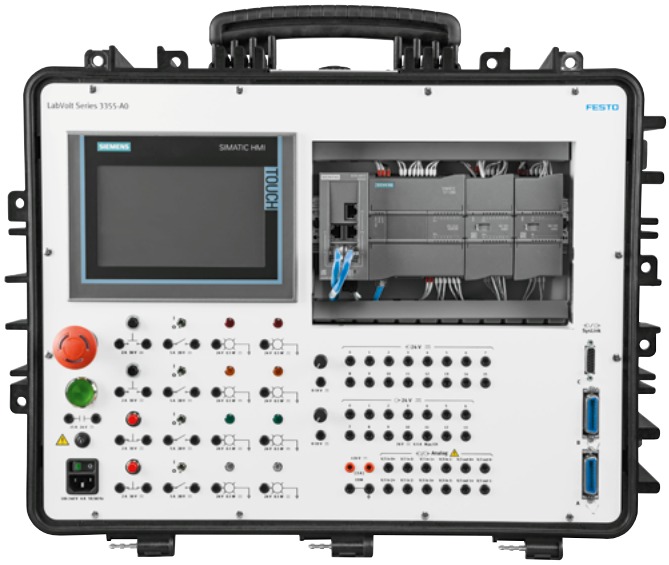
Recommended accessories:

I/O data cable with SysLink connectors (IEEE 488), 2.5 m	34031
Safety laboratory cable, 3 m	571817
IEC power cable 90° → Page 199	
Programming software RSLogix5000	8034585

Special license rules apply for schools and educational institutes in the commercial sector.

PLC EduTrainer Portable

Siemens S7-1200 or Allen-Bradley CompactLogix 5370



Siemens version illustrated



Rockwell Automation version

Siemens S7-1200	**595849**

Components: Siemens S7-1200 controller (PLC), MTP700 Unified Comfort Panel (HMI), SCALANCE XB005 industrial Ethernet switch, 16 digital inputs (including 6 high-speed counters), 4 universal analog inputs, 14 digital outputs (including 4 high-speed), 2 configurable analog outputs, front-panel access via 2-mm test leads, connection for controls and indicator lights, eight fault switches for troubleshooting exercises, SysLink interface.

Allen-Bradley (Rockwell Automation) CompactLogix 5370 *	**588969**

Note: This product cannot be sold or delivered in countries that require CE compliance.
Components: Allen-Bradley CompactLogix 5370 controller (PLC), PanelView Plus 7 graphic terminal (HMI), Stratix 2000 industrial Ethernet switch, 16 digital inputs, 4 analog inputs, 16 digital outputs, 2 analog outputs, front-panel access via 2-mm test leads, connection for controls and indicator lights, eight fault switches for troubleshooting exercises, SysLink interface

Also required, please order:
* Studio 5000 Logix Designer and FactoryTalk View Studio (for the CompactLogix PLC)
→ www.festo.com/didactic

Expansion options: PLC Applications --> Page 195

Electro-Pneumatic System	588682
Traffic Light	582533
Level Process	582544

Note: These products cannot be sold or delivered in countries that require CE compliance.

This advanced PLC training system is designed to help students understand the programming environment and languages, enabling them to learn PLC programming efficiently using industrial control equipment. Realistic examples are used to motivate students. These examples are displayed on a human machine interface (HMI) and correspond to real PLC applications that can be interfaced with the EduTrainer.

Benefits

- Built with Siemens or Allen-Bradley software and hardware, the system reflects the equipment used in actual manufacturing facilities
- Accompanied by a comprehensive curriculum featuring practical exercises
- Housed in a durable, wheeled suitcase for easy transport and safe storage
- Works as a standalone solution or in combination with existing PLC applications
- Develops industry-relevant skills for successfully performing automation and maintenance tasks

Learning objectives

- Familiarization to TIA Portal for the Siemens system **or** to Studio 5000 and FactoryTalk View Studio for the Rockwell Automation system
- Using standard PLC instructions, and understanding PLC addressing and operation
- PLC programming in four IEC 61131 languages: Ladder Logic (primary focus), Sequential Function Chart, Function Block Diagram, and Structured Text
- Designing user interaction for human-machine interfaces (HMIs)
- System troubleshooting and fault diagnosis

Recommended Learning Material

Workbooks



Campus license:

Rockwell Automation	589148
Siemens	8096774

Notes: Campus licenses are offered in English only. They include the student and the instructor PDF versions of the workbooks.

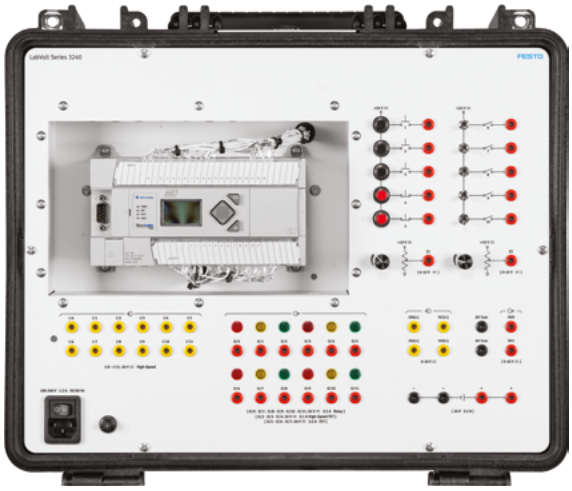
Courses on Festo LX

→ PLC and HMI Programming (Siemens S7-1200)
→ PLC and HMI Programming (CompactLogix AB)



PLC EduTrainer Portable

Allen-Bradley MicroLogix 1400





PLC EduTrainer Portable, Allen-Bradley MicroLogix 1400

100 – 240 V, 50/60 Hz	**8208214**

Note: This product cannot be sold or delivered in countries that require CE compliance.

Also required, please order
RSLogix Micro Software, Educational use (Order no. 587552)

Expansion options: PLC Applications --> Page 195

Electro-Pneumatic System	588682
Traffic Light	582533
Level Process	582544

Note: The applications cannot be sold or delivered in countries that require CE compliance.

The PLC EduTrainer Portable MicroLogix 1400 is designed to help students understand the programming environment and languages, enabling them to learn PLC programming efficiently.

This training system allows students to acquire hands-on experience with industrial control equipment. It is specially designed to help students develop skills in operating, programming, and troubleshooting modern PLC-controlled systems.

The training module is fully supported by instructional material and is compatible with several didactic applications. Several inputs (20 digital inputs, 12 digital outputs) and outputs (4 analog inputs and 2 analog outputs) are accessible from the front panel using 2-mm test leads. Five push-buttons and five toggle switches can be connected.

Features and benefits
- Built with Rockwell software and hardware, the system reflects the equipment used in actual manufacturing facilities
- Supported by instructional material and compatible with several didactic applications
- Housed in a durable, wheeled suitcase for easy transport and safe storage
- Works as a standalone solution or in combination with existing PLC applications
- Develops industry-relevant skills for successfully performing automation and maintenance tasks

Learning topics
- Familiarization with Rockwell RSLogix Micro
- Understanding the operating and programming of a modern PLC-controlled systems
- PLC programming in Ladder Logic
- Relay, timer, counter, comparison, move, sequencer instructions and online operations and monitoring I/O data files
- System troubleshooting and fault diagnosis

Recommended Learning Material

Workbooks



Campus license

en	585276

Note: Campus licenses is offered in English only. They include the student and the instructor PDF versions of the workbook “Programmable Logic Controller”.

Course on Festo LX

→ Programmable Logic Controller – Basic Programming



19” Simulation Modules

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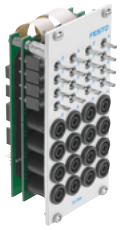

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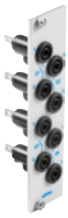

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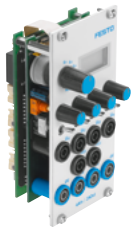

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11


1 **19” module 16IN (12 HP)**
16 digital inputs on 4 mm safety sockets and 16 switches/push-buttons for signal simulation.
Order no. **567111**

2 **19” module 8IN (6 HP), without switch**
8 digital inputs on 4 mm safety sockets.
Order no. **576620**

3 **19” module 16OUT (12 HP)**
16 digital outputs on 4 mm safety sockets.
Order no. **567112**

4 **19” module 8IN (6 HP)**
8 digital inputs on 4 mm safety sockets and 8 switches/push-buttons for signal simulation.
Order no. **567113**

5 **19” module 8OUT (6 HP)**
8 digital outputs on 4 mm safety sockets.
Order no. **567114**

6 **19” module 4OUTR (6 HP)**
– 4 relay outputs at eight 4 mm safety sockets
– Maximum load: 24 V, 4.5 A
Order no. **573278**

7 **19” module 4AIN/2AOUT (12 HP)**
– Analog value processing 4 analog inputs on 4 mm safety socket switchable to simulation via potentiometer and 2 analog outputs on 4 mm safety sockets
– Display for measured value indicator with selector switch for channel selection
– Voltage range: 0 – 10 V, -10 – +10 V
Order no. **567119**

8 **19” module 4AIN/2AOUT (6 HP)**
– 4 analog inputs at 4 mm safety sockets
– 2 analog outputs at 4 mm safety sockets
Order no. **574197**

9 **19” module word processing (12 HP)**
Two-line display for showing the input word and output word in HEX, DEZ and BCD. Changing of the input word via keypad.
Order no. **567118**

10 **19” module system connector 37-pin (9 HP)**
– 1x 37-pin Sub-D connector for 16 digital inputs
– 1x 37-pin Sub-D socket for 16 digital outputs
– Emergency stop jumper for 8 digital outputs
Order no. **567116**

11 **19” module system connector SysLink (9 HP)**
– 2x SysLink with 8 digital inputs and 8 digital outputs each
– 1x 15-pin Sub-D socket for 4 analog outputs and 2 analog inputs
– Emergency stop jumper for 8 digital outputs
Order no. **567122**

1 **19” module 24V/0V (9 HP)**
– 8x 24 V on 4 mm safety sockets, red
– 8x 0 V on 4 mm safety sockets, blue

Order no.	**567195**

2 **19” module 24V (6 HP)**
8x 24 V on 4 mm safety sockets, red

Order no.	**567120**

3 **19” blanking plate**

42 TE	**8022733**
18 TE	**8022732**
12 TE	**567123**
9 TE	**567124**
6 TE	**567125**
3 TE	**567126**

4 **16-pin flat cable**
16-pin flat cable, open at one end to connect 19” modules with analog connection to any PLC with screw or CageClamp contacts, 500 mm long.

Order no.	**567196**

5 **10-pin flat cable**
10-pin flat cable, open at one end to connect 19” modules with digital connection to any PLC with screw or CageClamp contacts, 500 mm long.

Order no.	**567197**

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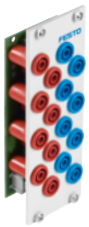

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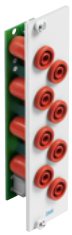

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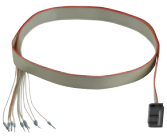


EduTrainer for Mini Control Systems

For a Basic Introduction to Control and Monitoring Tasks

Basic trainer for mini control systems

Mini control systems are becoming increasingly common in industry and trade. They are used for numerous small control and monitoring tasks for which a PLC would be oversized. Mini control systems or programmable control relays control and operate conveyors, monitor doors and gates, control heating, and so on.

For training purposes, they represent the link between classic safety circuits and programmable logic controllers. Functions can be implemented quickly and easily based on the learned ladder diagram or function chart methodology using simple programming software.

Mini control systems are characterized by the large number of features that they provide. They are easy to program and to connect, are flexible and low-cost, and are therefore indispensable in basic training.

Another advantage of these small and compact devices, which are suitable for mounting in 35 mm H-rails, is that they implement many functions in a single device.

Mini control systems include:
– Controllers
– Indicators
– Diagnostic tools
– Text displays with operating buttons
– Interfaces to fieldbus systems
– Web servers
– and many more.

Numerous extension modules expand the possible functions.

The **EduTrainer for mini control systems** provides a broad basic platform for your project work. The board is designed to hold mini control systems and expansion modules, for example the Siemens LOGO! 8, the EATON EasyE4 or a Controllino.

Up to 12 inputs can be picked off on 4 mm safety sockets. Four of these inputs can also be connected directly on the device using a pushbutton/latched switch. Up to 8 relay outputs can be changed to digital outputs using a toggle switch. Up to 2 analog outputs can also be connected to 4 mm safety sockets.

The device also includes two controllable analog encoders, which can be used to bridge voltages from 0 to 10 V at two inputs. An RJ45 Ethernet socket can connect the controller to the programming unit or network switch.

Please request a quotation for your individual requirements.







EduTrainer Mini Control System LOGO! 8

Bundle of 6



6x EduTrainer with LOGO! 8 + digital expansion
The EduTrainer provides a broad basic platform for your project work. The board is equipped with a Siemens LOGO! of the series 0BA8, an extension for digital signals.
The total of 12 outputs and 8 relay outputs of the controller are accessible on the device using 4 mm safety sockets. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analog encoders, which can be used to bridge voltages from 0 to 10 V at two inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch.

Scope of Delivery per Device
Training device with:
– 1x Siemens logo! 0BA8
– 1x extension module DM8
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometer for analog value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software classroom license

System requirements
– Windows XP, 7, 8, 10 (32 and 64 bit), Mac OSx 10.7 Lion up to Mac OSx El Capitan, Linux SUSE 11.3, SP3, K 3.0.76

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

Special license rules apply for schools and educational institutes in the commercial sector.

6x LOGO! 8 D without power supply	**8071409**
6x LOGO! 8 D with power supply*	**8071410**

Recommended accessories:

4 mm Safety laboratory cables → Page 199
Ethernet cable → Page 198
*IEC power cable 90° → Page 199



1x EduTrainer with LOGO! 8 + digital expansion
The EduTrainer provides a broad basic platform for your project work. The board is equipped with a Siemens LOGO! of the series 0BA8, an extension for digital signals.
The total of 12 outputs and 8 relay outputs of the controller are accessible on the device using 4 mm safety sockets. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analogue encoders, which can be used to bridge voltages from 0 to 10 V at two inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch.

Scope of Delivery
Training device with:
– 1x Siemens logo! 0BA8
– 1x extension module DM8
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometer for analogue value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software

System Requirements
– Windows XP, 7, 8, 10 (32 and 64 bit), Mac OSx 10.7 Lion up to Mac OSx El Capitan, Linux SUSE 11.3, SP3, K 3.0.76

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

1x LOGO! 8 D without power supply	**8071412**
1x LOGO! 8 D with power supply*	**8071413**

Recommended accessories:

4 mm Safety laboratory cables → Page 199
Ethernet cable → Page 198
*IEC power cable 90° → Page 199

EduTrainer Mini Control System LOGO! 8



EduTrainer with LOGO! 8
The EduTrainer provides a broad basic platform for your project work. The board is equipped with a Siemens LOGO! from the series 0BA8. All 8 inputs and 4 relay outputs of the controller are accessible on the device using 4 mm safety sockets. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analogue encoders, which can be used to bridge voltages from 0 to 10 V at two inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch

Scope of Delivery
Training device with:
– 1x Siemens logo! 0BA8
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometer for analogue value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software

System requirements
– Windows XP, 7, 8, 10 (32 and 64 bit), Mac OSx 10.7 Lion up to Mac OSx El Capitan, Linux SUSE 11.3, SP3, K 3.0.76

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

1x LOGO! 8 without power supply Netzteil	**8071407**
1x LOGO! 8 with power supply*	**8071408**

Recommended accessories:

4 mm Safety laboratory cables ➔ Page 199
Ethernet cable ➔ Page 198
*IEC power cable 90° ➔ Page 199



EduTrainer with LOGO! 8 + digital and analog expansion
The EduTrainer provides a broad basic platform for your project work. The board is equipped with a Siemens LOGO! of the series 0BA8, an extension for digital signals and an extension for analog outputs. The total of 12 outputs, 8 relay outputs and 2 analog outputs of the controller are accessible on the device using 4 mm safety sockets. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analog encoders, which can be used to bridge voltages from 0 to 10 V at two inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch.

Scope of Delivery
Training device with:
– 1x Siemens logo! 0BA8
– 1x extension module DM8
– 1x extension module AM2 AQ
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometers for
– Analog value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software

System requirements
– Windows XP, 7, 8, 10 (32 and 64 bit), Mac OSx 10.7 Lion up to Mac OSx El Capitan, Linux SUSE 11.3, SP3, K 3.0.76

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

1x LOGO! 8 DA without power supply	**8071414**
1x LOGO! 8 DA with power supply*	**8113746**

Recommended accessories:

4 mm Safety laboratory cables ➔ Page 199
Ethernet cable ➔ Page 198
*IEC power cable 90° ➔ Page 199

EduTrainer Mini Control System easyE4



EduTrainer with easyE4
The EduTrainer provides a broad basic platform for your project work. The board is equipped with an Eaton EASYE4- UC-12RC1, an extension for digital signals and an extension for analog outputs. The total of 12 outputs, 8 relay outputs and 2 analog outputs of the controller are accessible on the device using 4 mm safety sockets. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analog encoders, which can be used to bridge voltages from 0 to 10 V at two analog inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch.

Scope of Delivery
Training device with:
– 1x Eaton EASY-E4-UC-12RC1
– 1x extension module EASY-E4-UC-8RE1
– 1x extension module EASY-E4-DC-6AE1
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometer for analogue value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software

System requirements
– Windows 7 SP1/8/8.1/10

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

1x easyE4 DA without power supply	**8114298**
1x easyE4 DA with power supply*	**8114296**

Recommended accessories:

4 mm Safety laboratory cables → Page 199
Ethernet cable → Page 198
*IEC power cable 90° → Page 199

EduTrainer Mini control System Controllino



EduTrainer with Controllino
The EduTrainer provides a broad basic platform for your project work. The board is equipped with a Controllino MAXI Automation pure. 12 outputs, 8 relay outputs and 2 analog outputs of the controller are accessible on the device using 4 mm safety sockets. The inputs can be used either as digital or analog inputs. 4 of these inputs can also be connected directly on the device using a button/latched switch. The relay outputs can be changed to digital outputs using a toggle switch.

The device also includes two controllable analogue encoders, which can be used to bridge voltages from 0 to 10 V at two analog inputs.

An RJ45 Ethernet socket can connect the controller to the programming device or network switch.

Scope of Delivery
Training device with:
– 1x Controllino MAXI Automation pure
– 4x connections for 24 V power supply
– 12x input sockets
– 16x potential free connections for relay outputs
– 1x Ethernet socket
– 1x USB socket
– 2x 15 pin system interfaces (each 4 I/O)
– 2x potentiometer for analog value simulation
– 4x button/latched switches
– 1x output switch
– 1x programming software, open source

System Requirements
– Corresponds to the open source software Arduino IDE

Technical Data
– Front plate: 266 x 297 mm
– Device depth: approx. 90 mm
– Supply voltage: 24 V DC

1x Controllino without power supply	**8071415**
1x Controllino with power supply*	**8113747**

Recommended accessories:

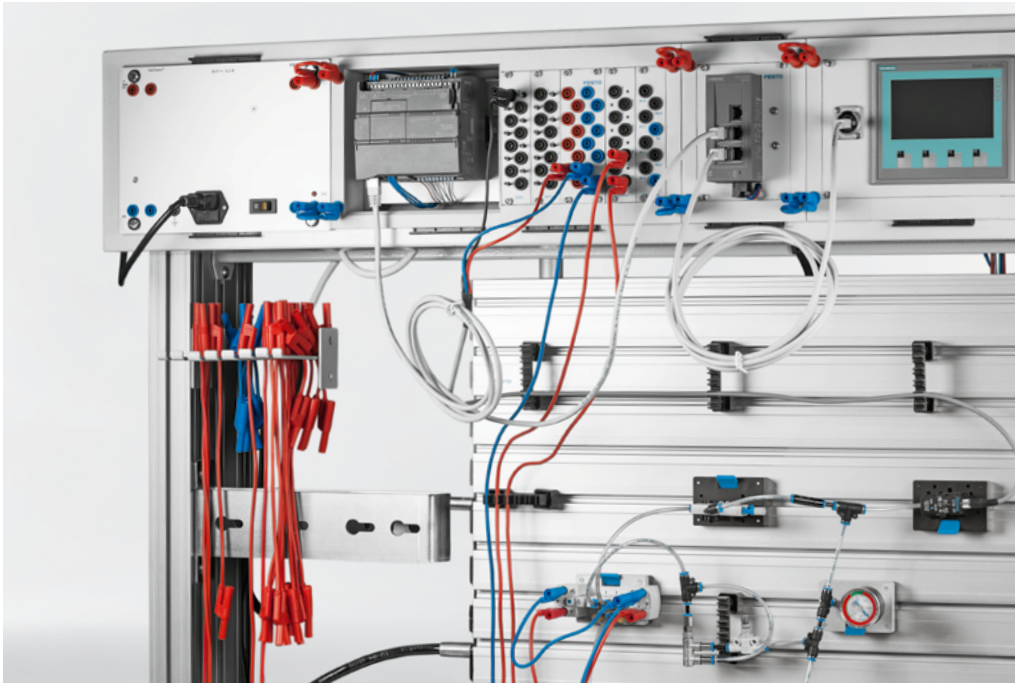
4 mm Safety laboratory cables → Page 199
Ethernet cable → Page 198
*IEC power cable 90° → Page 199

Operation and Networking in Basic Training
Control Panels (HMI) and Switches

Used in A4 mounting frame or as a desktop device



Used with pneumatics/hydraulics in ER mounting frame



HMI EduTrainer MTP700C

A flexible, modular HMI training system powered by the Siemens MTP700 Unified Comfort Panel.

Build core skills in HMI concepts, touch interaction, TIA Portal development, and intuitive, ergonomic interface design.

The HMI EduTrainer MTP700C is a modular training system designed for hands-on education using an industry-standard operator panel.

Specifically developed for beginners, the course offered through an online learning platform allows the device to be used either as a standalone system connected to a PC with the corresponding programming software, or as an expansion to existing training equipment – such as pneumatic or mechatronic learning systems that utilize PLC control.

Its highly modular design enables rapid reconfiguration and integration into a wide variety of mounting systems – within just minutes.

All communication ports and the panel's reset button are fully accessible, and the memory card slots can be used without any restrictions. This allows, for example, official Siemens training materials to be used without limitation, with no enclosure obstructing access or affecting the panel's functionality.

Learning goals
- Understand the definition and functional principles of a human–machine interface (HMI)
- Understand the structure and operating principles of different touch technologies
- Learn how to commission and program an HMI and integrate it into a process
- Learn to design graphical user interfaces using a structured development process and applying ergonomic design principles
- Learn to use the TIA Portal information system and work with basic objects and interface elements, including lines, rectangles, text, and graphic views

Benefits
- Modular housing design enables use in a wide range of applications: as a tabletop device with adjustable tilt angle, integrated into a mounting frame, installed on a profile plate, or flexibly attached to a VESA mount (depending on article number).
- Use of the widely established Siemens MTP700 Unified Comfort HMI ensures practical, industry-relevant training.
- The HMI programming course in TIA Portal – provided via a learning platform with multimedia training materials – can be used flexibly as a standalone learning module or as an extension to an existing training system.
- All communication ports, as well as the panel's reset button and memory card slots, remain fully accessible in all mounting configurations.
- The device can be supplied with power either via 4-mm safety connectors or through the panel's original hard-wired power input, offering maximum flexibility.

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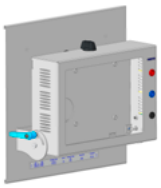

Overview of the four variants

1 **MTP700C-VE-P-AT**
- Includes the Siemens HMI MTP700 Unified Comfort panel and the corresponding programming software
- Operating voltage: 24 V DC
- Dimensions (H x W x D): 297 mm x 320 mm x 145 mm
- Mounting options: VESA standard, ER mounting frame, profile plate (vertical or horizontal), tabletop device, A4 mounting frame

Order no. **8222002**

2 **MTP700C-VE-P**
- Includes the Siemens HMI MTP700 Unified Comfort panel and the corresponding programming software
- Operating voltage: 24 V DC
- Dimensions (H x W x D): 210 mm x 320 mm x 125 mm
- Mounting options: VESA standard, ER mounting frame, profile plate (vertical or horizontal)

Order no. **8222064**

3 **MTP700C-VE**
- Includes the Siemens HMI MTP700 Unified Comfort panel and the corresponding programming software
- Operating voltage: 24 V DC
- Dimensions (H x W x D): 195 mm x 252 mm x 85 mm
- Mounting options: VESA standard, ER mounting frame

Order no. **8222504**

4 **MTP700C-CASE-VE-P-AT**
- Empty, pre-wired enclosure for mounting the Siemens HMI MTP700 Unified Comfort panel (panel not included)
- Operating voltage: 24 V DC
- Dimensions (H x W x D): 297 mm x 320 mm x 145 mm
- Mounting options: VESA standard, ER mounting frame, profile plate (vertical or horizontal), tabletop device, A4 mounting frame

Order no. **8222641**

Note: Special licence rules apply for schools and educational insitutes in the commercial sector.

Touch Panel KTP400 EduTrainer Compact



Training device for an ER mounting frame (pneumatics/hydraulics). The communication connections for 1x PROFINET and 1x USB are accessible at the front via sturdy plug connectors.

The Touch Panel KTP400 Basic PN is a 4" touch panel with 4 additional, programmable, tactile function buttons and is part of the new basic Siemens HMI series for simple applications.

Features of the basic panel:
– Touch and button functionality
– Interface for connecting to various PLCs
– Archiving via USB stick
– Programming as of WinCC Basic V13 (TIA portal)

Scope of delivery
– Siemens Touch Panel KTP400 Basic PN didactically set up in an ER unit
– Siemens Ethernet switch Scalance XB005 is supplied (not didactically set up)
– 2 Ethernet cables (CAT 6, crossed, 6 m)
– Programming software SIMATIC WinCC Basic

For schools and educational institutes in the commercial sector.

System requirements
– 64-bit: Windows 7, Windows 8 SP1
– 32-bit: Windows 7

Technical data
– Height x depth: approx. 170 x approx. 80 mm
– Device width: 245 mm
– Supply voltage: 24 V DC

Touch panel KTP400 EduTrainer Compact*	**8041758**

Recommended accessories:

EduTrainer Compact with Siemens controllers	
4 mm Safety laboratory cables ➔ Page 199	

Ethernet Switch XB005 EduTrainer Compact



Training device for an ER mounting frame (pneumatics/hydraulics). The universal Ethernet switch Siemens Scalance XB005 allows you to set up small star and linear structures and provides a simple way of showing how PLCs, touch panels (HMI) and other components are networked.

The device is used in combination with PLCs and Touch Panel EduTrainers.

Scope of delivery
– Scalance XB005 switch, set up in an ER unit

Technical data
– Height x depth: approx. 170 x approx. 80 mm
– Device width: 123 mm
– Supply voltage: 24 V DC

Ethernet switch XB005 EduTrainer Compact	**8041755**

Available as a package: Touch panel KTP400 EduTrainer Compact + Ethernet switch XB005 EduTrainer Compact*

1x Touch panel KTP400 EduTrainer Compact + 1x Ethernet switch XB005 EduTrainer Compact*	**8022734**
6x Touch panel KTP400 EduTrainer Compact + 6x Ethernet switch XB005 EduTrainer Compact*	**8022735**

* Special license rules apply for schools and educational institutes in the commercial sector.

Touch Panel KTP700 EduTrainer



Training device for an A4 mounting frame or as a desktop device. The communication connections for 1x PROFINET and 1x USB are accessible at the front via robust plug connectors.

The KTP700 Basic PN Touch Panel is a 7" touch panel with 8 additional, programmable, tactile function buttons and is part of the new basic Siemens HMI series for simple applications.

Features of the basic panel:
– Touch and button functionality
– Interface for connecting to various PLCs
– Archiving via USB stick
– Programming as of WinCC Basic V13 (TIA portal)

Scope of delivery
– Siemens KTP700 Basic PN Touch Panel set up on an A4 board
– Siemens Ethernet switch Scalance XB005
– 2 Ethernet cables (CAT 6, crossed, 6 m)
– Programming software not included. It is included in the recommended accessories for the part numbers or must be ordered separately.

For schools and educational institutes in the commercial sector.

System requirements
– 64 bit: Windows 7, Windows 8 SP1
– 32 bit: Windows 7

Technical data
– Front panel: 266 x 297 mm
– Device depth: 90 mm
– Supply voltage: 24 V DC

1x Touch panel KTP700 EduTrainer*	**8022731**
6x Touch panel KTP700 EduTrainer*	**8041505**

Recommended accessories:

Trainer Package SIMATIC S7-1200 DC/DC/DC*	567238
6x S7-1200-TP (ON)*	567241
6x S7-1200-TP*	567240
4 mm Safety laboratory cables ➔ Page 199	

Ethernet Switch XB005 EduTrainer



Training device for an A4 mounting frame or as a desktop device. The universal Siemens Ethernet switch Scalance XB005 allows you to set up small star and linear structures and provides a simple way of showing how PLCs, touch panels (HMI) and other components are networked.

The device is used in combination with PLCs and Touch Panel EduTrainers.

Scope of delivery
Siemens Ethernet Switch XB005 set up on an A4 board

Technical data
– Front panel: 133 x 297 mm
– Device depth: 90 mm
– Supply voltage: 24 V DC

Ethernet switch Scalance XB005	**4473300**

Available as a package: Touch panel KTP700 EduTrainer + Ethernet switch XB005 EduTrainer*

1x Touch panel KTP700 EduTrainer + 1x Ethernet switch XB005 EduTrainer*	**8062740**
6x Touch panel KTP700 EduTrainer + 6x Ethernet switch XB005 EduTrainer*	**8062741**

Touch Panel PanelView Plus 7 EduTrainer



Training device for an A4 mounting frame or as a desktop device. The communication connections for 1x Ethernet and 1x USB are accessible at the front via sturdy plug connectors.

The PanelView Plus 7 standard panels monitor and control devices connected to ControlLogix controllers in an EtherNet/IP network.

Features of the PanelView Plus 7 standard panels:
– Ethernet communication that supports networks with linear and star topologies.
– PDF display functions for accessing PDF files stored on the terminal.
– Programming with FactoryTalk View

Scope of delivery
Allen-Bradley Touch Panel PanelView didactically set up on an A4 board

System requirements
– Windows XP Professional SP3 32 bit
– Windows 7 SP1 Enterprise, Ultimate Edition
– Windows 8 Professional, Enterprise Edition 32 bit, 64 bit

Technical data
– Front panel: 266 x 297 mm
– Device depth: 90 mm
– Supply voltage: 24 V DC

Touch panel PanelView Plus 7 EduTrainer	**5007887**

Recommended accessories:

EduTrainer Universal with Allen-Bradley controllers → Page 178/179	
4 mm Safety laboratory cables → Page 199	
Ethernet cable → Page 198	
Programming software	On request

Ethernet Switch US5T EduTrainer



Training device for an A4 mounting frame or as a desktop device. The universal Allen-Bradley Ethernet switch US5T allows you to set up small network structures and provides a simply way of showing how PLCs, touch panels (HMI) and other components are networked.

The device can be used in combination with PLCs and Touch Panel EduTrainers.

Scope of delivery
Allen-Bradley Ethernet Switch US5T set up on an A4 board

Technical data
– Front panel: 133 x 297 mm
– Device depth: 90 mm
– Supply voltage: 24 V DC

Ethernet switch US5T EduTrainer	**4994634**

DIN Rail 100 A4 Module



Training device for an A4 mounting frame or as a desktop device. It can be used universally as a carrier for 24 V rail-mounted devices with a maximum width of 100 mm.

The power supply is external via 4 mm safety sockets.

Technical Data
– Operating voltage: 24 V DC
– Dimensions (H x W x D): 297 mm x 133 mm x 100 mm
– Mounting options: tabletop device, A4 mounting frame

DIN Rail 100 A4 module	**8075703**

DIN Rail 90 ER Module



Training device for the ER mounting frame. It can be used universally as a carrier for 24 V rail-mounted devices with a maximum width of 90 mm.

The power supply is external via 4 mm safety sockets.

Technical Data
– Operating voltage: 24 V DC
– Dimensions (H x W x D): 190 mm x 125 mm x 100 mm
– Mounting options: ER mounting frame

DIN Rail 90 ER module	**8215774**

Basic PLC Programming

TP 301



















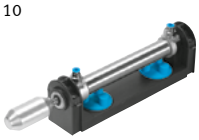







Complete equipment set TP 301	**167101**

The most important components at a glance:

1	1x Signal input, electrical	162242
2	1x Indicator unit and distributor, electrical	162244
3	1x Proximity sensor, inductive, M12	548643
4	1x Proximity sensor, capacitive, M12	548651
5	1x Proximity sensor, optical, M12	572744
6	4x Proximity sensor, electronic, with cylinder mounting	2344752
7	1x 5/2-way solenoid valve with LED	567199
8	1x 5/2-way double solenoid valve with LED	567200
9	1x Single-acting cylinder	152887
10	2x Double-acting cylinder	152888
11	1x Start-up valve with filter control valve	540691
12	1x Manifold	152896
13	2x Plastic tubing, 4x 0.75 silver 10 m	151496

Recommended accessories:

Aluminum profile plate → Page 196	
Universal connection unit, digital (SysLink)	162231
Power supply unit for mounting frame → Page 199	
4 mm Safety laboratory cables → Page 199	
EduTrainer	

Supplementary equipment set from TP 201 to TP 301

Supplements the Electropneumatics basic level equipment set, TP 201, to form a complete Programmable Logic Controllers equipment set, TP 301.

Complete supplementary equipment set TP 201 to TP 301	**167102**

The most important components at a glance:

3	1x Proximity sensor, inductive, M12	548643
4	1x Proximity sensor, capacitive, M12	548651
6	2x Proximity sensor, electronic, with cylinder mounting	2344752

Training content
- Benefits of the PLC compared to conventional solutions, such as electrical, electropneumatic or electrohydraulic solutions
- Functions of system components of a PLC
- Commissioning a PLC
- Application criteria for mechanical, optical, capacitive and inductive proximity sensors
- Sequence control and parallel logic
- Systematic programming of a PLC in accordance with international standard IEC 61131-3
- IEC 61131-3 programming languages: Function Block Diagram, Ladder Diagram, Statement List, Structured Text and Sequence Language

A PLC (SIMATIC S7-300 or Allen Bradley) is required to carry out the tasks. Connection with universal connection unit and I/O data cable (SysLink) or with 4 mm safety connectors. I/O modules can be connected via 4 mm safety connectors.

Also order:

Workbook Programmable Logic

de	**93313**
en	**93314**
es	**94427**

Recommended training media
Textbook Programmable Logic Controllers, Basic level

PLC Applications

Consolidate Programming Skills

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PLC Applications

1	Traffic Light (LabVolt Series 8075-1)	**582532**
2	Electro-Pneumatic System (LabVolt Series 8075-2)	**588682**
3	Level Process System (LabVolt Series 8075-6)	**582547**

Notes: These products cannot be ordered or delivered in countries where compliance with CE regulations is required. The PLC is sold separately.

Recommended accessory

Advanced PLC Learning System (→ Page 180)

Note: Customers may use their own PLC. Please contact a sales representative for PLC compatibility requirements.



The Traffic Light Application is shown here with the Advanced PLC Learning System.

The PLC Applications integrates fundamental PLC principles with more advanced concepts to support the design of small-scale systems commonly found in industry. Through hands-on applications, students develop a strong understanding of PLC programming and real-world applications.

Connections between the application and the PLC are made using flexible, PVC-insulated leads with 2 mm plugs. The control circuits operate at 24 V DC and are compatible with a wide range of PLCs.

Overview of the four applications:

The Traffic Light application uses a PLC to control vehicle and pedestrian traffic at an intersection.

The Electro-Pneumatic application uses a PLC to control a variety of pneumatic industrial systems.

The Level Process application introduces level control using a PLC, control relays, a pump, and a set of sensors.

Benefits

- Realistic applications to help students understand PLC principles and concepts
- Immediate hardware feedback when students test their programs
- Safe equipment
- Tabletop, cost-effective applications integrating realistic components
- Curriculum available with each application
- Fault switches on selected modules for troubleshooting exercises

Recommended learning material



Campus license

en	580489

Note: The campus license includes all learning material in PDF related to PLC applications.

Courses on Festo LX

- → PLC Applications – Traffic Lights
- → PLC Applications – Electro-Pneumatics
- → PLC Applications – Level Process Control

Accessories and Optional Components

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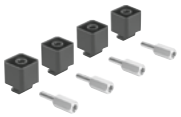

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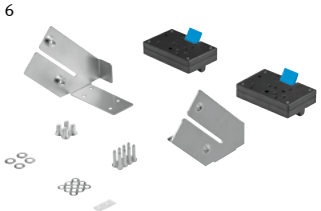

1 **Aluminum profile plate**
The anodized aluminum profile plate forms the basis for all training packages. All of the components fit securely and safely into the grooves on the profile plate. There are grooves on each side and, if required, both sides can be fitted with components. The grooves are compatible with the ITEM profile system. Grid dimensions: 50 mm.

For installation on tables we recommend the appropriate rubber feet (order no. 158343).

Sizes 350 x 1100 mm and 350 x 250 mm supplied without side caps (H x W).

350 x 250 mm	**159333**
350 x 1100 mm	**162360**
700 x 350 mm	**162386**
700 x 350 mm*	**170395**
700 x 550 mm	**159409**
700 x 700 mm	**159410**
700 x 1100 mm	**159411**

* with cable guide

2 **Slotted mounting plate**
All components with the Quick-Fix mounting system can be mounted on slotted mounting plates. The slotted mounting plates are fitted with elastic buffers and can be used horizontally on a table top. Order no. 159331 can also be inserted in conventional A4 mounting frames. The slotted mounting plates are not intended for use with actuators.

694 x 297 mm	**159331**
700 x 550 mm	**544246**

(overall external dimensions H x W)

3 **Rubber feet**
For non-slip, protective mounting of profile plates on tabletops of any type. Set (4 pieces).

Order no.	**158343**

4 **Plug-in adapter set**
The plug-in adapter set can be used to mount the ER units directly on the blue plug-in board or on the aluminum profile plate. One set is required to mount one unit.

Order no.	**541122**

5 **A4 ER mounting plate**
The ER mounting plate can be installed in any A4 mounting frame. A cut-out permits installation of 2 large or 4 small Festo Didactic ER units (H x W).

297 x 500 mm	**536200**

6 **Mounting bracket set**
This mounting bracket set makes it possible to mount an EduTrainer Compact either on a vertically or horizontally positioned profile plate using the Quick-Fix mounting system. It also offers the possibility to use an EduTrainer Compact in a stable inclined position on a table surface. The set includes the assembly instructions and all the necessary components for assembly.

Order no.	**8082962**

1 **Simulation box, digital**
The simulation box is used to display the input and outputs signals of an MPS station or PLC. Two modes of application are possible:
– Simulation of inputs for testing of a PLC program. Use I/O data cable (SysLink) (order no. 034031) for this purpose
– Setting of outputs (with separate 24 V supply) in order to operate an MPS station. The cable (order no. 167106, 2.5 m) required for this purpose is included in the scope of delivery.

The simulation box contains a SysLink socket.

Order no.	**170643**

2 **Simulation box, digital/analog**
The digital/analog simulation box additionally allows the simulation and display of analog signals (0 – 10 V). The simulation box is supplied without connection cables.

The following connection cables are recommended for flexible application:
– I/O data cable, parallel: Order no. 034031 (e.g. SimuBox with SPS EduTrainer or EasyPort)
– Analog cable, parallel: Order no. 529141 (e.g. SimuBox with EasyPort)
– Analog cable, crossover: Order no. 533039 (e.g. SimuBox with MPS Analog-Terminal)
– I/O data cable, crossover: Order no. 167197

Order no.	**526863**

3 **Connection unit, analog**
– Permissible voltage range: 22 – 27 V DC
– Reference: GND
– 4 analog voltage inputs: Range: -10 V – +10 V (max. 30 V), input resistance: 200 kΩ
– 4 analog current inputs: Range: 0 – 20 mA (max. -4 – +24 mA), input voltage: max. ±30 V
– 2 analog outputs: Voltage: -10 – +10 V, short-circuit-proof, max. ±30 V, fuse-protected, current: max. 20 mA

Using an analog cable (order no. 529141), the unit can also be used as an analog connection unit for the EduTrainer PLC or EasyPort USB.

Order no.	**567232**

4 **Universal connection unit, digital (SysLink)**
The universal connection unit connects all 4 mm safety sockets with the 24-pin system connector as per IEEE 488 (SysLink). It thus becomes a universal interface between units with 4 mm connection technology and devices equipped with SysLink connectors as per IEEE 488:
– Connection to an I/O terminal of an MPS station via an I/O cable with SysLink connectors at both ends, order no. 034031
– I/O coupling via the 4 mm laboratory connectors of a PLC using an open I/O cable (IEEE 488 connector – bare wires), order no. 167122
– Simple connection of actuators and sensors via 4 mm laboratory connectors with the EasyPort interface unit for FluidSIM

Inputs:
3 safety sockets each for 8 three-wire sensors
Outputs:
2 safety sockets each for 8 actuators
Connections:
4 mm safety sockets for 24 V DC
SysLink connector (IEEE 488)
I/O status display: Via LED

Order no.	**162231**

5 **Sensor tester**
The sensor tester speeds up commissioning of systems with integrated sensors and proximity sensors. It can be used for:
– Quick and simple checking of contacts
– Rapid fine adjustment
– Unambiguous detection of switch outputs

Order no.	**158481**

6 **Network interface BNI IOL with 8 programmable inputs/outputs**
For use as a decentralized module for connecting binary standard sensors and controlling actuators. An IO Link device communicates with the higher-level IO Link master module using the IO Link protocol.

Order no.	**8024926**

7 **BNI IOL network interface with 16 programmable inputs/outputs**
For use as a decentralized module for connecting standard binary sensors and controlling actuators. An IO Link device communicates with the IO Link master module via the IO Link protocol.

Order no.	**8024927**

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Accessories and Optional Components

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1 **I/O data cable with SysLink connectors (IEEE 488)**
For connection of SysLink interfaces, for example an EduTrainer PLC, with the universal connection unit, digital (order no. 162231).

2.5 m	**34031**

2 **I/O data cable with one SysLink connector as per IEEE 488 and open ends**
For connecting EasyPort to the I/O terminals of a PLC.

2.5 m	**167122**

3 **I/O data cable, crossover, with plug and socket**
Connects the EduTrainer Universal of an MPS station with EasyPort (order no. 548687).
Adapter cable for connecting any PLC to a universal connection unit (order no. 162231) via I/O data cable with SysLink connector on one side and open ends (order no. 167122).

0.3 m	**167197**

4 **PC data cable RS232**
For connection of the interface configuration box (EasyPort) to the RS232-interface of the PC.

female – female, 1.5 m	**160786**
male – female, 1.5 m	**162305**

5 **Analog cable, parallel**
EasyPort/PLC connection for a real process or a simulation box.

2 m	**529141**

6 **Analog cable, crossover**
EasyPort with actual PLC and/or simulation box.

2 m	**533039**

7/8 **PC adapter**
Connection between 2 PROFIBUS stations.

8 0.5 m	**533035**
9 2.0 m	**533036**

9 **Ethernet cable**
RJ45, CAT5

0.5 m	**8062902**
1 m	**8062903**
1.5 m	**8062904**
2 m	**567280**

10 **Safety laboratory cable, 3 m**
For connecting an EduTrainer Universal without a power supply unit to an external 24 V DC power supply unit. 3 m long, 3x 4 mm safety plugs (blue, red, green/yellow).

Order no.	**571817**

11 **Plug-in adapter, electrical**
Adapter for inserting cables with safety plugs into sockets without shock-hazard protection. This is no longer compliant with DIN EN 61010 (IEC 1010). Set of 10 adapters.

Order no.	**185692**

Connecting cable for solenoid valves with M8 central plug
Connecting cable (4-pin socket) for connecting solenoid valves with an M8 central plug.
– Cable length 2.5 m with open ends
– Cable length 1 m with 4 mm safety plugs and solenoid coil numbering

2.5 m with open ends

Order no.	**158962**

1 m with safety plugs

Order no.	**540703**

1 **Power supply unit for ER mounting frame**
– Input voltage: 85 – 265 V AC (47 – 63 Hz)
– Output voltage: 24 V DC, short-circuit-proof
– Output current: max. 4 A
– Dimensions: 170 x 240 x 92 mm
Without power cable

Order no.	**8049382**

Connector as per CEE 7/VII for DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID

Order no.	**159396**

Connector as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

Order no.	**162411**

Connector as per BS 1363 for GB, IE, MY, SG, UA, HK, AE

Order no.	**162412**

Connector as per AS 3112 for AU, NZ, CN, AR

Order no.	**162413**

Connector as per SEV 1011 for CH

Order no.	**162414**

Connector as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)

Order no.	**162415**

2 **IEC power cable 90°**
One end fitted with a 90° IEC connector and the other fitted with a country-specific connector. Preferred version for EduTrainer Universal.
Connector as per CEE 7/VII for DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID

Order no.	**549860**

Connector as per NEMA 5-15 for US, CA, Central America, BR, CO, EC, KR, TW, TH, PH, JP

Order no.	**549861**

Connector as per BS 1363 for GB, IE, MY, SG, UA, HK, AE

Order no.	**549862**

Connector as per AS 3112 for AU, NZ, CN, AR

Order no.	**549863**

Connector as per SEV 1011 for CH

Order no.	**549864**

Connector as per SANS 164-1 for ZA, IN, PT, SG, HK, (GB), (AE)

Order no.	**549865**

3 **4 mm Safety laboratory cables**
– Plugs with rigid protective sleeve and axial socket
– Conductor cross section: 1 mm²
– 1000 V CAT II
– Power rating: 16 A

4 mm Safety laboratory cables, **50 mm**

red	**8092626**
blue	**8092627**
black	**8092628**

4 mm Safety laboratory cables, **300 mm**

red	**8092630**
blue	**8092631**
black	**8092632**
green-yellow	**8092638**

4 mm Safety laboratory cables, **500 mm**

red	**8092639**
blue	**8092640**
black	**8092641**
green-yellow	**8092647**

4 mm Safety laboratory cables, **1000 mm**

red	**8092648**
blue	**8092649**
black	**8092650**
green-yellow	**8092656**

4 mm Safety laboratory cables, **1500 mm**

red	**8092657**
blue	**8092658**
black	**8092659**
green-yellow	**8092665**

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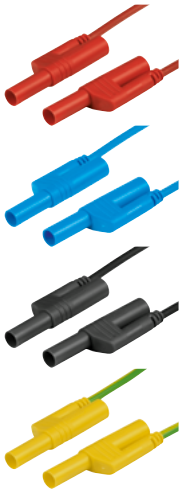
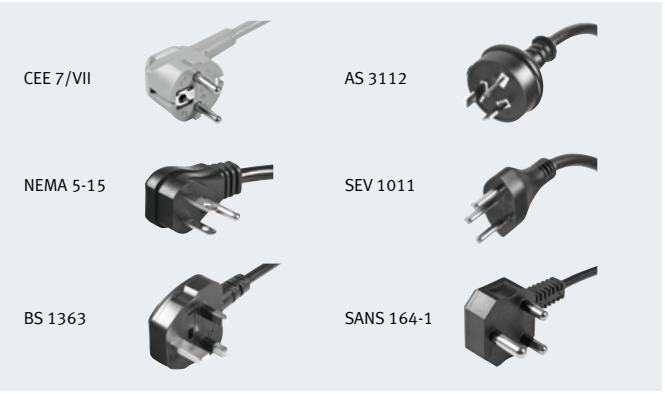




Fundamentals of Factory Automation





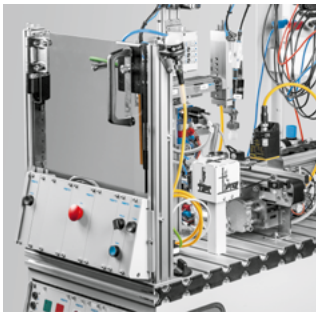
Overview 202
SkillsConveyor 204
Sensor Technology 212
Machine Safety 216
Commissioning and Troubleshooting 218
Electrical Drive Technology 220
CNC Technology 222
Mechanical Drives 228
Metrology 234
Fluid Power 240
Electrical Engineering/Electronics 242
Process Automation 244
MecLab 246

Fundamentals of Factory Automation

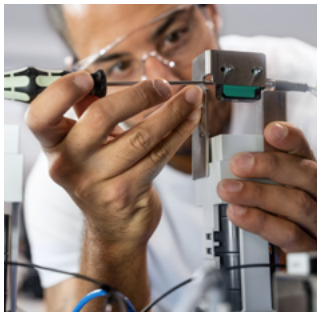




Sensor technology
Sensors are essential components of manufacturing systems, especially for control, monitoring and safety. They capture different variables and provide information about the entire manufacturing process. Skills in the selection, installation, operation, maintenance and troubleshooting of such devices are important. Our training packages take you step by step from the basics to smart sensor technology.



Machine safety
Alongside function and economy, safety is one of the key success factors of any machine. Furthermore, new directives and laws require intelligent solutions and increase the level of training requirements. By examining common safety devices, students can learn the basics of machine safety, the EC Machinery Directive and risk analysis.



Commissioning and troubleshooting
The commissioning of mechatronic systems and the troubleshooting of corresponding systems are essential core competences in the factory automation environment. In particular, strong troubleshooting skills and practical experience are crucial to quickly rectify faults and thus ensure smooth operation of systems.



Electrical drive technology
The use of electric drives in industry can lead to significant cost and energy savings. For this reason, they are increasingly used in industrial applications such as robots, fans, pumps, transport systems and manufacturing machines. Discover the training packages on electrical drive technology that provide important knowledge and skills on these applications.

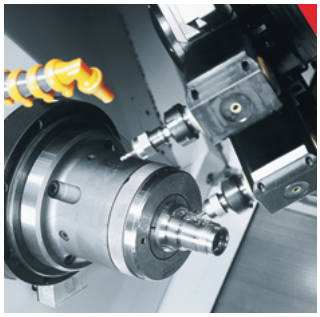




To support productivity and competitiveness

The success of production companies depends on a workforce that is competent in a wide range of technologies.

For this reason, Festo Didactic offers a holistic approach to qualification for the world of manufacturing, with deep coverage of many topics related to the fundamentals of production.



CNC technology
Digitalization of mechanical processing has become commonplace to support production. Software and computer-controlled machines such as lathes and milling machines help to make manufacturing processes more flexible and efficient. Mastery of CNC technology is particularly important for metalworking professions.



Mechanical drives
Mechanical drives are found in factory and industrial machinery with moving parts throughout industry. Installing, maintaining and repairing mechanical systems requires sound knowledge and problem-solving skills. The development of such skills is best achieved through extensive practical training with devices, tools and techniques commonly used in the workstation.



Metrology
Competencies in product dimensioning and tolerance are essential to enable quality control at the various stages of the production process and to ensure strict compliance of the product with the design specifications. For employees in production and quality assurance, these are essential competencies.



... and others fields of technology:
– Fluid power
– Electrical engineering/Electronics
– Process automation and closed-loop control technology

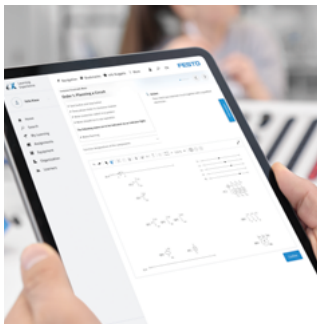
SkillsConveyor

The Most Universal Training System for the Basics of Automation Technology











The SkillsConveyor is an integration-ready system, developed in close cooperation with customers. Its ergonomic belt is designed to support both single workpiece flow and pallet-based goods carrier flow.

Available pre-assembled or as a kit, the SkillsConveyor sets a new standard of modularity in terms of hardware, software, courseware and interfaces to other Festo Didactic learning systems.

It starts with the basics of installation and commissioning and continues up to hard-wired programmed control, PLC and LOGO! programming as well as DC and AC motor control technology. Other topics are taught.



Rediscover automation technology

Anyone who wants to hold their own in the job environment of automation needs solid basic skills. The SkillsConveyor helps lay the foundation for basic training in automation technology. Offering a new standard of modularity in terms of hardware, software and courseware, as well as seamless integration into the curriculum, makes the SkillsConveyor the optimal learning system for technical education.

The SkillsConveyor is ideal for basic training in automation technology and mechatronics. The learning content is tailored in particular to the specific requirements of the training occupations mechatronics technician and industrial electrician due to the focus on mechanic and electric assembly as well as control and sensor technology.

Benefits
- Single workpiece flow and pallet transport on workpiece carriers in a training system
- The SkillsConveyor can be operated individually or in combination with other SkillsConveyors in rows or in blocks
- Comprehensive learning environment for all topics relating to the fundamentals of automation technology, and thanks to its exceptional modularity, it can be flexibly enhanced with additional key topics and ideally used for project work.
- Comprehensive training documentation breaks down complex topics into small steps and learning units, allowing teaching to be designed in a structured yet flexible manner.
- A specific teaching guide makes it easier for teachers to quickly get started with the training system and training materials and to integrate them into their own lessons.

Learning goals
- Mechanical construction, assembly, wiring and commissioning of a conveyor belt
- Basics of control cabinet technology and sensor technology and flexible use of industrial control elements
- Controlling a DC motor with a motor controller and wiring and controlling an AC motor (accessories required)
- GRAFCET basics, hard-wired programmed control (accessories required) and PLC programming basics (Siemens LOGO!, Siemens S7-1512) (accessories required)
- Integration and adjustment of digital and analog sensors and actuators, and advanced programming of mechatronic systems



SkillsConveyor

One System, Two Versions

→ Videos



Basic design
In its basic configuration, the SkillsConveyor consists of a 700 mm long conveyor belt driven by a DC motor. The motor controller is located next to a rail mounted terminal on a H-rail in the integrated control box. It can be flexibly removed from the front of the system – similar to a drawer.

The front of the control box contains various operating elements and sockets which – depending on the training scenario – can be individually rewired by the students in the control box and labeled on the operator panel. At the beginning of the belt, there is a diffuse light sensor, at the end of the belt there is a light barrier, each for the detection of workpieces.

Learning kit
In the SkillsConveyor Kit version, the students build the SkillsConveyor step by step at the beginning of the learning process. In addition to the empty control box and the mounting rack for the belt, the mechanical and electrical components are supplied clearly sorted in reusable shadow boards. The mechanical construction is followed by the assembly and wiring of the control box and the sensors. Subsequently, the commissioning is carried out with a suitable controller.

Process
Incoming workpieces can be conveyed on the conveyor to various machining and measuring positions. An optional add-on package with sensors, actuator, and sensor bracket allows a variety of sensor types to be mounted for object detection, measurement and object classification.

Control box
The removable control box as an integrated control cabinet with control elements is the pivotal point of the learning environment. On a H-rail inside the control box are various rail mounted terminals for flexible wiring, the fibre-optic units for the diffuse light sensor and the light barrier as well as the motor controller.

Wiring
The wiring of the system is flexibly achieved in the control box as an integrated control cabinet in free wiring via industrial terminals. This allows the greatest possible flexibility for rewiring within the learning process as well as the greatest possible degree of transparency and comprehensibility for the learner.

Extension options
Through various additional packages, the training system can be expanded step by step with targeted learning content.

SkillsConveyor

1 SkillsConveyor (pre-assembled/mounted)	**8184210**
2 SkillsConveyor Kit (unassembled/unmounted)	**8184211**

Extension options

3 SkillsPackage Distributing and Sorting	8214783
4 SkillsPackage Stacking Magazine	8214782
5 IIoT Kit Machine Learning	8158958
6 AC Motor Package	8189526
AC Motor Package (North America)	8210443
7 SkillsPackage Control Cabinet	8191357
8 EasyPort USB (→ Page 40)	548687
9 Simulation box, digital (→ Page 218)	170643
10 HMI EduTrainer MTP700 (→ Page 211)	8222002
EduTrainer Compact LOGO! (→ Page 173)	8073774
11 PLC EduTrainer Universal S7-1512C (→ Page 169)	8065452
PLC EduTrainer Compact S7-1215C (→ Page 172)	8096457
Sensors for Object Detection TP 1311	8150804
Smart Sensors TP 1312	8116358
Basic Principles of Circuits with Contacts TP 1211	8208247
Add-On Package SKC AC Motor Control, TP 1211	8206252
Basic Motor Control Technology, TP 1211-P → festo.com/didactic	
Basic Motor Control Technology, TP 1221 → festo.com/didactic	
Systainer for Shadow Boards	8193428

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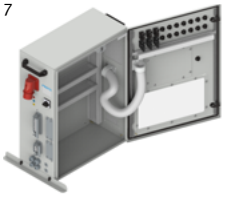

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11



Recommended Learning Material

Workbooks

Campus license
"Commissioning of the SkillsConveyor (unmounted)"

en	8191549
de	8191548
es	8193514
fr	8193515

Campus license
"Commissioning of the SkillsConveyor (mounted)"

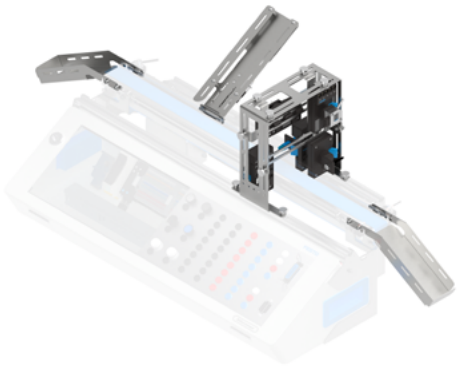
en	8188442
de	8188441
es	8193521
fr	8193522

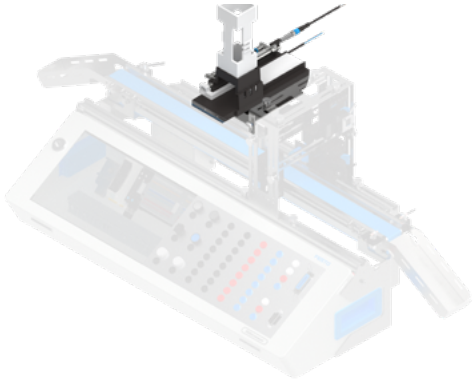
Note: Campus licenses are available for most of the courses listed below. Contact your representative for details.

Courses on Festo LX

- → Commissioning of the SkillsConveyor (mounted)
- → Commissioning of the SkillsConveyor (unmounted)
- → Hard-Wired Programmed Control with SkillsConveyor and Control Cabinet
- → Wiring and Controlling an AC Motor
- → Basics of PLC Programming (Siemens LOGO!)
- → Basics of PLC Programming (Siemens S7)
- → Applied PLC Programming and Sensor Technology
- → Basic Motor Control with SkillsConveyor and TP 1221
- → Hard-Wired Control with SkillsConveyor and TP 1211
- → Wiring and Control of an AC Motor with SkillsConveyor and TP 1211
- → Basics of Motor Control with SkillsConveyor and TP 1221
- → Applied RFID Technology on the SkillsConveyor

SkillsConveyor
Extension Options



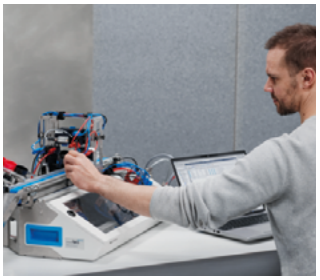


SkillsPackage Distribution and Sorting

This extension is ideal for quickly setting up and commissioning a sorting process. The system is easy to install and can be ready for operation in just a few minutes. Additional sensors and actuators can be connected safely and easily via 4 mm safety plugs. All components are equipped with a Quick-Fix fastening system. This flexible table solution does not require a compressed air supply but can be optionally extended with a pneumatically actuated stacking magazine as an alternative workpiece feeder.

Use our comprehensive course mate¬rial to learn about the mechanical and electrical setup and program-ming of a sorting process. Thanks to the full course materials, you can expand your skills in basic and advanced PLC programming as well as applied sensor technology and analog value processing. You will also become familiar with various programming languages such as FBD, Graph, and SCL.

Learning goals
- Set up a sorting process with simple modules on a mechatronic system and commission it
- Integrate and adjust various digital sensors in a mechatronic system
- Integrate and adjust an analogue distance sensor into a mechatronic system and use its analog values for a simple process
- Mount a digital drive in a mechatronic system and integrate it into the PLC program
- Acquire basic and advanced skills in PLC programming using a simple process



Order no. **8214783**

The most important components:
- 3x Digital sensors (optical, capacitive, inductive)
- 1x Digital actuator (separating chute)
- 1x Analog IO-Link-capable laser distance sensor
- 2x Sorting chutes
- 1x Sensor bridge

SkillsPackage Stacking Magazine Add-On

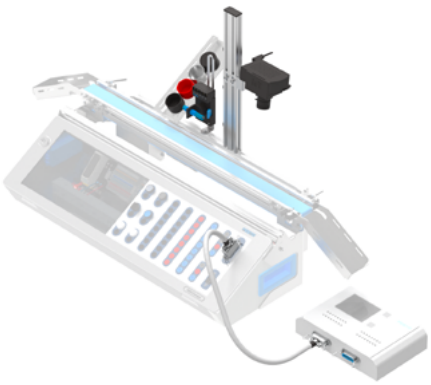
The SkillsPackage stacking magazine add-on separates workpieces or covers. A double-acting cylinder pushes the workpiece at the bottom out of the gravity feed magazine. The position of the extended piston rod is sensed electrically via an inductive 3-wire sensor. A monostable valve controls the cylinder, which places the workpiece on the conveyor. The stacking magazine provides optimum fastening options for mounting on a profile on the SkillsConveyor. The SkillsPackage stacking magazine is fully assembled and is an excellent addition to the SkillsConveyor and SkillsPackage Distributing and Sorting, bringing the topic of applied electropneumatics into the SkillsConveyor training system.

Learning goals
- Assemble, wire and connect the hoses of a pneumatically-driven workpiece separator
- Commission a pneumatically-driven workpiece separator
- Integrate a digital drive into an existing PLC program



Order no. **8214782**

The most important components:
- 1x Digital inductive sensor
- 1x Digital drive



IIoT Kit Machine Learning

The package deals with machine learning based on neural networks ('deep learning'), one of the most prominent sub-disciplines of artificial intelligence. The hardware includes a single-board computer equipped with an HD camera to record images that are then analyzed by a neural network.

The software for the MPS IoT Kit Machine Learning is based on Python programs and is operated via an intuitive graphical interface in the web browser. This enables access via mobile devices such as smartphones, tablets, laptops, etc. The system is supplied ready for use so that students can start their first experiments right away.

The aim of the MPS IoT KIT Machine Learning is for learners to understand the basic topics in the field of image processing with machine learning in a simple way.

Learning goals
- Artificial intelligence/machine learning in image processing
- Practical application of convolutional neural networks/deep learning
- Supervised machine learning
- Computer vision image classification
- IoT retrofit of legacy systems

Order no.	**8158958**

The most important components:
- Single-board computer with HD camera
- Ethernet cable
- HDMI cable
- Power connection



SkillsPackage AC Motor Control

The SkillsPackage AC Motor Control, in conjunction with the SkillsConveyor and the SkillsPackage Control Cabinet, teaches the basics of controlling AC motors via circuit breakers or hard-wired programmed logic controllers.

The students first inform themselves about the individual circuits and learning content via didactically prepared digital learning media. Then the students plan the circuit to be created in FluidSIM or alternatively on paper. Once the planning has been completed, the students assemble the respective circuits in the control cabinet (8191357) or with 4 mm safety laboratory cables on a profile plate (TP 1211 or TP 1221). Finally, they check and test the circuits they have created according to DIN VDE 0113-1 or IEC EN 60204-1 with the help of an installation tester.

Learning goals
- Basics of extra-low voltage and AC drive technology, as well as automated operation of a transport unit with AC technology
- Simple circuit breaker, direct reversing contactor circuit, indirect reversing contactor circuit, extension of a reversing contactor circuit with a time relay
- Basics of star/delta circuits, star/delta starting circuits with manual and automatic changeover via time relay
- Protection of circuits with safety relays and emergency stop; integration of motor protection switches and motor protection relays; integration of sensors in circuit breakers
- Standardized initial testing of electrical systems according to DIN VDE 0113 or IEC EN 60204-1

Order no.	**8189527**

The most important components:
- 1x Time relay, electronic response-delayed 1 change-over contact
- 1x Time relay, multifunction 1 change-over contact
- 1x Mechanical connection of the motor

SkillsConveyor
Extension Options

SkillsPackage Control Cabinet

The SkillsPackage Control Cabinet offers a hands-on assembly and wiring project that, combined with the SkillsConveyor, teaches essential industrial control and cabinet-building techniques.

The learning system is the ideal solution for modern, hands-on training in automation and mechatronics. The high-quality, industry-grade control cabinet offers a robust design and maximum flexibility: prepared interfaces, space for numerous control elements, and easy integration of Siemens HMI panels enable realistic training scenarios just like in a real industrial installation. A viewing window, variable power supply options, and multipole and network connections make the system ready to use right away and ensure safe, comfortable practice sessions.

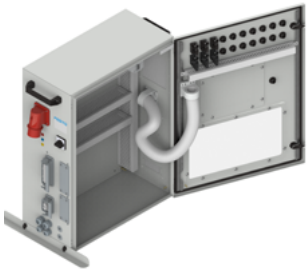
Together with the SkillsConveyor, the included components teach the fundamentals of hard-wired programmed control and the standard-compliant initial testing of electrical installations. The specially designed course on the Festo LX learning platform guides learners through basic relay and contactor circuits such as momentary operation, self-holding circuits, contactor and push-button interlocking. In addition, they learn protective measures using circuit breakers and residual current devices, including their design and trip behavior. Learners also acquire solid skills in practical troubleshooting within the control cabinet. After the information phase, they plan the circuits – preferably in FluidSIM – and simulate them. The circuits are then built in the control cabinet and tested according to standards using an installation tester. Finally, they identify and correct typical wiring faults prepared by the instructor.

In combination with expansion components and additional learning content – from PLC programming and HMI visualization to networking and motor technology – the result is a powerful training package that thoroughly prepares learners for real-world industrial practice.

Benefits
- Ready for use: the control cabinet housing, mounting plate assembly, power supply, operating elements, and external I/O connections come pre-installed
- Covenient operation and safety: a viewing window for reading status indicators on the PLC or frequency converter, carrying handles for easier handling, an alternative 24V power supply option, and a tool-free, easy-mount anti-tip feature
- Expandability and customization: the control cabinet is prepared for easy integration of PLCs, network components, frequency converters, a 7” Siemens HMI (other manufacturers upon request), and additional user-specific connections
- Included components for use: includes a set of components and wiring materials for learning the fundamentals of hard-wired programmed control
- Comprehensive learning materials break down complex topics into small steps and learning units, enabling structured yet flexible instruction

Learning goals
- Be able to explain the design, function, and applications of contactors, as well as their differences compared to relays
- Plan, simulate, and build relay circuits – including applying Ohm’s law, performing voltage and current measurements, safely using digital multimeters, and adhering to protection and safety regulations
- Plan and build latching circuits with on/off indication and jog mode, and understand their industrial applications
- Connect the conveyor belt learning system to the control cabinet via an interface and control it using a latching circuit
- Additional learning content such as motor technology, PLC, or HMI can be optionally integrated into the control cabinet by adding extra components









Technical data
- Includes a control cabinet with mounted enclosure add-ons, a wired 24 V DC power supply, and a materials kit for the hard-wired programmed control course
- Operating voltage via CEE 16A connector: 3 AC 400 V ±10%
- Optional operating voltage via 4 mm safety sockets: DC 24 V ±10% for programming the 24 V control components independently of the power section
- Dimensions (H x B x T): 800 mm x 730 mm x 350 mm
- Tool-free, easy-mount anti-tip protection
- Mounted DIN rails and cable ducts on the mounting plate and door
- Mounted and wired CEE panel connectors, main switch for power connection, 24 V power supply, and miniature circuit breakers
- Mounted 4 mm safety sockets for optional 24 V SELV supply
- Mounted carrying handles
- Mounted HMI carrier plate in the door
- Mounted viewing window in the door
- Mounted indicator lights and illuminated pushbuttons for the hard-wired programmed control course
- Additional mounting holes in the door for emergency stop buttons, indicator lights, and control elements
- Mounted RJ45 connections (2× RJ45)
- Mounted bulkhead housing with 24-pole multipole insert – intended for digital inputs and outputs
- Mounted bulkhead housing with 6-pole multipole insert – intended for motor connection
- Mounted cable glands (2× M20, 2× M25) – available for optional use
- Prepared cutouts for additional multipole connectors
- Mounted support plate for further optional interfaces

Technical specifications subject to change.

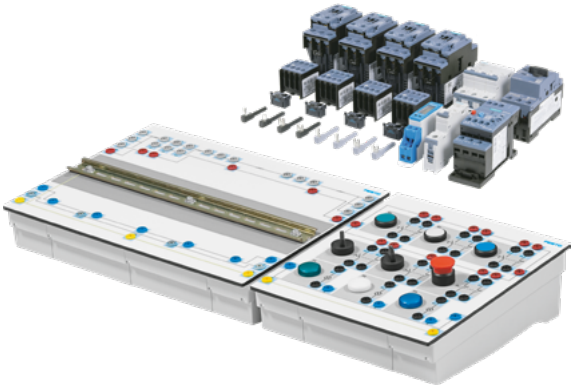
Order no.	**8191357**

Recommended accessories:

SkillsPackage AC Motor Control	8189527

Learning Paths

→ Hard-Wired Programmed Control (Industry)
→ AC-Motor Control (Industry)



Basic Principles of Circuits With Contacts TP 1211

Basic control circuits also have their place in modern automation technology, as simple automation tasks are still set up with low-cost safety circuits.

Realistic projects are executed using the equipment set and practical exercises. The design, function and areas of application of the components are explained along with their use. Selecting the correct switching elements and equipment is just as important as the correct use and adjustment of protective devices. The general operating principles are explained using examples and the basic knowledge of the control technology with contacts is explained comprehensively. Note: This training package comes disassembled. The safety connectors must be assembled by the end user.

Learning goals
- Motor control basic components: pushbuttons, switches, pilot lights, relays, contactors, protection devices, timing relays.
- Control methods: latching contacts, multiple controls, motor starter, reversing starters, star-delta starter, interlocking.
- Read component designations and select the right components.
- Understand electrical schematics and implement complete and standard industry motor controllers



Supplementary Equipment Set for SkillsConveyor, TP 1211

Order no.	**8208247**

The most important components:
- 1x EduTrainer Contactor Board
- 1x EduTrainer Operator and Signaling Unit
- 1x Motor Technology Contactor Set

Required equipment to use TP 1211 with the SkillsConveyor

Supplementary Equipment Set for SkillsConveyor, TP 1211	8206252



HMI EduTrainer MTP700C

The HMI EduTrainer MTP700C is a modular training system designed for hands-on education using an industry-standard operator panel.

Specifically developed for beginners, the course offered through an online learning platform allows the device to be used either as a standalone system connected to a PC with the corresponding programming software, or as an expansion to existing training equipment – such as pneumatic or mechatronic learning systems that utilize PLC control.

MTP700C-VE-P-AT
- Includes the Siemens HMI MTP700
- Unified Comfort panel and the corresponding programming software
- Operating voltage: 24 V DC
- Dimensions (H x W x D): 297 mm x 320 mm x 145 mm
- Mounting options: VESA standard, ER mounting frame, profile plate (vertical or horizontal), tabletop device, A4 mounting frame

Order no.	**8222002**



Sinamics G120 EduTrainer

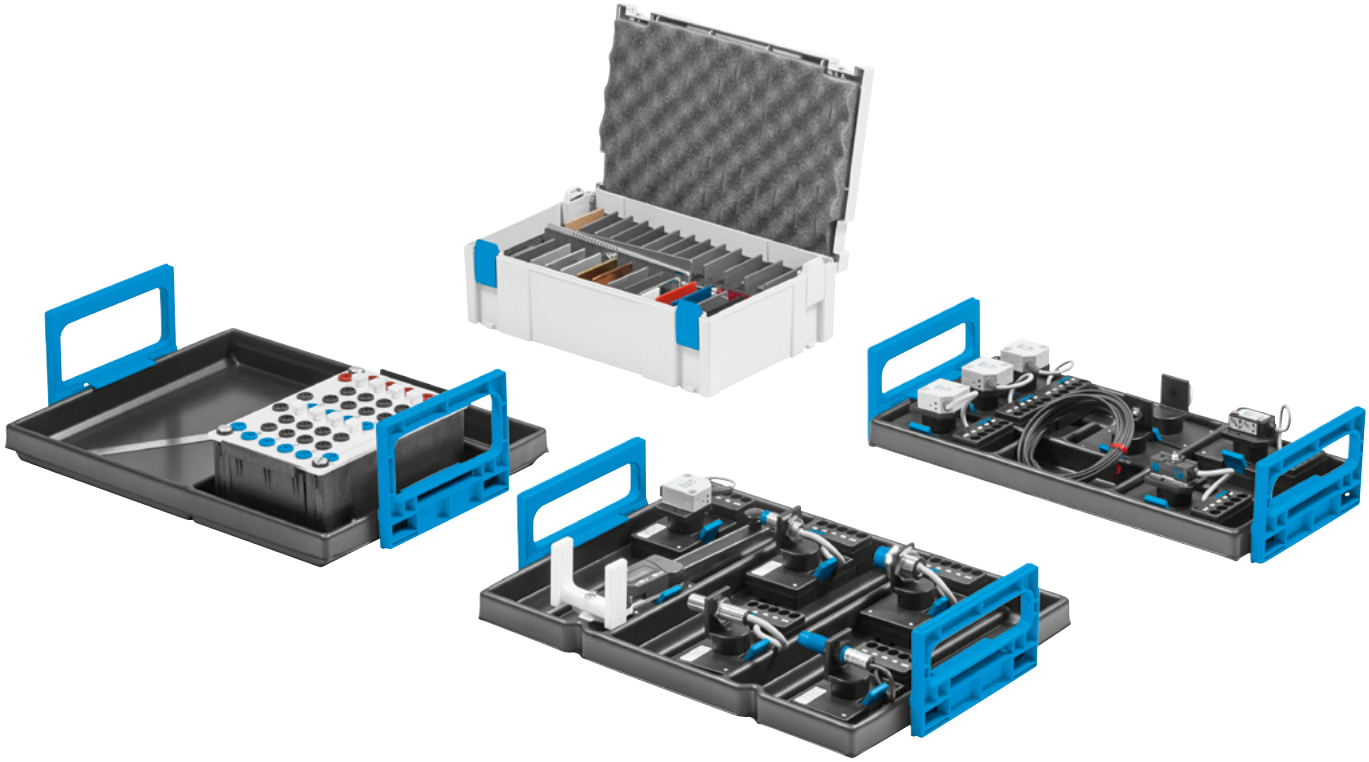
The G120 is well-suited as a beginner device, however its comprehensive functions offer plenty of potential for advanced users who want to implement complex drive tasks. Various bus systems, advanced safety functions, and an encoder input allow for adaptation to individual requirements and integration into control systems.

Learning goals
- Understand variable frequency drives operation and speed control principles of three-phase motors
- Navigate through variable frequency drive parameters and modify them based on a specific application
- Learn control circuits and advanced functions, such as acceleration and deceleration, motor braking, jogging and protection
- Install, maintain and troubleshoot a variable frequency drive

Order no.	**8105421**

Sensors for Object Detection

TP 1311



The purpose of automation technology

The subject of sensors for object detection is covered extensively in the TP 1311 equipment set. The topics include configuration, function, areas of application and the selection of sensors based on the requirements of an application.

The equipment set contains sensors with analogue and binary output signals, although the focus is on binary output signals. These sensors are called proximity switches.

The following types are contained in the equipment set:
– Magnetic proximity sensors
– Inductive proximity sensors
– Optical proximity sensors
– Capacitive proximity sensors
– Inductive sensors (analogue)

The special feature

Hands-on experience plays a central role in teaching the fundamentals of sensors for object detection. Examples are used to demonstrate the general operational principles of different sensors. Special attention is paid to the selection of the right sensor, its connection, the correct setting and functional checking.

With the TP 1311 students can acquire a thorough, basic knowledge about sensors for object detection.

Course topics
– Configuration, function and coefficients of the sensors used
– Basic principles of connection and circuit technology
– Influence of shape, material, surface and colour of the object on the switching characteristics of sensors
– Terms which describe coefficients and functional behaviour
– Configuration of logic circuits
– Selecting appropriate sensors by taking into account certain parameters

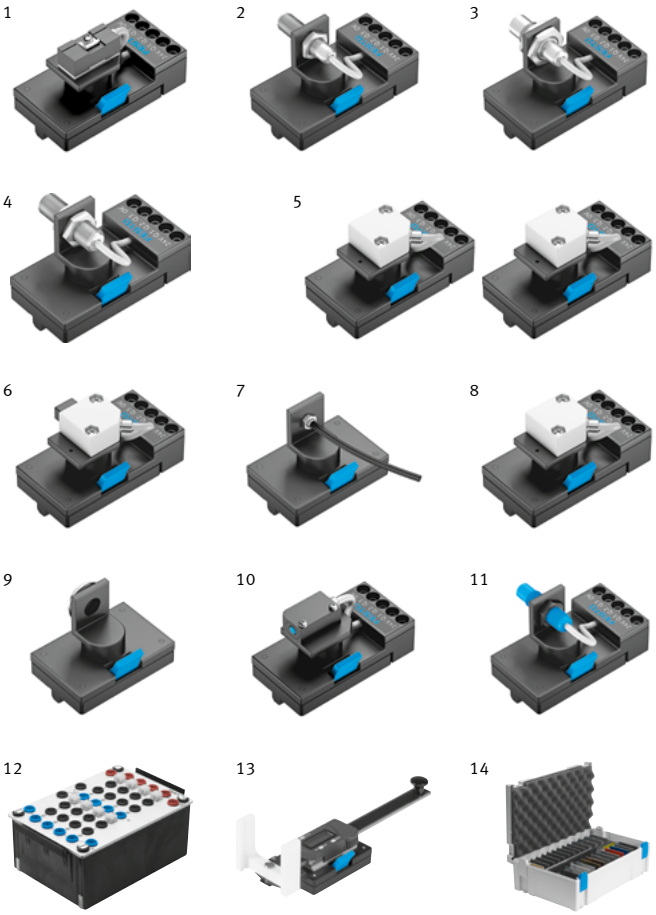
Complete equipment set TP 1311	**8150804**

The most important components at a glance:

1	1x Proximity sensor, magneto-resistive	566199
2	1x Proximity sensor, inductive, M12	548643
3	1x Proximity sensor, inductive, M18	548645
4	1x Analog sensor, inductive, M12	548644
5	1x One-way light barrier, transmitter and receiver	8147646
6	1x Fibre-optic unit	8147649
7	1x Fibre-optic cable	8147650
8	1x Retro-reflective sensor	8147647
9	1x Reflector (triple mirror), 20 mm	8147645
10	1x Diffuse sensor with background suppression	8147648
11	1x Proximity sensor, capacitive, M12	548651
12	1x Indicator unit and distributor, electrical	162244
13	1x Slide unit	572740
14	1x Set of test objects	549830

Recommended accessories:

Aluminium profile plate → Page 196
Slotted mounting plate → Page 196
Tabletop power supply unit → Page 149
Power supply unit for mounting frame → Page 199
4 mm Safety laboratory cables → Page 199



Also order:

Workbook



Fifteen projects based on industrial examples, suitable for equipment set TP 1311, each including problem descriptions, parameters and project tasks, deal in detail with the specific subject of sensors for object detection. The main topics are configuration, function and the influence of material properties on behaviour, possible applications and how to select a sensor based on the application conditions.

The content topicsare covered by exercises using magnetic, inductive, optical and capacitive proximity sensors.

The workbook includes:
– Sample solutions
– Training notes
– Data storage medium
– Exercise sheets for trainees

Campus license (→ Page 281):

de	**8158730**
en	**8163545**
es	**8163546**
fr	**8163547**

Supplementary media
– eLearning course
Sensor technology 2:
Sensors for object detection
– Textbook Proximity switches

Smart Sensors

TP 1312

→ Video



Understanding smart sensors
TP 1312 combines industrial components with project-oriented learning activities to efficiently build proficiency in smart sensor technology for Industry 4.0.

A complete learning concept
Comprehensive courseware guides students through detailed project-oriented learning activities. Starting with the basics of each sensor, students perform practical exercises in a simplified work environment, allowing them to focus on smart sensors.

Students can also connect these sensors to a PLC over PROFINET, EtherNet/IP or Modbus, just like in industry.

Industrial relevance
Smart sensors play a crucial role in the process automation. Several sensors from TP 1312, including flow, pressure, and temperature sensors, monitor process variables. Furthermore, the equipment and software of TP 1312 can be utilized to configure IO-Link devices specifically designed for Industrial Process Learning Systems.

Quick assembly
All components are based on the Quick-Fix mounting system, which allows for quick mounting and alignment of sensors and test objects without any tools. Components can be installed on a profile plate or on the optional Sensor Workstation.



Complete Equipment Set TP 1312	**8116358**

The most important components at a glance:

1	Diffuse photoelectric sensor with IO-Link	8110725
2	Inductive proximity sensor with IO-Link	8110726
3	Ultrasonic sensor with IO-Link	8110727
4	IO-Link master module with 4 ports	8110729
	Accessory kit for equipment set TP 1312	8112723

Necessary accessories, also order:

5	Sensor workstation*	8110723
6	Set of test objects	549830
	Slide unit	572740

* Please order the main cables separately. If the Sensor workstation is not ordered with the training package, be sure to have a profile plate to hold the sensors and a tabletop 24V DC power supply. A PLC is necessary for the last portion of the course. Several options are available. Please check with your sales representative for further details.

Recommended accessories:

IO-Link Bluetooth Interface	8132947
RFID sensor with IO-Link	8110728
Laser distance sensor with IO-Link	8115140
Temperature sensor with IO-Link	8115033
Code reader with Ethernet	8121748
Flow sensor with IO-Link	8115026
Pressure sensor with IO-Link	8115027
EduTrainer Universal with SIMATIC S7-1500	8065452
EduTrainer Universal with Allen-Bradley CompactLogix	8034582
EduTrainer Universal with Festo CECC-LK CODESYS V3.5	8043320
Equipment set TP 1311 – Sensors for object detection	8150804

Data monitoring
The software PACTware provides the interface to parameterize, adjust, and operate smart sensors. Monitoring real-time data prepares students to perform predictive maintenance and troubleshooting. An optional Smart IO-Link Interface seamlessly integrates mobile devices (iOS or Android) through Bluetooth for remote monitoring and operation.

Learning objectives
- Understanding the benefits of smart sensors in the context of Industry 4.0
- Selecting, parameterizing, monitoring, and adjusting sensors
- Setting up IO-Link communication
- Integrating sensors into different manufacturing communication layers
- Performing predictive maintenance
- Replacing sensors and uploading settings automatically
- Troubleshooting sensors

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4


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Recommended Learning Material

Workbooks



Campus license:

de	8148168
en	8122694
fr	8148172

Note: Campus licenses include the student and the instructor PDF versions of the workbooks “Fundamental Principles of Smart Sensors”, “Smart IO-Link Interface”, and “PLC Integration of Smart Sensors”.

Courses on Festo LX

→ Fundamental Principles of Smart Sensors



→ Smart IO-Link Interface (P&F SmartBridge)
→ PLC Integration of Smart Sensors
→ Smart IO-Link Interface

Machine Safety

TP 1321



Machine safety in the learning environment
Equipment set with various components relating to machine safety, the Machinery Directive and risk analysis. Works in perfect harmony with the illustrative project exercises provided in the accompanying workbook.

Scenario flexibility
The modular system can be used both in stand-alone operation, in conjunction with FluidSIM and attached to an MPS station. The system can be converted in just a few steps and new safety equipment can be implemented in practice.

Complex contents – simply presented
Alongside function and economy, safety is one of the key success factors of any machine. In addition, new directives and laws require intelligent solutions and increase the need for qualification. As a result, the product, information and qualification range for safety technology is diverse. With the TP 1321 equipment set, you can map the common safety devices of modern machines. This includes various circuits with safety and two-hand relays as well as various protective devices and guard locking.

Also order:

Workbook



The Machine Safety workbook deals specifically with the topic of safety technology in the industrial environment in 10 projects. The practical implementation of the projects is coordinated with the components of the TP 1321 equipment set. The focus is on the topics of standards, risk analysis, safety controls and protective devices. FluidSIM is required to complete the projects.

The workbook contains:
– Sample solutions
– Training notes
– Worksheets for students

Campus licence (→ Page 281):

de	**8125496**
en	**8136251**
es	**8136250**
fr	**8136251**

Machine Safety

TP 1321 and Machine Safety Mounting Kit for MPS

Complete equipment set TP 1321	**8112539**

The most important components at a glance:

- 1x Base frame with associated switch plates
- 1x Pilz safety relay PNOZ4.1 in the A4 module
- 1x Pilz two-handed relay PNOZ6.1 in the A4 module
- 1x Door for mounting various safety devices
- 1x Safety switch, without interlock
- 1x Safety switch, with interlock
- 1x Contactless safety switch
- 1x Magnetic guard control
- 1x Position switch
- 1x Sliding door with position switch
- 1x Enable button
- 1x M12 adapter, 4 mm safety socket
- 1x Multifunctional lamp
- 1x M12 cable set

Optional accessories:

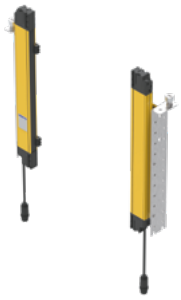
Mini EasyPort*	8075749
1 Light curtain	8112552

* Connection to FluidSIM Pneumatics and Electrical Engineering

Recommended accessories:

FluidSIM → Page 122

1



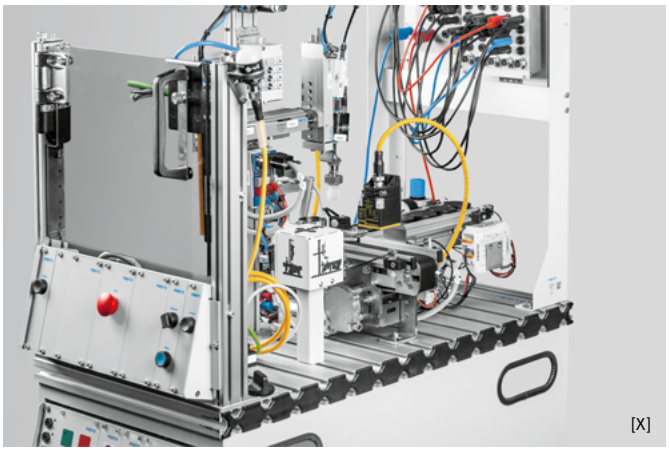
Light curtain
The light curtain is an optional component suitable for the equipment set Machine Safety. It is used to impart knowledge about safety devices with optical sensors.

Order no.	**8112552**

Machine Safety mounting kit for MPS
The mounting kit for MPS is an optional component for the TP 1321 Machine Safety. The carrier system and thus all other components of the TP 1321 can be mounted on an MPS station with the mounting kit. In this way, the topic of machine safety can be implemented and illustrated using a real example.

The mounting kit for MPS consists of the following components:
– 1x assortment of cables
– 1x mounting accessories
– 1x A4 mounting plate MPS

Mounting kit TP 1321 for MPS	**8131471**



[X]

[X] Figure contains additional equipment and accessories

Commissioning and Troubleshooting



Simulation box, digital
The simulation box is used to display the input and outputs signals of an MPS station or PLC. Two modes of application are possible:
– Simulation of inputs for testing of a PLC program. Use I/O data cable (SysLink) (order no. 034031) for this purpose.
– Setting of outputs (with separate 24 V supply) in order to operate an MPS station. The cable (order no. 167106, 2.5 m) required for this purpose is included in the scope of delivery.

The simulation box contains a SysLink socket.

Order no.	**170643**

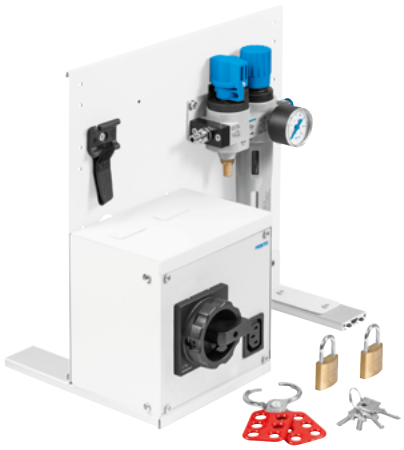


Simulation box, digital/analog
The digital/analog simulation box additionally allows the simulation and display of analog signals (0 – 10 V). The simulation box is supplied without connection cables.

The following connection cables are recommended for flexible application:
– I/O data cable, parallel
  Order no. 034031
  (e.g. Simulation Box with SPS EduTrainer or EasyPort)
– Analog cable, parallel
  Order no. 529141
  (e.g. Simulation Box with EasyPort)
– Analog cable, crossover
  Order no. 533039
  (e.g. Simulation Box with MPS Analog-Terminal)
– I/O data cable, crossover
  Order no. 167197

Order no.	**526863**





Error simulation box
The error simulation box allows deliberate errors to be generated in the processes of MPS stations or module applications. Individual input or output signals can be interrupted or switched to continuous signals, depending on how the error simulation box is integrated, for the purpose of exercises, for example.

Students can gain practical training in locating and remedying typical process faults, in order to acquire comprehensive knowledge of the functions and processes and also the servicing of a mechatronics system.

Order no.	**8074292**

Lockout-tagout module
The module offers the option of a central shut-down device for voltage and compressed air supply of a station or of an entire system. The main switch and shut off valve can each be secured with a padlock.

Technical data
– Nominal voltage: 110 V/230 V
– Max. switching capacity: 10 A
– Operating pressure:
  100 – 1000 kPa (1 – 10 bar)
– Standard nominal flow rate:
  750 l/min
– Weight: 3400 g
– Dimensions (W x D x H):
  305 x 240 x 312 mm

Training content
– Getting to know central shut-down devices for voltage and compressed air during maintenance work on industrial systems

Order no.	**8064829**

Electrical Drive Technology



The world of electrical drive technology

The increasing electrification of industrial processes requires a good understanding of electrical drive technology.

Modern electric actuators are characterized by a merging of electrical and mechanical components to form complete systems. Especially with rotating electrical machines, the system concept and practical relevance play the decisive role for a good learning approach in addition to the fundamentals of the individual components.

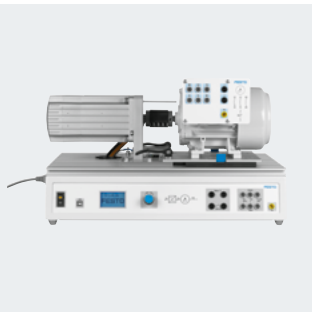
Contactor controls, servo motors and stepper motor controllers as well as frequency converters – each suitable for the actuator – are used to control the electric actuator.



Comprehensive course material
supports students through the necessary steps of introduction, planning and processing of exercises, evaluation of results and documentation.

Courses are available on Festo LX to expand on the knowledge in this topic.

Detailed information about these training packages and many others can be found on our website.

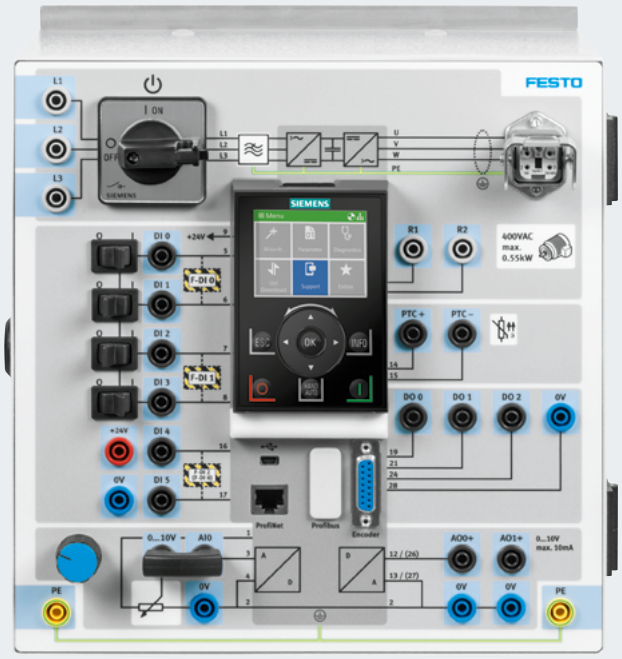


Servo brake and actuator system
A complete, flexible and convenient load and actuator system is provided in the compact housing. This allows the systems to be examined in different load situations. With the electric machines (optionally available), virtually all electric circuits and actuators used for industrial, commercial and domestic purposes can be explained in a practice-oriented manner based on the level of training.



Frequency converter
In close cooperation with test laboratories, Festo Didactic has developed the optimum solution for operating frequency inverters in training. Frequency inverters with suitable actuators are available in various designs for both simple and complex actuator tasks.

SINAMICS G120 EduTrainer



The next generation of the Sinamics G120 frequency converter – Optimised even further for training. Now in a completely new housing and EMC-compliant for use in laboratories without heeding installation instructions – just like that!

The G120 is well-suited as a beginner device, however its comprehensive functions offer plenty of potential for advanced users who want to implement complex drive tasks.

Various bus systems, advanced safety functions and an encoder input (available only in 8105137 and 8105421) permit perfect adjustment to the requirements and integration in control systems. All relevant ports are accessible on the front of the device and installed in 4 mm safety sockets or system connectors.

The motor is connected via the fully pre-assembled cable sold separately which permits EMC-compliant operation.

The devices can be used flexibly – suspended in an A4 frame or on a table, and are equipped with an EMC filter with low leakage current.

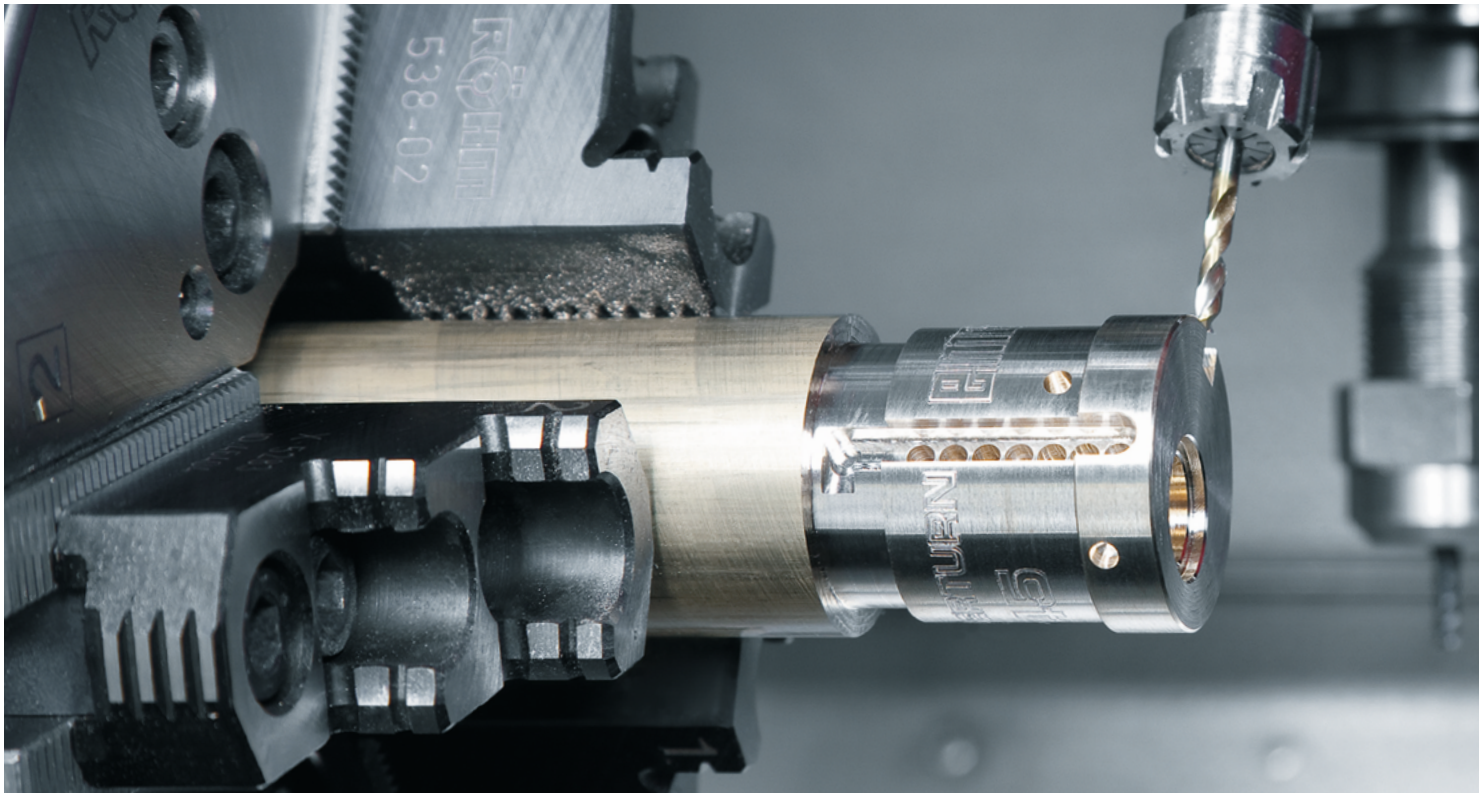
The control panel IOP-2 is included in the scope of delivery of order no. 8105137 and 8105421. The control panels for the G120-DP variant (IOP-2 and BOP-2) are available as accessories.

SINAMICS G120 DP	**8037819**
SINAMICS G120 PN-F with encoder port (1 AC input)	**8105137**
SINAMICS G120 PN-F with encoder port (3 AC input)	**8105421**

Special characteristics
- Simple parametrisation via STARTER/STARTDRIVE and the BOP-2 or IOP-2 control panels
- Versatile, programmable inputs/outputs voltage/frequency characteristic curves for constant, square torque
- Encoder-free vector regulation brake functions (resistance, DC, motor holding, compound brake)
- Integrated protection/overload functions

Technical data
- 6 digital inputs, depending on the variant, 2 of which can be parameterised as failsafe inputs
- 3 digital outputs
- 1 analogue input
- 2 analogue outputs
- USB parameterisation interface (3 m USB cable included)
- Connections for temperature sensor and for external braking resistor
- Dimensions (H x W x D) 297 x 266 x 340 – 360 mm, depending on the variant
- Input:
  1x 200 – 240 V AC
  (Order no. 8105137)
  3x 380 – 480 V AC
  (Order no. 8037819 and 8105421)
- Output:
  3x 400 V AC, 0.55 kW
  (Order no. 8037819)
  3x 400 V AC, 0.75 kW
  (Order no. 8105421)
  3x 230 V AC, 0.75 kW
  (Order no. 8105137)

CNC Technology from EMCO
Efficient Turning and Milling



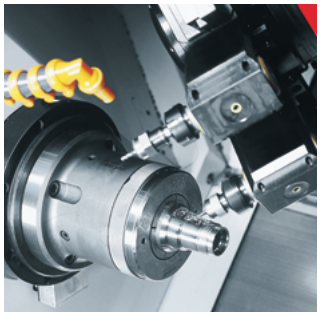
The training program

Festo Didactic integrates CNC training into its learning system to meet the requirements of modern basic and further training in the metals sector. CNC programming and machining, a key task in many metal-working companies, places high demands on students.



CNC technology from the market leader
Machine manufacturer EMCO offers a unique training concept consisting of high quality machines, modular software and supporting teachware.

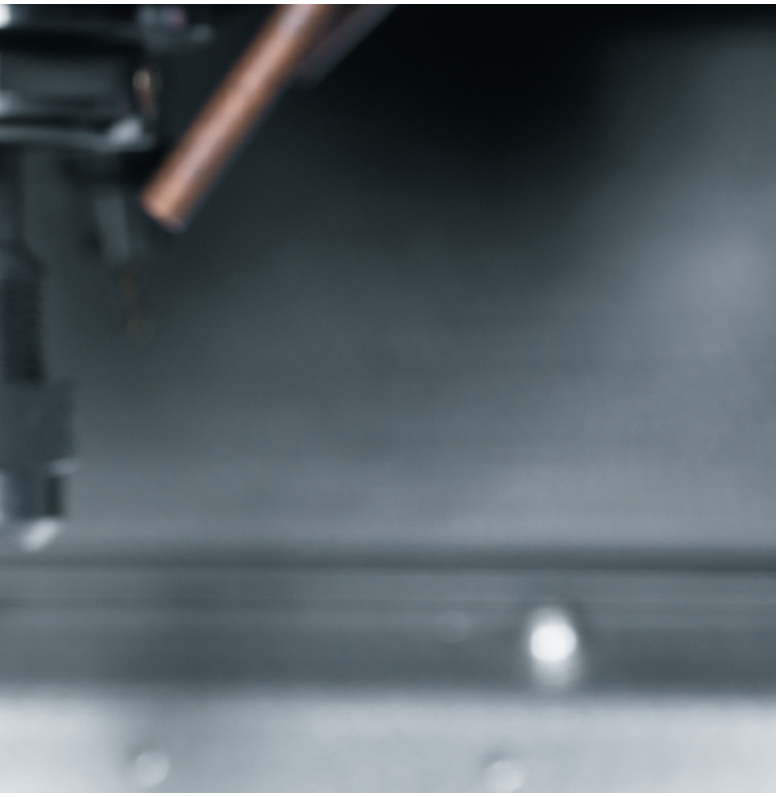
EMCO is the leading machine manufacturer in CNC training. All machines are tailored to the specific requirements of a training situation: safety engineering compliant with CE directives, variety of controllers, available space and price. With the EMCO machines, a complete solution can be offered, from conventional systems right up to CNC machines.



Perfect solutions for basic and further training
Expertise you'll benefit from. EMCO machines for basic and further technical training are characterized by:
– Design and quality that meet the current industry standards
– Long service life and consistently high precision of parts produced
– Scope and design of functionality like modern industrial machines



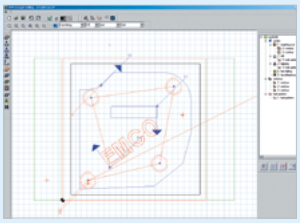
Changing controller? Not a problem.
Standard CNC machines are permanently linked to a CNC controller. If you need a different controller for training purposes, this almost always involves buying a new machine. But not with the PC-controlled turning and milling machines from EMCO: it is easy to change the control keyboard, load different software and start machining! This allows you to use all standard industrial controllers on a single machine.

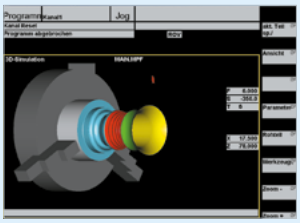


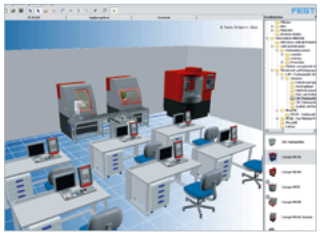
CAD/CAM and simulation

CAMConcept from EMCO provides you with a CAD/CAM system for turning and milling with 3D graphical simulation. Design simple parts with the integrated CAD functionality and create your CNC program without any controller-specific CNC knowledge.

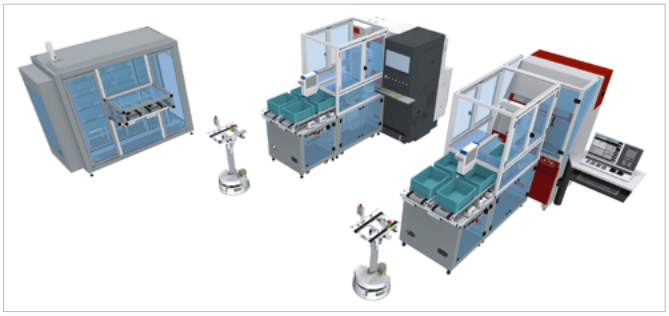
As an option, the WinNC machine controller can also be supplemented with 3D Simulation. Win3D-View allows easy 3D Simulation for turning and milling.







Individual machine or CNC laboratory
The controller software is also available as an offline programming workstation. Combined with individually available controller keyboards, we will be happy to plan a complete CNC training laboratory for you, with different controllers such as Sinumerik, Fanuc or Heidenhain.



CNC turning and milling technology integrated in systems
Our realistic systems accurately reflect the complexity of modern vocational apprenticeships. We have years of experience in FMS/CIM, and offer solutions using state-of-the-art production technologies as well as the latest control technology. Also, thanks to the switchable control of the EMCO Concept CNC machines, they are always one step ahead when it comes to CNC technology.

Please contact us for individual solutions. We'll be happy to advise you.

Recommended learning material for CNC technology

eTheory courses
– Introduction to CNC Technology



– Introduction to CAx systems



Evaluations
– Basics of CNC technology
– Basics of CAx-Systems

Concept MILL



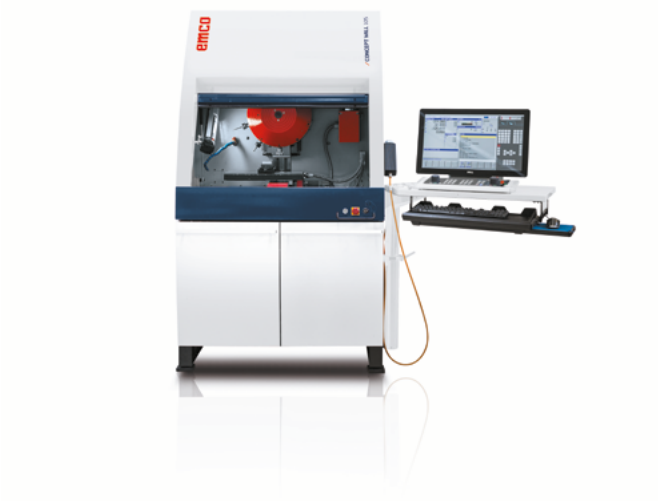
Milling machine Concept MILL 55

This compact milling machine is well suited to the training bench and has almost all the features of an industrial machine: optional with 8-station tool changer with swivel arm and pick-up system, NC indexing device as fourth axis, minimum quantity lubrication and latest state-of-the art control technology.

Automation options: integration in the FMS or CIM systems on request.

Highlights
- Stable, gray cast iron construction, suitable for industrial use
- Clockwise/anticlockwise spindle rotation
- Infinitely variable main drive
- Automatic reference points
- Fully covered working area
- Integrated EMCO EASY CYCLE control system

Concept MILL 55 without tool changer	**538395**
Concept MILL 55 with tool changer	**538865**



Milling machine Concept MILL 105

The compact machine is fitted with an infinitely variable main drive, 10-station tool changer, pneumatic vice and NC dividing attachment as an optional 4th axis. The slides and load-bearing elements of the Concept MILL 105 are made of gray cast iron, ensuring the highest precision.

Automation options: integration in the FMS or CIM systems on request.

Highlights
- Stable, gray cast iron construction, suitable for industrial use
- 10-station tool changer with directional logic
- Backlash-free bearing of the working spindle in precision, life-time-lubricated, angular ball bearings
- Infinitely variable main and feed drives
- Realistic execution of all important milling operations
- Integrated EMCO EASY CYCLE control system

Concept MILL 105	**534590**



Milling machine Concept MILL 260

Training at its best: with 7 kW drive power and a 20-station tool magazine with fast double gripper. Thanks to its sturdy and compact design, the Concept Mill 260 fits into the smallest of spaces.

Automation options: can be integrated in FMS or CIM systems on request.

Highlights
- High drive speed
- 20-station tool magazine
- Robust and compact machine design
- Best view when fully enclosed
- Crane loading possible
- Servo motor technology in all axes
- USB and Ethernet interfaces
- 21.5” TFT touchscreen monitor including Easy2control on-screen keyboard

Concept MILL 260	**8048100**

Concept TURN

Lathe Concept TURN 60

The Concept TURN 60 is a PC-controlled 2-axis CNC desktop lathe which conforms to the industry standard in terms of design and function. Building on the successful CT 55 model, the CT 60 offers the user greater performance and functionality, all according to the current lathe standard ISO 23125.

Automation options: integration in FMS or CIM systems on request.

Highlights
- Compact desktop CNC lathe
- Inclined design suitable for industry
- High-resolution axis motors
- Clockwise/anticlockwise rotating spindle
- Infinitely variable main drive
- Automatic 8-position tool changer
- Automatic referencing
- Profile rail guides (linear guides)
- Safety technology according to the latest lathe standard

Concept TURN 60	**8029475**



Lathe Concept TURN 105

The PC-controlled 2-axis lathe with table format not only easily fulfills all basic requirements for technical education and training but also manifests the finest technology: All precision components on the Concept TURN 105 such as headstock, slide, tool system, and tailstock are installed on a rigid, vibration-damping, gray cast-iron inclined bed. Generously sized motors ensure high feed forces and acceleration values.

Automation options: integration in the FMS or CIM systems on request.

Highlights
- Stable, gray cast-iron inclined-bed construction
- Three-point support for machine bed
- Hardened guideways
- Central lubrication system
- 8-station tool changer
- Fully enclosed working area
- Integrated EMCO EASY CYCLE control system

Concept TURN 105	**534575**



Lathe Concept TURN 260

Uncompromising quality down to the last screw at an unbeatable price. With an extremely solid machine bed, a thermally symmetrical spindle stock, precision spindle bearing, pretensioned roller bearing guides in all axes and a rapid tool revolver. Also the switchable controller EMCO WinNC.

Automation options: integration in FMS or CIM systems on request.

Highlights
- Extremely solid machine bed, maximum thermal stability
- Top machining precision
- Extremely compact machine design
- Switchable WinNC controller
- Switches between the WinNCs in a few minutes
- Top European quality of workmanship
- 21.5” TFT touchscreen monitor including Easy2control on-screen keyboard

Concept TURN 260-T	**8048094**
Concept TURN 260-TC	**8048095**
Concept TURN 260-TM	**8048096**
Concept TURN 260-TCM	**8048097**



Concept TURN



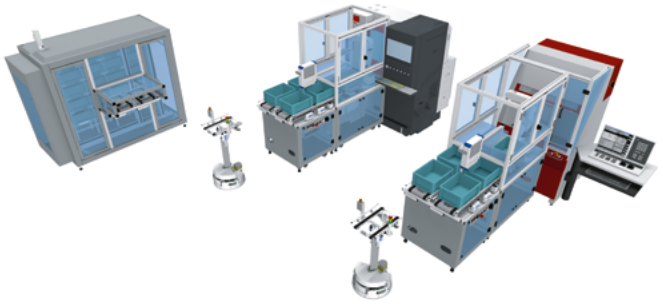
Lathe Concept TURN 460

A new dimension in industrial CNC training. Equipped with a C-axis, powered tools and digital drive technology, the function and performance of a Concept TURN 460 is equivalent to that of a modern industrial machine.

Automation options: integration in FMS or CIM systems on request.

Highlights
- Universal application
- Digital drive technology
- Extraordinary dynamic response
- Optimal thermal stability
- Top machining precision
- Compact machine design
- 21.5” TFT touchscreen monitor including Easy2control on-screen keyboard

Concept TURN 460-TC	**8068168**
Concept TURN 460-TCM	**8068169**



Automated CNC machines

Integrating CNC machines in installations like the CP Factory allows trainees to be taught using complex systems. It brings together all subsections of modern production plants – logistics, manufacturing, assembly and order management. The individual systems can be separated using mobile robotics. Thanks to their switchable controllers, the control technology of the EMCO Concept machines is always up to date so there is no need to change the complete machine.

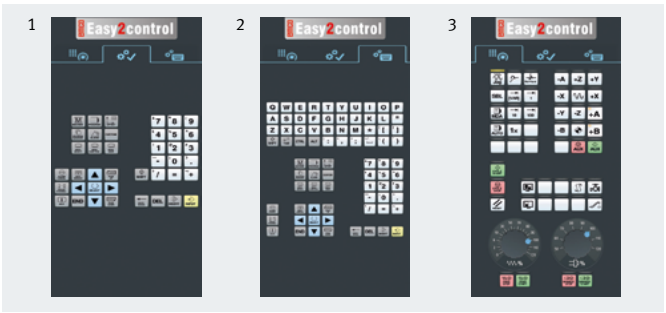
Highlights
- Fully automated CNC machine
- Modular structure
- Implementation of the latest production technologies
- Latest control technology
- Can be combined with mobile robotics

Automated CNC machines	**On request**

Software

The principle of the interchangeable controller

1 2 3



EMCO Easy2control

EMCO Easy2control is a software package that displays the controller-specific and machine keyboards of WinNC controllers on a 16:9 full HD screen.

The different control panels for the machine, the controller and the quick access functions can be switched via tabs.

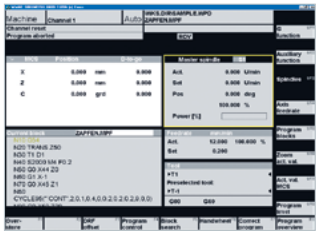
1 **Machine keyboard**
The operating area of the controller is reduced to essentials

2 **Quick access functions**
Operating area of the machine

3 **Controller-specific keyboard**
Operating area of the CNC controller

The keys and rotary knobs can be operated using the mouse or directly on the touchscreen.

EMCO Easy2control
On request



Win NC control software

- Operation using soft keys as in an original industrial controller
- 2D graphical simulation with auto zoom function
- Modern user interface
- Wide range of operating options
- Various language versions

Equipment
- Installation of interchangeable controllers on concept machines and/or PC
- Controller-specific keypad on concept machines and/or PC
- Easy replacement of key-specific module in just one minute

SINUMERIK 810D/840D turning/milling
On request
SINUMERIK Operate turning/milling
On request
Fanuc turning/milling
On request
HEIDENHAIN milling
On request

Mechanical Drives Training System



Shown with optional components

Machinery maintenance
Skilled industrial mechanics are in demand worldwide. We rely on them to install, maintain, repair, and replace a vast array of mechanical equipment.

Manual skills involving a variety of machine elements are most valued. With this in mind, we have designed a training system that exposes learners to the hardware, tools, and methods used by industrial mechanics to keep plants running.

Versatile workstation
A workstation equipped with movable T-slotted extrusions is included and is the foundation of the system. Learners use it to assemble a variety of mechanical drive set-ups. They test them with the included variable frequency drive and prony brake to control the motor speed and load, creating various usage scenarios.





Safety you can rely on
Safety is maintained with a detection circuit that cuts power when the polycarbonate cover of the workstation is opened. Learners are asked to perform a lockout/tagout procedure on the main switch to prevent accidental activation of the motor while they are working. The cover can also be locked when closed to further improve safety during operation and allow instructors to control access to the components.

Complete coverage
Instructors can rely on a turnkey learning solution that includes suggested experiments to teach the fundamentals every industrial mechanic must master. Most topics are combined in packages called "Levels" and cover:
– Belt, chain and gear drives
– Couplings and shaft alignment methods
– Bearings and seals
– Linear slides
– Gearboxes and clutch-brake units
– Vibration metering

Mechanical Drives Training System
Workstation package

Workstation Package

230 V, 50/60 Hz	**de**	**en**	**es**	**fr**
	594831	**594776**	**594833**	**594832**
The most important components at a glance:				
1 Workstation	593739	593737	593741	593740
2 Couplings and shafts panel	593745	593742	593744	593743
3 Pillow block bearings panel	593749	593746	593748	593747
Workstation accessories	593750	593750	593750	593750
Optional components:				
5 Wall-mounted support for 5 panels	594985	594985	594985	594985
4 Work bench	593855	593855	593855	593855

Workstation Package

120 V, 50/60 Hz		**594775**	**594830**	**594829**
The most important components at a glance:				
1 Workstation		593733	593735	593734
2 Couplings and shafts panel		593742	593744	593743
3 Pillow block bearings panel		593746	593748	593747
Workstation accessories		593750	593750	593750
Optional components:				
Wall-mounted support for 5 panels		594985	594985	594985
4 Work bench	593855	593855	593855	593855

Foundation of the system
The workstation package includes, besides the workstation itself, elements common to most experiments of the mechanical drives training system. Shafts, basic couplings, pillow block bearings, most required fasteners, basic tools, and measuring apparatus are part of this package. A three-phase motor and an adjustable-height motor mounting base are also included.

Topics
The job sheets offer exercises involving components commonly found in mechanical drives. Topics include:
– Introduction to mechanical drives
– Familiarization with the workstation
– Safety
– Pillow blocks bearings and shafts
– Motor, variable frequency drive, and tachometer
– Shaft alignment and couplings
– Torque, power, and efficiency

1







2



3



4



Recommended Learning Material

Workbooks



Campus license:

de	793116
en	793115
es	793118
fr	793117

Notes: Campus licenses include the student and the instructor PDF versions of the workbooks of the Workstation Package and Level 1: “Introduction to Mechanical Drives”, “Belt Drives I”, “Chain Drives I”, “Gear Drives I”, and the “Mechanical Drive Training System User Guide”.

Course on Festo LX
→ Introduction to Mechanical Drive Systems



Mechanical Drives Training System
Level 1

Mechanical Drives Training System – Level 1

	de	en	es	fr
	594834	**594777**	**594836**	**594835**

Note: Level 1 requires the Workstation Package.

The most important components at a glance:

1 Belt drives 1	593762	593759	593761	593760
2 Chain drives 1	593766	593763	593765	593764
3 Gear drives 1	593770	593767	593769	593768

Properly aligned pulleys, sprockets, and gears as well as adjustment of belt tension, chain slack and gear backlash are essential to minimize vibration, maximize power transmission, and meet the expected service-life of mechanical drives. Industrial mechanics must be trained to master the fundamental skills related to the identification, installation, and maintenance of belt, chain, and gear drives.

The Level 1 includes all the hardware and tools to teach these skills. Pulleys, sprockets and gears are stored on a panel for quick identification and inventory control.

Topics

Belt Drives 1:
– Introduction to belt drives
– Installation of belt drives
– Adjustment of belt tension
– Speed and torque ratios

Chain Drives 1:
– Introduction to chain drives
– Installation of chain drives
– Adjustment of chain slack
– Speed and torque ratios

Gear Drives 1:
– Introduction to gear drives
– Spur gear installation
– Gear alignment
– Backlash adjustment
– Speed, torque, and gear ratios
– Gear trains

1



2



3



Recommended Learning Material

Workbooks



Campus license:

de	793116
en	793115
es	793118
fr	793117

Notes: Campus licenses include the student and the instructor PDF versions of the workbooks of the Workstation Package and Level 1: “Introduction to Mechanical Drives”, “Belt Drives 1”, “Chain Drives 1”, “Gear Drives 1”, and the “Mechanical Drive Training System User Guide”.

Courses on Festo LX

→ Chain Drives 1



→ Belt Drives 1
→ Gear Drives 1

Mechanical Drives Training System

Level 2

Mechanical Drives Training System – Level 2

	de	en	es	fr
	594837	**594778**	**594839**	**594838**

Note: Level 2 requires Level 1.

The most important components at a glance:

1 Belt drives 2	593781	593778	593780	593779
2 Chain drives 2	593785	593782	593784	593783
3 Gear drives 2	593789	593786	593788	593787
Level 2 accessories	593790	593790	593790	593790

Building on the knowledge acquired in Level 1, Level 2 provides learners with more learning possibilities in installation procedures of hardware commonly used in a variety of belt drives, chain drives, and gear drives. There are several types of belts, pulleys, chain, sprockets, and gears suited for specific applications; industrial maintenance learners need to be able to identify and install them according to specifications. A selection of the most common components is included in Level 2.

Level 2 also includes new hardware and tools to teach these skills. Pulleys, sprockets, and gears are conveniently stored on panels.

Topics

Belt Drives 2:
– Wedge and notched wedge V-belts
– Idler pulleys
– Variable-speed belt drives
– Multiple-speed belt drives
– Multiple-belt drives
– Synchronous belt drives
– High torque synchronous belt drives

Chain Drives 2:
– Multiple-strand chain drives
– Idler sprockets

Gear Drives 2:
– Helical gears
– Worms and worm gears
– Miter gears
– Gearboxes

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Recommended Learning Material

Workbooks



Campus licenses:

de	595111
en	595110
es	595113
fr	595112

Notes: Campus licenses include the student and the instructor PDF versions of the workbooks “Belt Drives 2”, “Chain Drives 2”, and “Gear Drives 2”.

Courses on Festo LX

→ Gear Drives 2



→ Belt Drives 2
→ Chain Drives 2

Mechanical Drives Training System
Level 3

Mechanical Drives Training System – Level 3

	de	en	es	fr
230 V, 50/60 H	**594840**	**594779**	**594842**	**594841**
120 V, 50/60 Hz		**594780**	**594844**	**594843**

Note: Level 3 requires the Workstation Package.

The most important components at a glance:

1 Shaft alignment and couplings	593800	593797	593799	593798
2 Bearings and seals	593804	593801	593803	593802
Level 3 accessories, 230 V	595670	595670	595670	595670
Level 3 accessories, 120 V		593809	593809	593809
Spare parts for bearings and seals	593805	593805	593805	593805

Optional component:

3 Laser alignment of shafts*	593819	593816	593818	593817

* Add-on to Shaft alignment and Couplings

A fundamental aspect of mechanical drives is the axial transmission of torque from a driving machine to a driven machine. This is achieved by joining the shafts of each machine through a device called the coupling. A key requirement of any coupling is the alignment of the shafts.

The topic “Shaft alignment and couplings” introduces those aspects and presents couplings and shaft alignment methods suitable for various operating conditions. An optional Laser alignment of shafts add-on is available.

The topic “Bearings and seals” deals with the inner components of a machine. Using real applications such as a gearbox, a pump and a wheel hub, learners learn industry-proven methods for installing and removing bearings and seals in housings and on shafts. Essential concepts of bearings lubrication are also covered.

Topics

Shaft Alignment and Couplings:
– Shaft alignment: straight-edge and feeler gauge method, rim and face method, reverse dial indicator method, laser method (optional)
– Flange couplings
– Flexible sleeve couplings
– Chain/gear/grid couplings
– Universal joints

Bearings and Seals:
– Removal/installation of gaskets, and seals
– Use of an arbor press and a hammer for installation/removal of bearings
– Use of a splitter/puller
– Installation of a bearing by heating the inner raceway
– Removal/installation of shaft lock nuts, lock washers, and snap rings
– Introduction to cleaning and lubrication of bearings

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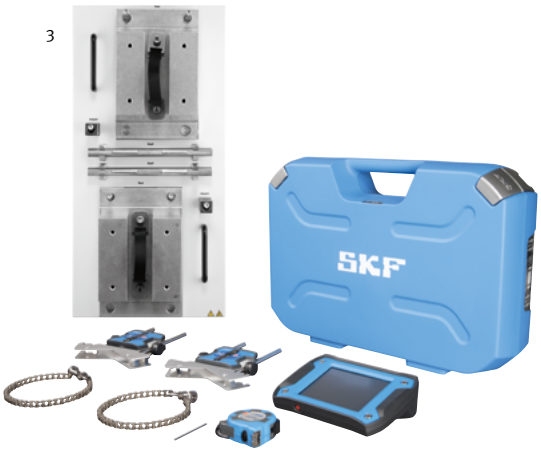

Recommended Learning Material

Workbooks



Campus licenses:

de	596178
en	596177
es	596180
fr	596179

Notes: Campus licenses include the student and the instructor PDF versions of the workbooks “Shaft Alignment and Couplings”, “Bearing and Seals”, “Vibration Metering”, and “Vibration Analysis”

Courses on Festo LX

→ Bearing and Seals



→ Shaft Alignment and Couplings
→ Vibration Metering
→ Vibration Analysis

Mechanical Drives Training System

Level 4

Mechanical Drives Training System – Level 4

	de	en	es	fr
	594845	**594781**	**594847**	**594846**

Note: Level 4 requires the Workstation Package.

The most important components at a glance:

1 Clutches and brakes	593823	593820	593822	593821
Electromagnetic clutch-brake unit*	593834	593834	593834	593834
2 Ball screws and linear bearings	593789	593786	593788	593787

* Shown with item 1

Several industrial applications, such as some conveyors, may require a load to be engaged/disengaged or braked while the motor keeps running. Other applications require the torque to be limited to protect mechanical equipment from overload caused by shock loads or machine jamming. The topic “Clutches and brakes” introduces those aspects and presents clutches for various operating conditions along with their proper installation procedure.

In modern industry, ball screws and linear bearings are commonly used to transform rotational movement into linear movement, and vice versa. Typical applications include many types of machine tools, such as CNC mills and CNC drills. The topic “Ball screws and linear bearings” introduces the main components and proper assembly steps of a linear slide. Essential concepts of maintenance and lubrication of linear bearings, ball screws, and ball nuts are also covered.

Topics

Clutches and Brakes:
– Freewheel clutches
– Torque limiters
– Electromagnetic clutches and brakes

Ball Screws and Linear Bearings:
– Linear bearings
– Ball nuts and ball screws
– Backlash
– Pitch, lead, start, and speed

1



2



Recommended Learning Material

Workbooks



Campus licenses:

de	596182
en	596181
es	596184
fr	596183

Notes: Campus licenses include the student and the instructor PDF versions of the workbooks “Clutches and Brakes” and “Ball Screws and Linear Bearings”.

Courses on Festo LX

→ Clutches and Brakes



→ Ball Screws and Linear Bearings

Basic Dimensional Metrology

TP 47220/47221



[X]

Essential skills for several trades
Proper selection and adequate handling of common measuring instruments such as tape measures, rules, protractors, calipers, micrometers and various gages can be challenging for beginners in dimensional metrology. This is even more the case when various types of reading scales and systems of units must be understood.

The basic dimensional metrology equipment set offers a structured, systematic introduction to concepts, instruments, and techniques related to dimensional metrology. Developing skills in interpreting technical drawings and making measurements is particularly important for machinists, CNC machine operators, millwrights, and workers involved in quality assurance activities..

Realistic experimentation
Through hands-on activities, the basic dimensional metrology training package enables instructors to efficiently convey the fundamental knowledge and know-how related to linear and angular measurements. Comprehensive courseware offers a large range of exercises and projects arranged in a sequence of increasing complexity. This approach allows students to reinforce and expand their skills in a fluid way and improves transferability to the workplace.

Guided exercises build basic know-how and confidence; realistic projects develop decision-making skills.

Build expertise with the right equipment
This package includes semi-precision and precision measuring instruments commonly used in the industry for metrology purposes. The value of the training package is based on the parts used for measurement activities. These parts – from simple to intricate ones – represent real-life consumer and industrial components and are carefully designed to challenge students' metrology skills in a variety of realistic scenarios. They allow the tools to be used to their fullest extent while providing multiple measurement opportunities. Parts are manufactured to ensure repeatability from one equipment set to another.

Also included are a set of master rings and a gauge block that allow students to self-assess their expertise and build confidence. They also develop their ability to perform routine field checks to detect conditions that may impair the accuracy and performance of instruments, a key aspect of metrology.

This helps them develop competencies in performing routine tests to identify conditions that could affect the accuracy and quality of the measuring equipment. This is an essential aspect of measuring technology.

Enhanced learning experience through Augmented Reality
Students use the free Festo Didactic AR app to visualize the features of parts in 3D from their home with smartphones or tablets.

The app is compatible with Apple and Android devices.

 [X] Illustration contains additional equipment and accessories

Equipment Set TP 47220 (Standard)	**8130867**
Equipment Set TP 47221 (Value)	**8130866**

Note

Whether you choose the Standard version which includes brand-name measuring instruments such as Mitutoyo and Starrett or the Value version with generic versions, the learning outcomes and student manuals and instructor guides remain the same.

The most important components at a glance:

1	Measuring instrument
2	Measuring instrument
3	Part
4	Part

The illustrations show components of the TP 47220 (standard) equipment set.

Recommendations for extensions and accessories:

Equipment Set TP 47222-10 (Standard)	8230510
Equipment Set TP 47223-10 (Value)	8230509
Equipment Set TP 47224-A (Add-on)	8145064
1x Systainer³ size V	8252764

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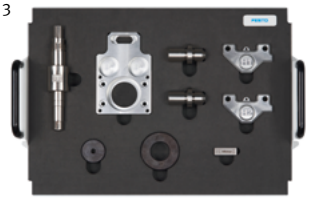

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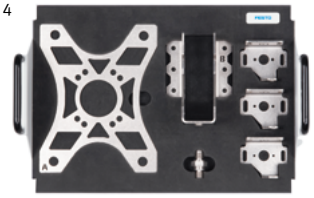
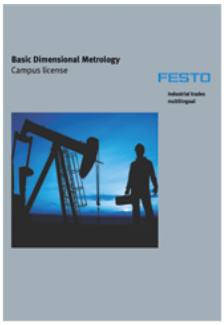


Included measuring instruments
- Tape measure, steel rules, protractor
- Digital, Vernier and outside calipers
- Depth and thickness gauges
- Screw pitch gauges
- Digital and Vernier micrometers with stand
- Set of thread measuring wires
- Small holes gauges
- Telescoping gauge

Included parts
- TV bracket
- Joist hanger
- Hydraulic fitting
- Sensor brackets
- Pump shaft
- Bearing cover
- Lock pins
- Hydraulic disc brake calipers

Learning outcomes
- Explain metrology concepts (measurement, errors, precision, accuracy, etc.) and SI and US unit systems
- Use and maintain precision and semi-precision measuring instruments
- Perform field check tasks
- Take and read measurements
- Read technical drawings

Also order:



Student manuals and instructor guides which includes:
- Guided exercises to build know-how
- Projects to develop decision making skills
- Activities to reinforce transversal skills

Campus license (➔ Page 281):

de, en, es, fr	**On request**

Geometric Dimensioning and Tolerancing (GD&T)

TP 47222/47223



Cross-borders skills for several trades
Production workers, engineers and anyone involved in design or manufacturing need a common language to efficiently communicate the intended function of parts. The geometric dimensioning and tolerancing equipment and courseware is centered around the comprehension of GD&T and the validation of work pieces to ensure they are within specifications.

Because manufacturing is globalized, the training package covers the subtle differences between the two different versions of standards that exist: one mainly used in North America (ASME) often referred to as GD&T, and one mainly used in the rest of the world (ISO) often referred to as GPS, which stands for Geometrical Product Specifications.

Develop know-how applicable to the job market
Through hands-on activities, the Geometric Dimensioning and Tolerancing (GD&T) training package enables instructors to efficiently convey the required knowledge and skills related to GD&T. Comprehensive courseware offers a large range of exercises and projects arranged in a sequence of increasing complexity. This approach allows students to reinforce and expand their skills in a fluid way and improves transferability to the workplace. Guided exercises build basic know-how and confidence; realistic projects develop decision-making skills.

Build expertise with the right equipment
This training package includes industrial-grade measuring instruments, hardware and a set of parts that represent real-life consumer and industrial components carefully designed to challenge students' GD&T skills in a variety of realistic scenarios. They allow the tools to be used to their fullest extent while providing multiple measurement opportunities. Parts are manufactured to ensure repeatability from one equipment set to another.

Enhanced learning experience through Augmented Reality
Students use the free Festo Didactic AR app to visualize the features of parts in 3D from their home with smartphones or tablets. The app is compatible with Apple and Android devices.

Equipment Set TP 47222-10 (Standard)	**8230510**
Equipment Set 47223-10 (Value)	**8230509**

Note

Whether you choose the Standard version which includes brand-name measuring instruments such as Mitutoyo and Starrett or the Value version with generic versions, the learning outcomes and student manuals and instructor guides remain the same.

The most important components at a glance:

1	Measuring instruments
2	Parts

The illustrations show components of the TP 47222 (standard) equipment set.

Recommendations for extensions and accessories:

Optional Measuring Instrument Set	8229238
Equipment Set 47220 (Standard)	8130867
Equipment Set 47221 (Value)	8130866
Equipment Set 47224 (Stand-alone)	8145063
2x Systainer³ size IV	8252763

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Included measuring instruments

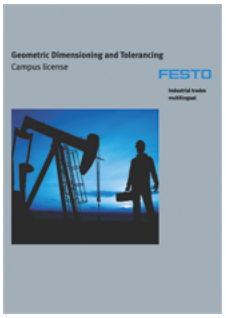
All the measuring instruments needed to perform the experiments:
- 1x set of gauge blocks
- 1x dial test indicator with a magnetic base and holder
- 1x portable granite surface plate
- 2x 1-2-3 setup blocks
- 2x v-blocks
- 1x sine bar
- 1x dial bore gauge
- 1x dial depth gauge
- 1x 3-point internal micrometer
- 1x depth micrometer
- 1x spring clamp
- 1x pair of inspection gloves
- 1x roll of adhesive-backed shim tape
- 1x hexagonal key with a key size of 4 mm
- 1x 20 mm master ring gauge
- 1x 24 mm cylindrical go-type gauge

Included parts

The following specially designed parts represent real consumer and industrial applications:
- 1x mold for mobile phone cases
- 1x part that represents a flange
- 1x part that represents a wedge used in machine tools
- 1x part that represents a bearing housing
- 4x parts that represent a conveyor roller
- 2x parts that represent an axle
- 1x part that represents a gearbox cover

Learning outcomes
- Understand ISO and ASME standards
- Read GD&T symbols
- Describe the main categories of geometric tolerances
- Use and maintain gauge blocks, as well as dial indicators and their accessories
- Measure straightness, circularity, cylindricity, parallelism, perpendicularity
- Perform advanced bores and depths measurements

Also order:



Student manuals and instructor guides which includes:
- Guided exercises to build know-how
- Projects to develop decision making skills
- Activities to reinforce transversal skills

Campus license (➔ Page 281):

de, en, es, fr	**On request**

Statistical Process Control

TP 47224/47224-A



Build solid students' skill set in quality control
Quality is a fundamental component of the organizational strategy of most manufacturing companies to remain competitive. Modern industries have turned toward statistical process control (SPC) to control and improve quality.

The Statistical Process Control training package focuses on the practical applications of SPC. With the right combination of hardware, course content and software, future quality control technicians and engineers learn to collect, analyze, and interpret data using SPC tools commonly used in the industry.

Develop know-how applicable to the job market
Through hands-on activities, the Statistical Process Control training package enables instructors to efficiently convey the required knowledge and skills related to SPC. Comprehensive courseware offers a large range of exercises and projects arranged in a sequence of increasing complexity. This approach allows students to reinforce and expand their skills in a fluid way and improves transferability to the workplace. Guided exercises build basic know-how and confidence; realistic projects develop decision-making skills.

Build expertise with the right equipment
This training package includes measuring instruments and part samples carefully designed to highlight the most important aspects of data collection in the context of SPC. These parts are manufactured to ensure repeatability from one equipment set to another, giving teachers peace of mind when working with multiple sets. Also included are a software and data transmission cable learner will use to recreate a typical industrial data collection and analysis process.

Equipment Set TP 47224 (Stand-alone)	**8145063**
Equipment Set TP 47224-A (Add-on)	**8145064**

Note:
TP 47224, Statistical Process Control (Stand-alone) version does not require any other equipment
TP 47224-A, Statistical Process Control (Add-on) requires either TP 47220, Basic Dimensional Metrology (Standard) or TP 47221, Basic Dimensional Metrology (Value).
The illustrations show components of the TP 47224 (Stand-Alone) equipment set.

Recommendations for extensions and accessories:

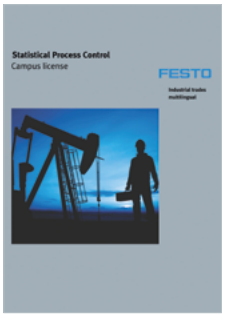
Equipment Set TP 47220 (Standard)	8130867
Equipment Set TP 47221 (Value)	8130866
Equipment Set TP 47222-10 (Standard)	8230510
Equipment Set TP 47223-10 (Value)	8230509
1x Systainer size I	8252760



Included measuring instruments and parts
– 1x digital caliper (only included with the stand-alone version)
– 1x go/no-go plug gauge
– 1x go/no-go thread gauge
– 1x go/no-go pipe thread plug gauge
– 1x USB cable that automatically transfers measuring data to a SPC software

Learning outcomes
– Explain and set sampling plans
– Take measurements with a connected tool and transfer them to an SPC spreadsheet
– Collect, summarize and present data
– Analyze and build control charts for variables and attributes
– Calculate and interpret process capability indices Cp, Cpu, Cpl, and Cpk
– Use fixed gauges to evaluate attributes on workpieces

Also order:



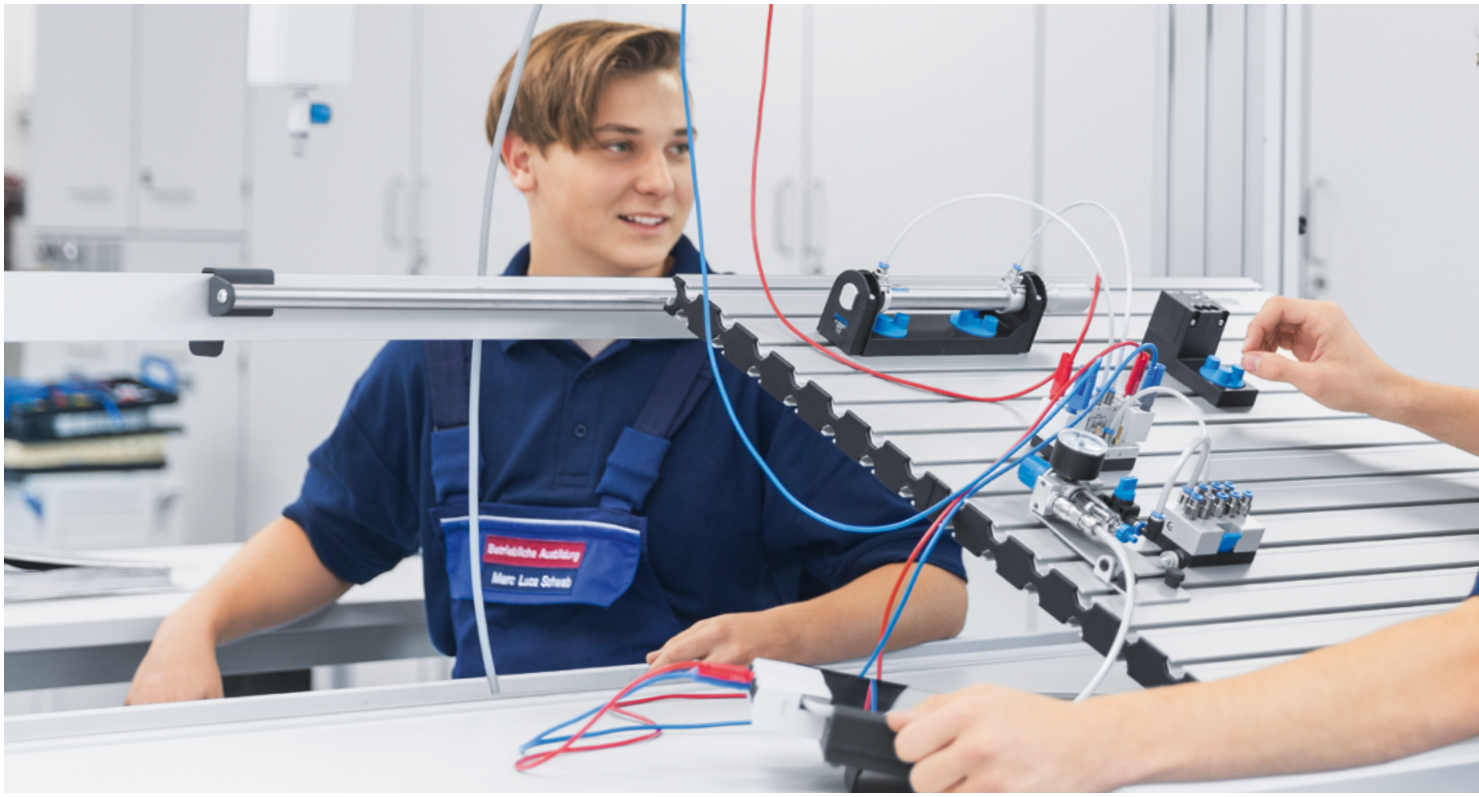
Student manuals and instructor guides which includes:
– Guided exercises to build know-how
– Projects to develop decision making skills
– Activities to reinforce transversal skills

Campus license (→ Page 281):

de, en, es, fr	**On request**

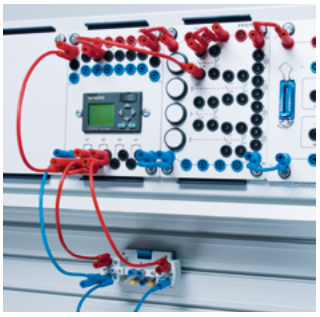
Fluid Power Training Packages

Innovative and Practical in Every Detail



Essential technologies
Fluid power is an essential part of contemporary industrial reality. Air is available everywhere, easy-to-transfer and store – to cite just a few of the many benefits of pneumatics. Hydraulics offers a solution wherever high pressures and forces are required in industry.

Modular for flexible expansion
Festo Didactic's training packages are modular in structure. For example, you could start with the basic level of electropneumatics and then move onto the advanced level, or start with the subject of electrohydraulics – the choice is yours. You'd like to explore a particular specialized topic? All equipment set components can also be ordered separately, so you can turn your own ideas into reality.



Position it – clamp it – done!
With the Quick-Fix mounting system, you can mount all components easily and securely on the profile plate and the profile column of a Learnline workstation. The electrical units are clamped into the ER mounting frame and sequenced individually. The profile slots on the workstations are the same for all pneumatic, hydraulic and electrical units – a single investment, with triple functionality.



Everything where you want it – systematic storage
Most equipment sets are delivered in practical, Systainer-compatible equipment trays. This equipment tray fits in the drawers of the workstations. The large pictogram on the components, designed in accordance with the latest standards, provides clear instructions for connecting the components and ensures short preparation and follow-up times. When dismantling circuits, you can quickly and easily locate where the component goes in the equipment tray.



Connect – and energy is there!
The pneumatic power supply is provided by connecting highly flexible plastic tubing to the push-in fitting QS. The hydraulic energy supply is provided by the tool-free connection of low-leakage couplings. The couplings are self-sealing when decoupled. All electrical components and units are connected by 4 mm safety sockets or 4 mm safety plugs.





Didactic plus

The workbooks accompanying the training packages contain project-oriented exercises of increasing complexity. There are also positional sketches, illustrations, videos, animations, and cross-sectional drawings, which explain how things look in the real world. For a complete and expert treatment of the topic of pneumatics, the training also covers basic physics, technical calculations, safety, economic efficiency, analytical fault-finding, and professional documentation.

Practical basic and specialized training using industrial components provides the confidence to apply the acquired knowledge in the workplace. The components are specially selected for the exercises in the workbook. Note: nearly all pneumatic and electrical connections are located on the easily accessible upper side of the components.



Your choice of training environment
User-friendly training environments for specific topic areas:
– Self-study phases with the training programs
– Designing and documentation with FluidSIM
– Hands-on experimentation with the training packages and the exercises in the workbooks
– Functional testing and optimization with measurement technology and FluidLab



Advanced courses made easy
New developments and trends in fluid engineering can be incorporated directly into our learning systems. New control systems can be integrated into the learning system using the EduTrainer concept. Basic packages can be easily expanded to include the subjects “Pneumatics measurement and control TP 210”, “Energy-efficient compressed air management, AirCS”, “Advanced electro-pneumatics TP 202” or “Pneumatics digitization TP 260”.



Product catalog Fluidpower

Learning solutions for basic and advanced training

In the Pneumatics and Hydraulics product catalog you will find our complete range of learning solutions in this area.

We offer learning solutions for the following topics:
– Pneumatics
– Electropneumatics
– Closed-loop pneumatics
– Vacuum technology
– Sensor technology
– Measurement and control
– Hydraulics
– Electrohydraulics
– Closed-loop hydraulics
– Proportional hydraulics
– Mobile hydraulics

Electrical Engineering/Electronics
Modern and Exciting Training



Everything from a single source – Equipment for electrical engineering laboratories

Regardless of the control and drive technology used, electrical engineering always plays a role.

No matter what your training focuses on, electrical engineering and electronics are part of the basic knowledge for all areas of production, process and automation technology.

With learning systems from Festo Didactic, learning laboratories – be they modular, customised or complete – can be equipped for any application and budget, whether for industry or trades, for teaching basic principles, for building systems or control or drive technology.



Rapid transfer
Whether in initial professional training or more advanced courses: It is essential to be able to recall what has been learned and apply it immediately. This is easier to do if the worlds of learning and work are as similar as possible. That is why the training packages for electrical engineering only contain industrial components, and the exercises in the course documents come from a typical, professional environment.



Maximum compatibility
Electrical engineering and electronics are fundamental components of automation. These training packages can therefore be used where mechatronics or bus technology are involved.
- 4 mm safety sockets and SysLink guarantee “electrical compatibility”
- A new standard coupling ensures that motors and driven elements are universally compatible
- H-rails and housing dimensions allow components from other manufacturers to be used



Useful modularity
The training packages for electrical engineering and electronics are expandable. For example, they begin with electrical protective measures and a domestic connection. Later, they add the starter kit for sub-distribution and the topic of building automation. This modularity has a further benefit: each training device is smaller, more portable and can be housed in a cabinet more easily.





Proven training concept

Festo Didactic's proven and continuously upgraded teachware concept also underpins the training packages for electrical engineering.

It is based on project-based exercises that increase in complexity from one exercise to the next. The knowledge learned is revisited, reinforced and consolidated in subsequent exercises.

Theoretical content can be illustrated and communicated more clearly with the help of the photos and videos on the enclosed multimedia storage device to communicate it more clearly.

Teacher and student versions of documents are provided, with identical page numbering to make it easier to answer questions. Exercise sheets can simply be printed as required.

All projects include practical problems. Drawings, images and videos give a broad view of industrial reality.



Safe connection technology
When it comes to dealing with electricity, safety and protective measures are a key focus. Of course, all of our electrical connections are fitted with safety sockets or plugs.
– The plug-in modules of the equipment set for the basic principles of electrical engineering/electronics
– Power supply units and power supplies
– Back plates and EduTrainer



Combination with self-study
Education in schools, companies or university cannot be successful without a willingness to do self-study. That is why the appropriate eLearning courses are available for all topics. Our range of digital training programs provides exciting learning scenarios and supplements the classroom-based parts of a course. The eLearning courses are particularly well suited for teaching the basic principles and thus provide the optimum supplement to practical experiments.



Product catalog Electronics and Electrical Engineering

Learning solutions for basic and advanced training

In the Electronics and Electrical Engineering product catalog, you will find our complete range of learning solutions in this area.



Discover:
– Basic principles of electrical engineering/electronics
– Basic principles of digital technology
– Basic principles of control technology
– Microcontroller Development Systems
– and much more ...

Process Automation

Expandable and Versatile Complete Learning Solutions



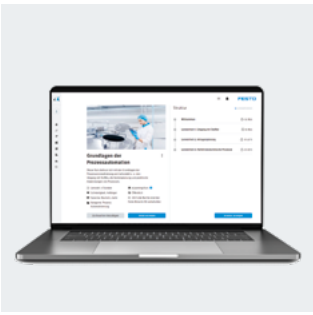
From the project kit to hybrid production

Since practical training at real production and industrial facilities is rarely possible, the project kits, stations, plants and fully equipped learning platforms optimally prepare learners for the requirements of their profession.



Thanks to the modularity of the learning solutions, a wide range of industries can implement typical production processes in a variety of configurations in a safe learning environment.

Industry-based learning
With practice-oriented learning devices, students can better understand the behavior of individual components, select the appropriate instrumentation for the needs of the process, conceptualize and program control strategies, and troubleshoot complex controls. They will be able to delve into specific topics and technologies and thus develop a systemic understanding of closed-loop control technology.



Multimedia support
Computer-aided tools supplement the process automation training in several phases. Multimedia courses provide a motivating introduction to the process industry. Simulation, control and data acquisition software programs are linked to hardware to make laboratory tests easier and more efficient.





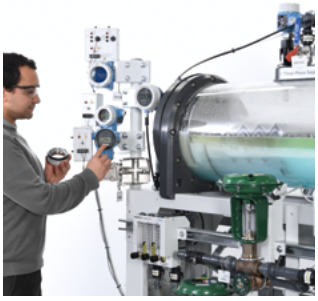
Festo – a key partner in the process industry

It is extremely important to keep variables such as pressure, flow rate, (fill) level, temperature and pH value within the specified range in order to produce goods with a reliable composition and quality. Process automation is a broad and complex field that covers several industry segments and thus has a great need for qualified staff.

Our extensive experience in factory and process automation makes us a key partner for the process industry. We work with leading partners in education, research and industry. Our learning systems for process automation benefit from this expertise and are tailored to the requirements of different industries.



Start with the basics
Process automation is a broad and complex field. For this reason, we have developed a series of learning system for the introduction. These learning systems teach students the basics of closed-loop control technology and process automation – from beginners in STEM projects to students in higher technical schools.



One process system in your lab
The modularity of our learning solutions for industrial instrumentation and process control allows instructors to meet training or research needs without any unnecessary equipment. There are several configurations available for the systems and optional equipment. Discover our learning systems for industrial closed-loop control technology and our unique learning programs



Learning solutions for basic and advanced training

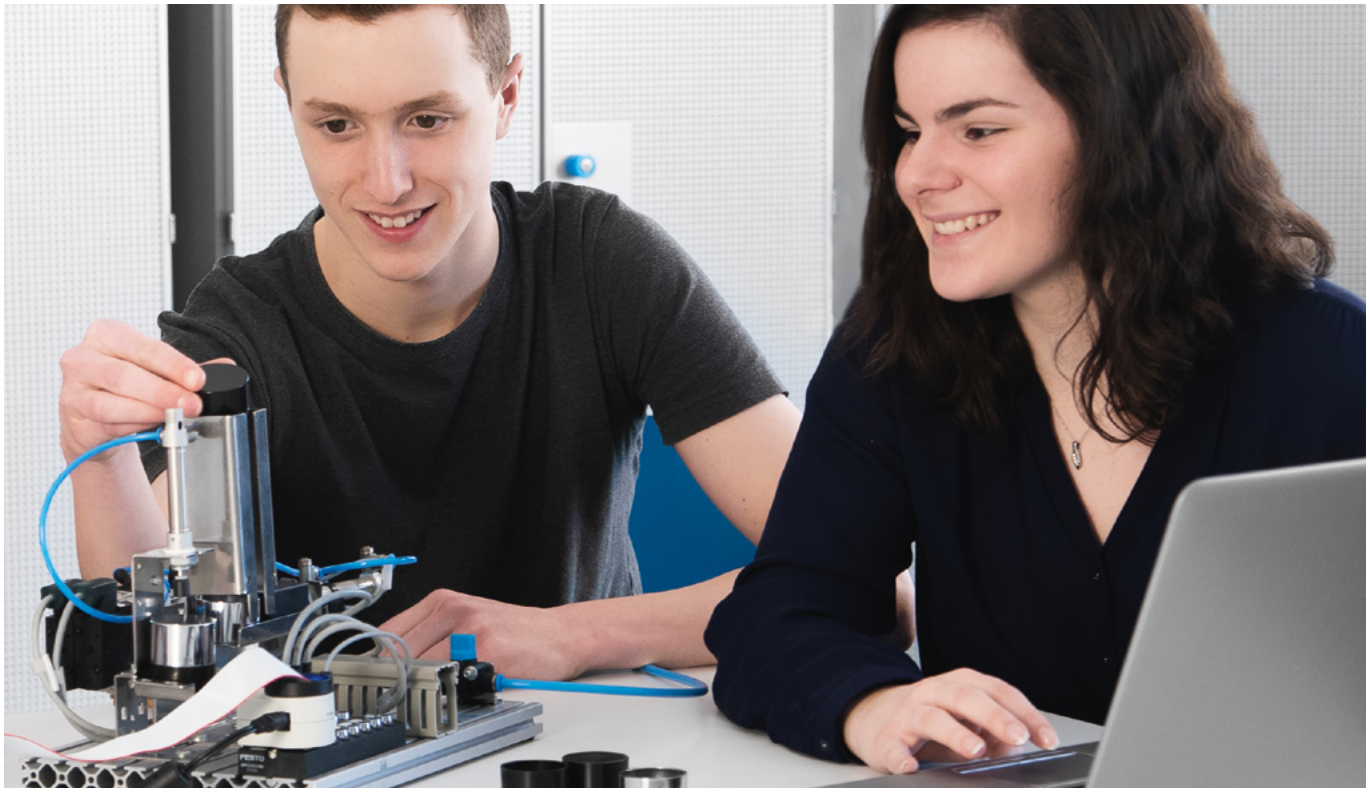
In the product catalog process automation and closed-loop control, you can find information about our learning solution introduction and basics.

Discover:
– EduKit PA
– MPS PA stations and systems
– MPS PA Compact Workstation
– EDS Water Management

You will also find our product line for industrial process control. Discover learning systems for:
– Pressure, flow, level and temperature processes
– pH and conductivity processes
– Air pressure and flow processes
– Distributed control system (DCS)
– Three-phase separator

Understanding Technology. Shaping the Future. With MecLab

The Preferred Learning System for Entry into Automation Technology



Understand the basics of automation with MecLab – and contribute to a digital and future-proof world. The learning system enables a structured introduction to central topics of industrial automation technology and combines theoretical basics with realistic applications.

Through project-oriented work, pupils learn to analyze, plan and implement technical processes – comparable to practice-oriented mechatronic training in a school context.

MecLab offers technical education with relevance – for teaching that combines understanding, application and future competence.

Realistic and challenging
The three MecLab stations represent simplified models of typical production processes found in most automated factories. Only industrial components are used. Each station has a specific function:
– The **Conveyor Station** transports and sorts the parts.
– The **Stack Magazine Station** stores, feeds, and presses the part.
– The **Handling Station** uses a pneumatic gripper to pick up the part and deposit each at predefined point

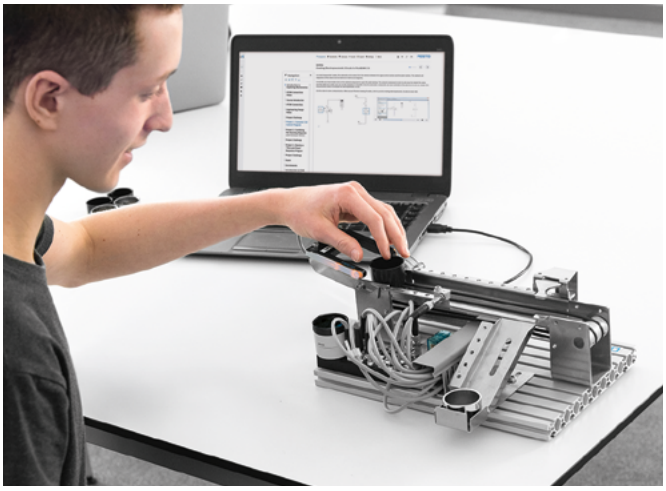
Each station is delivered assembled and ready for use in a Systainer. It is sturdy and capable of withstanding the rigors of a school environment.

All necessary tools and hardware required for making modifications are included. Wiring of the electrical components is simple, using standard industrial connectors.

Modular and flexible
MecLab stations can be used individually. Each station performs a practical function and safely demonstrates the characteristics of a fully-automated process. The stations can be joined together to form more complex production lines.

Students can take on the role of an engineer and design special tasks and projects, including joining the three stations together to form a mini production line.

Learning objectives
MecLab covers a variety of topics and objectives including:
– Knowledge and correct use of technical terms
– Planning, developing, and building automated systems
– Understanding and applying technical documentation
– Building models and creating simulations
– Knowing and using open and closed-loop control systems
– Kowing and using pneumatic and electrical actuators, sensors, and controllers
– Using computers as tools for programming and simulation



Course material
The system includes a range of tasks designed to challenge the student in a hands-on environment of constructing, modifying, and programming an automated mechatronic system.

The system includes a CD-ROM with the electronic version of:

Instructor's Guide: Detailed step-by-step instructions show how to connect the stations to the computer and how to write simple programs. Suggestions for lesson planning are included.

Textbook: Explains the basics of pneumatics, electrical engineering, electrical actuators, sensors, and control technology.

Workbook: Contains 5-7 tasks per station, prepared worksheets in *.doc format, and tasks solutions.

This course material can be downloaded from our website. Further STEM education content is also available in digital format on the digital learning portal Festo LX.

Control with FluidSIM Light/MecLab
The stations are controlled with FluidSIM Light/MecLab software and the EasyPort interface.

FluidSIM is used for creating and simulating pneumatic, electrical circuits and programmable logic controllers. With its universal PC interface, FluidSIM can directly control each MecLab station. Students are able to create and simulate an electro-pneumatic circuit then create a control program for the MecLab station.

FluidSIM Light/MecLab is supplied as a school license for 8 seats per station. The purchase of additional license packages (8-seat license) is possible at any time.

Students can run exercise solutions via software simulation before testing them on the station. The software provides information at the click of a mouse about all components and includes descriptive and animated sequences.

Recommended Learning Material

Courseware



Download the "MecLab Courseware" for free → **click here**



Festo LX for Education in STEM is our all-in-one platform solution with access to all STEM related content, features and the AI supported authoring tool, for your perfect learning experience in schools.

Topics covered amongst others in our STEM and Bionics courses: Electrical Engineering, Mechatronics, Metal Working and CAD, Sensors, Robotics and Coding, Renewable Energies, Water and Process Engineering.

1-year subscription	8219895
3-year subscription	8219896
5-year subscription	8219897

Note: Unlimited number of users with 100 concurrent users.

MecLab
Individual Stations

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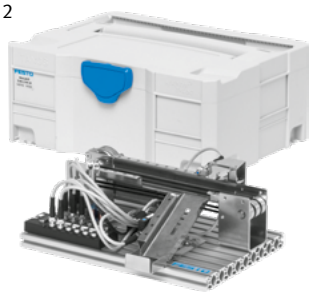
2


3


1 Stacking Magazine Station

Function
In an automated production line, workpieces are stored and fed into the process in a timed sequence. In MecLab, this is the job of the Stacking Magazine Station. It stores and feeds each workpiece. Workpieces stored in the stack magazine are pushed out by a horizontally positioned cylinder. A second, vertically positioned cylinder replicates a press-fit process (e.g., pressing a lid onto a can). All processes are controlled electro-pneumatically. The included magnetic reed switch can be used to verify the position of a cylinder.

Covered topics
– Fundamentals of pneumatics
– Single-acting cylinders
– Double-acting cylinders
– Solenoid valves
– Sensor technology – magnetic limit switches
– Pneumatic plumbing
– Electrical wiring
– Relay control systems

Scope of delivery
– Stacking magazine module
– Press-fit unit module
– Multi-pin plug distributor
– 2x solenoid valves
– 2x cylinders
– 1x magnetic reed switch
– Aluminum slotted profile plate
– Tool set
– Workpieces
– Systainer storage container
– Equipment trays
– FluidSIM Light/MecLab software (8-seat license) and documentation

Order no.	**548704**

Recommended accessories:

Control package	8075749
Compressor ➔ Page 251	

2 Conveyor Station

Function
Transporting workpieces from one manufacturing station to the next is an important task in production. In the real world, driverless transport systems, forklift trucks and above all conveyor belts are used for this purpose. The Conveyor Station in MecLab allows realistic simulation of an industrial workpiece transport system. The drive motor can run forwards and backwards; workpieces can be detected with the sensors and distinguished from one another. The solenoid allows workpieces to be separated or rejected onto the slide.

Covered topics
– Control of direct current motors
– Sensor technology – inductive and optical sensors
– Relay circuits
– Polarity reversal circuits
– PLC programming
– Control using logic operations
– Construction and wiring

Scope of delivery
– Conveyor belt module with DC motor
– Solenoid as stopper/deflector
– Multi-pin plug distributor
– Inductive sensor
– Optical sensor (light barrier)
– Aluminum slotted profile plate
– Tool set
– Workpieces
– Systainer storage container
– Equipment trays
– FluidSIM Light/MecLab software (8-seat license) and documentation

Order no.	**548705**

Recommended accessories:

Control package	8075749

3 Handling Station

Function
Whether it's a simple pick & place operation or highly complex assembly work – handling systems are always involved. Handling devices range from simple, two-axis systems to highly complex industrial robots with six axis. The Handling Station in MecLab consists of pneumatic cylinders with simple bearing guides and two axis. The workpiece is held by a pneumatic gripper. The station can be used to transport the workpiece between stations or to join two workpiece halves together.

Covered topics
– Fundamentals of pneumatics
– Double-acting cylinders
– Grippers
– Solenoid valves
– Sensor technology
– Pneumatic plumbing
– Electrical wiring
– Relay control systems
– Control logic
– PLC controllers
– Operation sequencing

Scope of delivery
– Handling module
– 3x solenoid valves
– 4x magnetic limit switches
– 2x pneumatic cylinders with simple bearing guide
– 1x pneumatic gripper
– Multi-pin plug distributor
– Aluminum slotted profile plate
– Tool set
– Workpieces
– Systainer storage container
– Equipment trays
– FluidSIM Light/MecLab software (8-seat license) and documentation

Order no.	**548706**

Recommended accessories:

Control package	8075749
Compressor ➔ Page 251	

MecLab

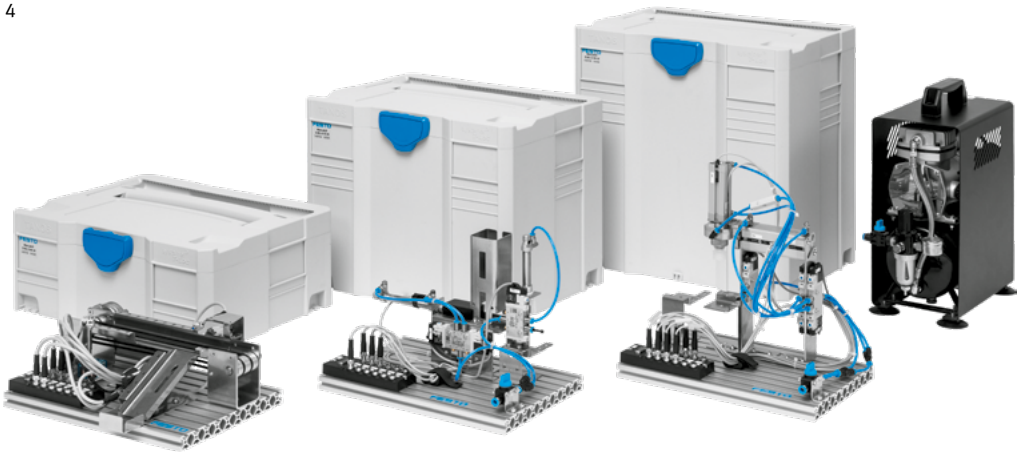
Complete Package, Expansion Set, Software

4 **Complete Package MecLab**

Contains everything you need for working with MecLab:
– Stack Magazine Station
– Conveyor Station
– Handling Station
– Compressor
– 3 x EasyPorts
– 3 x Power Supplies (24 vdc)
– Software FluidSIM Light/MecLab
– Documentation on CD-ROM
– Workpieces
– Tools
– Hardware set
– Systainer

120 V AC	**556276**
230 V AC	**549786**

4



5 **MecLab Expansion Set**

This expansion set contains a range of components for realizing your own project ideas packed in a practical Systainer.

Scope of delivery
– 2x double-acting cylinders with one-way flow control valves
– 2x solenoid valves
– 1x diffuse sensor
– 2x magnetic limit switches
– 1x profile kit
– 1x profile plate
– 1x electrical button
– 1x electrical switch
– 1x indicator light

Order no.	**556245**

5

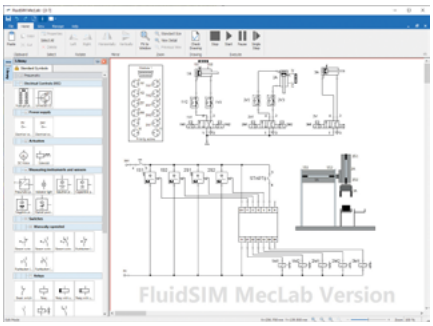


6 **FluidSIM Light/MecLab**

The package includes an 8-seat license for updating to the current version or as an extension of existing licenses already provided with the MecLab stations or complete package. FluidSIM Light/MecLab covers the following topics:
– Basics of electropneumatics
– Basics of digital technology

Order no.	**8169296**

6



Recommended Accessories
Control Options

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1 **The control package – Process Interface with Power Supply and Connecting Cables**

It contains everything you need for controlling MecLab: EasyPort Mini EasyKit – Process Interface V2
– 6 digital or analog input and output channels
– Maximum current per output channel 0.5 A, 24 V (digital) or 0...10 V / 6 mA ±3% (analog)
– Digital input switching threshold 5.2 V hysteresis 1.4 V or analogue 0...10 V, Ri > 10 kΩ
– Power supply 24 V DC, ±10% via a 2.1 x 5.5 mm DC plug
– The status of the digital inputs/outputs and the module's ID appear on a 64 x 48 pixel monochrome graphic display
– EasyLab software can also be used to program the module
– USB 2.0 interface to connect to a PC via micro USB socket
– Micro USB 2.0 connecting cable
– Short circuit proof
Power supply unit
– 24 V DC output voltage
– Output current max. 2.5 A
– Supply voltage 100...240 V, 1.3 A, 50...60 Hz
– Short circuit proof
– Dimensions: 49.5 x 114.5 x 33 mm

Order no.	**8075749**

Accessories (not included)
Power supply cable → next page

2 **Trainer Package LOGO! 8**

FluidSIM contains a software-based minicontroller, e.g., as an introduction to the LOGO!, the minicontroller from SIEMENS. Package includes:
– 6 x LOGO! 12/24 RCE (V8) with 8 digital inputs and 4 digital outputs
– 6 x extension modules with 4 additional digital inputs and 4 digital outputs
– 6 copies of programming software LOGO! Soft Comfort V8

Order no.	**8040049**

3 **Connecting Cable**

Connecting cable with 15-pin D-Sub connector and free cable ends for connecting a LOGO! to the multi-pin plug distributor of a MecLab station. Connecting cable for the end-position controller SPC 11 with 4 mm safety plugs.

Order no.	**177673**

4 **Trainer Package SIMATIC S7-1200 DC/DC/DC**

Consisting of:
– 6x SIMATIC S7-1200, CPU 1215C, compact CPU, DC/DC/DC, 2 PROFINET Port, onboard I/O: 14 DI 24 V DC; 10 DO 24 V DC; 0.5 A; 2 AI 0...10V DC, 2 AO 0...20 mA DC, power supply: 20.4...28.8 V DC, Program/data memory 125 kB
– 6x SIMATIC S7, STEP 7 BASIC floating license, E-SW, SW and documentation on DVD, class A, license key on USB stick, 2 languages (DE, EN), reference HW: S7-1200
– 6x SIMATIC NET, Industrial ETHERNET TP XP Cord RJ45/RJ45, CAT 6 A, crossed TP cable 4x2, length 6 m

Order no.	**8092587**

Connecting Cable SysLink – D-Sub (not shown)

Cable for connection MecLab stations with sub-assemblies that have a 24-pin SysLink plug.

Order no.	**560752**

5 **MecLab Interface**

MecLab Interface is a component that bridges a Microcontroller Development System (TP 1515 PIC or TP 1516 Arduino) with any MecLab Station. It allows control of the station by the microcontroller located on TP 1515 or TP 1516. Using the visual programming software Flowcode, students can quickly and easily code a microcontroller to perform a sequence of actions on the station. The program is uploaded to the microcontroller and test run on the station. Two variants are available, depending if your MecLab Stations are equipped or not with the EasyPort Mini EasyKit with Power supply and Connecting cables.

Complete version	**8136430**
Add-on version	**8127367**

Recommended Accessories

Compressors and Power Supply Units

1



2



3



1 **Compressor for MecLab**

Low-cost compressor for MecLab with only 53 DB (A), making it well suited for use in classrooms. Supplies up to 4 stations. Complete with pressure regulator, water separator, 5 m tubing 6 mm in diameter and 3 T-distributors.
– Pressure: max. 400 kPa (4 bar)
– Suction capacity: 20 l/min
– Reservoir capacity: 2.5 l
– Dimensions: 310 x 150 x 370 mm

Version: 230 V/50 Hz
With mains cable suitable for:
DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR,TR, IT, DK, IR, ID
Order no. **548707**

Version: 120 V/60 Hz with IEC power supply cable to NEMA 5-15
Order no. **556275**

2 **Compressor**

Oil-lubricated, extremely quiet (45 dB (A)) compressor. Ideally suited for use in classrooms. Comes with pressure regulator with gauge and water separator. Supplies up to 8 stations.
– Pressure: 800 kPa (8 bar)
– Suction capacity: 50 l/min
– Reservoir capacity: 24 l
– Compressed air outlet: ¼" or KD4

Version: 230 V/50 Hz
With power cable suitable for:
DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID
Order no. **91030**

Version: 120 V/60 Hz with IEC power socket and plug to NEMA 5-15
Order no. **565440**

Compressor accessories
(not shown)

– Coupling socket (KD3-CK-4 and KD4-1/4-A)
– Coupling plug (KS4-CK-4)
– 6 x Tubing (silver 2.5 m)
Order no. **102725**

3 **Tabletop power supply unit**

– Input voltage: 85...265 V AC (47...63 Hz)
– Output voltage: 24 V DC, short-circuit-proof
– Output current: max. 4 A
– Dimensions: 75 x 155 x 235 mm

Without power supply cable
Order no. **8049633**

With power cable, 1.3 m, suitable for:
DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID
Order no. **162417**
US, CA, Central America, BR, CO, YU, EC, KR, TW, TH, PH, JP
Order no. **162418**
GB, IE, MY, SG, UA, HK
Order no. **162419**
AU, NZ, CN, AR
Order no. **162380**
CH
Order no. **162381**
ZA, IN, PT, SG, AE, HK, (GB)
Order no. **162382**

Power supply Cable

IEC power socket and plug to NEMA 5-15.
Order no. **350362**

Power supply Cable (not shown)

One end designed as a C7 IEC power socket and one end with a country-specific plug. Type: Connector as per BS 1363 for GB, IE, MY, SG, UA, HK, AE
Order no. **8060969**

Power supply cable for Small Appliances
(not shown)

One end designed as a C7 IEC power socket and one end with a country-specific plug. Type: Connector as per AS 3112 for AU, NZ, CN, AR
Order no. **8060970**

Power supply cable
One side designed as a connector and one side with a country-specific plug.
DE, FR, NO, SE, FI, PT, ES, AT, NL, BE, GR, TR, IT, DK, IR, ID
Order no. **247661**
US, CA, MX, BZ, GT, HN, SV, NI, CR, PA, CU, PR, JM, BR, CO, EC, KR, TW, TH, PH, JP
Order no. **350362**
GB, IE, MY, SG, UA, HK
Order no. **350363**
AU, NZ, CN, AR
Order no. **350364**
CH
Order no. **350366**
ZA, IN, PT, SG, AE, HK, (GB)
Order no. **350367**

Recommended Accessories

Actuators, Sensors

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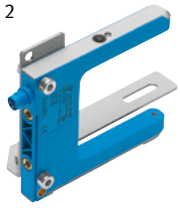

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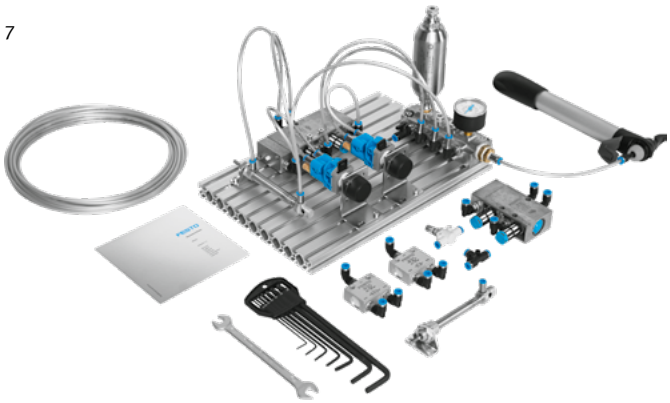

1 Double-Acting Cylinder to Complement MecLab

Double-acting cylinder, Ø 10 mm, stroke 50 mm, complete with one-way flow control valves, foot mounting and retaining screws.

Order no. **556248**

2 Light Barrier MecLab

Fork light barrier, fork width 50 mm, complete with connecting cable and mounting material.

Order no. **549791**

3 Fiber-Optic Sensor MecLab

Fiber-optic diffuse light sensor, complete with optical fibers, connecting cable and mounting material.

Order no. **549792**

4 Inductive Sensor MecLab

Inductive sensor, cylindrical design with external thread M5, switching distance 0.6 mm, complete with connecting cable and mounting material.

Order no. **549793**

5 Vacuum Grippers MecLab

Vacuum gripper kit for Handling station as replacement for mechanical gripper, complete with vacuum nozzle, suction pad Ø 20 mm and mounting material.

Order no. **549796**

6 Electrical Signal Input/Output MecLab

Electrical input and output elements for MecLab.

- 1x electric push button (normally open and normally closed)
- 1x electrical control switch
- 1x indicator light LED

Complete with mounting hardware and connecting cable.

Order no. **556249**

7 Modular System P-Starter

Beginner's set for the introduction to pneumatics, automation and logic for technology teaching in general education schools.

Scope of delivery:
- 1x double-acting cylinder
- 1x single-acting cylinder
- 1x 5/2-way valve, monostable, pneumatically actuated
- 1x 5/2-way valve, bistable, pneumatically actuated
- 2x 3/2-way pushbutton valve
- 1x And valve
- 1x Or valve
- 1x flow control valve
- 1x aluminum profile plate, one-piece
- Mounting material for cylinders and valves
- Tube
- Tool kit
- Plastic storage tray
- Detailed documentation on CD (de/en/es/fr): Collection of exercises with more than 18 exercises and solutions as well as didactic notes for use in the classroom; accompanying material with numerous colored illustrations, diagrams of principles, photos and sectional views; safety instructions; copyright included.

Order no. **8022999**

More accessories (valves, connecting cables...) and spare parts are available on our website.

Recommended Accessories
Station Extensions

1 **Press-fit unit MecLab**

Press-fit unit for attaching to the stacking magazine station or conveyor, comprising single-acting cylinder with 25 mm stoke and 10 mm diameter, complete with one-way flow control valve, mounting bracket and mounting screws.

Order no. **549805**

2 **Slide MecLab**

Slide for transporting or storing workpieces, 40 mm in diameter, for maximum 3 workpieces, mounting surface for sensors and actuators Complete with mounting accessories.

Order no. **549797**

3 **Low tray MecLab**

Support plate for retaining workpieces with 40 mm diameter and 39 mm height. Complete with fixing material.

Order no. **549798**

4 **High tray MecLab**

Holding tray for retaining workpieces 40 mm in diameter and 62 mm in height. Complete with mounting accessories.

Order no. **549799**

5 **Stopper and Deflector MecLab**

Lifting magnet for mounting on both sides of the conveyor belt, function deflector or stopper, complete with connecting cable and mounting material.

Order no. **549795**

6 **Workpieces set MecLab**

Workpiece set consisting of 6 plastic cans in silver, red and black (2 of each), diameter 40 mm, height 25 mm, and 6 lids.

Order no. **549800**

7 **Profile Plate MecLab**

Profile plate with dimensions 200 x 300 mm, 20 mm thick, groove spacing 20 mm. Complete with self-adhesive rubber feet.

Order no. **556246**

8 **Mounting Kit MecLab**

Mechanical construction parts for the expansion of MecLab. Composition of aluminum profiles 20 mm x 20 mm in lengths 120 mm and 180 mm. Complete with fixing material.

Order no. **556247**

9 **Profile panel connector MecLab**

Connector for two aluminum slotted assembly boards with 20 mm grid dimension. Complete with mounting screws.

Order no. **549802**

10 **Extension Kit MecLab**

Range of components for realizing your own project ideas. All in a practical Systainer.
– 2x double-acting cylinders with one-way flow control valves
– 2x solenoid valves
– 1x diffuse sensor
– 2x magnetic limit switches
– 1x profile kit
– 1x profile plate
– 1x electrical push button
– 1x electrical control switch
– 1x indicator light

Order no. **556245**

11 **Dolly Truck for Systainer MecLab**

Rolling board for transporting T-LOC Systainers sizes I to V. Four guide rollers, two of which have parking brakes.

Order no. **8143501**

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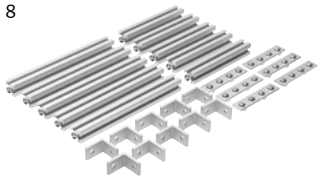

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Learning Media





Festo LX
Introduction 256
eLearning Courses 260

Digital Learning Material
Learning Material Overview 274

Festo LX

The Digital Learning Portal for Customized Learning Experiences



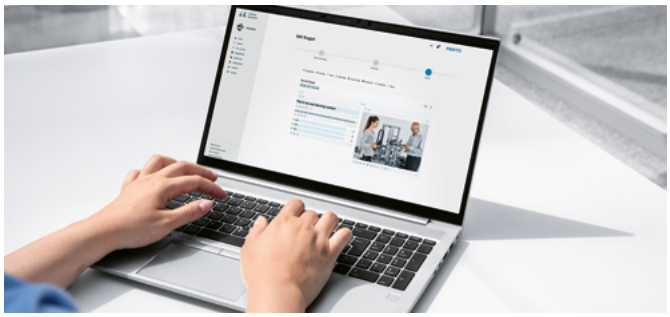
What makes Festo LX unique
With Festo LX, we have created a digital learning portal that offers a high degree of flexibility, personalization and hardware integration.

Included in Festo LX is an extensive library of course content. Different learning formats are combined to make learning as varied and interactive as possible. The existing content is created on the basis of individual learning nuggets and can thus be quickly and easily adapted to the specific needs of the learners.

Combining theory and practice is easy with Festo LX. Matching the connected learning systems, Festo LX shows suitable courses to perform practical exercises.

Individual learning with Festo LX
Festo LX offers a high degree of individualization so that learners are taught exactly the knowledge they need.

Festo LX follows the so-called nugget concept with its courses. Nuggets are small, self-contained learning contents that offer the opportunity to learn in a targeted and effective manner. Nuggets are usually designed with a combination of text, images, videos, animations, quizzes, links and other interactive elements. Several nuggets can be combined to form a specific course and thus convey content on a specific topic.



LX Creator
Thanks to our nugget concept, existing courses and learning paths can be updated quickly and easily. With the LX Creator, educators can also develop their own content using an intuitive tool supported by AI for generating texts and quizzes. The Creator ensures the same look and feel as Festo Didactic content, giving learners a consistent experience while making content creation simpler for teachers.

Learning paths
Learning paths are made up of a combination of different courses on a specific topic or professional field. They provide structures and recommendation for the ideal order in which courses should be completed. Our learning paths are based on our didactic expertise as well as on national occupational profiles and curriculum frameworks. The learning paths can be revised and created in the same way as courses using the LX Creator.



Festo LX
The advantages at a glance

– Individual and goal-oriented design of the lessons
– Flexible to use
– Supports many different teaching and learning scenarios
  – traditional or flipped classroom
  – distance learning
  – self-paced learning
  – and more
– Existing course materials can be linked with the appropriate learning systems from Festo Didactic in order to combine theory with practice and ensure a steep earning curve



– The learning content on Festo LX can be personalized using the online authoring tool LX Creator in order to meet the needs of teachers and students
– Existing learning content can be enhanced with own materials

→ **Festo LX Course Catalog (PDF)**



Course content in Festo LX
Festo LX offers a wide range of different learning contents for many areas of technical education and training. The Festo LX learning library includes more than 600 courses on factory automation, fluid power, Industrial Internet of Things (IIoT) and Industry 4.0, as well as electrical engineering, process automation, renewable energy and STEM. The learning content available on Festo LX is constantly revised and expanded to meet educational needs.



LX Tutor: an AI-based companion
The LX Tutor enhances the learning and teaching experience by supporting users through interactive, educational conversations. It answers questions related to Festo LX learning content with referenced sources and offers proactive guidance when learners struggle – for example, after incorrect quiz answers, extended learning times, or repeated access to the same material. The LX Tutor can be enabled or disabled at any time and is automatically deactivated during evaluations.



Partnerships
Together with partners, we are constantly developing and improving the content available on Festo LX. In this way, we ensure that the learning content on Festo LX meets the requirements of the industry and that learners are trained in the necessary skills.



Easy access
Festo LX is a cloud-based learning portal. This eliminates the need for local installations and gives you access to the latest updates on functionalities and learning content at all times. Festo LX is used via license packages that are tailored to the number of users and the period of use.

Festo LX

Course Formats and Subscription Options



Festo LX provides a wide variety of learning materials covering many areas of technical education and training. These areas include factory automation, fluid technology, the Industrial Internet of Things (IIoT), Industry 4.0, electrical engineering, process automation, renewable energies, STEM, and many other technical fields. Additionally, we provide technology-independent, comprehensive learning content on lean management, project management, and soft skill development.

To make lessons as effective and varied as possible, it is necessary to use different learning formats. Festo LX offers a wide range of options for presenting and conveying learning content.

eLearning courses
Our eLearning courses are interactively designed learning content, usually with a storytelling approach and with a narrator guiding through the course. These courses are particularly suitable as an introduction to new topics and provide a high-level overview. Best of all, all you need is a tablet, laptop, or smartphone with an Internet connection to complete the courses.

eLab courses
Our eLab courses offer a wide range of hardware-related learning content, taught either through the use of Festo Didactic equipment or simulation software. Our associated learning systems are required to complete the courses. Our eLab courses are designed to test previously learned theoretical knowledge with practical tasks.

eTheory courses
Our eTheory courses offer a wide range of hardware-independent learning content on technical topics. Compared to eLearning courses, they generally impart broader knowledge.

Simulations
Our simulations guide learners to perform hands-on, safe experiments that have no impact on real-world processes. The simulations provide a cost-effective learning extension, saving the need to purchase additional learning equipment.

A **Festo LX** subscription gives you full access to our extensive library of technical training content, as well as all standard functionalities of the digital portal. You can modify existing courses and learning paths or build your own custom courses and paths, and then manage the entire learning process – including assignment, delivery, and tracking – directly within the Festo LX environment.

Festo LX for Education

1-year subscription	**8219584**
3-year subscription	**8219585**
5-year subscription	**8219586**

Note: Unlimited number of users with 100 concurrent users.

Festo LX for Industry

1-year subscription (single user)	**8219587**
3-year subscription (single user)	**8246988**
5-year subscription (single user)	**8246989**

Note: The number of users can be tailored to customer requirements.

A **Festo LX Premium** subscription seamlessly and securely connects Festo LX to your learning management system (LMS). Through this LMS integration, you can use the Festo course library, modify content or build your own courses in Festo LX, and then make them available in your LMS for assignment/delivery and tracking – without disrupting your usual LMS workflows.

Festo LX for Education Premium **New**

1-year subscription, 100 users	**8251501**
1-year subscription, 500 users	**8251502**
3-year subscription, 100 users	**8251503**
3-year subscription, 500 users	**8251504**
5-year subscription, 100 users	**8251505**
5-year subscription, 500 users	**8251506**

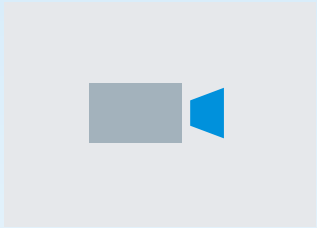
Festo LX for Industry Premium **New**

1-year subscription (single user)	**8251507**
3-year subscription (single user)	**8251508**
5-year subscription (single user)	**8251509**

Expansion option for all subscriptions

Single Sign-On (SSO) Festo LX	**8157218**

Note: Please clarify the technical requirements with your IT before placing an order for Festo LX SSO. Establishing SSO for Festo LX is a one-time service fee and does not need to be ordered again when the subscription for Festo LX will be extended.



Learning videos
In our learning videos, experts present complex topics in a simple way. In the videos, current topics within the scope of technical training are explained in an easy-to-understand and practical manner, which enables fast and effective learning.



Evaluations
Thanks to the integrated evaluations in Festo LX, knowledge tests can be automatically carried out and evaluated.



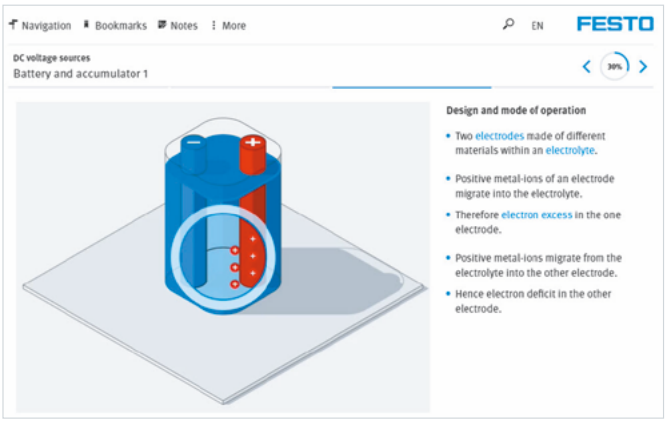
User guides
Our user guides serve as digital manuals that support getting started with a new learning system or software in an interactive and engaging way.



eBooks
We make courses that are not yet digitally optimized available as eBooks on Festo LX. We are continuously working on new interactive content.

Campus licenses are available for offline usage.
PDF or printable versions are available for selected learning materials, catering to those who prefer offline solutions or need additional resources. Campus licenses allow schools and small companies to use the licensed educational material at a single location, providing users with modification and reproduction rights as outlined in the license agreement. Delivery options (downloads, printed documents, USB keys...) and formats, as well as language variations, depend on the specific educational material.

Electrical Engineering 1



The “Electrical engineering 1” training program is one of a series of new programs in the field of electrical engineering and electronics. These programs are real-world oriented and authentically structured. Case studies from practice provide a concise illustration of the topicscovered. All training co ntent is taught by means of audio clips. Additionally, the narrative text can be viewed on the sitemap.

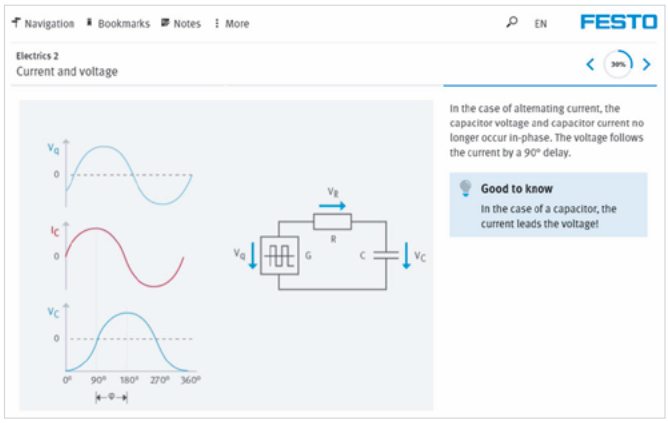
Trainees experience a regular exchange of input and output, with phases of presentation and explanation alternating with phases of activity and interaction. This enhances motivation and learning.

Various tools are built-in to the training program, such as Excel worksheets, an integrated calculator, PDF files, and various downloads. The training programs contain both a comprehensive glossary and a full text search.

From the table of contents:
– Closed circuit
– Electrical conductivity
– Units and symbols
– Ohm’s Law
– Measuring in the circuit
– Voltage supplies
– The resistor as a component
– Series connection of resistors
– Parallel connection of resistors
– Voltage divider
– The resistor as a sensor

A range of practical examples provide a reference point for real-world use:
– Battery-powered screwdriver (components and functions, voltage measurement, current measurement)
– Measuring range extension (voltage measurement, current measurement, high-voltage shunt)
– Temperature controlled heating (control diagram, switching on closed-loop controller, upper and lower switching value, controlled heating, switching value setting via potentiometer)
– Level detection (level detection with full and empty tank, test in operation)

Electrical Engineering 2



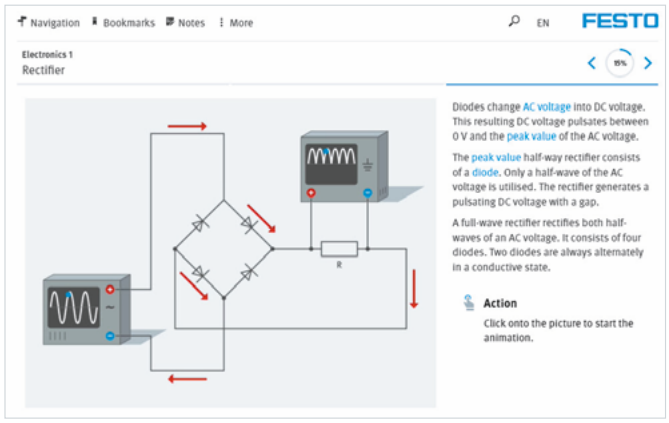
The “Electrical engineering 2” training program is one of a series of new training programs in the field of electrical engineering and electronics. These programs are real-world oriented and authentically structured. Case studies from practice provide a concise illustration of the topics covered. All training content is taught by means of audio clips. Additionally, the narrative text can be viewed on the sitemap.

Various tools are built-in to the training program, such as Excel worksheets, an integrated calculator, PDF files, and various downloads. The training programs contain both a comprehensive glossary and a full text search.

From the table of contents:
– Electric charge
– Capacitor
– A capacitor in a DC circuit
– A capacitor in an AC circuit
– Applications of the capacitor
– Variable capacitor
– Coil
– A coil in a DC circuit
– A coil in an AC circuit
– Applications of the coil
– Physical variables
– Calculating with changing values

A range of practical examples provide a reference point for real-world use:
– Light switch-off delay
– Electrical behaviour of a grinder (work, performance, efficiency)
– Power generation and transmission (generator 6 kV/10 kV, transformer 110 kV)

Electronics 1



The “Electronics 1” training program is one of a series of new programs in the field of electrical engineering and electronics. These programs are real-world oriented and authentically structured. Case studies from practice provide a concise illustration of the topics covered. All training content is taught by means of audio clips. Additionally, the narrative text can be viewed on the sitemap.

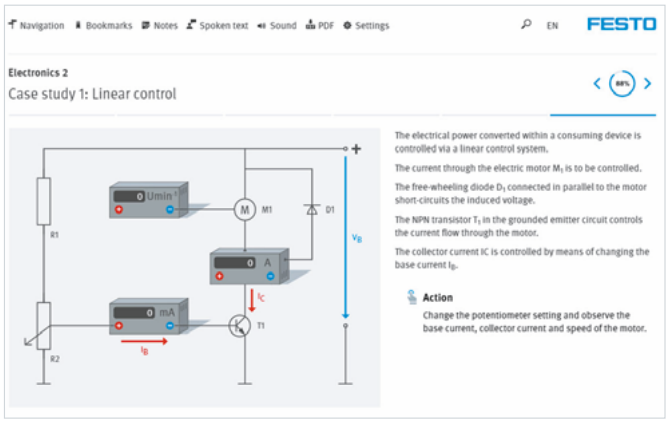
Trainees experience a regular exchange of input and output, with phases of presentation and explanation alternating with phases of activity and interaction. This enhances motivation and learning.

Various tools are built-in to the training program, such as Excel worksheets, an integrated calculator, PDF files, and various downloads. The training programs contain both a comprehensive glossary and a full text search.

From the table of contents:
– Semiconductor technology
– Diodes
– Bipolar transistors
– Field-effect transistors

A range of practical examples provide a reference point for real-world use:
– Regulated power supply (transformer, rectifier, smoothing, voltage regulation by Zener diode, transistor amplifier, current limitation)
– Audio amplifier (components, FET preamplifier with volume controller, power end stage, loudspeaker with/without frequency shunt)
– Audio amplifier with sound control (preamplifier, power amplifier, low-pass, high-pass)

Electronics 2



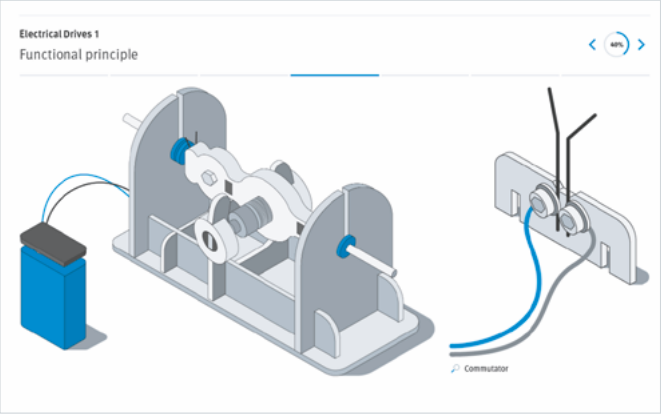
The “Electronics 2” training program is one of a series of new programs in the field of electrical engineering and electronics. These programs are real-world oriented and authentically structured. Real case studies provide a concise illustration of the topics covered. All training content is taught using audio clips. Additionally, the narrative text can be viewed on the sitemap.

Various tools are built-in to the training program, such as Excel worksheets, an integrated calculator, PDF files, and various downloads. The training programs contain both a comprehensive glossary and a full text search.

From the table of contents:
– Signal types
– Integrated circuits
– Operational amplifier (OpAmp)
– AC voltage of various frequencies
– Characteristic values of amplifying circuits
– Circuit technology of amplifiers
– Filters
– Bistable flip-flop
– Single flip-flop
– Sine wave generator
– Rectangle generator

A range of practical examples provide a reference point for real-world use:
– Thyristor-controlled drilling machine
– Brightness control using a triac
– Adjusting the speed of an electric screwdriver (linear, synchronous)

Electric Drives 1

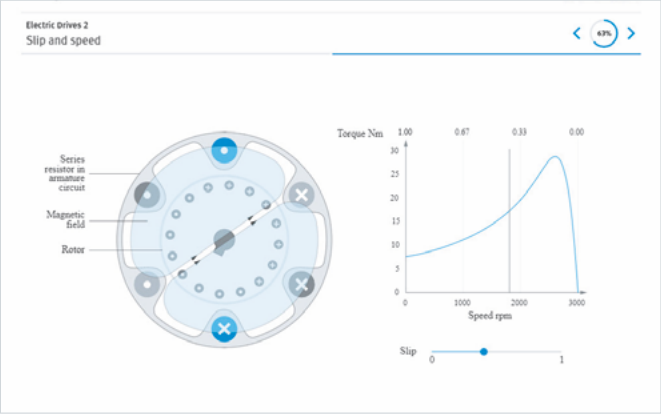


The “Electric drives 1” interactive multimedia training program provides an engaging introduction to the world of electric motors.

The first section sets out the basic principles of electric drives. The second section illustrates the construction and functioning of DC motors, while the third section deals with the special features of AC motors.

From the table of contents:
– Basic principles of electric drives
– Familiarization with different motor types (stepper motor, asynchronous motor, universal motor)
– Mechanical principles (conversion of mechanical/electrical energy, motor - generator, circuit diagram and current direction, transmission variables (force, mechanical power, efficiency etc.), definitions of torque and speed)
– Electronic principles (basic principle of the motor, Lorentz force using the example of a conduction loop, electrical and magnetic fields, occurrence of torque, right-hand rule)
– Familiarization with different DC motors
– General (functional principles, commutation, technical data, brushless DC motor, load dependency, difference between series and parallel connection)
– Parallel connection behaviour
– AC motors
– Difference in power supply (DC, AC, three-phase AC)
– Familiarization with different AC motors
– General functional principle (difference between synchronous and asynchronous motor), technical data, rating plate, characteristic curves and their interpretation, definition of reactive, apparent, and effective power)
– Single-phase AC motor
– Three-phase AC motor
– Stepper motors
– Summary and review exercises

Electric Drives 2



The training program “Electric drives 2” further explores the material covered in “Electric drives 1” and also includes new topic areas.

This training program is suitable for beginners and advanced students. The first two chapters address the topic of controlling DC and AC motors. The third chapter focuses on the energy efficiency of electric drives, looking at economic and environmental aspects.

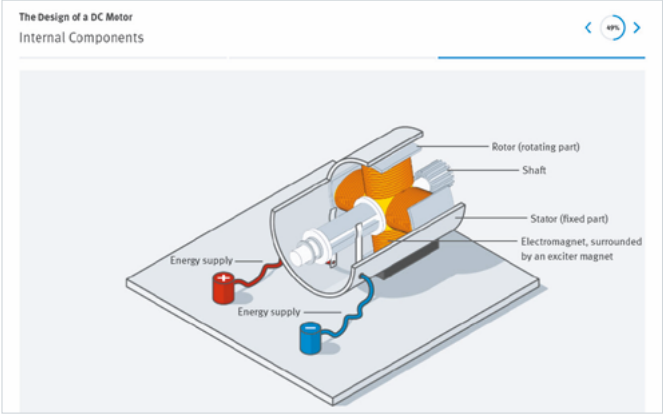
From the table of contents:

Controlling DC motors
– Armature reaction
– Speed control
– Four-quadrant operation

Controlling AC motors
– Motor characteristic curve
– Open-loop and closed-loop speed control
– Frequency converters
– Smooth start-up

Energy efficiency
– Economic aspects
– Degree of efficiency
– Minimizing losses
– Reliability
– Energy efficiency measures
– Environmental aspects
– Merits of electric motors

Actuators – DC Motor

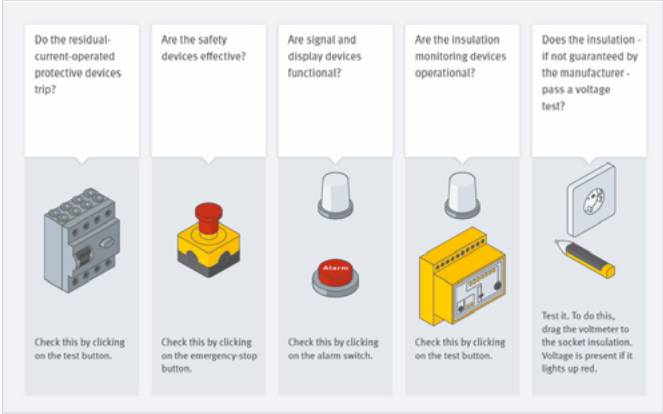


Using the everyday example of a car park access control system, the trainee learns the basics of a mechatronic system.

Building on this, the training program determines what function the actuators have in the controller. A DC motor is then studied in more detail as an example of a typical actuator, e.g., its structure and the laws which govern its operation. Further chapters cover speed control and the use of data sheets, as well as the transmission ratios which can be achieved by using a gearbox.

From the table of contents:
– The function of actuators in mechatronic systems
– Electric motors
– DC motor
– Torque and current
– Behavior of DC motors
– Induced voltage and speed control
– Characteristic torque/speed curve
– Working with data sheets
– Determining the transmission ratio

Electrical Protective Measures



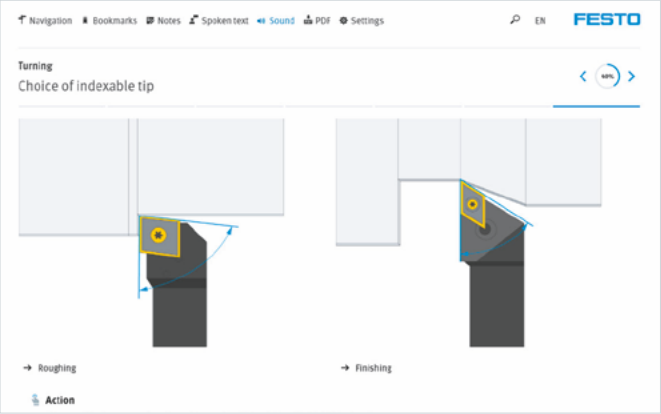
This interactive multimedia training program provides an introduction to the complex topic of protective measures. It explains what electrical protective measures are and how they are classified. Trainees will also become familiar with all the legal regulations in this area.

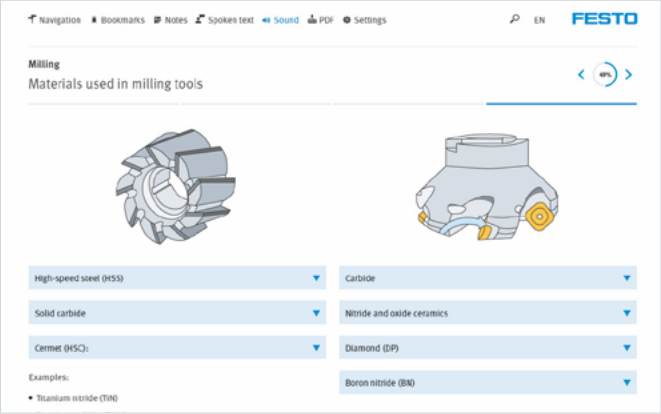
The measures that are effective in preventing direct and indirect contact are outlined using various specific examples and functional principles.

Finally, there is an explanation of how protective measures are tested and what actions should be taken in case of an accident involving electricity.

From the table of contents:
– The dangers of electricity
– Humans and electricity
– Electric shock hazards
– What are electrical protective measures and how are they classified?
– Protection levels
– Protective measures, protection classes
– Differences between DIN standards, VDE regulations and DIN-VDE standards, statutory requirements, and legal consequences.
– Definition and overview of protective measures to prevent direct contact
– Protection by insulating active components
– Protection by covering or cladding
– Protection by barriers
– Protection by distance
– Definition and overview of protective measures to prevent indirect contact
– Production by disconnecting power supply
– Mains systems (TN, TT, IT systems)
– Protection by disconnection
– Testing protective measures
– Measurement and measuring devices
– Safety and assistance
– Summary and questions to check understanding

Basic Principles of Metalworking





Whether in machine manufacturing, toolmaking or vehicle production, metalworking is an essential element in trades and industry. The “Basic principles of metalworking” series covers the basic principles of machining with geometrically defined cutting edges. Machining methods are so important because of their high accuracy and geometrically almost unlimited processing possibilities.

Turning
Turning is a cutting production method for manufacturing rotationally symmetrical workpieces. During the turning process, the workpiece performs the main rotary cutting motion and the single-edged tool, the lathe tool, performs the advancing motion. Both motions bring about continuous chip removal.

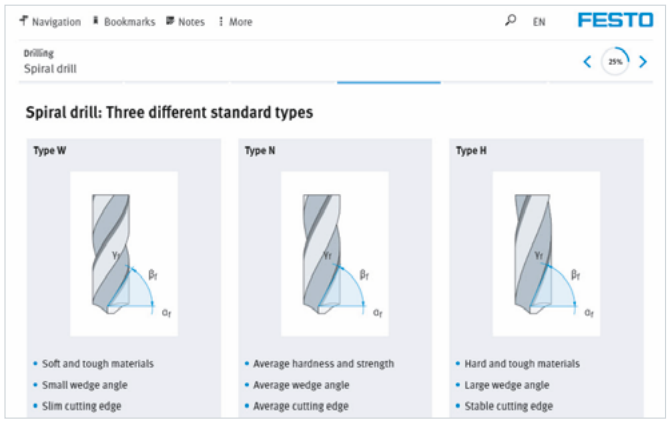
In the “Turning” training program of the “Basic principles of metalworking” series, you will acquire basic knowledge of turning.

From the table of contents:
– How does a lathe work?
– Selecting the tool
– Clamping the workpieces
– Turning

Milling
Milling is a machining method for processing metal, wood, and plastics. In the milling process, a milling tool produces flat surfaces and contours. An uninterrupted cut is characteristic of milling. Chips are removed by the rotation of the multi-blade milling tool relative to the rigidly clamped workpiece.

In the “Milling” training program of the “Basic principles of metalworking” series, you will acquire basic knowledge of milling.

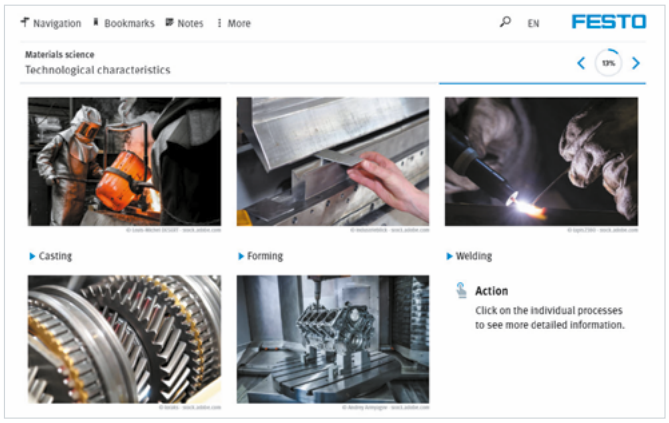
From the table of contents:
– How does a milling machine work?
– Selecting the tool
– Clamping the workpieces
– Milling



Drilling
Drilling is a machining method for producing round holes. A chip-removing cutting motion is produced by the circular cutting motion and the straight-line feed motion of the tool.

In the “Drilling” training program of the “Basic principles of metal-working” series, you will acquire basic knowledge of drilling.

From the table of contents:
– What is drilling?
– Selecting the tool
– Drilling
– Counterboring
– Reaming

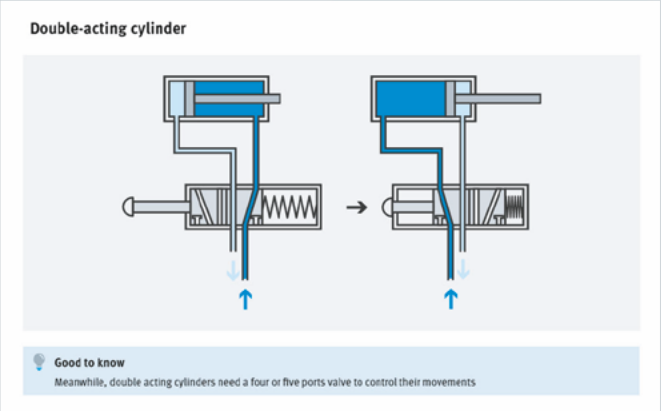


Materials science
Materials are needed to produce machines, tools, and devices. Knowledge of material properties is important in selecting suitable materials.

In the “Materials science” training program of the “Basic principles of metalworking” series, you will acquire basic knowledge of materials.

From the table of contents:
– An overview of materials
– Material properties
– Types of materials
– Testing of materials

Pneumatics



Nowadays, it is hard to imagine industrial production without pneumatics.
But how does pneumatics actually work and which important basic principles are needed to use it efficiently and safely?

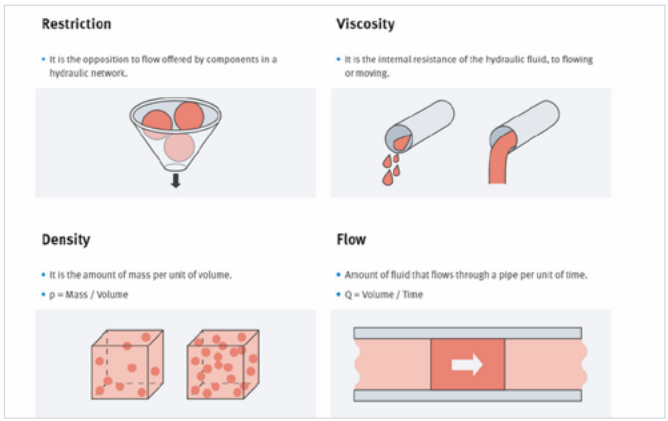
Discover the basics of pneumatics in our modular and interactive eLearning course. The fundamental principles are explained using practical examples and evaluated using various reflection questions.

The eLearning course is divided into five modules:

– Module 1: Pneumatic fundamentals
– Module 2: Pneumatic air treatment
– Module 3: Pneumatic actuators
– Module 4: Pneumatic valves
– Module 5: Pneumatic circuits

Training content:
– Fundamentals (definition of pneumatics, what is the air, advantages and disadvantages)
– Physical principles (system of units, characteristics, laws)
– Power supply (air quality requirements, compressed air generation, pressure distribution and compressed air preparation
– Drive components (types of motion, areas of application, linear and rotary drives)
– Directional control valves (representation according to ISO 1219-1, ports identification according to ISO 5599, actuation types, internal construction)
– Shut-off valves (check valves, processing valves, quick exhaust valves, shut-off valves)
– Flow control valves (throttle valves, one-way flow control valves, applications)
– Pressure valves (pressure regulator, pressure relief valves, pressure sequence valves)
– Special combined valves (e.g. pneumatic timer)
– Circuit diagram (basic structure of a pneumatic circuit, direct and indirect control, combinational logic circuits, sequential logic circuits; speed, time and pressure control)
– Circuits design tools (displacement-step diagram, displacement-time diagram, GRAFCET)

Hydraulics



Hydraulic components can be found in many applications in industrial practice – from traditional manu facturing processes to heavy duty machines and cranes.

But how does a hydraulic system work? What needs to be taken into account when it comes to the power supply? And which components can be used to build a hydraulic system?

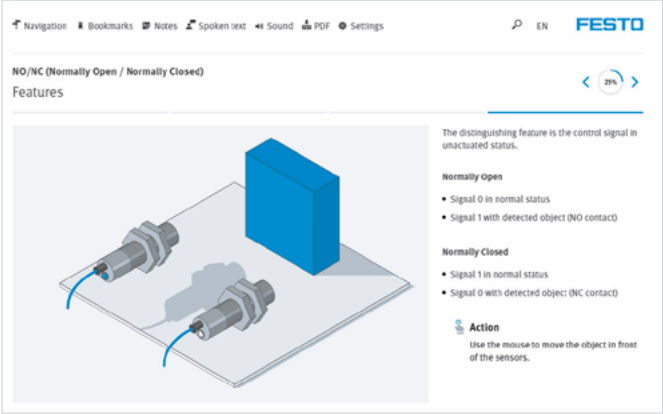
Discover the basics of hydraulics in our modular and interactive eLearning course. The fundamental principles are explained using practical examples and evaluated using various reflection questions.

The eLearning course is divided into five modules:

– Module 1: Hydraulic fundamentals
– Module 2: Hydraulic Power Pack
– Module 3: Hydraulic actuators
– Module 4: Hydraulic valves
– Module 5: Basic hydraulic circuits

Training content:
– Fundamentals (what is hydraulics, typical applications, advantages and disadvantages)
– Hydraulic systems (principles of a hydraulic system and its fluids)
– Physical principles (system of units, characteristics, laws)
– The components of the hydraulic power unit, how they work and how they interact with each other (drives, pumps, tanks, filters)
– Different hydraulic drive components and their principles (linear and rotary drives including single-acting cylinders, double-acting cylinders and hydraulic motors)
– Different types of hydraulic valves and their functionality
– Directional valves (design characteristics, 2/2 directional valves, 3/2 directional valves, 4/2 directional valves, 4/3 directional valves)
– Shut-off valves (non-return valves, pilot operated non-return valves)
– Pressure control valves (pressure relief valves, pressure regulation valves)
– Flow control valves (throttle valves, flow control valves)
– Circuit diagrams (basic structure of a hydraulic circuit, direct control, combined logic circuits, sequential logic circuits, speed, and pressure control)
– Tools for creating hydraulic circuits (displacement-step diagram, displacement-time diagram, GRAFCET)

Sensor Technology 1 – Sensors in Pneumatics

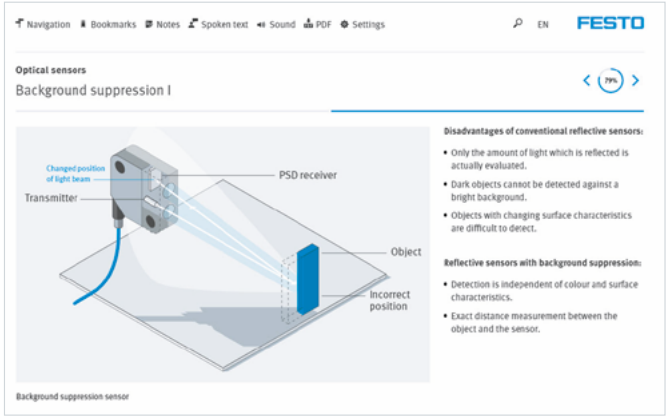


This training program deals in detail with the sensors used to detect end position on cylinders and with pressure and flow sensors in pneumatic systems. Based on a complex example from industrial practice, trainees are taught to select suitable sensors. The necessary basic knowledge for this is provided in the Technical Knowledge and Components modules, to which they can refer at any time.

All training content is taught by means of audio clips. Additionally, the narrative text can be viewed.

From the table of contents:
– Project: Selection of sensors in one of the clamping units of a processing centre
– Advantages and disadvantages of various end position sensors on cylinders
– Simple displacement encoders on cylinders
– Use of pressure sensors to improve safety in pneumatic systems
– Use of flow sensors to safeguard system cycle times
– Output signals from sensors
– Connection technology
– NO/NC (Normally Open, Normally Closed)
– Switching functions
– Sensors for end position detection: Pneumatic and mechanical limit switch, reed switch, transistor switch, Hall sensor, position sensor
– Types of pressure measurement
– Sensors for pressure measurement: Mechanical pressure switch, electronic pressure sensor,
– Sensors for flow measurement: Volumetric flow meter, effective pressure principle, ultrasonic flow meter, mass flow meter, heat-loss method

Sensor Technology 2 – Sensors for Object Detection

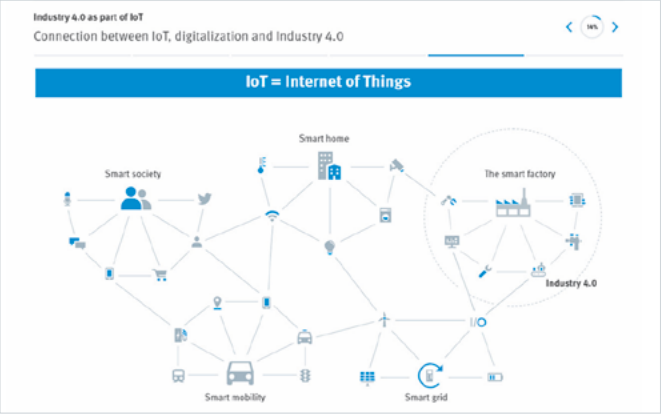


This training program deals in detail with the sensors used to detect objects in automated systems. Based on a complex example from industrial practice, trainees are taught to select the suitable sensors. The necessary basic knowledge for this is provided in the Technical Knowledge and Components modules, to which they can refer at any time.

All training content is taught by means of audio clips. Additionally, the narrative text can be viewed.

From the table of contents:
– Project: Selection of sensors in a milk bottling plant
– Object detection in industrial practice
– Switching characteristics of proximity sensors
– Hysteresis
– Connection technology: Two-wire technology, three-wire technology, four-wire technology
– NO/NC (Normally Open, Normally Closed)
– Inductive sensors: Construction and mode of operation, factor-1 sensors, special designs, flush fitting sensors, application examples
– Optical sensors: Diffuse sensor, through-beam sensor, retro-reflective sensor, background fade-out, fibre optic cable, light types, reflection types, adjustment, contrast sensor, colour sensor
– Capacitive sensors: Construction, mode of operation, usage and examples
– Ultrasonic sensors: Construction, mode of operation, applications

Introduction to Industry 4.0

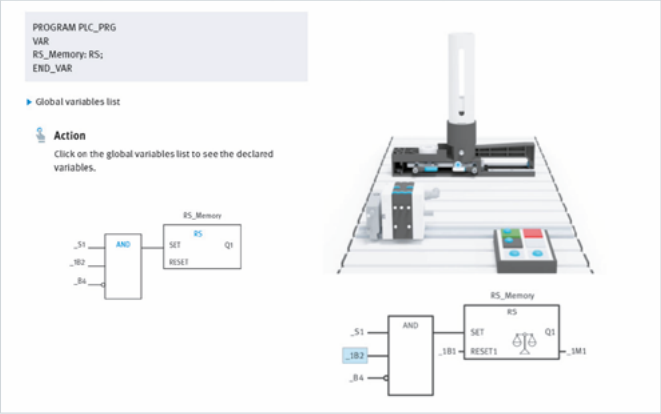


Industry 4.0 and Digitalization is an increasingly trending topic in the industrial environment but also our private lives. What are the major technologies and benefits of the fourth industrial revolution and how does this affect employees and job roles?

In this eLearning course, you will find answers to these questions in an interactive and engaging way. Practical examples and reflection questions help you to put the learned knowledge into practice.

From the table of contents:
– From Industry 1.0 to 4.0 (major inventions in the four industrial revolutions and key factors that enabled Industry 4.0)
– Difference between Digitalization/ IoT and Industry 4.0
– Core Technologies of Industry 4.0 (e.g. Big Data, Digital Twin, Smart Maintenance, RFID, Machine-to-Machine Communication and many more)
– Digitalization in private life and our benefits
– Changing job profiles require new competencies

PLC Programming in accordance with IEC 61131



Programmable logic controllers (PLCs) are used to control machines and systems, and play a central role in automation.

The program of a programmable logic controller can be flexibly adapted for any task. Various programming languages, which are all based on the IEC 61131 international standard, are available for creating the control program in compliance with standards.

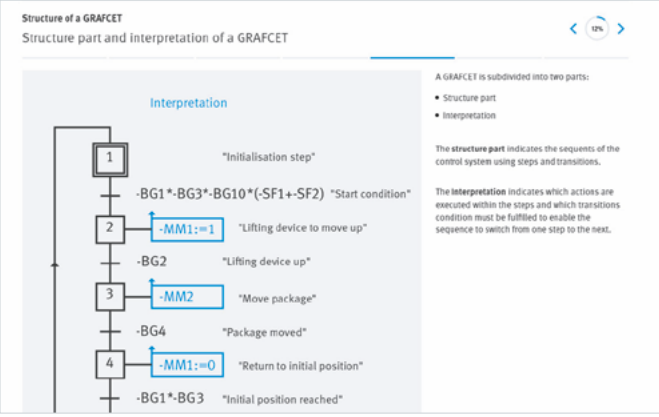
This training program enables users to understand with function charts, ladder diagrams, instruction lists, sequential function charts, and structured texts in five programming languages, which are presented step-by-step through the use of practice exercises.

From the table of contents:
– Programmable logic controllers
– Project organization
– Programming languages in accordance with IEC 61131
– Link-oriented programming languages
– Sequential function chart
– Structured text
– Sequence programming project

The training program provides beginners with an ideal introduction to IEC-compliant programming.

In addition to trainees, pupils and students, this training program is also useful for skilled workers, technicians, and engineers who have previously only programmed in IL, LDR, or FCH. The higher-level, IEC-compliant languages offer numerous advantages over the others.

GRAFCET



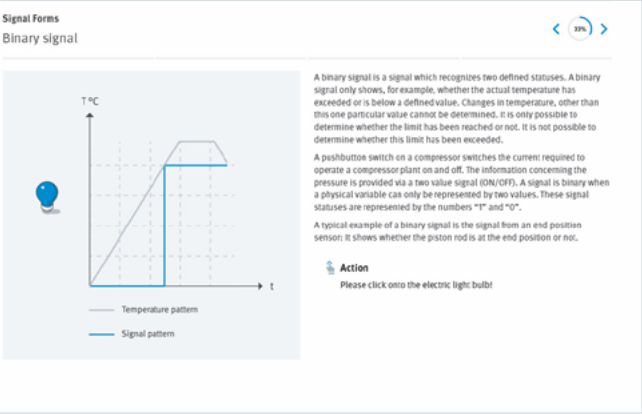
GRAFCET – The new specification language for sequential function charts

Good documentation is a prerequisite for the quick construction and smooth commissioning of a system. As a result, products reach customers more quickly. Furthermore, the sequence description is an important tool for quickly and accurately locating and eliminating errors, and thus reduces production downtimes. GRAFCET can describe what the function chart has previously been unable to represent.

It introduces the new standard step-by-step, with the aid of practice exercises.

From the table of contents:
- Definitions
- Advantages of GRAFCET
- Differentiation from PLC programming language
- Configuring a GRAFCET
- Graphical representation of the language elements
- Graphical representation of the sequential structures
- Structuring of GRAFCETs
- Case studies
- Exercises
- Glossary

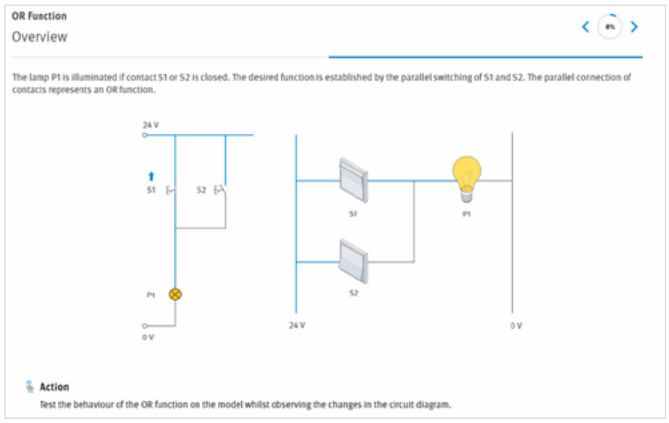
Open- and Closed-Loop Control



This training program uses practical examples to show the difference between open- and closed-loop control in automation. Easy-to-understand tasks are used first to examine the overall process of a simple functioning system. Later sections then look at different types of controllers, the different ways in which signals are represented and processed, and the ways in which programs are implemented.

From the table of contents:
- Differences between open- and closed-loop control (characteristics of controllers, characteristics of regulators
- DIN 19226
- Signal types
- Differences between types of control
- Signal processing (synchronous control, controlling links, asynchronous control, process control)
- Types of control (regulating to fixed values, tracking values)
- Regulators (P, I, and D controllers, combined controllers such as PI or PID controllers)

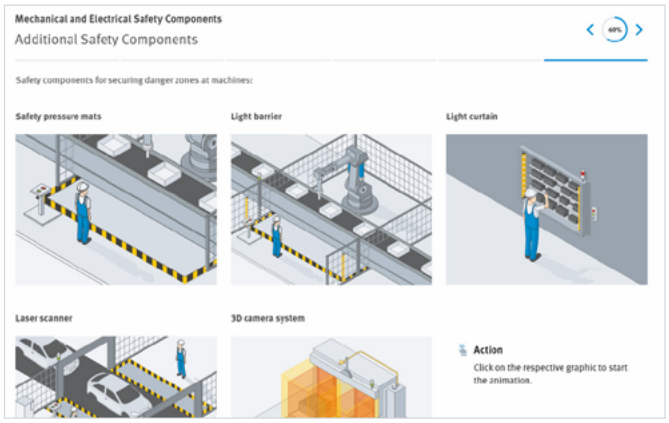
LOGO! Training



The LOGO! training program provides an introduction to logic functions, beginning with AND & OR functions and processes, which are shown in function tables. These are followed by other basic control functions, such as memory, timer, and counter functions. The next part of the course begins by covering the basics of open- and closed-loop control circuits and exploring the elements of a controller. Finally concluding with a detailed focus on the features and applications of mini-controllers.

From the table of contents:
– Basic technical functions (AND & OR function, memory function, timer function, counter function)
– Digital minicontrollers (differentiation between open- and closed-loop control)
– Control components
– Positioning with digital minicontrollers
– Design and function of a minicontroller
– Cyclical program processing
– Areas of application
– Programming languages

Safety Engineering



This training program provides an introduction to the complex subject of safety engineering in industrial machines and systems.

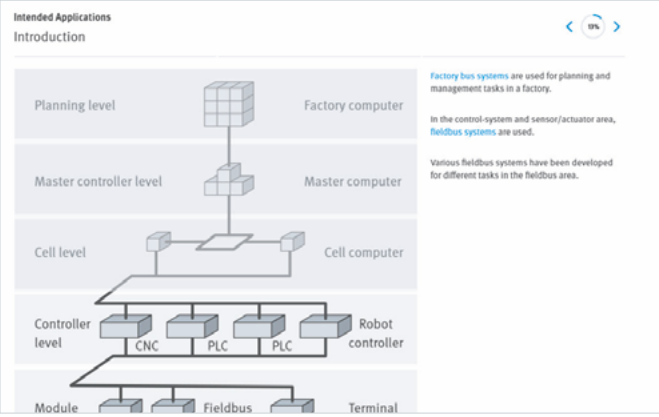
The aim is to make participants more aware of the problems in the design aspects of safety engineering and help them understand safety engineering equipment and hazard analysis methods.

The training program is based on an amended version of the EC machinery directive 2006/42/EC.

How is the overall performance level of a technical safety measure determined? The training program explains concepts such as probability of failure (POF), diagnostic coverage (DC), common cause failure (CCF), redundancy, and diversity. A detailed explanation of all the components for safety equipment is also provided.

From the table of contents:
– Introduction to machine safety
– The question of liability (who is liable in the case of an accident?)
– European directives
– The relationship between directives and standards
– The new EU machinery directive 2006/42/EC
– The hierarchy of the European standards for machine safety
– Machine safety in the USA
– Risk assessment procedure according to EN ISO 14121 and EN ISO 12100
– Definitions
– Risk evaluation: determining the required performance level
– Risk reduction measurements: design measures, technical safety measures, instructional measures
– Selecting the safety function
– Determining the control category

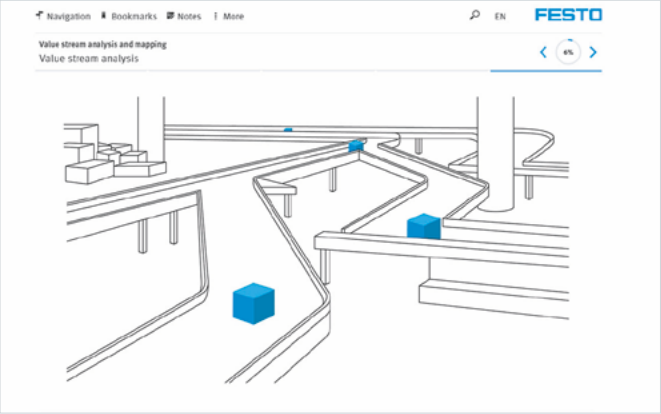
Fieldbus Technology



The multimedia and interactive training program covers the basics of Fieldbus technology and is suitable for beginners who would like an overview of the subject. Animations are used to illustrate various practical examples. All relevant terms on the subject of bus technology can be found in the integrated dictionary.

From the table of contents:
- Advantages of Fieldbus systems
- The design of Fieldbus systems (different areas of application, open and closed technical concepts, such as message-oriented bus systems, user-oriented bus systems, multi-master concepts, database concepts, installation concepts)
- RS 485/RS 422 (introduction, cabling, function)
- Topology (introduction, line, ring, tree)

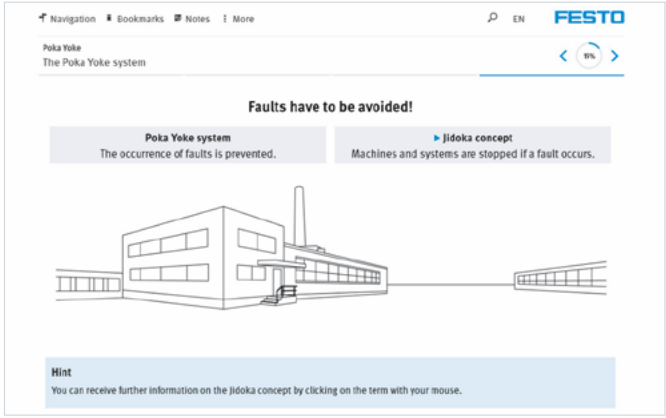
Lean Management/Lean Production



Value stream analysis and mapping
Those who deal with value stream analysis and value stream mapping have one goal: to create production and production processes that achieve a true value stream.

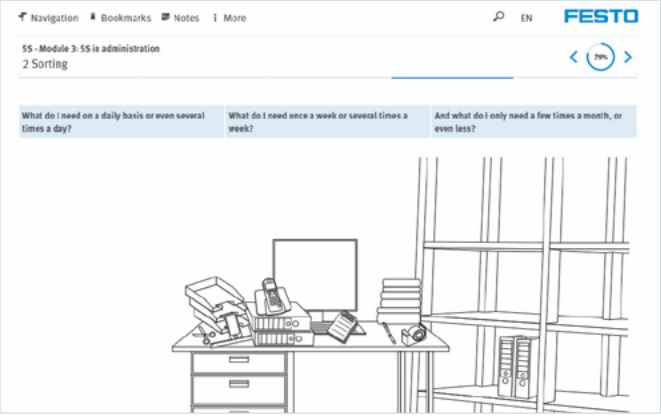
The purpose of value stream analysis is to make all the processes (from the initial request through to the delivery of the product) transparent. This can quickly highlight a significant potential for effective reshaping of processes.

From the table of contents:
– Improving the value stream
– Added value and value stream
– Value stream analysis
– Use of value stream analysis and value stream mapping
– Working with value stream mapping methods
– Overview of the ACTUAL situation
– Example: The Cycle Accessories GmbH & Co. KG
– Value stream mapping
– The seven types of waste
– The situation as it SHOULD be
– Tasks and exercises



Poka Yoke
Nowadays, Poka Yoke measures are an established part of quality assurance. Poka Yoke is a well-known principle, which originated in Japan. In Japanese, Poka Yoke means avoiding unintentional human error. Poka Yoke describes a principle that includes technical measures/equipment for preventing errors and eliminating them immediately.

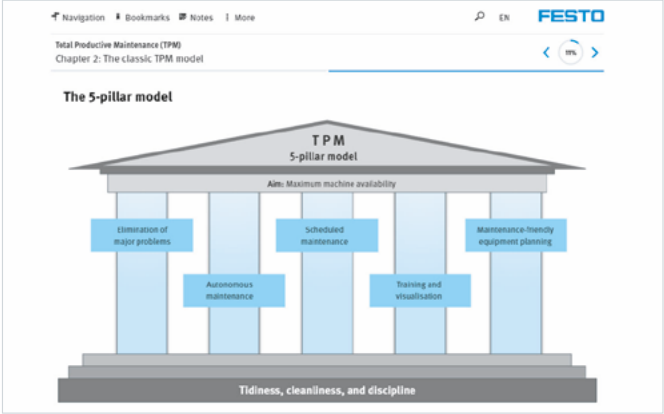
From the table of contents:
– The story of Poka Yoke
– Inclusion of the seven types of waste
– The Poka Yoke system
– Typical examples of human error
– Basic elements of Poka Yoke
– Error-oriented approach
– Process-oriented approach
– Production-oriented approach
– Case studies
– Tasks and exercises



5S – Workstation organization
The objective of the 5S training program is to become familiar with methods for creating ideal, exemplary, well-organized workstations (both in industrial and administrative areas), where work can be carried out without unnecessary searching, long transport distances, and waiting times (i.e., waste-free).

The basic principle of every high-quality product or service is a clean and orderly working environment. Quality, as a basic customer need, has the highest priority at such value-added locations, and therefore contributes to securing the order.

From the table of contents:
– General basic principles
– The 5S model
– The seven types of waste
– Visualization in 5S
– The 5S audit and its application
– 5S in production
– 5S in administration
– 5S workshop procedure



TPM – Total Productive Maintenance
It is always better to act than to react. Bearing this in mind, many businesses strive to stabilize plant performance, and to introduce preventive maintenance. The term TPM stands for “Total Productive Maintenance.”

The following results were achieved in industry processes thanks to the implementation of this method: a 40% increase in operating times, a 10% increase in machine speed, a 95% reduction in the number of unexpected machine downtimes, a 90% reduction in the error rate as well as an increase in productivity of up to 50% and an increase of almost 200% in ROI. However, in spite of the concept being very simple, many companies fail at the implementation stage. TPM requires meticulous planning as well as interlinking with other methods of the value added system; it should also be targeted at the specific conditions of employees and machines. 20% of TPM is therefore a technical challenge, while 80% of it is an organisational challenge.

This training program explores what TPM is and how to implement this model in practice.

Learning Material Overview





Modular Production System (MPS)

eLearning and eTheory Courses

● Suitable for the Learning System
○ Independent of the Learning System

						MPS 400 Systems and System Modules							
						MPS 402-1/MPS 402-1 R (8160307 | 8160309 | 8160308)	**MPS 403-1/MPS 403-1 R** (8130882 | 8160311 | 8160310)	**MPS 404-1/MPS 404-1 R** (8150260 | 8160313 | 8160312)	**MPS 400 distributing Pro** (8129394)	**MPS 400 measuring Pro** (8137077)	**MPS 400 joining** (8129125)	**MPS 400 sorting inline** (8129438)	**Robotino 4** (8159799 | 8159801)
		DE	**EN**	**ES**	**FR**								
Sensors for Object Sensing	LX	x	x	x	x	○	○	○	○	○	○	○	○
Electric Drives 1	LX	x	x	x	x	○	○	○	○				
Actuators – DC Motor	LX	x	x	x	x	○	○	○	○				
Pneumatic Fundamentals	LX	x	x	x	x	○	○	○	○	○	○	○	
PLC Programming	LX	x	x	x	x	○	○	○	○	○	○	○	
Safety Technology	LX	x	x	x	x	○	○	○	○	○	○	○	
Process Automation	LX	x	x	x	x	○	○	○	○	○	○	○	
Introduction to Industry 4.0	LX	x	x	x	x	○	○	○	○	○	○	○	○
GRAFCET	LX	x	x	x	x	○	○	○	○	○	○	○	
		DE	**EN**	**ES**	**FR**								
Introduction to Robotics	LX	x	x	x	x	○	○	○					○
CIROS – First Steps	LX	x	x	x	x	○	○	○	○	○	○	○	○
Introduction to RFID Technology	LX	x	x	x	x	○	○	○	○	○	○	○	
From Maintenance to Smart Maintenance	LX	x	x	x	x	○	○	○	○	○	○	○	
Introduction to Collaborative Robotics (HRC)	LX	x	x	x	x	○	○	○					○

MPS Generation D									MPS Modules								Robotics
Distributing station D (8034566)	**Sorting station D** (8046325)	**Pick&Place station D** (8034567)	**Measuring station D** (8038623)	**Separating station D** (8038802)	**Joining station D** (8063910)	**Packaging station D** (8062644)	**Storing station v2 D** (8082795)	**Robot station with MPS modules D** (8039313)	**Conveyor module** (different variants possible)	**Stack magazine module** (different variants possible)	**Pick&Place module** (different variants possible)	**Two-axis handling module with stepper motor** (8049257)	**Packaging module** (8043505)	**Rotary/lifting module** (8035936)	**Detection module** (8044527)	**RFID module** (8063388)	**Robotino 4** (8101344)
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Modular Production System (MPS)

eLab Courses

● Suitable for the Learning System
○ Independent of the Learning System
\+ Additional hardware required

		DE	EN	ES	FR	MPS 400 Systems and System Modules							
						MPS 402-1/MPS 402-1 R (8160307 | 8160309 | 8160308)	**MPS 403-1/MPS 403-1 R** (8130882 | 8160311 | 8160310)	**MPS 404-1/MPS 404-1 R** (8150260 | 8160313 | 8160312)	**MPS 400 distributing Pro** (8129394)	**MPS 400 measuring Pro** (8137077)	**MPS 400 joining** (8129125)	**MPS 400 sorting inline** (8129438)	**Robotino 4** (8159799 | 8159801)
Basics of Sensors and Actuators	LX	x	x	x	x	●	●	●	●				
From Object Identification to Product Memory with RFID	LX	x	x	x	x	●	●	●	●				
Plant Visualization with HMI	LX	x	x	x	x	●	●	●	●				
Smart Sensors for Smart Systems	LX	x	x	x	x	●	●	●	●				
Basics of Pneumatics	LX	x	x	x	x	●	●	●			●		
Basics of PLC Programming	LX	x	x	x	x	●	●	●				●	
PLC Programming for Smart Systems	LX	x	x	x	x	●	●	●				●	
Industrial Communication with PROFINET	LX	x	x	x	x		●	●					
Industrial Communication with OPC-UA +	LX	x	x	x	x		●	●					
Plant Control and Commissioning with MES	LX	x	x	x	x		●	●					
Energy Efficiency in Production +	LX	x	x	x	x		●	●					
IT-Security for Production System +	LX	x	x	x	x		●	●					
Autonomous Mobile Robotics with Robotino 4	LX	x	x	x	x	●	●	●					●
Basics of RFID Technology	LX	x	x	x	x								
CIROS – Basics of 3D Simulation	LX	x	x	x	x	●	●	●	●	●	●	●	●

MPS Generation D								
Distributing station D (8034566)	**Sorting station D** (8046325)	**Pick&Place station D** (8034567)	**Measuring station D** (8038623)	**Separating station D** (8038802)	**Joining station D** (8063910)	**Packaging station D** (8062644)	**Storing station v2 D** (8082795)	**Robot station with MPS modules D** (8039313)
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MPS Modules								
Conveyor module (different variants possible)	**Stack magazine module** (different variants possible)	**Pick&Place module** (different variants possible)	**Two-axis handling module with stepper motor** (8049257)	**Packaging module** (8043505)	**Rotary/lifting module** (8035936)	**Detection module** (8044527)	**RFID module** (8063388)
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						○	
							●

Robotics
Robotino 4 (8101344)
●
●

Modular Production System (MPS)

eBooks (LX) and Workbooks (Print)

Campus license
The standard option for commercial (professional) use.
For all those wishing to use the training materials at a single location.

Teaching material (workbook with data medium/download)
– No data protection
– Document can be modified
– Commercial/educational organisations (single location)

● Suitable for the Learning System
+ Additional hardware required

						MPS 400 Systems and System Modules								
						MPS 402-1/MPS 402-1 R (8160307 | 8160309 | 8160308)	**MPS 403-1/MPS 403-1 R** (8130882 | 8160311 | 8160310)	**MPS 404-1/MPS 404-1 R** (8150260 | 8160313 | 8160312)	**MPS 400 distributing Pro** (8129394)	**MPS 400 measuring Pro** (8137077)	**MPS 400 joining** (8129125)	**MPS 400 sorting inline** (8129438)	**Robotino 4** (8159799 | 8159801)
		DE	**EN**	**ES**	**FR**								
Machine Safety +	LX print	x 8125496	x 8136251	x 8136250	x 8136251	●	●	●			●		
MPS Distributing station D	LX print	x 8087661	x 8092173	x 8092176	x 8092175								
MPS Joining station D	LX print	x 8085846	x 8097023	x 8099293	x 8099294								
MPS Sorting station D	LX print	x 8072675	x 8082438	x 8094277	x 8094359								
MPS Pick&Place station D	LX print	x 8072676	x 8082439	x 8094276	x 8094358								
Handling with Industrial Robots	LX print	x 8046573	x 8046575	x 8094260	x 8094352								
PLC Programming Basic (Conveyor module)	LX print	x 8046578	x 8046580	x 8094273	x 8094355								
PLC Programming Advanced (Conveyor module)	LX print	x 8063315	x 8094360	x 8094272	x 8094354								
PLC Programming Basic (Pick&Place module)	LX print	x 8063320	x 8094362	x 8094357	x 8094275								
PLC Programming Advanced (Pick&Place module)	LX print	x 8063325	x 8094361	x 8094274	x 8094356								
EuroSkills Graz 2021 – Skill 04 Mechatronics	LX print		x										

MPS Generation D									MPS Modules									Robotics
Distributing station D (8034566)	**Sorting station D** (8046325)	**Pick&Place station D** (8034567)	**Measuring station D** (8038623)	**Separating station D** (8038802)	**Joining station D** (8063910)	**Packaging station D** (8062644)	**Storing station v2 D** (8082795)	**Robot station with MPS modules D** (8039313)	**Conveyor module** (different variants possible)	**Stack magazine module** (different variants possible)	**Pick&Place module** (different variants possible)	**Two-axis handling module with stepper motor** (8049257)	**Packaging module** (8043505)	**Rotary/lifting module** (8035936)	**Detection module** (8044527)	**RFID module** (8063388)	**Robotino 4** (8101344)
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Modular Production System (MPS)

User Guides

● Suitable for the Learning System
○ Independent of the Learning System

		DE	EN	ES	FR	MPS 400 Systems and System Modules							
						MPS 402-1/MPS 402-1 R (8160307 | 8160309 | 8160308)	**MPS 403-1/MPS 403-1 R** (8130882 | 8160311 | 8160310)	**MPS 404-1/MPS 404-1 R** (8150260 | 8160313 | 8160312)	**MPS 400 distributing Pro** (8129394)	**MPS 400 measuring Pro** (8137077)	**MPS 400 joining** (8129125)	**MPS 400 sorting inline** (8129438)	**Robotino 4** (8159799 | 8159801)
Smart Sensors – First Steps	LX	x	x	x	x	●	●	●	●				
Quick Start – MES	LX	x	x	x	x		●	●	●				
Commissioning Energy Efficiency Package	LX	x	x	x	x		●	●					
Integration of the Vacuum Generator	LX	x	x	x	x		●	●					
Integration of the Air-Saving Circuit	LX	x	x	x	x		●	●					
CIROS – Installation Instructions	LX	x	x	x	x	○	○	○	○	○	○	○	○

MPS Generation D									MPS Modules									Robotics
Distributing station D (8034566)	**Sorting station D** (8046325)	**Pick&Place station D** (8034567)	**Measuring station D** (8038623)	**Separating station D** (8038802)	**Joining station D** (8063910)	**Packaging station D** (8062644)	**Storing station v2 D** (8082795)	**Robot station with MPS modules D** (8039313)	**Conveyor module** (different variants possible)	**Stack magazine module** (different variants possible)	**Pick&Place module** (different variants possible)	**Two-axis handling module with stepper motor** (8049257)	**Packaging module** (8043505)	**Rotary/lifting module** (8035936)	**Detection module** (8044527)	**RFID module** (8063388)	**Robotino 4** (8101344)	
○	○	○	○	○	○	○	○	○									○	

Modular Production System (MPS)
Evaluation

● Suitable for the Learning System
○ Independent of the Learning System

		DE	EN	ES	FR	MPS 400 Systems and System Modules							
						MPS 402-1/MPS 402-1 R (8160307 I 8160309 I 8160308)	**MPS 403-1/MPS 403-1 R** (8130882 I 8160311 I 8160310)	**MPS 404-1/MPS 404-1 R** (8150260 I 8160313 I 8160312)	**MPS 400 distributing Pro** (8129394)	**MPS 400 measuring Pro** (8137077)	**MPS 400 joining** (8129125)	**MPS 400 sorting inline** (8129438)	**Robotino 4** (8159799 I 8159801)
Basics of Pneumatics	LX	x	x	x	x	○	○	○	○	○	●	○	
Basics of Plant Visualisation with HMI	LX	x	x	x	x	●	●	●	●				
Basics of Smart Sensors	LX	x	x	x	x	●	●	●	●				
From Maintenance to Smart Maintenance	LX	x	x	x	x	○	○	○	○	○	○	○	
Basics of PLC Programming	LX	x	x	x	x	●	●	●	○	○	○	●	
PLC Programming for Smart Systems	LX	x	x	x	x	●	●	●				●	
Basics of MES	LX	x	x	x	x		●	●					
Basics of Energy Efficiency	LX	x	x	x	x		●	●					
Basics of GRAFCET Programming	LX	x	x	x	x	○	○	○	○	○	○	○	
Basics of Robotics	LX	x	x	x	x	●	●	●					●
Basics of Collaborative Robotics	LX	x	x	x	x								○

Distributing station D									MPS Modules									Robotics
Distributing station D (8034566)	**Sorting station D** (8046325)	**Pick&Place station D** (8034567)	**Measuring station D** (8038623)	**Separating station D** (8038802)	**Joining station D** (8063910)	**Packaging station D** (8062644)	**Storing station v2 D** (8082795)	**Robot station with MPS modules D** (8039313)	**Conveyor module** (different variants possible)	**Stack magazine module** (different variants possible)	**Pick&Place module** (different variants possible)	**Two-axis handling module with stepper motor** (8049257)	**Packaging module** (8043505)	**Rotary/lifting module** (8035936)	**Detection module** (8044527)	**RFID module** (8063388)	**Robotino 4** (8101344)	
○	○	○	○	○	○	○	○			○	○							
○	●	○	○	○	○	○	○		○	○	○	○	○	○	○			
○	○	○	○	○	○	○	○		○	○	○	○	○	○	○			
								●									●	
								○									○	

CP Lab
eLearning Courses

○ Independent of the Learning System

		DE	EN	ES	FR	CP Lab 400 System			
						CP Lab 404-1 (8092833)	**CP Lab 406-1** (8092834)	**CP Lab 408-1** (8092835)	**CP Lab 4010-1** (8092836)
Sensors for Object Sensing	LX	x	x	x	x	○	○	○	○
Electric Drives 1	LX	x	x	x	x	○	○	○	○
Actuators – DC Motor	LX	x	x	x	x	○	○	○	○
Pneumatic Fundamentals	LX	x	x	x	x	○	○	○	○
PLC Programming	LX	x	x	x	x	○	○	○	○
Safety Technology	LX	x	x	x	x	○	○	○	○
Process Automation	LX	x	x	x	x	○	○	○	○
Introduction to Industry 4.0	LX	x	x	x	x	○	○	○	○
GRAFCET	LX	x	x	x	x	○	○	○	○
Metalworking: Drilling	LX	x	x	x	x	○	○	○	○
Industrial Safety in the Workplace	LX		x			○	○	○	○

Application Modules												Module	Robotics
Magazine application module (D13007)	**Drilling application module** (D13001)	**iDrilling application module** (D13013)	**Measuring application module** (D13019)	**Turning application module** (D13002)	**Pick-by-Light application module** (D13022)	**Camera inspection application module** (D13029)	**Muscle press application module** (D13015)	**Labelling application module** (D13024)	**Tunnel furnace application module** (D13012)	**Output application module** (D13018)	**High-bay storage application module** (D13023)	**CP Lab basic module**	**Robotino 4** (8101344)
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○		
○	○	○	○	○	○	○	○	○	○	○	○	○	
	○												
○	○	○	○	○	○	○	○	○	○	○	○		

CP Lab

eTheory and eLab Courses

● Suitable for the Learning System
○ Independent of the Learning System

		DE	EN	ES	FR	CP Lab 400 System			
						CP Lab 404-1 (8092833)	**CP Lab 406-1** (8092834)	**CP Lab 408-1** (8092835)	**CP Lab 4010-1** (8092836)
Introduction to Robotics	LX	x	x	x	x				
CIROS – First Steps	LX	x	x	x	x	○	○	○	○
Introduction to RFID Technology	LX	x	x			○	○	○	○
From Maintenance to Smart Maintenance	LX	x	x	x	x	○	○	○	○
AAS - Communication Architecture of I4.0	LX	x	x			○	○	○	○
Introduction to Collaborative Robotics (HRC)	LX	x	x	x	x				

		DE	EN	ES	FR				
Basics of CAD Design with NX	LX	x	x	x	x	●	●	●	●
Basics of Modeling with NX MCD	LX	x	x	x	x	●	●	●	●
Modeling with NX MCD	LX	x	x	x	x	●	●	●	●
Basics of Virtual Commissioning with NX MCD	LX	x	x	x	x	●	●	●	●
Virtual Commissioning with NX MCD	LX	x	x	x	x	●	●	●	●
Autonomous Mobile Robotics with Robotino 4	LX	x	x	x	x				

Application Modules													Module	Robotics
Magazine application module (D13007)	**Drilling application module** (D13001)	**iDrilling application module** (D13013)	**Measuring application module** (D13019)	**Turning application module** (D13002)	**Pick-by-Light application module** (D13022)	**Camera inspection application module** (D13029)	**Muscle press application module** (D13015)	**Labelling application module** (D13024)	**Tunnel furnace application module** (D13012)	**Output application module** (D13018)	**High-bay storage application module** (D13023)	**CP Lab basic module**	**Robotino 4** (8101344)
													○
○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○		
○	○	○	○	○	○	○	○	○	○	○	○		
○	○	○	○	○	○	○	○	○	○	○	○		
													○
●	●	●	●	●	●	●	●	●	●	●	●		
●	●	●	●	●	●	●	●	●	●	●	●		
●												●	
												●	
●												●	
													●

CP Lab

eBooks (LX)/Workbooks (Print) and User Guides

Campus license
The standard option for commercial (professional) use.
For all those wishing to use the training materials at a single location.

Teaching material (workbook with data medium/download)
– No data protection
– Document can be modified
– Commercial/educational organisations (single location)

● Suitable for the Learning System
○ Independent of the Learning System

		DE	EN	ES	FR	CP Lab 400 System			
						CP Lab 404-1 (8092833)	CP Lab 406-1 (8092834)	CP Lab 408-1 (8092835)	CP Lab 4010-1 (8092836)
HMI – Operation and Visualization I Part 1: Hardware, Base objects and Elements	LX print	x 8075239	x 8084442			●	●	●	●
Object Identification RFID	LX print	x 8094339	x 8094340		x 8094341	●	●	●	●
Production Planning and Control with MES4	LX print	x 8075236	x 8081993		x 8086246	○	○	○	○
PLC Programming – From the Basics to Simple Station Operation	LX print	x 8095705	x 8115592			●	●	●	●
Device Configuration	LX print	x 8115588	x 8115590			●	●	●	●
PLC Programming for I4.0 Systems	LX print	x 8075238	x 8084441		x 8106096	●	●	●	●

		DE	EN	ES	FR				
Quick Start – MES	LX	x	x	x	x				
CIROS – Installation Instructions	LX	x	x	x	x	○	○	○	○
Introduction to Modeling with NX MCD	LX	x	x	x	x	○	○	○	○
Introduction to Virtual Commissioning with NX MCD	LX	x	x	x	x	○	○	○	○

Application Modules													Module	Robotics
Magazine application module (D13007)	**Drilling application module** (D13001)	**iDrilling application module** (D13013)	**Measuring application module** (D13019)	**Turning application module** (D13002)	**Pick-by-Light application module** (D13022)	**Camera inspection application module** (D13029)	**Muscle press application module** (D13015)	**Labelling application module** (D13024)	**Tunnel furnace application module** (D13012)	**Output application module** (D13018)	**High-bay storage application module** (D13023)	**CP Lab basic module**	**Robotino 4** (8101344)
												●	
												●	
												○	
●	○	○	○	○	○	○	○	○	○	○	○	○	
●	●	●	●	●	●	●	●	●	●	●	●	●	
	●												
○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	

CP Lab
Evaluation

● Suitable for the Learning System
○ Independent of the Learning System

		DE	EN	ES	FR	CP Lab 400 System			
						CP Lab 404-1 (8092833)	**CP Lab 406-1** (8092834)	**CP Lab 408-1** (8092835)	**CP Lab 4010-1** (8092836)
Basics of Pneumatics	LX	x	x	x	x	○	○	○	○
Basics of Plant Visualisation with HMI	LX	x	x	x	x	●	●	●	●
Basics of Smart Sensors	LX	x	x	x	x	●	●	●	●
From Maintenance to Smart Maintenance	LX	x	x	x	x	○	○	○	○
Basics of PLC Programming	LX	x	x	x	x	●	●	●	○
PLC Programming for Smart Systems	LX	x	x	x	x	●	●	●	●
Basics of MES	LX	x	x	x	x	○	○	○	○
Basics of GRAFCET Programming	LX	x	x	x	x	○	○	○	○
Basics of Robotics	LX	x	x	x	x				
Basics of Collaborative Robotics	LX	x	x	x	x				
Basics of CAD Design with NX	LX	x	x	x	x	○	○	○	○
Basics of Modeling with NX MCD	LX	x	x	x	x	○	○	○	○
Basics of Virtual Commissioning with NX MCD	LX	x	x	x	x	○	○	○	○
AAS – Communication Architecture of I4.0	LX	x	x			○	○	○	○
Industrial Safety in the Workplace	LX		x			○	○	○	○

Application Modules													Module	Robotics
Magazine application module (D13007)	**Drilling application module** (D13001)	**iDrilling application module** (D13013)	**Measuring application module** (D13019)	**Turning application module** (D13002)	**Pick-by-Light application module** (D13022)	**Camera inspection application module** (D13029)	**Muscle press application module** (D13015)	**Labelling application module** (D13024)	**Tunnel furnace application module** (D13012)	**Output application module** (D13018)	**High-bay storage application module** (D13023)	**CP Lab basic module**	**Robotino 4** (8101344)	
○	●	○		○	○	○	○	○	○	○	○			
○	○	○												
○	○	●		○	●	○	○	○	○	○	○			
		●												
○	○	○	○	○	○	○	○	○	○	○	○			
													○	
													○	
												●		
												●		
												●		
○	○	○	○	○	○	○	○	○	○	○	○			
○	○	○	○	○	○	○	○	○	○	○	○	●		

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